**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.**

**(AUTONOMOUS)**

**B.Tech**

**(COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

**(Effective for the batches admitted in 2020-2021)**

Semester I (First year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|--------|----------|-------------|--------------|---|---|---|---------|-----|-----|-------|
| | | | | L | T | P | C | | | |
| 1 | BS | 20ABS9901 | Algebra & Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | BS | 20ABS9904 | Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | ES | 20AES0501 | Problem Solving and Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | ES | 20AES0301 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | ES | 20AES0505 | Information Technology and Numerical Methods | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | ES LAB | 20AES0506 | Computer Science and Engineering Workshop | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | BS LAB | 20ABS9909 | Chemistry Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | ES LAB | 20AES0503 | Problem Solving and Programming Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| | | | **Total credits** | | | | **19.5** | **240** | **560** | **800** |

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.

## (AUTONOMOUS)

## B.Tech

## (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

### (Effective for the batches admitted in 2020-2021)

### Semester II (First year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|--------|----------|-------------|--------------|----|----|----|---------|-----|-----|-------|
| | | | | L | T | P | C | | | |
| 1 | BS | 20ABS9902 | Applied Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | BS | 20ABS9911 | Probability and Statistics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | HS | 20AHS9901 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | ES | 20AES0502 | Data Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | ES | 20AES0507 | Web Design | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 6 | HS LAB | 20AHS9902 | Communicative English Lab | 0 | 0 | 2 | 1.5 | 30 | 70 | 100 |
| 7 | BS LAB | 20ABS9907 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | ES LAB | 20AES0504 | Data Structures Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 9 | MC | 20AMC9903 | Environmental Studies | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| | | | **Total credits** | | | | **19.5** | **270** | **560** | **830** |

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## (AUTONOMOUS)

## B.Tech

## (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

## (Effective for the batches admitted in 2020-2021)

### Semester III (Second year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | BS | 20ABS9914 | Discrete Mathematical Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3601 | Digital Electronics and Microprocessors | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3602 | Database Management Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | PC | 20APC3604 | Basics of Python Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | ES | 20AES0205 | Basics of Electrical and Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | PC Lab | 20APC3603 | Database Management Systems Laboratory | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3605 | Basics of Python Programming Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | ES Lab | 20AES0206 | Basics of Electrical and Electronics Engineering Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 9 | SC | 20ASC3601 | Client Side Scripting | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 10 | MC | 20AMC9902 | Constitution of India | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| | | | **Total credits** | | | | **21.5** | **370** | **560** | **930** |

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## (AUTONOMOUS)

## B.Tech

## (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

### (Effective for the batches admitted in 2020-2021)

### Semester IV (Second year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | PC | 20APC3606 | Computer Organization | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3607 | Computer Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3609 | Object Oriented Programming through Java | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | PC | 20APC3611 | Operating Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | HS | 20AHSMB01 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | HS | 20AHS9905 | Universal Human Values | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3608 | Computer Networks Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | PC Lab | 20APC3610 | Object Oriented Programming through Java Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 9 | PC Lab | 20APC3612 | Operating Systems Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 10 | SC | 20ASC3602 | Server Side Scripting | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| | | | **Total credits** | | | | **24.5** | **370** | **630** | **1000** |

**Community Service Project (Mandatory) for 6 weeks duration during summer vacation.**
(To visit the selected community to conduct survey (Socio-economic &amp; domain survey) and conduct sensitization/awareness program/activities at the end of IV- semester before commencement of V-semester and complete immersion programme also during V-Semester and submit report in V - semester. Assessment will be done at the end of V-Semester)

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## (AUTONOMOUS)

## B.Tech

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### (Effective for the batches admitted in 2020-2021)

### Semester V (Third year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|--------|----------|-------------|--------------|---|---|---|---------|-----|-----|-------|
| | | | | L | T | P | C | | | |
| 1 | PC | 20APC3613 | Cryptography and Network Security | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3615 | Embedded Systems and Internet of Things | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3617 | Fundamentals of Blockchain Technology | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | OE-1 | 20AOE9926<br><br>20AOE0303<br>20APC0213 | Mathematical Modeling and Simulation<br>Optimization Techniques<br>Control Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | PE-1 | 20APE3601<br>20APE3602<br>20APE3603 | Software Engineering<br>Distributed Database<br>Automata Theory and Compiler Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | PC Lab | 20APC3614 | Cryptography and Network Security Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3616 | Embedded Systems and Internet of Things Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | SC | 20ASA0502 | Soft Skills | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 9 | MC | 20AMC9901 | Biology for Engineers | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| 10 | CSP | 20CSP3601 | Evaluation of Community Service Project | 0 | 0 | 0 | 1.5 | 100 | 0 | 100 |
| Total credits | | | | | | | 21.5 | 440 | 490 | 930 |

**OE/JOEs for NPTEL**

| S. No | Job Oriented Elective (12 weeks) | Open Elective (12 weeks) |
|---|---|---|
| 1 | The Joy Of Computing Using Python | Introduction to Machine Learning |
| 2 | Software Testing | Business analytics and data mining modeling using R. |
| 3 | Privacy And Security In Online Social Media | Decision making with spread sheet |
| 4 | Data analytics with python | Introduction To Wireless and Cellular Communications |
| 5 | Development using UML, JAVA and Patterns. | Text, Textually and Digital Media |
| 6 | Programming In Modern C++ | Psychology Of Learning |
| 7 | Data Structure And Algorithms Using Java | Public Speaking |
| 8 | Computational Complexity | Organizational Behavior |
| 9 | Cyber Security and Privacy | Entrepreneurship |
| 10 | Parameterized Algorithms | Introduction to Film Studies |
| 11 | Computational number theory and algebra | Partition of India in print media and Cinema |
| 12 | Hardware Security | Data Analysis and decision making |
| 13 | GPU architecture and programming | Education for sustainable development |
| 14 | Introduction to game theory and mechanism | Training and development |
| 15 | Statistical learning for reliability analysis | Literature Culture and Media |
| 16 | Advanced distributed systems. | Introduction to Cultural Studies |
| 17 | Secure computation: part-1 | Science, Technology and Society |
| 18 | Secure computation: part-2 | Human Resource Development |
| 19 | Pattern recognition and application | E - Business. |

* Student shall register any number of MOOC courses listed by the department as approved by the BOS from III year. But student is required to submit the pass certificate on NPTEL platform for at least one course with in the Programme duration (Before IV-II examination notification released).

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.

## (AUTONOMOUS)

## B.Tech

## (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

### (Effective for the batches admitted in 2020-2021)

### Semester VI (Third year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | PC | 20APC3618 | Cyber Security | 3 | 1 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3620 | Advanced IoT Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3622 | Building Private Block chain | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | PE-2 | 20APE3604 20APE3605 20APE3606 | Mobile Application Development Real time Operating System Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | PC Lab | 20APC3619 | Cyber Security Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 6 | PC Lab | 20APC3621 | Advanced IoT Programming Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3623 | Building Private Block chain Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | SC | 20ASA0501 | Basics of Cloud Computing | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 9 | MC | 20AMC9904 | Professional Ethics and Human Values | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| | | | **Total credits** | | | | **18.5** | **340** | **490** | **830** |
| **Industrial/Research Internship (Mandatory) 2 Months during summer vacation** | | | | | | | | | | |

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.

## (AUTONOMOUS)

## B.Tech

## (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

### (Effective for the batches admitted in 2020-2021)

### Semester VII (Fourth year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | PE-3 | 20APE3607<br>20APE3608<br>20APE3609 | Block chain Technologies and Use Cases<br>Crypto currencies<br>Fundamentals of Bit Coin Technology | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PE-4 | 20APE3610<br><br>20APE3611<br>20APE3612 | Cyber Security Risk Management and Mitigation<br>Cloud Security<br>Offensive and Defensive Cyber Security Techniques | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PE-5 CBCC | 20APE3613<br>20APE3614<br>20APE3615 | Data Analytics<br>Software Project Management<br>Linux Environment System | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | JOE/OE-2 | 20AOE3602<br>20AOE3603<br>20AOE3604 | Information Retrieval Techniques<br>Soft Computing<br>Principles of Data science | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | OE-3 | 20APE0407<br>20APEO411<br>20APE0415<br>20APC0425<br>20APE0417<br>20APC0323 | Digital Image Processing<br>Embedded Systems<br>Wireless Communications<br>Analog and Digital IC Application<br>Sensor Networks<br>Operations Research | 3<br>3<br>3<br>3<br>3<br><br>3 | 0<br>0<br>0<br>1<br>0<br><br>0 | 0<br>0<br>0<br>0<br>0<br><br>0 | 3<br>3<br>3<br>3<br>3<br><br>3 | 30 | 70 | 100 |
| 6 | HE | 20AOE0302<br>20AOE9901<br><br>20AHSMB02 | Management Science<br>English for Research Paper Writing<br>Entrepreneurship Development | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 7 | SA | 20ASA3601 | Ethical Hacking | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 8 | PR | 20APR3601 | Evaluation of Industry Internship(III-II Summer Internship) | 0 | 0 | 0 | 3 | 100 | 0 | 100 |
| | | | Total credits | | | | 23 | 380 | 420 | 800 |

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**(AUTONOMOUS)**

**B.Tech**

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**(Effective for the batches admitted in 2020-2021)**

**Semester VIII (Fourth year)**

| Sl. No. | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | OE-4 | 20AOE3605 | MOOCS | 0 | 0 | 0 | 3 | 25 | 75 | 100 |
| 2 | PR | 20APR3602 | Internship | 0 | 0 | 0 | 3 | 100 | | 100 |
| 3 | PR | 20APR3603 | Project work | 0 | 0 | 0 | 9 | 60 | 140 | 200 |
| | | | Total credits | | | | 15 | 185 | 215 | 400 |

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

## (AUTONOMOUS)

## B.Tech program in CSE (IoT and Cyber Security including Blockchain Technology)

### HONOURS IN COMPUTER SCIENCE AND ENGINEERING – CIC

**Note:** Students can choose a few courses from the following list approved by BOS either 3 credits/ 4 credits courses based on the availability in SWYAM-NPTEL portal, and secure minimum of 20 credits on passing the selected courses.

| Sl.No | SUB.CODE | COURSE NAME | WEEKS | CREDITS |
|-------|----------|-------------|-------|---------|
| 1 | 20AHN3601 | DESIGN AND IMPLEMENTATION OF HUMAN COMPUTER INTERFACES | 12 Weeks | 3 or 4 |
| 2 | 20AHN3602 | SOCIAL NETWORKS | 12 Weeks | 3 or 4 |
| 3 | 20AHN3603 | NO SQL DATABASES | 12 Weeks | 3 or 4 |
| 4 | 20AHN3604 | ADVANCED IOT APPLICATIONS | 12 Weeks | 3 or 4 |
| 5 | 20AHN3605 | INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS | 12 Weeks | 3 or 4 |
| 6 | 20AHN3606 | GETTING STARTED WITH COMPETITIVE PROGRAMMING | 12 Weeks | 3 or 4 |
| 7 | 20AHN3607 | COMMUNICATION NETWORKS | 12 Weeks | 3 or 4 |
| 8 | 20AHN3608 | COMPUTER NETWORKS AND INTERNET PROTOCOL | 12 Weeks | 3 or 4 |
| 9 | 20AHN3609 | ALGORITHMIC GAME THEORY | 12 Weeks | 3 or 4 |
| 10 | 20AHN3610 | SCALABLE DB. | 12 Weeks | 3 or 4 |
| 11 | 20AHN3611 | APPLIED ACCELERATED ARTIFICIAL INTELLIGENCE. | 12 Weeks | 3 or 4 |
| 12 | 20AHN3612 | AI: SEARCH METHODS FOR PROBLEM SOLVING. | 12 Weeks | 3 or 4 |
| 13 | 20AHN3613 | ARTIFICIAL INTELLIGENCE: KNOWLEDGE REPRESENTATION AND REASONING | 12 Weeks | 3 or 4 |
| 14 | 20AHN3614 | MULTI-CORE COMPUTER ARCHITECTURE-STORAGE | 12 Weeks | 3 or 4 |
| 15 | 20AHN3615 | SOCIAL NETWORK ANALYSIS. | 12 Weeks | 3 or 4 |
| | | **TOTAL** | | **20** |

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

## (AUTONOMOUS)

## B.Tech program in CSE (IoT and Cyber Security including Blockchain Technology)

### MINOR DEGREE IN CIC FOR ECE, EEE, CE & ME

**Note:** Students of other programmes to get "minor in CIC" shall pass a few SWAYAM-NPTEL courses listed below which are approved by BOS and obtain 15 credits and submitting a minor discipline project in CIC for scoring 5 credits is compulsory and all together total credits requirement count to be minimum of 20.

| Sl. No | SUB.CODE | COURSE NAME | WEEKS | CREDITS |
|--------|----------|-------------|-------|---------|
| 1 | 20AMN3601 | OPERATING SYSTEMS | 12 Weeks | 3 or 4 |
| 2 | 20AMN3602 | COMPUTER ORGANIZATION | 12 Weeks | 3 or 4 |
| 3 | 20AMN3603 | COMPUTER NETWORKS | 12 Weeks | 3 or 4 |
| 4 | 20AMN3604 | CYBER SECURITY | 12 Weeks | 3 or 4 |
| 5 | 20AMN3605 | INTERNET OF THINGS | 12 Weeks | 3 or 4 |
| 6 | 20AMN3606 | PROGRAMMING IN MODERN C++ | 12 Weeks | 3 or 4 |
| 7 | 20AMN3607 | DATA ANALYTICS WITH PYTHON | 12 Weeks | 3 or 4 |
| 8 | 20AMN3608 | SOFTWARE ENGINEERING | 12 Weeks | 3 or 4 |
| 9 | 20AMN3609 | SOFTWARE PROJECT MANAGEMENT | 12 Weeks | 3 or 4 |
| 10 | 20AMN3610 | INTRODUCTION TO DATABASE SYSTEMS | 12 Weeks | 3 or 4 |
| 11 | 20AMN3611 | CLOUD COMPUTING | 12 Weeks | 3 or 4 |
| 12 | 20AMN3612 | FOUNDATION OF CRYPTOGRAPHY | 12 Weeks | 3 or 4 |
| 13 | 20AMN3613 | HARDWARE SECURITY | 12 Weeks | 3 or 4 |
| 14 | 20AMN3614 | COMPUTER NETWORKS AND INTERNET PROTOCOL | 12 Weeks | 3 or 4 |
| 15 | 20AMN3615 | COMMUNICATION NETWORKS | 12 Weeks | 3 or 4 |
| 16 | 20AMN3616 | **MINOR DISCIPLINE PROJECT IN CIC (COMPULSORY)** | - | 5 |
|  |  | **TOTAL** |  | **20** |

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**(Effective for the batches admitted in 2020-2021)**

Semester I (First year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | BS | 20ABS9901 | Algebra & Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | BS | 20ABS9904 | Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | ES | 20AES0501 | Problem Solving and Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | ES | 20AES0301 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | ES | 20AES0505 | Information Technology and Numerical Methods | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | ES LAB | 20AES0506 | Computer Science and Engineering Workshop | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | BS LAB | 20ABS9909 | Chemistry Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | ES LAB | 20AES0503 | Problem Solving and Programming Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| | | | **Total credits** | | | | **19.5** | **240** | **560** | **800** |

| Course Code | Year & Sem | Algebra and Calculus | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ABS9901 | I-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1. Apply the matrix algebra techniques for solving various linear equations.

CO2. Analyze the linear transformations of quadratic forms and mean value theorems.

CO3. Apply the fundamental concepts of partial derivatives for multi variable functions.

CO4. Evaluate the multiple integrals in cartesian, polar, cylindrical, and spherical co-ordinate systems.

CO5. Evaluate the improper integrals using special functions like Beta and Gamma.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | **Apply** | the matrix algebra techniques | for solving various linear equations | | **L3** |
| 2 | **Analyze** | the linear transformations of quadratic forms and mean value theorems. | | | **L4** |
| 3 | **Apply** | the fundamental concepts of partial derivatives | for multi variable functions | | **L3** |
| 4 | **Evaluate** | the multiple integrals | in cartesian, polar, cylindrical, and spherical co-ordinate systems | | **L5** |
| 5 | **Evaluate** | the improper integrals | using special functions like Beta and Gamma | | **L5** |

**Unit I : Matrix Operations and Solving Systems of Linear Equations          12hrs**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem,

**Unit II : Quadratic Forms and Mean Value Theorems          9hrs**

Diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.
Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

**Unit III: Multivariable calculus          9hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

**Unit IV: Multiple Integrals          10hrs**

Double integrals, change of order of integration, double integration in polar coordinates, change of Variables in double integration (Cartesian to polar),areas enclosed by plane curves.Evaluation of triple integrals.

**Unit V: Special Functions          10hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions, Bessel functions, Bessel's equation, Recurrence formulae or $J_n(x)$, Generating function- Orthoganality of Bessels functions.

## Textbooks:
1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

## References:
1. Dr.T.K.VIyengar, B.Krishna Gandhi, S. Ranganathamamd M.V.S.S.N Prasad, Mathematics – 1, S.Chand publications.

2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. B.V.Ramana, Higher Engineering Mathematics, McGraw Hill Education.
4. N.Bali, M.Goyal, C.Watkins, Advanced Engineering Mathematics, Infinity Science Press.

## Mapping of COs to POs

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 |     | 3   |     |     |     |     |     |     |     |      |      |      |
| CO2 | 3   |     |     |     |     |     |     |     |     |      |      |      |
| CO3 | 3   |     |     |     |     |     |     |     |     |      |      |      |
| CO4 |     | 3   |     |     |     |     |     |     |     |      |      |      |
| CO5 |     | 3   |     |     |     |     |     |     |     |      |      |      |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

## Correlation matrix

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | correlation | Verb | BTL | | | |
| 1 | 14 | 21.21 | 3 | Apply | L3 | PO2 | Apply (L3) | 3 |
| 2 | 10 | 15.15 | 2 | Analyze | L4 | PO2 | Analyze (L4) | 3 |
| 3 | 14 | 21.21 | 3 | Apply | L3 | PO1 | Apply (L3) | 3 |
| 4 | 14 | 21.21 | 3 | Evaluate | L5 | PO1 | Apply (L3) | 3 |
| 5 | 14 | 21.21 | 3 | Evaluate | L5 | PO1 | Apply (L3) | 3 |

## Justification:

**CO1: Apply** the matrix algebra techniques for solving various linear equations.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
**CO2: Analyze** the linear transformations of quadratic forms and mean value theorems.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
**CO3: Apply** the fundamental concepts of partial derivatives for multi variable functions.
Action Verb: Apply (L3)
PO2 Verbs: Analyze (L4)
CO3 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO4: Evaluate** the multiple integrals in cartesian, polar, cylindrical, and spherical co-ordinate systems.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO4 Action Verb is high level to PO1 verb; Therefore correlation is high (3).

**CO5: Evaluate** the improper integrals using special functions like Beta and Gamma.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO5 Action Verb is high level to PO1 verb; Therefore correlation is high (3).

| Course Code | Year & Sem | Chemistry | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ABS9904 | I-I | (Common to I Sem- CSE & CIC,  II Sem EEE, ECE) | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO 1: **Understand** the interaction of energy levels between atoms and molecules

CO 2: **Apply** the electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors

CO 3: **Analyze** the preparation and mechanism of polymers

CO 4: **Analyze** the separation of gaseous and liquid mixtures using instrumental methods

CO 5: **Apply** the purification technique to remove hardness of water and to check the quality of water

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | **Understand** | The interaction of energy levels between atoms and molecules | | | L2 |
| 2 | **Apply** | The electrochemical principles | | to the construction of batteries, fuel cells and electrochemical sensors | L3 |
| 3 | **Analyze** | The preparation and mechanism of polymers | | | L4 |
| 4 | **Analyze** | The separation of gaseous and liquid mixtures | Using instrumental methods | | L4 |
| 5 | **Apply** | The purification technique to remove hardness of water | | to check the quality of water | L3 |

## Unit 1: Structure and Bonding Models                                   (10 hrs)

Planck's quantum theory, Schrodinger wave equation, significance of $\Psi^1$ and $\Psi^2$ , applications to hydrogen, particle in a box and their applications for conjugated molecules, crystal field theory – salient features – energy level diagrams for transition metal ions – splitting of orbital's in tetrahedral and octahedral complexes, magnetic properties,  molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of $O_2$ , $N_2$ and CO, calculation of bond order.

## Unit 2: Electrochemistry and Applications                               (10 hrs)

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode) electrochemical cell, Nern'st equation, cell potential calculations, numerical problems, concept of pH, pH meter and applications of pH metry (acid-base titrations), potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications, photogalvanic cells with specific examples. Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, alkali metal sulphide batteries, Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Secondary cells – lead acid, nickel-metal hydride and lithium ion batteries- working of the batteries including cell reactions, button cells,

## Unit 3: Polymer Chemistry                                               (10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation. Plastics - Thermoplastics and Thermosettings, Preparation,

properties and applications of – Bakelite, urea-formaldehyde, Nylon-66, carbon fibres, Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

### Unit 4: Instrumental Methods and Applications                    (10 hrs)

Principle and applications of Colorimetry, AAS, AES, UV-Viscible spectrophotometry (Beer-Lambert's law, Instrumentation ,Principles  and applications of Chromatographic techniques(GC & HPLC), separation of gaseous mixtures and liquid mixtures(GC & HPLC methods).

### Unit 5: Water Technology                    (10 hrs)

Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles **-** scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

### Text books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.

2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

### Reference books:

1. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. Ben L. Feringa and Wesley R. Browne, Molecular Switches, 2/e, Wiley-VCH, 2011.
4. Willard Merritt Dean Settle, 7 th Edition Instrumental methods for analysis

**Mapping of COs to POs and PSOs**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | | | | | | | | | | | | | |
| CO2 | 3 | | | | | | | | | | | | | |
| CO3 | | 3 | | | | | | | | | | | | |
| CO4 | | 3 | | | | | | | | | | | | |
| CO5 | 3 | | | | | | | | | | | | | |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**CO-PO mapping justification:**

| CO | Percentage of contact hours over the total planned contact hours | | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|----|-------------------|-------------------|------|------|------------|-----|----------|---------------------|------------|
| | Register (Hrs) | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| 1 | 10 | 10 | 15.6 | 2 | Understand | L2 | PO1 | PO1: Apply (L3) | 2 |
| 2 | 10 | 17 | 26.5 | 3 | Apply | L3 | PO1 | PO1: Apply (L3) | 3 |
| 3 | 10 | 12 | 18.7 | 3 | Analyze | L4 | PO2 | PO2: Analyze (L4) | 3 |
| 4 | 10 | 13 | 20.3 | 3 | Analyze | L4 | PO2 | PO2: Analyze (L4) | 3 |
| 5 | 10 | 12 | 18.7 | 3 | Apply | L3 | PO1 | PO1: Apply (L3) | 3 |
| | 50 | 64 | | | | | | | |

**CO1: Understand the interaction of energy levels between atoms and molecules**
**Action Verb: Understand (L2)**
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
**CO2: Apply the electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors**
**Action Verb: Apply (L3)**
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
**CO3: Analyze the preparation and mechanism of polymers**
**Action Verb: Analyze (L4)**
PO2 Verb: Analyze (L4)
CO3 Action Verb level isequal to PO2 verb; Therefore correlation is high (3).
**CO4: Analyze the separation of gaseous and liquid mixtures using instrumental methods**
**Action Verb: Analyze (L4)**
PO2 Verb: Analyze (L4)
CO4 Action Verb level isequal to PO2 verb; Therefore correlation is high (3).
**CO5: Apply the purification technique to remove hardness of water and to check the quality of water**
**Action Verb: Apply (L3)**
PO1 Verb: Apply (L3)
CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

| Course Code | Year & Sem | Problem Solving And Programming | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0501 | I-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO 1: **Understand** the Programming and Algorithms concepts to Perform Basic operations.

CO 2: **Apply** the problem solving approaches to generate different algorithms.

CO 3: **Understand** the various operators to perform mathematical operations.

CO 4: **Apply** the Pointers and Array Techniques to manipulate the data.

CO 5: **Analyze** the Sorting and Searching Techniques to arrange the data in sorted order.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the Programming and Algorithms concepts | | to Perform Basic operations. | L2 |
| **CO2** | Apply | the problem solving approaches | | to generate different algorithms | L3 |
| **CO3** | Understand | the various operators | | to perform mathematical operations | L2 |
| **CO4** | Apply | the Pointers and Array Techniques | | to manipulate the data | L3 |
| **CO5** | Analyze | the Sorting and Searching Techniques | | to arrange the data in sorted order. | L4 |

| **UNIT - I** | | 8 Hrs |
|---|---|---|

**Computer Fundamentals**: What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU.

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

| **UNIT - II** | | 9 Hrs |
|---|---|---|

**Introduction to computer problem solving**: Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, and the analysis of algorithms.

**Fundamental algorithms**: Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.

| **UNIT - III** | | 8 Hrs |
|---|---|---|

**Types, Operators, and Expressions**: Variable names, data types and sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

**Input and output**: standard input and output, formatted output-Printf, formatted input-Scanf.

Control Flow: Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Do- while, break and continue, Goto and labels.

**Functions and Program Structure**: Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.

| **UNIT - IV** | | 9 Hrs |
|---|---|---|

**Factoring methods:** Finding the square root of a number, the smallest divisor of a number, the greatest common divisor of two integers, generating prime numbers.

**Pointers and arrays**: Pointers and addresses, pointers and function arguments, pointers and arrays, address arithmetic, character pointers and functions, pointer array; pointers to pointers, Multi-dimensional arrays, initialization of arrays, pointer vs. multi-dimensional arrays, command line arguments, pointers to functions, complicated declarations.

**Array Techniques**: Array order reversal, finding the maximum number in a set, removal of duplicates from an order array, finding the kth smallest element

| UNIT - V | | 9 Hrs |
|---|---|---|

**Sorting and Searching**: Sorting by selection, sorting by exchange, sorting by insertion, sorting by partitioning, binary search.

**Structures**: Basics of structures, structures and functions, arrays of structures, pointers to structures, self referential structures, table lookup, typedef, unions, bit-fields.

**Some other Features**: Variable-length argument lists, formatted input-Scanf, file access, Error handling-stderr and exit, Line Input and Output, Miscellaneous Functions.

**Textbooks:**

1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.

**Reference Books:**

1. RS Bichkar "Programming with C", 2012, Universities Press.
2. Pelin Aksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage Learning.
3. Byron Gottfried and Jitender Kumar Chhabra, "Programming with C", 4th Edition, 2019, McGraw Hill Education.

**Online Learning Resources:**

www.nptel.ac.in

## Mapping of course outcomes with program outcomes

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | | 3 | |
| CO2 | 3 | 2 | 3 | | | | | | | | | 2 | 2 | |
| CO3 | 2 | 3 | | | | | | | | | | 2 | 2 | |
| CO4 | 3 | 3 | 3 | | | | | | | | | 2 | 2 | |
| CO5 | 3 | 3 | 3 | | | | | | | | | 2 | 2 | 2 |

## Correlation matrix

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 1 | 19 | 25% | 3 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 2<br>3 |
| 2 | 10 | 14% | 2 | CO2: Apply | L3 | PO1<br>PO2<br>PO3<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3: Develop (L3)<br>PO12: Thumb rule | 3<br>2<br>3<br>2 |
| 3 | 19 | 25% | 3 | CO3: Understand | L2 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO12: Thumb rule | 2<br>3<br>2 |
| 4 | 15 | 20% | 2 | CO4: Apply | L3 | PO1<br>PO2<br>PO3<br>PO12 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO3: Develop (L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>2 |
| 5 | 12 | 16% | 2 | CO5: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO12 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO3: Develop(L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>2 |
| | 75 | 100 % | | | | | | |

## Justification Statements :

**CO1: Analyze** the Programming and Algorithms concepts to Perform Basic operations.
**Action Verb: Analyze (L4)**
**PO1 Verb: Apply (L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
**PO2 Verb: Review (L2)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**CO2: Apply** the problem solving approaches to generate different algorithms.
**Action Verb: Apply (L3)**
**PO1: Apply (L3)**
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
**PO2: Analyze (L4)**
CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)
**PO3: Develop (L3)**
CO2 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
**PO12: Thumb rule**
**Some of the Algorithm knowledge are used to solve various problems. Therefore, the correlation is medium (2)**

**CO3: Understand the various operators to perform mathematical operations.**
**Action Verb: Understand (L2)**
**PO1: Apply (L3)**
CO3 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
**PO2: Review (L2)**
CO3 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
**PO12: Thumb rule**
For some mathematical operations to perform operators are used to create programs. Therefore, the correlation is medium (2)

**CO4: Apply the Pointers and Array Techniques to manipulate the data.**
**Action Verb: Apply (L3)**
**PO1: Apply (L3)**
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
**PO2: Review (L2)**
CO4 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
**PO12: Thumb rule**
For some mathematical operations to perform Pointers and Array Techniques are used to create programs. Therefore, the correlation is medium (2)

**CO5: Analyze the Sorting and Searching Techniques to arrange the data in sorted order.**
**Action Verb: Analyze (L4)**
**PO1: Apply (L3)**
CO5 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)
**PO2: Review (L2)**
CO5 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)
**PO12: Thumb rule**
For some Data Structures operations to perform Sorting and Searching Techniques are used to create programs. Therefore, the correlation is medium (2)

| Course Code | Year & Sem | Engineering Graphics | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0301 | I-I | | 1 | 0 | 4 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1. **Apply** the concepts of engineering curves for technical drawing

CO2. **Understand** the quadrant system to locate the position of points and projection of lines

CO3. **Analyze** the projection of planes as well as solids located in quadrant system

CO4. **Analyze** the sectional views and development of surfaces of regular solids

CO5. **Apply** orthographic and isometric projections concepts to construct the given object.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms Level |
|---|---|---|---|---|---|
| CO1 | Apply | the concepts of engineering curves | | for technical drawing | L3 |
| CO2 | Understand | the quadrant system to locate the position of points and projection of lines | | | L2 |
| CO3 | Analyze | draw the projection of planes as well as solids | | located in quadrant system | L4 |
| CO4 | Analyze | the sectional views and development of surfaces | | of regular solids | L4 |
| CO5 | Apply | orthographic and isometric projections concepts to construct the given object | | | L3 |

**Unit I: Introduction to Engineering graphics**: Principles of Engineering Graphics and their significance Conventions in drawing - lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, epicycloids and hypocycloid

**Unit II: Projection of points, lines**: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line, traces.

**Unit III: Projections of Planes**: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

**Projections of Solids**: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

**Unit IV: Sections of solids**: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

**Development of surfaces**: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

**Unit V: Orthographic Projections**: Systems of projections, conventions and application to orthographic projections.

**Isometric Projections**: Principles of isometric projection- Isometric scale; Isometric views -lines, planes, figures, simple and compound solids.

**Text Books:**

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers
3. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill

4. Shah and Rana, Engineering Drawing, 2/e, Pearson Education
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill

**Articulation Matrix**

| COs | Programme Outcomes (POs) & Programme Specific Outcomes (PSOs) | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | | 3 | | | | | | | 3 | | | 2 | 2 |
| CO2 | 2 | | 2 | | | | | | | 3 | | | 2 | 2 |
| CO3 | 2 | | 2 | | | | | | | 3 | | | 2 | 2 |
| CO4 | 3 | | 3 | | | | | | | 3 | | | 2 | 2 |
| CO5 | 3 | | 3 | | | | | | | 3 | | | 2 | 2 |

**Co-relation Matrix:**

| CO | CO | | | | | Program Outcomes (PO) | PO(s): Action Verb and BTL (for PO1 to PO5) | Level of Correlation |
|----|------------------------|-----|-------------|------------|-----|-----|-----|-----|
| | Lesson Plan (Hrs) | % | Correlation | Verb | BTL | | | |
| 1 | 18 | 24 | 3 | Apply | L3 | PO1 | Apply (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| | | | | | | PO10 | TR | 1 |
| | | | | | | PSO1 | TR | 2 |
| | | | | | | PSO2 | TR | 2 |
| 2 | 15 | 20 | 2 | Understand | L2 | PO1 | Apply (L3) | 2 |
| | | | | | | PO3 | Develop (L3) | 2 |
| | | | | | | PO10 | TR | 1 |
| | | | | | | PSO1 | TR | 2 |
| | | | | | | PSO2 | TR | 2 |
| 3 | 15 | 20 | 2 | Analyze | L4 | PO1 | Apply (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| | | | | | | PO10 | TR | 1 |
| | | | | | | PSO1 | TR | 2 |
| | | | | | | PSO2 | TR | 2 |
| 4 | 15 | 20 | 2 | Analyze | L4 | PO1 | Apply (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| | | | | | | PO10 | TR | 1 |
| | | | | | | PSO1 | TR | 2 |
| | | | | | | PSO2 | TR | 2 |
| 5 | 12 | 16 | 2 | Apply | L3 | PO1 | Apply (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| | | | | | | PO10 | TR | 1 |
| | | | | | | PSO1 | TR | 2 |
| | | | | | | PSO2 | TR | 2 |

**Justification Statements:**

**CO1: Apply** the concepts of engineering curves for technical drawing
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Develop (L3)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO10 Verb: Thumb Rule (TR)
CO1: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO2: Understand** the quadrant system to locate the position of points and projection of lines.
**Action Verb: Understand (L2)**
PO1 Verb: **Apply (L3)**
CO2: Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: **Develop (L3)**
CO2: Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)

PO10 Verb: Thumb Rule (TR)

CO2: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO3: Analyze** the projection of planes as well as solids located in quadrant system.

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

CO3: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO3: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO3: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO4: Analyze** the sectional views and development of surfaces of regular solids

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

CO4: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO4: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO4: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO5: Apply** orthographic and isometric projections concepts to construct the given object.

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

CO5: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO5: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

| Course Code | Year & Sem | Information Technology and Numerical Methods | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0505 | I-I | **(common to CSE,CSE(DS),CIC)** | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the Digital World and Exploring Cyber space.
CO2: **Analyze** the needs of hardware and software required for a computation task.
CO3: **Analyze** Peripheral devices networking and internet concepts.
CO4: **Apply** the concepts of Errors, Algebraic & Transcendental Equations to solve different Engineering problems.
CO5: **Analyze** the relevant numerical methods in interpolation, curve fitting, numerical differentiation and integration.
CO6: **Evaluate** the numerical solutions of ordinary differential equations by using different methods.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the Digital World | | Exploring Cyber space. | L2 |
| **CO2** | Analyze | the needs of hardware and software required for a computation task | | | L4 |
| **CO3** | Analyze | Peripheral devices, networking and internet concepts | | | L4 |
| **CO4** | Apply | the concepts of Errors, Algebraic & Transcendental Equations | | to solve different Engineering problems. | L3 |
| **CO5** | Analyze | the relevant numerical methods in interpolation, curve fitting, numerical differentiation and integration. | | | L4 |
| **CO6** | Evaluate | the numerical solutions of ordinary differential equations | by using different methods. | | L5 |

| Information Technology | |
|---|---|
| **UNIT – I** | 8 Hrs |

**INTRODUCTION TO INFORMATION TECHNOLOGY Your Digital World:** The Practical User: How Becoming Computer Savvy Benefits You, Information Technology & Your Life: The Future Now, Infotech Is All Pervasive: Cell phones, Email, the Internet, & the E-World, The "All-Purpose Machine": The Varieties of Computers, Understanding Your Computer: How Can You Customize (or Build) Your Own PC?, Where Is Information Technology Headed?

**THE INTERNET & THE WORLD WIDE WEB Exploring Cyberspace:** Connecting to the Internet: Narrowband, Broadband, & Access Providers, How Does the Internet Work? The World Wide Web, Email & Other Ways of Communicating over the Net, The Online Gold Mine: Telephony, Multimedia, Webcasting, Blogs, E-Commerce, & the Social Web, The Intrusive Internet: Snooping, Spamming, Spoofing, Phishing, Pharming, Cookies, & Spyware.

| **UNIT – II** | 9 Hrs |
|---|---|

**SOFTWARE Tools for Productivity & Creativity:** SOFTWARE: TOOLS FOR PRODUCTIVITY & CREATIVITY, **System Software:** The Power Behind the Power, The Operating System: What It Does? Other System Software: Device Drivers & Utility Programs, Common Features of the User Interface, Common Operating Systems, Application Software: Getting Started, Word Processing, Spreadsheets, Database Software, Specialty Software

**HARDWARE:** THE CPU & STORAGE How to Choose a Multimedia Computer System: HARDWARE: THE CPU & STORAGE: HOW TO CHOOSE A MULTIMEDIA COMPUTER SYSTEM, Microchips, Miniaturization,

& Mobility, the System Unit: The Basics, More on the System Unit, Secondary Storage, Future Developments in Processing & Storage

| **UNIT – III** | | 8 Hrs |
|---|---|---|

**HARDWARE: INPUT & OUTPUT Taking Charge of Computing & Communications:** Input & Output, Input Hardware, Output Hardware, Input & Output Technology & Quality of Life: Health & Ergonomics, The Future of Input & Output

**COMMUNICATIONS, NETWORKS, & SAFEGUARDS The Wired & Wireless World:** From the Analog to the Digital Age, Networks, Wired Communications Media, Wireless Communications Media, Cyber Threats, Hackers, & Safeguards

**Textbooks:**

1. Using Information Technology 9th Edition By Brian Williams and Stacey Sawyer, Mcgraw Hill Publications
2. "Computer Oriented Numerical Methods" by V Rajaraman

**Reference Books:**

1. Uttam K Roy, ―Web Technologies‖, Oxford University Press, 1st Edition, 2010.
2. HTML and CSS: Design and Build Websites 1st Edition by Jon Duckett (Author) india price
3. Steven Holzner, ―The Complete Reference PHP‖, Tata McGraw-Hill, 1st Edition, 2007.
4. HTML & CSS: The Complete Reference, Fifth Edition (Complete Reference Series)
5. Deitel and Deitel and Nieto, ―Internet and World Wide Web - How to Program‖, Prentice Hall, 5 th Edition, 2011.
6. Numerical Methods by E Balaguruswamy

<div align="center">

**Numerical Methods**

</div>

| **UNIT – I** | | 15 Hrs |
|---|---|---|

**Errors in Numerical computations:** Errors and their Accuracy, Mathematical Preliminaries, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation.

**Solution of Algebraic and Transcendental Equations:** The Bisection Method – The Method of False Position– NewtonRaphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method

| **UNIT – II** | | 15 Hrs |
|---|---|---|

**Interpolation:** Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

**Curve fitting:** Fitting of a straight line – Second degree curve – Exponential curve-Power curve by method of least squares. Numerical Differentiation for Newton's interpolation formula. Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

| **UNIT – III** | | 16 Hrs |
|---|---|---|

**Numerical solution of Ordinary Differential equations:** Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method- Runge - Kutta Methods. Numerical solutions of Laplace equation using finite difference approximation. Initial Value Problem, Eigen Value Problem and Boundary-value Problem

**TEXT BOOKS:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | | 2 | |
| CO2 | | 3 | | 3 | 3 | | | | | | | | | |
| CO3 | 3 | 3 | | | | | | | | | | 3 | | |
| CO4 | 3 | | | | | | | | | | | | | |
| CO5 | | 3 | | | | | | | | | | | | |
| CO6 | | 3 | | | | | | | | | | | | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 36% | 3 | CO1: understand | L2 | PO1 PO2 | PO1: Apply(L3) PO2: Review(L2) | 2 3 |
| 2 | 10 | 33% | 3 | CO2: Analyze | L4 | PO2 PO4 PO5 | PO2: Identify(L3) PO4: Analyze (L4) PO5: Apply(L3) | 3 3 3 |
| 3 | 9 | 31% | 3 | CO3: Analyze | L4 | PO1 PO2 PO10 | PO1: Apply(L3) PO2:  Identify(L3) PO12:Thumbrule | 3 3 3 |
| | 30 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand the Digital World and Exploring Cyber space.**

**Action Verb : Understand (L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than level of PO1 verb by one level. Therefore, the correlation is medium of (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is Same as level of PO2  Therefore, the correlation is High(3)
**CO2: Analyze** the needs of hardware and software required for a computation task.
**Action Verb : Analyze(L4)**
**PO2 Verb Identify(L3)**
**CO2  Action verb is more than level of PO2 verb by one level. Therefore, the correlation is High(3)**
**PO4 Verb : Analyze(L4)**

CO2  Action verb is same as level of PO4 verb  Therefore, the correlation is High(3)
**PO5: Apply(L3)**
CO2 Action verb is hreater than level of PO2 verb by one level. Therefore, the correlation is High(3)

**CO3: Analyze Communications, networking and internet concepts.**
**Action Verb : Analyze(L4)**

**PO1: Apply(L3)**
CO3 Action verb is greater than level of PO1 verb by one level. Therefore, the correlation is High(3)
**PO2:  Identify(L3)**

CO3 Action verb is greater than level of PO2 verb by one level. Therefore, the correlation is High(3)
**PO12:Thumbrule**
CO3:Networking and Peripheral  concepts of updates required .so one its to learn frequently  Therefore, the correlation is High(3)
**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 4 | 15 | 33% | 3 | CO4: **Apply** | L3 | PO1 | PO1: Apply(L3) | 3 |
| 5 | 15 | 33% | 3 | CO5: Analyze | L4 | PO2 | PO2: Analyze(L4) | 3 |
| 6 | 16 | 34% | 3 | CO6: **Evaluate** | L5 | PO2 | PO2: Analyze(L4) | 3 |
| | 30 | 100 % | | | | | | |

**Justification Statements :**

CO4: **Apply** the concepts of Errors, Algebraic & Transcendental Equations to solve different Engineering problems.

**Action Verb : Apply (L3)**

**PO1 Verb : Apply(L3)**

CO4 Action verb is same as PO1 verb. Therefore, the correlation high (3)

CO5: **Analyze** the relevant numerical methods in interpolation, curve fitting, numerical differentiation and integration.

**Action Verb : Analyze(L4)**

**PO2 Verb Analyze(L4)**

CO5  Action verb is same as PO2 verb. Therefore, the correlation is High(3)

CO6: **Evaluate** the numerical solutions of ordinary differential equations by using different methods.

**Action Verb : Evaluate (L5)**

**PO2:  Analyze(L4)**

CO6 Action verb is greater than level of PO2 verb. Therefore, the correlation is High(3)

| Course Code | Year & Sem | Computer Science and Engineering Workshop | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0506 | I-I | | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the Process of assembling and disassembling of a computer system.

**CO 2: Analyze** the Software Installation steps to trouble shoot the Hardware and software

**CO 3: Apply** the basic formulas and functions, formatting text & objects on a required content.

 **CO 4: Apply** the designs and templates for creating effective presentations.

**CO 5: Understand** the fundamentals of the Internet of Things (IoT) and its real-world applications.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | the Process of assembling and disassembling of a computer system | | | L2 |
| **CO2** | **Analyze** | the Software Installation steps | | to trouble shoot the Hardware and software | L4 |
| **CO3** | **Apply** | the basic formulas and functions, formatting text & objects on a required content | | | L3 |
| **CO4** | **Apply** | the designs and templates | | for creating effective presentations | L3 |
| **CO5** | **Understand** | the fundamentals of the Internet of Things (IoT) and its real-world applications | | | L2 |

**Preparing your computer**

**Task 1: Assembling a Computer:** Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer. **(CO1)**

**Task 2: Install Operating system:** Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process. **(CO2)**

**Productivity tools**

**Task 3: Word Processor:** Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered. **(CO3)**

**Task 4: Spreadsheet:** Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing  the worksheet environment, creating cell data, inserting and deleting cell  data,  format  cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.**(CO3)**

**Task 5: Presentations:** creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual   of the Presentation tool considered.**(CO4)**

**IoT**

**Task 6: Raspberry Pi**

Study the architecture of Raspberry pi, configure software, Install SD card, Connect the cables, Install Raspbian (or any other) operating system, Configure Wi-Fi, Remotely connect to your Raspberry Pi.**(CO5)**

**Story Telling**

**Task 7: Storytelling**

Use Adobe spark or any other tool to create Graphics, Webpages, and Videos. **(CO5)**

**Reference Books:**

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", 2nd edition, Tata McGraw-Hill, 2002
2. "MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
4. Rusen, "Networking your computers and devices", PHI
5. Bigelows, "Trouble shooting, Maintaining & Repairing PCs", TMH.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | | 2 | |
| CO2 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 3 | | | | | | | 3 | 2 | 2 |
| CO4 | 3 | | 3 | 2 | 3 | | | | | | | 3 | 2 | |
| CO5 | 2 | 2 | | | | | | | | | | | 2 | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|
| 1 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 2<br>3 |
| 2 | CO2: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3) | 3<br>3<br>3<br>3<br>3 |
| 3 | CO3: Apply | L3 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO3: Develop(L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>3<br>3 |
| 4 | CO4: Apply | L3 | PO1<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO3: Develop(L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3)<br>PO12: Thumb rule | 3<br>3<br>2<br>3<br>3 |
| 5 | CO5: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Identify (L3) | 2<br>2 |

**Justification Statements :**

**CO 1: Understand** the Process of assembling and disassembling of a computer system.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**PO2 Verb: Review(L2)**
CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)

**CO 2: Analyze** the Software Installation steps to trouble shoot the Hardware and software
**Action Verb: Analyze (L4)**
**PO1: Apply (L3)**
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
**PO2: identify(L3)**
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
**PO5: Apply (L3)**
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO 3: Apply** the basic formulas and functions, formatting text & objects on a required content
**Action Verb: Apply (L3)**
**PO1: Apply (L3)**
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2: Review(L2)**
CO3 Action verb is less than as PO2 verb. Therefore, the correlation is medium(2)
**PO3: Develop(L3)**
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is less than as PO4 verb. Therefore, the correlation is medium(2))
**PO5: Apply (L3)**
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO12: Thumb rule**
Documentation and presentation is learning process to find the solution better manner the correlation is high (3)

**CO 4: Apply** the designs and templates for creating effective presentations.

**Action Verb: Apply (L3)**
**PO1: Apply (L3)**
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2: idetify(L3)**
CO4 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO4 Action verb is less than PO4 verb. Therefore, the correlation is medium (2)
**PO5: Apply (L3)**
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO12: Thumb rule**
Spread sheets in Excel is the trending approach in the current days Therefore, the correlation is high (3)
**CO 5: Understand** the fundamentals of the Internet of Things (IoT) and its real-world applications

**Action Verb: Understand (L2)**
**PO1 Verb: Apply (L3)**
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
**PO2 Verb: Review(L2)**
CO5 Action verb is less than PO2 verb. Therefore, the correlation is medium (2)

| Course Code | Year & Sem | CHEMISTRY LAB | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ABS9909 | I-I | **(Common to I Sem – CSE, CIC, II Sem ECE/EEE)** | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Analyze** the hardness of ground water sample.
**CO2: Apply** the internal and external indicators in volumetric analysis.
**CO3: Analyze** the preparation and applications of advanced polymer materials.
**CO4: Apply** the electro analytical technique to measure the strength of acids.
**CO5: Analyze** the mixture of components by chromatographic techniques.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Analyze | The Hardness of ground water sample. | | | **L4** |
| **CO2** | Apply | The internal and external indicators | | In volumetric analysis | **L3** |
| **CO3** | Analyze | The preparation and applications advanced polymer materials | | | **L4** |
| **CO4** | Apply | The electro analytical technique | | to measure the strength of acids | **L3** |
| **CO5** | Analyze | The Mixture of components | By chromatographic techniques | | **L4** |

**List of Experiments:**

1. Determination of Hardness of a groundwater sample. (CO1)
2. Estimation of iron (II) using Diphenylamine indicator (Dichrometry – Internal indicator method) (CO2)
3. Determination of pH metric titration of strong acid vs. strong base (CO4)
4. Conductometric titration of strong acid vs. strong base (CO4)
5. Determination of Fe (II) in Mohr's salt by potentiometric method. (CO4)
6. Determination of percentage of Iron in Cement sample by colorimetry
7. Determination of Strength of an acid in Pb-Acid battery (CO2)
8. Preparation of phenol-formaldehyde resin (CO3)
9. Preparation of $TIO_2$/ZnO nano particles (Precipitation Method) (CO3)
10. Estimation of Calcium in port land Cement (CO2)
11. Adsorption of acetic acid by charcoal (CO2)
12. Thin layer chromatography (CO5)

**Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO Experiments may be conducted in virtual mode.**

**Reference:**

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publicationsby J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

**Mapping of COs to POs and PSOs**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 3 | | | | | | | | | | |
| CO2 | | | | 3 | | | | | | | | | | |
| CO3 | | | | 3 | | | | | | | | | | |
| CO4 | | | | 3 | | | | | | | | | | |
| CO5 | | | | 3 | | | | | | | | | | |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**CO-PO mapping justification:**

| CO | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| | Verb | BTL | | | |
| 1 | Analyze | L4 | PO4 | PO4: Analyze (L4) | 3 |
| 2 | Apply | L3 | PO4 | PO4: Analyze (L3) | 2 |
| 3 | Analyze | L4 | PO4 | PO4: Analyze (L4) | 3 |
| 4 | Apply | L3 | PO4 | PO4: Analyze (L3) | 2 |
| 5 | Analyze | L4 | PO4 | PO4: Analyze (L4) | 3 |

**CO1:** Analyze the hardness of ground water sample.

**Action Verb:** Analyze **(L4)**

PO4 Verb: Analyze (L4)

CO1 Action Verb is equal to PO4 verb; Therefore correlation is high (3).

**CO2:** Apply the internal and external indicators in volumetric analysis.

**Action Verb:** Apply **(L3)**

PO4 Verb: Analyze (L3)

CO2 Action Verb is less than PO4 verb; therefore, correlation is less (2)

**CO3:** Analyze the preparation and applications of advanced polymer materials.

**Action Verb:** Analyze **(L4)**

PO4 Verb: Analyze (L4)

CO3 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO4:** Apply electro analytical technique to measure the strength of acids.

**Action Verb:** Apply **(L3)**

PO4 Verb: Analyze (L4)

CO4 Action Verb is less than PO4 verb; therefore, correlation is less (2)

**CO5:** Analyze mixture of components by chromatographic techniques.

**Action Verb:** Analyze **(L4)**

 PO4 Verb: Analyze (L4)

CO5 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

| Course Code | Year & Sem | **Problem Solving And Programming Lab** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|---|
| 20AES0503 | I-I | | **0** | **0** | **3** | **1.5** |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Analyze** the basics of computer and concepts of C for writing simple programs.

**CO 2: Analyze** the control statements for solving the problems using C

**CO 3: Design** the algorithm for implementing complex problems using C.

**CO 4: Analyze** the arrays to store and retrieve the elements.

**CO 5: Apply** the different sorting techniques for solving real world problems.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Analyze** | the basics of computer and concepts of C | | for writing simple programs | L4 |
| **CO2** | **Analyze** | the control statements | using C | for solving the problems | L4 |
| **CO3** | **Design** | the algorithm | using C | for implementing complex problems | L6 |
| **CO4** | **Analyze** | the arrays | | to store and retrieve the elements. | L4 |
| **CO5** | **Apply** | the different sorting techniques | | for solving real world problems | L3 |

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**List of Experiments**

1. Assemble and disassemble parts of a Computer **(CO1)**
2. Design a C program which reverses the number**(CO1)**
3. Design a C program which finds the second maximum number among the given list of numbers. **(CO2)**
4. Construct a program which finds the kth smallest number among the given list of numbers. **(CO2)**
5. Design an algorithm and implement using C language the following exchanges a ← b ← c ← d ← a**(CO2)**
6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them. **(CO2)**
7. Implement the C program which computes the sum of the first n terms of the series Sum = 1 – 3 + 5 -7 + 9**(CO2)**
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565. **(CO2)**
9. Design an algorithm and implement using a C program which finds the sum of the infinite series $1 - x2/2! + x4/4! - x6/6! + ....$ **(CO3)**
10. Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1. **(CO3)**
11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa. **(CO3)**
12. Develop an algorithm which computes the all the factors between 1and100 for a given number and implement it using C. **(CO3)**
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n. **(CO3)**
14. Design a C program which reverses the elements of the array. **(CO4)**
15. Given a list of n numbers, Design an algorithm which prints the number of stars equivalent to the value of the number. The starts for each number should be printed horizontally. **(CO4)**
16. Implement the sorting algorithms a. Insertion sort b. Exchange sort c. Selection sort d. Partitioning sort. **(CO5)**
17. Illustrate the use of auto, static, register and external variables. **(CO5)**
18. Design algorithm and implement the operations creation, insertion, deletion, traversing on a singly linked list. **(CO5)**
19. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers. **(CO5)**
20. Design a C program which sorts the strings using array of pointers. **(CO5)**

Instructors may add some experiments to the above list. Moreover, 50% of the experiments are to be changed every academic year. Instructors can choose the experiments, provided those experiments are not repetitions.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | | | | | | | | | | | 2 | |
| CO2 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 2 | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|
| 1 | CO1: Analyze | L4 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 3<br>3 |
| 2 | CO2: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3) | 3<br>3<br>3<br>3<br>3 |
| 3 | CO3: Design | L6 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Formulate (L6)<br>PO3: Design(L6)<br>PO4: Analyze (L4)<br>PO5: Create (L6)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| 4 | CO4: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| 5 | CO5: Apply | L3 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3) | 3<br>3<br>3<br>2<br>3 |

**Justification Statements :**

**CO1: Analyze** the basic concepts of C for writing simple programs.

**Action Verb: Analyze (L4)**
**PO1 Verb: Apply (L3)**
CO1 Action verb is Greater than PO1 verb. Therefore, the correlation is high(3)
**PO2 Verb: Review(L2)**
CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

**CO2: Analyze** the control statements for solving the problems.
**Action Verb: Analyze (L4)**
**PO1: Apply (L3)**
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
**PO2: idetify(L3)**

CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
**PO5: Apply (L3)**
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO3: Design** the algorithm for implementing complex problems using C.
**Action Verb: Design (L6)**
**PO1: Apply (L3)**
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
**PO2: Formulate(L6)**
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
**PO3: Design (L6)**
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
**PO5: create (L6)**
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO12: Thumb rule**
Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

**CO4: Analyze** the arrays to store and retrieve the elements.

**Action Verb: Analyze (L4)**
**PO1: Apply (L3)**
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
**PO2: idetify(L3)**
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO4 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
**PO5: Apply (L3)**
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**PO12: Thumb rule**
Data analysis is the trending approach in the current days Therefore, the correlation is high (3)

**CO5: Apply** the different sorting techniques for solving real world problems.

**Action Verb: Apply (L3)**
**PO1: Apply (L3)**
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2: idetify(L3)**
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
**PO5: Apply (L3)**
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.

## (AUTONOMOUS)

## B.Tech

## (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

### (Effective for the batches admitted in 2020-2021)

### Semester II (First year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | BS | 20ABS9902 | Applied Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | BS | 20ABS9911 | Probability and Statistics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | HS | 20AHS9901 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | ES | 20AES0502 | Data Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | ES | 20AES0507 | Web Design | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 6 | HS LAB | 20AHS9902 | Communicative English Lab | 0 | 0 | 2 | 1.5 | 30 | 70 | 100 |
| 7 | BS LAB | 20ABS9907 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | ES LAB | 20AES0504 | Data Structures Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 9 | MC | 20AMC9903 | Environmental Studies | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| | | | **Total credits** | | | | **19.5** | **270** | **560** | **830** |

| Course Code | Year & Sem | APPLIED PHYSICS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ABS9902 | I-II | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the properties of light and electromagnetic waves.

**CO 2: Analyze** the fundamentals of Lasers and optical fibers.

**CO 3: Analyze** the properties of dielectric and magnetic materials.

**CO 4: Analyze** the charge carrier dynamics in semiconductors by implementing the equations of state.

**CO 5: Apply** the basic concepts of superconductors and nanomaterials for engineering problems.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **1** | **Understand** | The properties of light and electromagnetic waves. | | | L2 |
| **2** | **Analyze** | The fundamentals of Lasers and optical fibers. | | | L4 |
| **3** | **Analyze** | The properties of dielectric and magnetic materials. | | | L4 |
| **4** | **Analyze** | The charge carrier dynamics in semiconductors. | By implementing the equations of state. | | L4 |
| **5** | **Apply** | The basic concepts of superconductors and nanomaterials | | for engineering problems. | L3 |

**Unit I: Optics and EM Theory**                                                  **10 Hrs**

Interference of light -principle of superposition-Conditions for sustained
Interference-Interference in thin films (reflected light) - Newton's Rings -Determination of Wavelength.
Diffraction-Fraunhofer diffraction- Single slit and double slit- Diffraction Grating.
Divergence and Curl of Electric and Magnetic Fields - Gauss' theorem for divergence and Stokes'
theorem for curl - Maxwell's Equations (Quantitative) – Electromagnetic wave -
propagation in non-conducting medium - Poynting's Theorem.

**Unit II : Lasers and Fiber Optics**                                            **10 Hrs**

Lasers – Introduction – Characteristics – Spontaneous and Stimulated Emission – Einstein
Coefficients – Population Inversion – Excitation Mechanism and Optical Resonator - He-Ne Laser -
Nd:YAG Laser – Semiconductor Diode Laser – Applications of Lasers.

Introduction to Optical Fibers – Total Internal Reflection – Critical angle of propagation –Acceptance
angle – Numerical Aperture – Classification of fibers based on Refractive index profile – Propagation of
electromagnetic wave through optical fiber – modes – importance of V-number-Attenuation, Block
Diagram of Fiber optic Communication – Industrial Applications –Fiber optic Sensors.

**Unit III : Dielectric and Magnetic Materials**                                  **8 Hrs**

Introduction—Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant-
Types of polarizations : Electronic and Ionic,(Quantitative), Orientation Polarizations (Qualitative)
          - Frequency dependence of polarization-Lorentz (internal) field-Claussius-Mosotti equation-
Applications of Dielectrics: Ferroelectricity.
Introduction-Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability-Origin
of permanent magnetic moment – Classification of Magnetic materials - Weiss theory of
ferromagnetism (qualitative) – Hysteresis– soft and hard magnetic materials – Magnetic memory device
applications.

## Unit IV: Semiconductors                                           8 Hrs

Origin of Energy bands (Qualitative)-Intrinsic and Extrinsic semiconductors –Direct and indirect band gap semiconductors- Density of charge carriers – Fermi energy–-Dependence of Fermi energy on carrier concentration and temperature – Electrical conductivity – Drift and Diffusion currents – Continuity equation - Hall effect -Applications of Hall effect and Semiconductors.

## Unit V: Superconductors and Nanomaterials

Superconductors-Properties-Meissner'seffect-BCSTheory(Qualitative) - Josephson effect (AC&DC)-Types of Superconductors-Applications of superconductors.
Nanomaterials–Significance of nanoscale–: Physical, Mechanical, Magnetic, Optical properties of nanomaterials –Synthesis of nanomaterials:Top-down-Ball Milling, Bottom-up-Chemical vapour deposition–Characterization of nanomaterials : X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM)-Applications of Nanomaterials.

**Textbooks:**
1. M. N. Avadhanulu, P. G. Kshirsagar &TVS Arun Murthy" A Text book of Engineering Physics"-S. Chand Publications,11th Edition2019.
2. B.K.Pandey and S.Chaturvedi, Engineering Physics, Cengage Learning,2012.

**References:**

1. K Thyagarajan "Engineering Physics",-Mc Graw Hill Publishing Company Ltd, 2016
2. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education,2018
3. David J.Griffiths,"Introduction to Electrodynamics"-4/e, Pearson Education, 2014
4. T Pradeep, "A Text book of NanoScience and NanoTechnology"-Tata Mc Graw Hill 2013.

**Mapping of COs to POs and PSOs**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | | | | | | | | | | | | | |
| CO2 | 3 | | | 3 | | | | | | | | | | |
| CO3 | 3 | | | 3 | | | | | | | | | | |
| CO4 | 3 | | | 3 | | | | | | | | | | |
| CO5 | 3 | | | | | | | | | | | | | |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**Correlation matrix**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|----|------------------------|------|-------------|------------|-----|----------------------|---------------------------------------------|----------------------------|
| | Lesson Plan (Hrs) | % | correlation | Verb | BTL | | | |
| 1 | 16 | 23.8 | 3 | Understand | L2 | PO1 | PO1: Apply (L3) | 2 |
| 2 | 11 | 16.4 | 2 | Analyze | L4 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 3 3 |
| 3 | 12 | 17.9 | 2 | Analyze | L4 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 3 3 |
| 4 | 13 | 19.4 | 2 | Analyze | L4 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 3 3 |
| 5 | 15 | 22.3 | 3 | Apply | L3 | PO1, PO4 | PO1: Apply (L3) | 3 |
| | 67 | | | | | | | |

**Justification Statements :**

**CO1: 1.Understand the properties of light and electromagnetic waves.**
**Action Verb: Understand (L2)**
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
**CO2: Analyze the fundamentals of Lasers and optical fibers.**
**Action Verb: Analyze (L4)**
PO1 Verbs: Apply (L3);
PO4 Verbs: Analyze (L4);
CO2 Action Verb is greater than PO1 verb; Therefore, correlation is high (3).
CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
**CO3: Analyze the properties of dielectric and magnetic materials.**
**Action Verb: Analyze (L4)**
PO1 Verbs: Apply (L3);
PO4 Verbs: Analyze (L4);
CO3 Action Verb is greater than PO1 verb; Therefore, correlation is high (3).
CO3 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
**CO4: Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.**
**Action Verb: Analyze (L4)**
PO1 Verbs: Apply (L3); PO4 Verbs: Analyze (L4);
CO4 Action Verb is greater than PO1 verb; Therefore, correlation is high (3).
CO4 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
**CO5: 5.Apply the basic concepts of superconductors and nanomaterials for engineering problems.**
**Action Verb: Apply (L3)**
PO1 Verb: Apply (L3)
CO5 Action verb is equal to PO1 verb; therefore, the correlation is high (3).

| Course Code | Year & Sem | Probability and Statistics | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ABS9911 | I-II | | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1**:Understand the discrete and continuous data through various statistical methods.

**CO2**:Analyze the concepts of probability, Baye's theorem and its applications.

**CO3**:Analyze the discrete and continuous probability distributions for random data.

**CO4:**Apply the techniques for testing of hypothesis for large samples.

**CO5**:Apply the techniques for testing of hypothesis for small samples.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the discrete and continuous data | through statistical methods. | | **L2** |
| **CO2** | Analyze | The concepts of probability and its applications | | | **L4** |
| **CO3** | Analyze | The discrete and continuous probability distributions | for random data. | | **L4** |
| **CO4** | Apply | The techniques for testing of hypothesis | For large samples | | **L3** |
| **CO5** | Apply | The techniques for testing of hypothesis | For small samples | | **L3** |

| UNIT – I | Descriptive statistics and methods for data science | 9 Hrs |
|---|---|---|

Data science, Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Type of variable: dependent and independent Categorical and Continuous variables, Data visualization, Measures of Central tendency, Measures of Variability (spread or variance) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, principle of least squares, method of least squares, regression lines

| UNIT – II | Probability | 9 Hrs |
|---|---|---|

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

| UNIT – III | Probability distributions | 9 Hrs |
|---|---|---|

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties.

| UNIT – IV | Estimation and Testing of hypothesis, large sample tests | 9 Hrs |
|---|---|---|

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems.

| UNIT – V | Small sample tests | 9 Hrs |
|---|---|---|

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $x2$ - test for goodness of fit.

**Textbooks:**

1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

**Reference Books:**

1. S.Chand ,Probability and Statistics, Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 |     | 1   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO2 |     | 3   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO3 |     | 3   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO4 | 3   |     |     |     |     |     |     |     |     |      |      |      |      |      |
| CO5 | 3   |     |     |     |     |     |     |     |     |      |      |      |      |      |

**Correlation matrix**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|----|-------------------|-------|-------------|------------|-----|------|------|------|
|    | Lesson Plan (Hrs) | %     | correlation | Verb       | BTL |      |      |      |
| 1  | 11                | 15.06 | 2           | Understand | L2  | PO2  | Analyze (L4) | 1 |
| 2  | 15                | 20.52 | 3           | Analyze    | L4  | PO2  | Analyze (L4) | 3 |
| 3  | 16                | 21.9  | 3           | Analyze    | L4  | PO2  | Analyze (L4) | 3 |
| 4  | 16                | 21.9  | 3           | Apply      | L3  | PO1  | Apply (L3) | 3 |
| 5  | 14                | 20    | 3           | Apply      | L3  | PO1  | Apply (L3) | 3 |

**Justification Statements :**
**CO1:** Understand the discrete and continuous data through various statistical methods.
**Action Verb: Understand (L2)**
PO2 Verbs: Analyze(L4)

CO1 Action Verb is low level to PO2 verb by two levels; Therefore correlation is low (1).
**CO2:** Analyze the concepts of probability, Baye's theorem and its applications.
**Action Verb: analyze (L4)**

PO2 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
**CO3:** Analyze the discrete and continuous probability distributions for random data.
**Action Verb: Analyze (L4)**

PO2 Verb: Analyze (L4)

CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
**CO4:** Apply the techniques for testing of hypothesis for large samples.
**Action Verb: Apply (L3)**

PO1 Verb: Apply(L3)

CO4 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
**CO5:** Apply the techniques for testing of hypothesis for small samples.
**Action Verb: Apply**
PO1 Verb: Apply (L3)
CO5 Action verb is equal to PO1 verb ; therefore the correlation is high (3).

| Course Code | Year & Sem | COMMUNICATIVE ENGLISH | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AHS9901 | I-II | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1.** Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (Listening and Writing)

**CO2:** Apply grammatical structures to formulate sentences and correct word forms (Grammar )

**CO3:** Analyze discourse markers to speak clearly on a specific topic in informal discussions (Speaking)

**CO4:** Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.(Reading and Writing)

**CO5:** Create a coherent paragraph interpreting a figure/graph/chart/table (Writing)

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | Understand | the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English. | | | L2 |
| 2 | Apply | grammatical structures to formulate sentences and correct word forms. | | | L3 |
| 3 | Analyze | discourse markers to speak clearly on a specific topic in informal discussions. | | | L4 |
| 4 | Evaluate | reading/listening texts and to write summaries based on global comprehension of these texts. | | | L5 |
| 5 | Create | a coherent paragraph interpreting a figure/graph/chart/table. | | | L6 |

| UNIT – I | | 10 Hours (4L+6P) |
|---|---|---|

**Lesson: On the Conduct of Life: William Hazlitt**

**Listening**: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

**Speaking**: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

**Reading**: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

**Writing** : Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

**Grammar and Vocabulary- I** : Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form – wh questions; word order in sentences.

| UNIT – II | Probability | 10 Hours (4L+6P) |
|---|---|---|

**Lesson: The Brook: Alfred Tennyson**

**Listening**: Answering a series of questions about main idea and supporting ideas after listening to audio texts.

**Speaking**: Discussion in pairs/small groups on specific topics followed by short structured talks.

**Reading**: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Writing**: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

**Grammar & Vocabulary building-1**: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

**Vocabulary building:2** Idioms and Phrases, Homonyms, Homophones and Homographs.

| UNIT – III | | 10 Hours (4L+6P) |
|---|---|---|

**Lesson: The Death Trap: Saki**

**Listening**: Listening for global comprehension and summarizing what is listened to.

**Speaking**: Discussing specific topics in pairs or small groups and reporting what is discussed

**Reading**: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

**Writing**: Summarizing – identifying main idea/s and rephrasing what is read.

**Grammar and Vocabulary building-II**: Direct and indirect speech, reporting verbs for academic purposes.

**Technical Writing-1**: personal experiences, unforgettable incidents, travelogues. (Imaginative, Narrative and Descriptive).

| UNIT – IV | | 10 Hours (4L+6P) |
|---|---|---|

Lesson: **Innovation: Muhammad Yunus**

**Listening**: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

**Speaking**: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions

**Reading**: Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicate processes or display complicated data.

**Writing**: Letter Writing: Official Letters/Report writing, e-mail writing

**Grammar and Vocabulary**: Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice.

**Vocabulary:2** : Jigsaw Puzzles, Vocabulary Activities through Web tools

| UNIT – V | | 10 Hours (4L+6P) |
|---|---|---|

Lesson: **Politics and the English Language: George Orwell**

**Listening**: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

**Speaking**: Formal oral presentations on topics from academic contexts - without the use of PPT slides.

**Reading**: Reading for comprehension.

**Writing**: Writing structured essays on specific topics using suitable claims and evidences.

**Grammar and Vocabulary**: Editing short texts –identifying and correcting common errors in grammar and usage.

**Technical Writing-2**: Narrative short story, News paper articles on science fiction.

| **Textbooks:** |
|---|

1.Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

| **Reference Books:** |
|---|

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

| **Web Links** |
|---|

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html
www.myenglishpages.com

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 |     |     |     |     |     |     |     |     |     | 3    |      |      |      |      |
| CO2 |     |     |     |     |     |     |     |     | 2   | 3    |      |      |      |      |
| CO3 |     |     |     |     |     |     |     |     |     | 3    |      |      |      |      |
| CO4 |     |     |     |     |     |     |     |     |     | 3    |      |      |      |      |
| CO5 |     |     |     |     |     |     |     |     |     | 3    |      |      |      |      |

**Corelation Matrix**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| **1** | 10 | 20 | 2 | **Understand** | **L2** | PO10 | Communication | 2 |
| **2** | 10 | 20 | 2,2 | **Apply** | **L3** | PO9,PO10 | Individual and Team work, Communication | 2,2 |
| **3** | 10 | 20 | **3** | **Analyze** | **L4** | PO10 | Communication | 3 |
| **4** | 10 | 20 | **3** | **Evaluate** | **L5** | PO10 | Communication | 3 |
| **5** | 10 | 20 | **3** | **Create** | **L6** | PO10 | Communication | 3 |

**Justification Statements :**

**CO1: Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English**

**Action Verb: Understand (L2)**

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate(2).

**CO2:  Apply grammatical structures to formulate sentences and correct word forms.**
**Action Verb: Apply (L3)**

CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2)

**CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions**
**Action Verb: Analyze (L4)**

CO3 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).

**CO4: Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.**
**Action Verb: Evaluate (L5)**

CO4 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

**CO5: Create a coherent paragraph interpreting a figure/graph/chart/table**
**Action Verb: Create (L6)**

CO5 Action Verb Create is of BTL 6. Using Thumb rule, L6 correlates PO6 to PO12 as high (3).

| Course Code | Year & Sem | Data Structures | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0502 | I-II | **(common to CSE,CIC,CSE(DS))** | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the basic concepts of an Algorithm to measure its performance

**CO 2: Apply** the Linear Data Structure to arrange the data in memory

**CO 3: Apply** the Non-Linear Data Structure to organize the data in hierarchical structure

**CO 4: Evaluate** the real time problems using graphs and hashing techniques

**CO 5: Apply** the File handling and sorting methods to rearrange the data**.**

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | the basic concepts of an Algorithm | | to measure its performance | L2 |
| **CO2** | **Apply** | the Linear Data Structure | | to arrange the data in memory | L3 |
| **CO3** | **Apply** | the Non-Linear Data Structure | | to organize the data in hierarchical structure | L3 |
| **CO4** | **Evaluate** | the Real Time Problems | using Graphs and Hashing Techniques | | L5 |
| **CO5** | **Apply** | the File handling and sorting methods | | to rearrange the data | L3 |

| **UNIT – I** | | 9 Hrs |
|---|---|---|

**Introduction**

Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, how fast can we sort, Merge sort, Heap sort

| **UNIT – II** | | 9 Hrs |
|---|---|---|

**Stack, Queue and Linked lists**

Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

| **UNIT – III** | | 9 Hrs |
|---|---|---|

**Trees**

Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, Optimal Binary search Trees, AVL Trees. B-Trees: B- Trees, B + Trees.

| **UNIT – IV** | | 9 Hrs |
|---|---|---|

**Graphs and Hashing**

The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure

Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

| **UNIT – V** | | 9 Hrs |
|---|---|---|

**Files and Advanced sorting**

File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization.

Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

**Textbooks:**

1.Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Galgotia Book Source, Pvt. Ltd., 2004.

2.Alan L. Tharp, "File Organization and Processing", Wiley and Sons, 1988.

**Reference Books:**

1.D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.

2.Peter Bras, "Advanced Data Structures", Cambridge University Press, 2016

3.Richard F.Gilberg, Behrouz A.Forouzan, "Data Structures A Pseudo code Approach with C", Second Edition, Cengage Learning 2005.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | | 2 | |
| CO2 | 3 | 3 | | 3 | | | | | | | | 2 | 2 | 1 |
| CO3 | 3 | 3 | | 3 | | | | | | | | 2 | 2 | 1 |
| CO4 | 1 | 2 | 3 | 3 | | | 3 | | | | | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 2 | 2 |

**Correlation matrix**

| Unit No. | CO | | | | | | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|----------|-----------------|-----|-------------|------------------|------|----------------------|-----------------------------------------------|----------------------------|
| | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | | | |
| 1 | 18 | 24% | 3 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 2<br>3 |
| 2 | 14 | 19% | 2 | CO2: Apply | L3 | PO1<br>PO2<br>PO4<br>PO12 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO4: Develop (L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>2 |
| 3 | 15 | 20% | 2 | CO3: Apply | L3 | PO1<br>PO2<br>PO4<br>PO12 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO4: Develop (L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>2 |
| 4 | 13 | 18% | 2 | CO4: Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO7<br>PO12 | PO1: Apply(L3)<br>PO2: Formulate (L6)<br>PO3: Develop (L3)<br>PO4: Analyze(L4)<br>PO7: Thumb rule<br>PO12: Thumb rule | 1<br>2<br>3<br>3<br>3<br>3 |
| 5 | 14 | 19% | 2 | CO5: Apply | L3 | PO1<br>PO2<br>PO3<br>PO4<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop(L3)<br>PO4: Analyze(L4)<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>3 |
| | 74 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand the basic concepts of an Algorithm to measure its performance**
**Action Verb: Understand (L2)**

PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: Review (L2)
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**CO2: Apply the Linear Data Structure to arrange the data in memory**
**Action Verb: Apply (L3)**

PO1: Apply (L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L2)

CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)
PO4: Develop (L3)
CO2 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
For some of Linear Data Structure applications, array and structure concepts are used to write programs. Therefore, the correlation is medium (2)

### CO3: Apply the Non-Linear Data Structure to organize the data in hierarchical structure
### Action Verb: Apply (L3)

PO1: Apply (L3)
CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L2)
CO3 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO4: Develop (L3)
CO3 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
For some of Non-Linear Data Structure applications, array and structure concepts are used to write programs. Therefore, the correlation is medium (2)

### CO4: Evaluate the real time problems using graphs and hashing techniques
### Action Verb: Evaluate (L5)

PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)
PO2: Review (L2)
CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is greater than PO4 verb. Therefore, the correlation is high (3)
PO7: Thumb rule
For some of Real Time problems Data Structure applications, Graph concept is indirectly used to sustainable environment development. Therefore, the correlation is high (3)
PO12: Thumb rule
For some of Real Time problems Data Structure applications, Graph and Hash concepts are used to write programs and evaluation. Therefore, the correlation is high (3)

### CO5: Apply the File handling and sorting methods to rearrange the data.
### Action Verb: Apply (L3)

PO1: Apply(L3)
CO5 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO12: Thumb rule
For some of data manipulations Sorting and File Organization methods are used to solve storage problems. Therefore, the correlation is high (3)

| Course Code | Year & Sem | Web Design | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0507 | I-II | | 1 | 0 | 4 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** basic HTML tags to design web pages

**CO 2: Apply** Advanced features to your webpage including special effects

**CO 3: Apply** The CSS Knowledge to add colors and text formatting

**CO 4: Apply** Advanced CSS to style effective presentation of webpage

**CO 5: Create** HTML and CSS Programs to create registration form

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms Level |
|---|---|---|---|---|---|
| CO1 | **Understand** | basic HTML tags | | to design web pages | L2 |
| CO2 | **Apply** | Advanced features | | to your webpage including special effects | L3 |
| CO3 | **Apply** | The CSS Knowledge | | to add colours and text formatting | L3 |
| CO4 | **Apply** | Advanced CSS style | | to style effective presentation of webpage | L3 |
| CO5 | **Create** | HTML and CSS Programs | | to create Registration form | L6 |

| **UNIT – I** | | 9 Hrs |
|---|---|---|

**Where Do I Start**-What Does a Web Designer Do, What Languages Do I Need to Learn, What Do I Need to Buy, How the Web Works-The Internet Versus the Web, Serving Up Your Information, A Word About Browsers, Web Page Addresses (URLs), The Anatomy of a Web Page, Some Big Concepts You Need to Know-A Dizzying Multitude of Devices, Sticking with the Standards, Progressive Enhancement, Responsive Web Design, One Web for All (Accessibility), The Need for Speed (Site Performance)

**HTML Markup for Structure:** Creating a Simple Page-A Web Page, Launch a Text Editor, Step 1: Start with Content, Step 2: Give the Document Structure, Step 3: Identify Text Elements, Step 4: Add an Image, Step 5: Change the Look with a Style Sheet, When Good Pages Go Bad, Validating Your Documents. Marking Up Text-Paragraphs, Headings, Lists, More Content Elements, Organizing Page Content, The Inline Element Roundup, Generic Elements (div and span), Some Special Characters

| **UNIT – II** | | 9 Hrs |
|---|---|---|

**HTML Markup for Structure:** Adding Links-The href Attribute, Linking to Pages on the Web, Linking Within Your Own Site, Targeting a New Browser Window, Mail Links, Telephone Links. Adding Images-First, a Word on Image Formats, The img Element, A Window in a Window. Table Markup-How Tables Are Used, Minimal Table Structure, Spanning Cells, Table Accessibility, Wrapping Up Tables

**HTML Markup for Structure:** Forms-How Forms Work, The form Element, Variables and Content, The Great Form Control Roundup, Form Accessibility Features, Form Layout and Design. What's Up, HTML5-A Funny Thing Happened on the Way to XHTML 2, In the Markup Department, Meet the APIs, Video and Audio, Canvas

| **UNIT – III** | | 9 Hrs |
|---|---|---|

**CSS for Presentation:** Cascading Style Sheets Orientation-The Benefits of CSS, How Style Sheets Work, The Big Concepts, Moving Forward with CSS. Formatting Text-The Font Properties, Changing Text Color, A Few More Selector Types, Text Line Adjustments, Underlines and Other "Decorations", Changing Capitalization, Spaced Out, Text Shadow, Changing List Bullets and Numbers. Colors and Backgrounds-Specifying Color Values, Foreground Color, Background Color, Playing with Opacity, Introducing...Pseudo-class Selectors, Pseudo-element Selectors, Attribute Selectors, Background Images, The Shorthand background Property, Like a Rainbow (Gradients), External Style Sheets. Thinking Inside

the Box-The Element Box, Specifying Box Dimensions, Padding, Borders, Margins, Assigning Display Roles, Adding Drop Shadows to Boxes

| **UNIT – IV** | | 9 Hrs |
|---|---|---|

**CSS for Presentation:** Floating and Positioning- Normal Flow, Floating, Positioning Basics, Relative Positioning, Absolute, Positioning, Fixed Positioning. Page Layout with CSS- Page Layout Strategies, page Layout Techniques, Multicolumn Layouts Using Floats, Positioned Layout, Top-to-Bottom Column Backgrounds. Transitions, Transforms, and Animation- Ease-y Does It (CSS Transitions), CSS Transforms, Keyframe Animation. **CSS Techniques**- A Clean Slate (CSS Reset), Image Replacement Techniques, CSS Sprites, Styling Forms, Styling Tables, Basic Responsive Web Design, Wrapping Up Style Sheets.

| **UNIT – V** | | 9 Hrs |
|---|---|---|

1. Design a page having suitable background colour and text colour with title "My First Web Page" using all the attributes of the Font tag.
2. Create a HTML document giving details of your [Name, Age], [Address, Phone] and [Register Number, Class] aligned in proper order using alignment attributes of Paragraph tag.
3. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style.
4. Create a page to show different character formatting (B, I, U, SUB, SUP) tags.
   i. *viz :*    $log_b m^p = p \, log_b m$
5. Write HTML code to create a Web Page that contains an Image at its centre.
6. Create a web page with an appropriate image towards the left hand side of the page, when user clicks on the image another web page should open.
7. Create web Pages using Anchor tag with its attributes for external links.
8. Create a web page for internal links; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.
9. Write a HTML code to create a web page with pink colour background and display moving message in red colour.
10. Create a web page, showing an ordered list of all second semester courses (Subjects).
11. Create a web page, showing an unordered list of names of all the Diploma Programmes (Branches) in your institution.
12. Create a HTML document containing a nested list showing a content page of any book.
13. Create the following table in HTML

| Student | Maths | Physics | Chemistry | Computer |
|---|---|---|---|---|
| I-R2C1 | I-R1C1 | I-R4C1 | I-C2 | |
| | II-C1 | | II-C1 | |
| III-R2C2 | | | III-C1 | II-R1C5 |
| | | | IV-C1 | |

14. Create a web page which divides the page in two equal frames and place the audio and video clips in frame-1 and frame-2 respectively.

| i. FRAME-1 | ii. FRAME-2 |
|---|---|

15. Create a web page which should generate following output:

| i. FRAME-1 | ii. FRAME-2 |
|---|---|
| | iii. FRAME-3 |

16. Create a table to show your class time table.
17. Use tables to provide layout to your HTML page describing your college infrastructure.
18. Use <span> and <div> tags to provide a layout to the above page instead of a table layout.
19. Use frames such that page is divided into 3 frames 20% on left to show contents of pages, 60% in center to show body of page, remaining on right to show remarks.

20. Embed Audio and Video into your HTML web page.
21. Create a webpage with HTML describing your department use paragraph and list tags.
22. Apply various colors to suitably distinguish key words , also apply font styling like italics, underline and two other fonts to words you find appropriate , also use header tags.
23. Create links on the words e.g. —Wi-Fi and —LAN‖ to link them to Wikipedia pages.
24. Insert an image and create a link such that clicking on image takes user to other page.
25. Change the background color of the page; At the bottom create a link to take user to the top of the page.
26. Develop static pages (using only HTML) of an online book store, the pages should resemble: www.amazon.com, the website should consist the following pages, home page, registration and user login, user profile page, books catalog, shopping cart, payment by credit card, order confirmation.
27. Create a web page using Embedded CSS and multimedia
28. Write an HTML page that contains a selection box with a list of 5 countries, when the user selects a country, its capital should be printed next to the list; Add CSS to customize the properties of the font of the capital (color, bold and font size).
29. Wap in html to design a Bio-Data.
30. Wap in html to create a webpage with four frames (Picture, table, list, and hyperlink).
31. Wap in html to show all character elements in html.
32. Wap in html to create a webpage to show the block level elements and text level elements.
33. Wap in html to create a webpage to show various confectionary items using ordered list and unordered list.
34. Wap in html to create a webpage to show different hobbies.
35. Wap in html to show India map.
36. Wap in html to create a web page using style sheet.
37. Wap in html to create a web page to show registration
38. Wap in html to show books in inventory in different tables by using rowspan and colspan.
39. Create a Web Page in HTML to show Admission form in OITM
40. A Web Page in HTML to show your resume using Appropriate Formatting Elements.
41. A Web Page in HTML to show all the Text, Color, Background and Font Elements
42. Write a Program to Create a Nested List.

| Textbooks: |
| --- |
| 1.  Jennifer Niederst Robbins, "Learning Web Design", OREILLY 4th Edition |

| Reference Books: |
| --- |
| 1.  Uttam K Roy, —Web Technologies‖, Oxford University Press, 1st Edition, 2010. |
| 2.  HTML and CSS: Design and Build Websites 1st Edition by Jon Duckett  (Author) india price |
| 3.  Steven Holzner, —The Complete Reference PHP‖, Tata McGraw-Hill, 1st Edition, 2007. |
| 4.  HTML & CSS: The Complete Reference, Fifth Edition (Complete Reference Series) |
| 5.  Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program‖, Prentice Hall, 5 th Edition, 2011. |

| Online Learning Resources: |
| --- |
| 1.  http://www.scoopworld.in |
| 2.  http://www.sxecw.edu.in |
| 3.  http://www.technofest2u.blogspot.com |
| 4.  http://www.ptutorial.com/php-example/php-upload-image |
| 5.  http://www.ptutorial.com/php-example/php-change-case |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | 2 | | 2 | | | | | | 3 | | | | 2 | 2 |
| CO2 | 3 | | 2 | | | | | | 3 | | | | 2 | 2 |
| CO3 | 3 | | 2 | | | | | | 3 | 3 | 3 | | 2 | 2 |
| CO4 | 3 | | 2 | | | | | | 3 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 3 | | 3 | 3 | | | | | 3 | 3 | 3 | 3 | 2 | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | **CO1: Understand** | L2 | PO1<br>PO3<br>PO9 | PO1: Apply(L3)<br>PO3: Design(L6)<br>PO9: Thumb Rule | 2<br>2<br>3 |
| 2 | **CO2: Apply** | L3 | PO1<br>PO3<br>PO9 | PO1: Apply(L3)<br>PO3: Design(L6)<br>PO9: Thumb Rule | 3<br>2<br>3 |
| 3 | **CO3: Apply** | L3 | PO1<br>PO3<br>PO9<br>PO10<br>PO11 | PO1: Apply(L3)<br>PO3: Design(L6)<br>PO9: Thumb Rule<br>PO10: Thumb Rule<br>PO11: Thumb Rule | 3<br>2<br>3<br>3<br>3 |
| 4 | **CO4: Apply** | L3 | PO1<br>PO3<br>PO9<br>PO10<br>PO11<br>PO12 | PO1: Apply(L3)<br>PO3: Design(L6)<br>PO9: Thumb Rule<br>PO10: Thumb Rule<br>PO11: Thumb Rule<br>PO12: Thumb Rule | 3<br>2<br>3<br>3<br>3<br>3 |
| 5 | **CO5: Create** | L6 | PO1<br>PO3<br>PO4<br>PO9<br>PO10<br>PO11<br>PO12 | PO1: Apply(L3)<br>PO3: Design(L6)<br>PO4: Design(L6)<br>PO9: Thumb Rule<br>PO10: Thumb Rule<br>PO11: Thumb Rule<br>PO12: Thumb Rule | 3<br>3<br>3<br>3<br>3<br>3<br>3 |

**Justification Statements:**

**CO1: Understand** basic HTML tags to design web pages
**Action Verb: Understand (L2)**
**PO1 Verb: Apply (L3)**
CO1 Action verb is lesser than as PO1 verb. Therefore, the correlation is medium (2)
**PO3: Design(L6)**
CO1 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
**PO9: Thumb Rule**
CO1 Using Basic HTML tags, mages and colors, therefore the correlation is high (3)

**CO2: Apply** Advanced features to your webpage including special effects
**Action Verb: Apply (L3)**
**PO1: Apply (L3)**
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
**PO3: Design(L6)**
CO2 Action verb is lesser than as PO3 verb. Therefore, the correlation is high (2)
**PO9: Thumb rule**
CO2   Using HTML elements like links, adding audio & video to the web page, therefore the correlation is high (3)

**CO3: Apply** The CSS Knowledge to add colours and text formatting
**Action Verb: Apply(L3)**
**PO1: Apply (L3)**
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO3: Design(L6)**

CO3 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
**PO9: Thumb rule**
CO3 Styling and decorating with box dimensions, padding. Websites plays very crucial role in present days, therefore the correlation is high (3)
**PO10: Thumb rule**
CO3 Web pages are used to create blogs to share effective content, therefore the correlation is high (3)
**PO11: Thumb rule**
CO3 Web pages and CSS knowledge is to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)


### CO4: Apply Advanced CSS to style effective presentation of webpage

**Action Verb: Apply(L3)**
**PO1: Apply (L3)**
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO3: Design(L6)**
CO4 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
**PO9: Thumb rule**
CO4 Using advanced CSS style presentations, therefore the correlation is high (3)
**PO10: Thumb rule**
CO4 Using advanced CSS techniques, therefore the correlation is high (3)
**PO11: Thumb rule**
CO4 Advanced CSS style presentation and techniques to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)
**PO12: Thumb rule**
CO4 Using page layout strategies & techniques, CSS Image Replacement Techniques, Styling Tables for life long learning in the broadest context of technological change, therefore the correlation is (3)

### CO5: Create HTML and CSS Programs to create registration form, to show India map
**Action Verb: Create(L6)**
**PO1: Apply (L3)**
CO5 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
**PO3: Design(L6)**
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
**PO4: Design(L6)**
CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
**PO9: Thumb rule**
CO5 Creating HTML and CSS programs, therefore the correlation is high (3)
**PO10: Thumb rule**
CO5 Creating HTML and CSS programs, therefore the correlation is high (3)
**PO11: Thumb rule**
CO5 Using HTML and CSS programs to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)
**PO12: Thumb rule**
CO5 Using HTML and CSS programs, Styling Tables for lifelong learning in the broadest context of technological change, therefore the correlation is (3)

| Course Code | Year & Sem | COMMUNICATIVE ENGLISH  LAB | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AHS9902 | I-II | | 0 | 0 | 2 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1:** Evaluate awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

**CO2:** Understanding the different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions.

**CO3:** Apply knowledge of vocabulary and skills in various language learning activities.

**CO4:** Analyze speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

**CO5:** Evaluate the acceptable etiquette essentials in social and professional presentations.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | **Evaluate** | awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English. | | | **L5** |
| 2 | **Understand** | The different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions. | | | **L2** |
| 3 | **Apply** | knowledge of vocabulary and skills in various language learning activities | | | **L3** |
| 4 | **Analyze** | speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. | | | **L4** |
| 5 | **Evaluate** | the acceptable etiquette essentials in social and professional presentations. | | | **L5** |

| **UNIT – I** | | | |
|---|---|---|---|
| 1. Phonetics 2. Non - verbal communication 3. Vocabulary (word formation, one word substitutes, words often misused & confused, collocations idioms & phrases) | | | |
| **UNIT – II** | | | |
| 1. Reading Comprehension 2. JAM 3. Distinction between Native and Indian English accent (Speeches by TED and Kalam). | | | |
| **UNIT – III** | | | |
| 1. Situational dialogues/Giving Directions 2. Describing objects/places/persons | | | |
| **UNIT – IV** | | | |
| 1.  Fun – Buzz (Tongue twisters, riddles, puzzles etc) 2   Formal Presentations | | | |
| **UNIT – V** | | | |
| 1. Debate (Contemporary / Complex topics) 2. Group Discussion | | | |
| **Software Source** | | | |
| K-Van Solutions Software | | | |
| **Reference Books:** | | | |
| Teaching English - British Council | | | |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | | | 3 | | | | |
| CO2 | | | | | | | | | 2 | | | | | |
| CO3 | | | | | | | | | | 2 | | | | |
| CO4 | | | | | | | | | | 3 | | | | |
| CO5 | | | | | | | | | | 3 | | | | |

**Corelation Matrix**

| CO | Percentage of contact hours over the total planned contact hours (Approx. Hrs) | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|----|-----|-----|------|-----------|-----|------|------------|-----|
| | | % | corr | Verb | BTL | | | |
| 1 | 9 | 25 | 3 | **Evaluate** | **L5** | PO10 | Communicate | 3 |
| 2 | 6 | 16 | 2 | **Understand** | **L2** | PO9 | Function | 2 |
| 3 | 6 | 16 | **2** | **Apply** | **L3** | PO10 | Communicate | 2 |
| 4 | 6 | 16 | **3** | **Analyze** | **L4** | PO10 | Communicate | 3 |
| 5 | 9 | 25 | **3** | **Evaluate** | **L5** | PO10 | Communicate | 3 |

**Justification Statements:**

**CO1: Evaluate awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.**
**Action Verb: Evaluate (L5)**
CO1 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

**CO2: Understanding the different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions**
**Action Verb: Understand(L2)**
CO2 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2)

**CO3: Apply knowledge of vocabulary and skills in various language learning activities**
**Action Verb: Apply (L3)**
CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

**CO4: Analyze speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension**
**Action Verb: Analyze (L4)**
CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).

**CO5: : Evaluate the acceptable etiquette essentials in social and professional presentations.**
**Action Verb: Evaluate (L5)**
CO5 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

| Course Code | Year & Sem | Applied Physics Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ABS9907 | I-II | | 0 | 0 | 3 | 1.5 |

## Course Outcomes:

After studying the course, student will be able to

**CO1:** Analyze the properties of light for solving engineering problems.
**CO2:** Understand the basic concepts of electromagnetic induction.
**CO3:** Evaluate the crystallite size using X-ray diffraction.
**CO4:** Analyze the basic properties of dielectric and magnetic behavior of the given material.
**CO5:** Evaluate the basic parameters of a given semiconductor material.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **1** | **Analyze** | **The properties of light for solving engineering problems.** | | | **L4** |
| **2** | **Understand** | **The basic concepts of electromagnetic induction.** | | | **L2** |
| **3** | **Evaluate** | **The crystallite size** | **using X-ray diffraction.** | | **L5** |
| **4** | **Analyze** | **The basic properties of dielectric and magnetic behavior of the given material.** | | | **L4** |
| **5** | **Evaluate** | **The basic parameters of a given semiconductor material.** | | | **L5** |

| List of Experiments |
|---|
| 1. Determination of the thickness of the wire using wedge shape method. **(CO1)** |
| 2. Determination of the radius of curvature of the lens by Newton's ring method. **(CO1)** |
| 3. Determination of wavelength by plane diffraction grating method. **(CO1)** |
| 4. Dispersive power of a diffraction grating. **(CO1)** |
| 5. Study of the Magnetic field along the axis of a circular coil carrying current. **(CO2)** |
| 6. Study the variation of B versus H of the magnetic material (B-H curve) **(CO4)** |
| 7. Determination of the numerical aperture of a given optical fiber and angle of acceptance. **(CO1)** |
| 8. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect. **(CO5)** |
| 9. Determination of the energy gap of a semiconductor. **(CO5)** |
| 10. Determination of crystallite size using X-Ray diffraction spectra. **(CO3)** |
| 11. Determination of Wavelength of LASER using diffraction grating. **(CO1)** |
| 12. Determination of particle size using LASER. **(CO1)** |
| 13. Determination of the resistivity of semiconductor by Four probe method. **(CO5)** |
| 14. Determination of dielectric constant by charging and discharging method. **(CO4)** |
| 15. Study the temperature dependence of resistance of a thermister. **(CO5)** |

**Reference Books:**

1. S. Balasubramanian, M.N.Srinivasan, "A Text book of Practical Physics"-S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php-VirtualLabs, Amrita University.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | | 3 | | | | | | | | | | |
| **CO2** | 2 | | | 1 | | | | | | | | | | |
| **CO3** | 3 | | | 3 | | | | | | | | | | |
| **CO4** | 3 | | | 3 | | | | | | | | | | |
| **CO5** | 3 | | | 3 | | | | | | | | | | |

**Corelation Matrix:**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | correlation | Verb | BTL | | | |
| 1 | 9 | 25 | 3 | **Analyze** | L4 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 3 3 |
| 2 | 6 | 16 | 2 | **Understand** | L2 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 2 1 |
| 3 | 6 | 16 | 2 | **Evaluate** | L5 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 3 3 |
| 4 | 9 | 25 | 3 | **Analyze** | L4 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 3 3 |
| 5 | 6 | 16 | 2 | **Evaluate** | L5 | PO1, PO4 | PO1: Apply (L3), PO4: Analyze (L4) | 3 3 |
| | 36 | | | | | | | |

**Justification Statements:**

**CO1: Analyze the properties of light for solving engineering problems.**
**Action Verb: Analyze (L4)**
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
CO1 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
 CO1 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO2: Understand the basic concepts of electromagnetic induction.**

**Action Verb: Understand (L2)**
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO2 Action Verb is greater than PO1 verb by two levels; Therefore correlation is low (1).
**CO3: Evaluate the crystallite size using X-ray diffraction.**

**Action Verb: Evaluate (L5)**
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
CO3 Action Verb level is greater than PO1 action verb by two levels; Therefore correlation is high (3).
CO3 Action Verb level is greater than PO4 action verb by one level; Therefore correlation is high (3).
**CO4: Analyze the basic properties of dielectric and magnetic behavior of the given material.**

**Action Verb: Analyze (L4)**
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
CO4 Action Verb is equal to PO4 verb; Therefore correlation is high (3).


**CO5: Evaluate the basic parameters of a given semiconductor material.**

**Action Verb: Evaluate (L5)**
PO1 and PO4 Verb: Apply (L3)
CO5 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).
CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

| Course Code | Year & Sem | Data Structures Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0504 | I-II | | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Apply** the sorting and searching algorithms using suitable data structure

**CO 2: Design** the algorithms to solve real time problems using Linked lists

**CO 3: Design** the solutions for computational problems using stacks and queues

**CO 4: Evaluate** the operations of breadth first search using queues

**CO 5: Design** the algorithms to perform operations on trees and graphs

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Apply** | sorting and searching algorithm | using suitable data structure | | L3 |
| **CO2** | **Design** | the algorithms | using Linked lists | To solve real time problems | L6 |
| **CO3** | **Design** | the solutions for computational problems | using stacks and queues | | L6 |
| **CO4** | **Evaluate** | the operations of breadth first search | using queues | | L5 |
| **CO5** | **Design** | the algorithms | | to perform operations on trees and graphs | L6 |

**List of Experiments**

1. String operations using array of pointers **(CO1)**

2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms. **(CO1)**

3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time. **(CO1)**

4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List**(CO2)**

5. Stack implementation using arrays**(CO3)**

6. Stack implementation using linked lists**(CO3)**

7. Queue implementation using arrays. Implement different forms of queue. While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank. **(CO3)**

8. Queue implementation using linked lists**(CO3)**

9. Creation of binary search tree, performing operations insertion, deletion, and traversal. **(CO4)**

10. Breadth first search**(CO4)**

11. Depth first search**(CO4)**

12. Travelling sales man problem**(CO4)**

13. File operations**(CO4)**

14. Indexing of a file**(CO4)**

15. Reversing the links (not just displaying) of a linked list. **(CO4)**

16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using 'Ladies first' principle. You may create new linked lists if necessary. **(CO5)**

17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form. **(CO5)**

18. A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table. The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table. User may like to remove row/column. Create table data type and support different operations on it. **(CO5)**

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 3 | | | | | | | | 2 | |
| CO2 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | 1 |
| CO4 | 3 | 3 | 2 | 3 | 2 | | 3 | | | | | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | **CO1: Apply** | L3 | PO1<br>PO2<br>PO3<br>PO5 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO5:Apply(L3) | 3<br>3<br>3<br>3 |
| 2 | **CO2: Design** | L6 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Develop (L3)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5:Create(L6)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| 3 | **CO3: Design** | L6 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Develop (L3)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5:Create(L6)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| 4 | **CO4: Evaluate** | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO7<br>PO12 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO3: Design (L6)<br>PO4: Analysis(L4)<br>PO5:Create(L6)<br>PO7: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>2<br>3<br>3 |
| 5 | **CO5: Design** | L6 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Design(L6)<br>PO4: Analysis(L4)<br>PO5:Create(L6)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |

**Justification Statements :**

**CO1: Apply** the sorting and searching algorithms using suitable data structure
**Action Verb: Apply (L3)**
PO1 Verb: Apply (L3)
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review(L2)
CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop(L3)
CO1 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: Apply (L3)
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**CO2: Design** the algorithms to solve real time problems using Linked lists
**Action Verb: Design (L6)**
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L6)

CO2 Action verb is same level  PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L3)
CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)

**CO3: Design** the solutions for computational problems using stacks and queues
**Action Verb: Design (L6)**
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L3)
CO3 Action verb is same level  PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L6)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO3 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
For some of  Data Structure applications, stacks concepts are used to manage data in the memory. Therefore, the correlation is high (3)

**CO4: Evaluate the** operations of breadth first search using queues
**Action Verb: Evaluate (L5)**
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO4 Action verb is less than PO3 verb by one level. Therefore, the correlation is medium (2)
PO4: Analysis (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO4 Action verb is greater than PO5 verb. Therefore, the correlation is medium (2)
PO7: Thumb rule
For some of Real Time problems Data Structure applications, queues concept is indirectly used to sustainable environment development. Therefore, the correlation is high (3)
PO12: Thumb rule
For some of Real Time problems Data Structure applications, queues concepts are used to write programs and evaluation the memory operations. Therefore, the correlation is high (3)

**CO5: Design** the algorithms to perform operations on trees and graphs
**Action Verb: Design (L6)**
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO5 Action verb is greater than PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
For some of data manipulations tree and graphs concepts are used to solve data storage problems. Therefore, the correlation is high (3)

| Course Code | Year & Sem | ENVIRONMENTAL STUDIES | L | T | P | C |
|---|---|---|---|---|---|---|
| **20AMC9903** | I-II | | **3** | **0** | **0** | **0** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.

**CO2: Understand** the ecosystem and biodiversity to solve complex environmental problems

**CO3: Apply** various types of pollution and solid waste management and related preventive measures

**CO4: Apply** rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.

**CO5:Understand** the population explosion

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **1** | **Understand** | Multidisciplinary nature of environmental studies and various renewable and nonrenewable resources | | | **L2** |
| **2** | **Understand** | Ecosystem and biodiversity to solve complex environmental problems | | | **L2** |
| **3** | **Apply** | Various types of pollution and solid waste management and related preventive measures | | | **L3** |
| **4** | **Apply** | Rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation | | | **L3** |
| **5** | **Understand** | Population explosion | | | **L2** |

| UNIT – I | | 9 Hrs |
|---|---|---|

**Multidisciplinary Nature of Environmental Studies**: Introduction  Multidisciplinary Nature of Environmental Studies-Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources**: Renewable and non-renewable energy resources – Natural resources and associated problems.

**Forest resources**: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.

**Water resources**: Use and over utilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems.

**Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

**Food resources**: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.

**Energy resources**: Renewable and non-renewable energy resources.

| UNIT – II | | 9 Hrs |
|---|---|---|

**Ecosystems**: Concept of an ecosystem. – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

**Biodiversity And Its Conservation**: Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity:  habitat loss, poaching of wildlife, man-wildlife conflicts - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

| UNIT – III | | 9 Hrs |
|---|---|---|

**Environmental Pollution**: Definition, Causes, effects and its control measures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, and Thermal pollution and Nuclear hazards.
**Solid Waste Management**: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone, Tsunami and landslides.

| UNIT – IV | | 9 Hrs |
|---|---|---|

**Social Issues and the Environment**: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and  watershed management – Resettlement and rehabilitation of people ☐ Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies–Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act-Public awareness

| UNIT – V | | 9 Hrs |
|---|---|---|

**Human Population and the Environment**: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**Textbooks:**

1.Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.

2.Environmental Studies by Kaushik, New Age Publishers.

3.Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

**Reference Books:**

1.  Environmental studies by R.Rajagopalan, Oxford University Press.

2.  Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.

3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 2 | 2 | | | | | | | |
| CO2 | | | | | | | 2 | | | | | 2 | | |
| CO3 | | | | | | 2 | 2 | | | | | | | |
| CO4 | | | | | | 2 | 2 | | | | | | | |
| CO5 | | | | | | | 2 | | | | | 2 | | |

**Correlation matrix**

| CO | Percentage of  contact hours over the total planned contact hours | | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|---|
| | Register (Hrs) | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| 1 | 10 | 12 | 23 | 3 | Understand | L2 | PO6,PO7 | PO6: PO7: | 2,2 |
| 2 | 15 | 15 | 28 | 3 | Understand | L2 | PO7,PO12 | PO7: PO12: | 2,2 |
| 3 | 8 | 8 | 15 | 2 | Apply | L3 | PO6 PO7 | PO6: PO7: | 2,2 |
| 4 | 9 | 10 | 19 | 2 | Apply | L3 | PO6,PO7 | PO6: PO7: | 2,2 |
| 5 | 8 | 8 | 15 | 2 | Understand | L2 | PO7,PO12, | PO7: PO12: | 2,2 |
| | 50 | 53 | 100 | | | | | | |

**Justification Statements:**

**CO1: Understand the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.**

**Action Verb: Understand (L2)**

CO1 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO2:** Understand the ecosystem and biodiversity to solve complex environmental problems

**Action Verb: Understand (L2)**

CO2 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO3:** Apply various types of pollution and solid waste management and related preventive measures

**Action Verb: APPLY (L3)**

CO3 Action Verb is **APPLY** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO4:** Apply rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.

**Action Verb: APPLY (L3)**

CO4 Action Verb is **APPLY** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO5:  Understand** the population explosion

**Action Verb: Understand (L2)**

CO5 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

### Semester III (Second year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|--------|----------|-------------|--------------|----|----|----|---------|-----|-----|-------|
| | | | | L | T | P | C | | | |
| 1 | BS | 20ABS9914 | Discrete Mathematical Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3601 | Digital Electronics and Microprocessors | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3602 | Database Management Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | PC | 20APC3604 | Basics of Python Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | ES | 20AES0205 | Basics of Electrical and Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | PC Lab | 20APC3603 | Database Management Systems Laboratory | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3605 | Basics of Python Programming Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | ES Lab | 20AES0206 | Basics of Electrical and Electronics Engineering Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 9 | SC | 20ASC3601 | Client Side Scripting | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 10 | MC | 20AMC9902 | Constitution of India | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| | | | **Total credits** | | | | **21.5** | **370** | **560** | **930** |

| Course Code | Year & Sem | Discrete Mathematical Structures | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ABS9914 | II-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Apply** the concepts of mathematical logic in various engineering fields.

**CO2: Understand** the concepts related to set theory and algebraic structures.

**CO3: Analyze** the theory of elementary combinatorics by using binomial and multinomial theorems.

**CO4: Evaluate** the solutions of homogeneous and non-homogeneous recurrence relations.

**CO5: Apply** the graph theory in solving computer science problems and finite difference approximation.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | **Apply** | the concepts of mathematical logic | in various engineering fields | | L3 |
| 2 | **Understand** | the concepts related to set theory and algebraic structures. | | | L2 |
| 3 | **Analyse** | the theory of elementary combinatorics | by using binomial and multinomial theorems | | L4 |
| 4 | **Evaluate** | the solutions of homogeneous and non homogeneous recurrence relations. | | | L5 |
| 5 | **Apply** | the graph theory solving computer science problems. | | and finite difference approximation. | L3 |

**Unit I: Mathematical Logic:** 9 hrs

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus

**Unit II: Set theory:** 9 hrs

Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism.

**Unit III: Elementary Combinatorics:** 9 hrs

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

**Unit IV: Recurrence Relations**: 9 hrs

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

**Unit V: Graphs:** 9 hrs

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem equation using finite difference approximation.

**Text books and Reference books:**

1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.,
3. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited
4. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo

**Online Learning Resources**: http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

**Mapping of COs to POs**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| 1 | 3 | | | | | | | | | | | |
| 2 | 2 | | | | | | | | | | | |
| 3 | | 3 | | | | | | | | | | |
| 4 | | 3 | | | | | | | | | | |
| 5 | 3 | | | | | | | | | | | |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**CO - PO mapping justification:**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|----|-------------------|------|-------------|-----------|------|------|------|------|
| | Lesson Plan (Hrs) | % | correlation | Verb | BTL | | | |
| **1** | **15** | 21.7 | 3 | **Apply** | **L3** | PO1 | **Apply (L3)** | 3 |
| **2** | **11** | 15.9 | 2 | **Understand** | **L2** | PO1 | **Apply (L3)** | 2 |
| **3** | **14** | 20.2 | **3** | **Analyze** | **L4** | PO2 | **Analyze (L4)** | 3 |
| **4** | **14** | 20.2 | **3** | **Evaluate** | **L5** | PO2 | **Analyze (L4)** | 3 |
| **5** | **15** | 21.7 | **3** | **Apply** | **L3** | PO1 | **Apply (L3)** | 3 |

**CO1: .Apply the concepts of mathematical logic in various engineering fields**
 **Action Verb: Apply (L3)**
PO1 Verbs: **Apply** (L3)
CO1 Action Verb is equal to PO1 verb . Therefore correlation is high (3).
**CO2: Understand the concepts related to set theory and algebraic structures**
 **Action Verb: Understand (L2)**
PO1 Verbs: Apply (L3)
CO2 Action Verb is one level below to PO1 verb; Therefore correlation is moderate (2).
**CO3: .** Analyze the theory of elementary combinatorics by using binomial and multinomial theorems.
**Action Verb: Analyse (L4)**
PO2 Verb: **Analyse** (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
**CO4:** Evaluate the solutions of homogeneous and non homogeneous recurrence relations.
**Action Verb: Evaluate (L5)**
PO2 Verb: Analyze (L4)
CO4 Action Verb level is one level high to PO2 verb; Therefore correlation is high (3).
**CO5:** Apply the graph theory in solving computer science problems and finite difference approximation.
**Action Verb: Apply(L3)**
PO1 Verb: Apply (L3)
CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

| Course Code | Year & Sem | Digital Electronics & Microprocessors | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3601 | II-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the different logic circuits using concepts of Boolean algebra.

**CO2: Analyze** the different logic circuit by combining sequential and combinational circuits.

**CO3: Evaluate** the different sequential logic circuits for construct complex circuits like counters and registers.

**CO4: Apply** the 8086 microprocessors to design application for real world issues.

**CO5: Apply** the 8051 micro controllers to construct complex microprocessor working model for real world problems.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | the different logic circuits | using concepts of Boolean algebra | | L2 |
| CO2 | Analyze | the different logic circuit | by combining sequential and combinational circuits | | L4 |
| CO3 | Evaluate | the different sequential logic circuits | | for construct complex circuits like counters and registers. | L5 |
| CO4 | Apply | the 8086 microprocessors | | to design application for real world issues | L3 |
| CO5 | Apply | the 8051 micro controller | | to construct complex microprocessor working model for real world problems. | L3 |

**Syllabus:**

**UNIT - I Number Systems & Code Conversion**
Number Systems & Code conversion, Boolean Algebra & Logic Gates, Truth Tables, Universal Gates, Simplification of Boolean functions, SOP and POS methods – Simplification of Boolean functions using K-maps, Signed and Unsigned Binary Numbers.

**UNIT - II Combinational Circuits**
Combinational Logic Circuits: Adders & Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Programmable Logic Devices.

**UNIT - III Sequential Circuits**
Sequential Logic Circuits: RS, Clocked RS, D, JK, Master Slave JK, T Flip-Flops, Shift Registers, Types of Shift Registers, Counters, Ripple Counter, Synchronous Counters, Asynchronous Counters, Up-Down Counter.

**UNIT - IV Microprocessors - I**
8085 microprocessor Review (brief details only), 8086 microprocessor, Functional Diagram, register organization 8086, Flag register of 8086 and its functions, Addressing modes of 8086, Pin diagram of 8086, Minimum mode & Maximum mode operation of 8086, Interrupts in 8086.

**UNIT – V Microprocessors - II**
Instruction set of 8086, Assembler directives, Procedures and Macros, Simple programs involving arithmetic,

logical, branch instructions, Ascending, Descending and Block move programs, String Manipulation Instructions. Overview of 8051 microcontroller, Architecture, I/O ports and Memory organization, addressing modes and instruction set of 8051(Brief details only), Simple Programs.

**Text Books:**
1. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers, Oxford Publishers, 2010.
4. Advanced microprocessors and peripherals-A.K Ray and K.M. Bhurchandani, TMH, 2nd edition, 2006.
**Reference Books:**
1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 |  | 2 |  |  |  |  |  | 2 |  |  | 2 | 3 |  |
| CO2 | 3 |  | 2 |  |  |  |  |  | 2 |  |  | 2 | 2 |  |
| CO3 | 3 |  | 3 |  |  |  |  |  | 2 |  |  | 2 | 2 |  |
| CO4 | 3 |  | 3 |  |  |  |  |  | 2 | 2 |  | 2 | 2 |  |
| CO5 | 2 |  | 2 | 2 |  |  |  |  | 2 |  |  | 2 | 2 |  |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| 1 | 14 | 23% | 3 | CO1: Understand | L2 | PO1 PO3 PO9 | PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule | 2 2 2 |
| 2 | 10 | 17% | 2 | CO2: Analyze | L4 | PO1 PO3 PO9 | PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule | 3 3 2 |
| 3 | 12 | 20% | 2 | CO3: Evaluate | L3 | PO1 PO2 PO9 PO10 | PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule PO10: Thumb Rule | 3 3 2 2 |
| 4 | 10 | 17% | 2 | CO4: Apply | L3 | PO1 PO3 PO9 PO10 | PO1: Apply(L3) PO3: Develop(L3) PO9: Thumb Rule PO10: Thumb Rule | 3 3 2 2 |
| 5 | 14 | 23% | 3 | CO5: Analyze | L4 | PO1 PO3 PO4 PO10 | PO1: Apply(L3) PO3: Develop(L3) PO4: Apply(L3) PO10: Thumb Rule | 2 2 2 2 |
|  | 60 | 100 % |  |  |  |  |  |  |

**Justification Statements:**

**CO 1: Understand** the different logic circuits using concepts of Boolean algebra.
**Action Verb : Understand (L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one, Therefore the correlation is medium (2)
**PO2 Verb : Identify(L3)**
CO1 Action verb is less than PO2 verb by one. Therefore, the correlation is medium (2)
**PO9: Thumb rule**
To involvement of individual must know all the basic concept to understand team work outcomes. Therefore the correlation is medium (2)

**CO 2: Analyze** the different logic circuit by combining sequential and combinational circuits
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO2 Action verb is less than PO1 verb. Therefore, the correlation is high (3)
**PO2: Identify(L3)**
CO2 Action verb is less than PO2 verb. Therefore, the correlation is high (3)
**PO9: Thumb rule**
At the time of design sequential and combinational circuits were need to form the team and develop required circuits in long period. Therefore the correlation is medium (2)

**CO 3: Evaluate** the different sequential logic circuits for construct complex circuits like counters and registers.
**Action Verb : Evaluate (L5)**
**PO1: Apply(L3)**
CO3 Action verb is greater than PO1 verb. Therefore, the correlation is High (3)
**PO2: Identify (L3)**
CO3 Action verb is greater than PO2 verb. Therefore, the correlation is High (3)
**PO9: Develop (L3)**
Need to analyze real time application from the whole team for construct complex circuits. Therefore, the correlation is high(3)
**PO10: Thumb rule**
For resolving  solutions to complex problem required a strong engineering concepts. Therefore, the correlation is high(3)

**CO 4: Apply** the 8086 microprocessors to design application for real world issues.
**Action Verb :Apply (L3)**
**PO1: Apply(L3)**
CO4  Action verb is same as PO1 verb. Therefore the correlation is high (3)
**PO3: Develop(L3)**
CO4 Action verb is same as PO3 verb. Therefore the correlation is high(3)
**PO9: Thumb rule**
To implement real world application, the individual should have deep knowledge about 8086 microprocessors. Therefore, the correlation is medium. Therefore the correlation is medium(2)
**PO10: Thumb rule**
Once the model ready with 8086 microprocessors, need to narrate about model with understandable manner Therefore the correlation is medium (2)

**CO 5:  Analyze**  the 8051 micro controller to construct complex microprocessor working model for real world problems.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high(3)
**PO3: Develop (L3)**
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)
**PO9: Thumb rule**
Once the model ready with 8085 micro controllers, need to narrate about model with understandable manner Therefore the correlation is high(3)

| Course Code | Year & Sem | Database Management Systems | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3602 | II-I | **(common to CSE,CIC,AIDS,AIML,CSE(DS))** | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the fundamentals of databases to design relational models.
**CO2: Apply** the SQL and PL/SQL concepts to formulate queries.
**CO3: Apply** the E-R model for data base design of real world applications.
**CO4: Analyze** the query processing and optimization for data manipulation.
**CO5: Analyze** the concurrent transactions and recover systems to prevent data loss in system crash.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | The fundamentals of databases | | To design relational models. | L2 |
| **CO2** | Apply | the SQL and PL/SQL concepts | | To formulate queries. | L3 |
| **CO3** | Apply | the E-R model | | for data base design of real world applications | L3 |
| **CO4** | Analyze | the query processing and optimization | | For data manipulation. | L4 |
| **CO5** | Analyze | the concurrent transactions and recover systems | | to prevent data loss in system crash. | L4 |

| UNIT - I | **Introduction, Introduction to Relational Model** | 9Hrs |
|---|---|---|

Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators, Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations

| UNIT - II | **Introduction to SQL, Advanced SQL** | 9 Hrs |
|---|---|---|

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL: Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.
Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.

| UNIT - III | **Database Design and the E-R Model, Relational Database Design** | 9 Hrs |
|---|---|---|

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.
Relational Database Design:Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms.

| UNIT - IV | **Query Processing, Query optimization** | 9 Hrs |
|---|---|---|

Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.
Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

| UNIT - V | **Transaction Management, Concurrency control and Recovery System** | 10Hrs |
|---|---|---|

Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.
Concurrency Control: Lock-based Protocols, Deadlock Handling, Multiple granularity, Timestamp-based Protocols, and Validation-based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations.

**Textbooks:**

1. A. Silberschatz, H.F.Korth, S.Sudarshan, "Database System Concepts",6/e, TMH 2019

**Reference Books:**

1. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
2. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, StevenMorris, Peter Robb, Cengage Learning.
3. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke,TMH

**Online Learning Resources:**

https://onlinecourses.nptel.ac.in/noc21_cs04/preview

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 2 | | |
| CO3 | 3 | 3 | 3 | 2 | 3 | | | 2 | 2 | | | 2 | | |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | 3 | | | | | 2 | |
| CO5 | | 3 | 3 | 3 | 3 | | | 2 | 2 | | | 2 | | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| 1 | 13 | 14% | 2 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 2<br>3 |
| 2 | 19 | 20% | 2 | CO2 :Apply | L3 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2:  Review(L2)<br>PO12: Thumb rule | 3<br>3<br>2 |
| 3 | 18 | 19% | 2 | CO3 :Apply | L3 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO8<br>PO9<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO8:  Thumb rule<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>3<br>2<br>2<br>2 |
| 4 | 18 | 19% | 2 | CO4 :Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO8 | PO1: Apply(L3)<br>PO2: Analyze(L4)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO8:  Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| 5 | 25 | 27% | 3 | CO5 :Analyze | L4 | PO2<br>PO3<br>PO4<br>PO5<br>PO8<br>PO9<br>PO12 | PO2:  Analyze(L4)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO8:  Thumb rule<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>2<br>2<br>2 |
| | 93 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand the fundamentals of databases to design relational models.**

**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the SQL and PL/SQL concepts to formulate queries.**
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2  Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Review (L2)**
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO12: Thumb rule**
For some of DB applications, PL/SQL concepts are used to formulate queries. Therefore the correlation is medium (2)


**CO3: Apply the E-R model for data base design of real world applications.**
**Action Verb : Apply(L3)**
**PO1: Apply(L3)**
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2:Review (L2)**
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
**PO4:  Analyze(L4)**
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
**PO5: Apply(L3)**
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
**PO8 : Thumb rule**
Since ethical principles should be followed to create a database. Therefore the correlation is medium(2)
**PO9 : Thumb rule**
Team work is required between DBA and Database designer to create a database. Hence the correlation is medium (2)
**PO12: Thumb rule**
For some of DB applications, ER model concepts are used to create designs. Therefore the correlation is medium(2)


**CO4: Analyze** the query processing and optimization for data manipulation.
**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO4  Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2: Analyze (L4)**
CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
**PO8: Thumb rule**
Since ethical principles shall be followed in data manipulation. Therefore the correlation is high(3)


**CO5: Analyze the concurrent transactions and recover systems to prevent data loss in system crash.**
**Action Verb : Analyze (L4)**
**PO2: Analyze (L4)**
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
**PO8 : Thumb rule**
Since ethical principles should be followed for transaction management. Therefore the correlation is medium(2)
**PO9 : Thumb rule**
Team work is required for transaction management and recovery of failure transactions. Hence the correlation is medium (2)
**PO12: Thumb rule**
In real time transaction management is continuously updating. Therefore the correlation is medium (2)

| Course Code | Year & Sem | Basics of Python Programming | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3604 | II-I | **(common to CSE,CIC)** | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the Basic concepts of python programming to build scripts in IDLE.

**CO2: Apply** the modularity techniques to invoke user defined functions.

**CO3: Apply** the concept of Strings and Lists to perform iterative operations on data.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the Basic concepts of python programming | | to build scripts in IDLE | L2 |
| **CO2** | Apply | the modularity techniques | | to invoke user defined functions | L3 |
| **CO3** | Apply | the concept of Strings and Lists | | to perform iterative operations on data | L3 |
| **CO4** | Apply | the Mutable and Immutable data types | | to perform python Programs | L3 |
| **CO5** | Analyze | the oops concepts | | to develop applications with reusability . | L4 |

**CO4: Apply** the Mutable and Immutable data types to perform python Programs.

**CO5: Analyze** the oops concepts to develop applications with reusability.

| UNIT – I | | 9Hrs |
|---|---|---|

**Introduction:** What is a program, Running python, Arithmetic operators, Value and Types. **Variables, Assignments and Statements**: Assignment statements, Script mode, Order of operations, string operations, comments. **Functions**: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

| UNIT – II | | 9 Hrs |
|---|---|---|

**Case study:** The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring. **Conditionals and Recursion**: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input. **Fruitful Functions**: Return values, Incremental development, Composition, Boolean functions, more recursion, Leap of Faith, Checking types

| UNIT – III | | 9 Hrs |
|---|---|---|

**Iteration**: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms. **Strings**: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison. **Case Study**: Reading word lists, Search, Looping with indices. **Lists**: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

| UNIT – IV | | 8 Hrs |
|---|---|---|

**Dictionaries**: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables. **Tuples:** Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences. **Files:** Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules. **Classes and Objects**: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.

| UNIT – V | | 10Hrs |
|---|---|---|

**Classes and Functions:** Time, Pure functions, Modifiers, Prototyping versus Planning **Classes and Methods**: Object oriented features, Printing objects, The init method, The __str__method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation **Inheritance**: Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Data encapsulation. **The Goodies:** Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, default dict, Named tuples, Gathering keyword Args

| Textbooks: |
|---|

1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.

| Reference Books: |
| --- |
| 1. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018. |
| 2. Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015. |
| 3. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019 |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | 2 | 3 | | | 2 | | | | | | | | | |
| CO2 | 3 | 3 | 3 | | 3 | | | | | | | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 2 | | | | | | | | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | | | | | | | | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 2 | 2 |

**Correlation matrix**

| Unit No. | CO | | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | | | | |
| 1 | 10 | 19% | 2 | CO1 :Understand | L2 | | PO1<br>PO2<br>PO5 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO5: Apply(L3) | 2<br>3<br>2 |
| 2 | 13 | 24% | 3 | CO2 : Apply | L3 | | PO1<br>PO2<br>PO3<br>PO5<br>PO12 | PO1:Apply(L3)<br>PO2: Review (L2)<br>PO3: Develop (L3)<br>PO5: Apply(L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>2 |
| 3 | 10 | 19% | 2 | CO3 : Apply | L3 | | PO1<br>PO2<br>PO3<br>PO4<br><br>PO12 | PO1:  Apply(L3)<br>PO2: Review (L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br><br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>2 |
| 4 | 9 | 17% | 2 | CO4 : Apply | L3 | | PO1<br>PO2<br>PO3<br>PO4<br>PO12 | PO1:  Apply(L3)<br>PO2:  Review(L2)<br>PO3: Develop (L3)<br>PO4:  Analyze(L4)<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>2 |
| 5 | 11 | 20% | 3 | CO5 :Analyze | L4 | | PO1<br>PO2<br>PO3<br>PO4<br>PO12 | PO1:Apply(L3)<br>PO2: Review (L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>2 |
| | 53 | 100 % | | | | | | | |

# Justification Statements :

**CO1: Understand the Basic concepts of python programming to build scripts in IDLE..**
**Action Verb : Understand(L2)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
 PO2 Verb : Review(L2)
CO1 Action verb is same as PO2 verb.. Therefore the correlation is high (3)
PO5: Apply(L3)
CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)

**CO2: Apply the modularity techniques to invoke user defined functions.**
**Action Verb : Apply (L3)**

PO1: Apply(L3)
CO2 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation high (3)
PO3: Develop (L3)
CO2 Action verb same as PO3 verb. Therefore the correlation high (3)
PO5: Apply(L3)
CO2 Action verb same as PO5 verb. Therefore the correlation high (3)
PO12: Thumb rule
For some modular applications user defined functions are created to meet societal needs. Therefore the correlation is medium (2)

### CO3: Apply the concept of Strings and Lists to perform iterative operations on data.
### Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is less than PO1 verb by two level. Therefore the correlation is medium (2)
PO2: Review (L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than one  level as PO4 verb. Therefore the correlation is medium (2)
PO12: Thumb rule
For some of python Program Concepts are used to create programs. Therefore the correlation is medium (2)

### CO4: Apply the Mutable and Immutable data types to perform python Programs.
### Action Verb : Apply(L3)

PO1: Apply(L3)
CO4 Action verb is same as PO1 verb by one level. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO4 Action verb is less than one level as PO4 verb. Therefore the correlation is medium (2)
PO12: Thumb rule
For some of python Program Concepts are used to create programs. Therefore the correlation is medium(2)

### CO5: Analyze the oops concepts to develop applications with reusability.
### Action Verb : Analyze(L4)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than  PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO12: Thumb rule
For some of python Program Concepts are used to create programs. Therefore the correlation is medium (2)

| Course Code | Year & Sem | BASICS OF ELECTRICAL AND ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0205 | II-I | **ENGINEERING** | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Apply** the concepts of Kirchhoff Laws and the basic theorems for Electrical Circuits.

**CO2: Analyze** the operational characteristics of D.C motor, generator, induction motor and transformer.

**CO3: Understand** the basic operation of Electrical Power generation and transmission systems.

**CO4: Understand** the operations of different diodes, transistors and op-amps.

**CO5: Analyze** the characteristics of BJT, FET and OPAMP applications.

**CO6: Understand** various modulation concepts and examples of Communication Systems.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Apply | The Concepts of Kirchhoff Laws and basic theorems for Electrical circuits | | | L3 |
| **CO2** | Analyze | The operational characteristics of D.C motor, generator, induction motor and transformer. | | | L4 |
| **CO3** | Understand | The Basic operation of electrical power generation and transmission systems | | | L2 |
| **CO4** | Understand | The operations of different diodes, transistors and op-amps. | | | L2 |
| **CO5** | Analyze | The characteristics | | of BJT, FET and OPAMP applications. | L4 |
| **CO6** | Understand | Various modulation concepts and examples of Communication Systems. | | | L2 |

| PART-A |
|---|
| **BASIC ELECTRICAL ENGINEERING** |

| UNIT - I | DC & AC Circuits | 9Hrs |
|---|---|---|

Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

| UNIT - II | DC & AC Machines | 9 Hrs |
|---|---|---|

Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [ Elementary treatment only ]

| UNIT - III | Basics of Power Systems | 9 Hrs |
|---|---|---|

Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.

**TEXTBOOKS:**
1. D. P. Kothari and I. J. Nagrath - "Basic Electrical Engineering" - Tata McGraw Hill -2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Power System" – S.Chand – 2018.

**REFERENCE BOOKS:**
1. L. S. Bobrow - "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.
3. C.L. Wadhwa – "Generation Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International Publications.

| | | PART-B (Electronics Engineering) | | |
|---|---|---|---|---|

**PART-B**
**(Electronics Engineering)**

| **UNIT – I** | | 12Hrs |
|---|---|---|

**PN JUNCTION DIODE AND SPECIAL DIODE CHARACTERISTICS:** Overview of Semiconductors, PN junction diode, Zener diode, Applications of diode as switch and rectifier, Zener diode as regulator, special purpose diodes: schottky diode, tunnel diode, varactor diode, photodiode, phototransistor and LED. BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.

| **UNIT – II** | | 12Hrs |
|---|---|---|

**TRANSISTOR CHARACTERISTICS:** BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.

| **UNIT – III** | | 10Hrs |
|---|---|---|

**COMMUNICATION SYSTEMS:** Introduction, Elements of Communication Systems, EM spectrum, basics of electronic communication, Amplitude and Frequency modulation, Pulse modulation, Communication receivers, Examples of communication systems: Microwave & Satellite, Fibre optic, Television, mobile communication (block diagram approach).

**Textbooks:**

1. D.P. Kothari, I.J.Nagrath, Basic Electronics, 2nd edition, McGraw Hill Education(India)Private Limited
2. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.

**Reference Books:**

1. R. Muthu subramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw Hill Education, Reprint 2012.
2. David Bell, Electronic Devices and Circuits: Oxford University Press, 5th edition. 2008.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 1 | | | | | | | 2 | |
| CO2 | 3 | 3 | | | | 1 | | | | | | | 1 | |
| CO3 | 2 | 1 | | | | 1 | | | | | | | 1 | |
| CO4 | 2 | 3 | | | | | | | | | | | | |
| CO5 | 3 | 3 | | 3 | | | | | | | | | | |
| CO6 | 2 | 3 | | | | | | | | | | | | |

**Correlation matrix**

| CO | CO | | | | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| 1 | 15 | 33.33 | 3 | Apply | L3 | PO1, PO2 , PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule | 3 2 1 |
| 2 | 17 | 37.77 | 3 | Analyze | L4 | PO1, PO2 , PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule | 3 3 1 |
| 3 | 13 | 28.88 | 3 | Understand | L2 | PO1, PO2 , PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule | 2 1 1 |
| | 45 | | | | | | | |

**CO1: Apply the concepts of Kirchhoff Laws and the basic theorems for Electrical Circuits.**

Action Verb: Apply (L3)

PO1: Apply (L3)

CO1 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).

PO6: Using thumb rule, CO1 correlates PO6 as low (1).

**CO2: Analyze the operational characteristics of D.C motor, generator, induction motor and transformer.**

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

| Unit No. | CO | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | Correlation | Co's Action verb | BTL | | | |
| **1** | **16** | 42 | 3 | Understand | **L2** | PO1, PO2 | PO1: Apply (L3) PO2: | 2 3 |
| **2** | **12** | 32 | 3 | Analyze | **L4** | PO1, PO2,PO4 | PO1: Apply (L3) PO2: Review(L2) PO4: Analyze(L4) | 3 3 3 |
| **3** | **10** | 26 | 3 | Understand | **L2** | PO1, PO2 | PO1:Apply(L3) PO2:Review (L2) | 2 3 |
| | **38** | **100%** | | | | | | |

**Justification Statements:**

**CO 4: Understand the fundamental concepts of diodes, transistors and op-amps.**

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

 CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO2 Verbs: Review (L2)

 CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO 5: Analyze the characteristics of BJT and MOSFET devices**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)

 CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

 CO5 Action Verb is greater than PO2 verb by two level; Therefore correlation is high (3).

PO4 Verbs: Analyze (L4**)**

 CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO 6: Understand the basic concepts and examples of Communication Systems.**

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

 CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (2).

PO2 Verbs: Review (L2)

 CO6 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

| Course Code | Year & Sem | Database Management System Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3603 | II-I | | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Apply** the DDL, DML Commands for manipulating the data.

**CO 2: Evaluate** the simple mathematical operations using PL/SQL.

**CO 3: Apply** the Triggers to automate the actions on database

**CO 4: Apply** the cursors to access system memory in PL/SQL Programs

**CO 5: Apply** the Entity-Relationship for real time applications.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Apply** | the DDL, DML Commands | | for manipulating the data. | L3 |
| **CO2** | **Evaluate** | the simple mathematical operations | using PL/SQL | | L5 |
| **CO3** | **Apply** | the Triggers | | to automate the actions on database | L3 |
| **CO4** | **Apply** | the cursors | | to access system memory in PL/SQL Programs. | L3 |
| **CO5** | **Apply** | the Entity-Relationship | | for real time applications | L3 |

| List of Experiments: |
|---|

**Week-1: CREATION OF TABLES**

1. Create a table called Employee with the following structure.

| Name | Type |
|---|---|
| Empno | Number |
| Ename | Varchar2(20) |
| Job | Varchar2(20) |
| Mgr | Number |
| Sal | Number |

- Add a column commission with domain to the Employee table.
- Insert any five records into the table.
- Update the column details of job
- Rename the column of Employ table using alter command.
- Delete the employee whose empno is19. **(CO1)**

2. Create department table with the following structure.

| Name | Type |
|---|---|
| Deptno | Number |
| Deptname | Varchar2(20) |
| location | Varchar2(20) |

a. Add column designation to the department table.
b. Insert values into the table.
c. List the records of emp table grouped by deptno.
d. Update the record where deptno is 9.
e. Delete any column data from the table **(CO1)**

3. Create a table called Customer table

| Name | Type |
|---|---|
| | |

| Cust name | Varchar2(20) |
|-----------|--------------|
| Cust street | Varchar2(20) |
| Cust city | Varchar2(20) |

    a. Insert records into the table.
    b. Add salary column to the table.
    c. Alter the table column domain.
    d. Drop salary column of the customer table.
    e. Delete the rows of customer table whose ust_city is 'hyd'. **(CO1)**

4. Create a table called branch table. **(CO1)**

| Name | Type |
|------|------|
| Branch name | Varchar2(20) |
| Branch city | Varchar2(20) |
| asserts | Number |

5. Increase the size of data type for asserts to the branch.
    a. Add and drop a column to the branch table.
    b. Insert values to the table.
    c. Update the branch name column
    d. Delete any two columns from the table **(CO1)**

6. Create a table called sailor table

| Name | Type |
|------|------|
| Sid | Number |
| Sname | Varchar2(20) |
| rating | Varchar2(20) |

    a. Add column age to the sailor table.
    b. Insert values into the sailor table.
    c. Delete the row with rating>8.
    d. Update the column details of sailor.
    e. Insert null values into the table. **(CO1)**

7. Create a table called reserves table

| Name | Type |
|------|------|
| Boat id | Integer |
| sid | Integer |
| day | Integer |

    a. Insert values into the reserves table.
    b. Add column time to the reserves table.
    c. Alter the column day data type to date.
    d. Drop the column time in the table.
    e. Delete the row of the table with some condition. **(CO1)**

**Week-2: QUERIES USING DDL AND DML**

1. a. Create a user and grant all permissions to the user.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result. **(CO1)**
2. a. Create a user and grant all permissions to the user.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result. **(CO1)**
3. a. Create a user and grant all permissions to the user.
   b. Insert values in the department table and use commit.
   c. Add constraints like unique and not null to the department table.
   d. Insert repeated values and null values into the table. **(CO1)**
4. a. Create a user and grant all permissions to the user.
   b. Insert values into the table and use commit.

c. Delete any three records in the department table and use rollback.

d. Add constraint primary key and foreign key to the table.

5.  a. Create a user and grant all permissions to the user. **(CO1)**
    b. Insert records in the sailor table and use commit.
    c. Add save point after insertion of records and verify save point.
    d. Add constraints not null and primary key to the sailor table.
    e. Create a user and grant all permissions to the user.
    f. Use revoke command to remove user permissions.
    g. Change password of the user created.
    h. Add constraint foreign key and not null. **(CO1)**

6.  a. Create a user and grant all permissions to the user.
    b. Update the table reserves and use savepoint and rollback.
    c. Add constraint primary key , foreign key and not null to the reserves table
    **d.** Delete constraint not null to the table column **(CO1)**

## Week-3:QUERIES USING AGGREGATE FUNCTIONS

1.  a. By using the group by clause, display the enames who belongs to deptno 10 along with average salary.
    b. Display lowest paid employee details under each department.
    c. Display number of employees working in each department and their department number.
    d. Using built-in functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptnme foreach row, do the required thing specified above.
    e. List all employees which start with either B or C.
    f. Display only these ename of employees where the maximum salary is greater than or equal to 5000. **(CO1)**

2.  a. Calculate the average salary for each different job.
    b. Show the average salary of each job excluding manager.
    c. Show the average salary for all departments employing more than three people.
    d. Display employees who earn more than the lowest salary in department 30
    e. Show that value returned by sign (n)function.
    f. How many days between day of birth to current date **(CO1)**

3.  a. Show that two substring as single string.
    b. List all employee names, salary and 15% rise in salary.
    c. Display lowest paid emp details under each manager
    d. Display the average monthly salary bill for each deptno.
    e. Show the average salary for all departments employing more than two people.
    f. By using the group by clause, display the eid who belongs to deptno 05 alongwith average salary. **(CO1)**

4.  a. Count the number of employees in department20 **(CO1)**

## b. Find the minimum salary earned by clerk.

    a. Find minimum, maximum, average salary of all employees.
    b. List the minimum and maximum salaries for each job type.
    c. List the employee names in descending order.
    d. List the employee id, names in ascending order by empid. **(CO1)**

5.  a.Find the sids ,names of sailors who have reserved all boats called"INTERLAKE
    b. Find the age of youngest sailor who is eligible to vote for each rating level with at least twosuch sailors.
    c. Find the sname, bid and reservation date for each reservation.
    d. Find the ages of sailors whose name begin and end with B and has at least 3characters.
    e. List in alphabetic order all sailors who have reserved redboat.
    f. Find the age of youngest sailor for each rating level. **(CO1)**

6.  a. List the Vendors who have delivered products within 6 months from order date.
    b. Display the Vendor details who have supplied both Assembled and Subparts.
    c. Display the Sub parts by grouping the Vendor type (Local or Nonlocal).
    d. Display the Vendor details in ascending order.
    e. Display the Sub part which costs more than any of the Assembled parts.
    f. Display the second maximum cost Assembled part**(CO1)**

## Week-4: PROGRAMS ON PL/SQL

1.  a. Write a PL/SQL program to swap two numbers. **(CO2)**
    b. Write a PL/SQL program to find the largest of three numbers.
2.  a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade.
    b. Write a PL/SQL program to find the sum of digits in a given number. **(CO2)**
3.  a. Write a PL/SQL program to display the number in reverse order.
    b. Write a PL/SQL program to check whether the given number is prime or not. **(CO2)**
4.  a. Write a PL/SQL program to find the factorial of a given number.

    b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius and area. **(CO2)**

5.   a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When 'hello' passed to the program it should display 'Hll' removing e and o from the world Hello).

    b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less thanor equal to 10. Else display an error message. Otherwise Display the remainder in words. **(CO2)**

## Week-5: PROCEDURES AND FUNCTIONS

1. Write a function to accept employee number as parameter and return Basic +HRA together assingle column. **(CO2)**
2. Accept year as parameter and write a Function to return the total net salary spent for a given year. **(CO2)**
3. Create a function to find the factorial of a given number and hence find NCR. **(CO2)**
4. Write a PL/SQL block o pint prime Fibonacci series using local functions. **(CO2)**
5. Create a procedure to find the lucky number of a given birth date. **(CO2)**
6. Create function to the reverse of given number**(CO2)**

## Week-6: TRIGGERS

1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE orDELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values **(CO3)**

CUSTOMERS table:

| ID | NAME | AGE | ADDRESS | SALARY |
|----|------|-----|---------|--------|
| 1 | Alive | 24 | Khammam | 2000 |
| 2 | Bob | 27 | Kadappa | 3000 |
| 3 | Catri | 25 | Guntur | 4000 |
| 4 | Dena | 28 | Hyderabad | 5000 |
| 5 | Eeshwar | 27 | Kurnool | 6000 |
| 6 | Farooq | 28 | Nellore | 7000 |

2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database. Passenger( Passport_ id INTEGER PRIMARY KEY, Name VARCHAR (50)Not NULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) Not NULL);
   a.  Write a Insert Trigger to check the Passport_id is exactly six digits or not.
   b.  Write a trigger on passenger to display messages '1 Record is inserted', '1 record is deleted', '1 record is updated' when insertion, deletion and updation are done on passenger respectively. **(CO3)**
3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can raised before insert, updateor delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETE occurs. **(CO3)**
4. Convert employee name into uppercase whenever an employee record is inserted or updated.Trigger to fire before the insert or update. **(CO3)**
5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete _emp and also record user who has deleted the record and date and time of delete. **(CO3)**
6. Create a transparent audit system for a table CUST_MSTR. The system must keep track of therecords that are being deleted or updated**(CO3)**

## Week-7:PROCEDURES

1. Create the procedure for palindrome of given number. **(CO3)**
2. Create the procedure for GCD: Program should load two registers with two Numbers and thenapply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is theGCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD is found.
3. Write the PL/SQL programs to create the procedure for factorial of given number. **(CO3)**
4. Write the PL/SQL programs to create the procedure to find sum of N natural number. **(CO3)**
5. Write the PL/SQL programs to create the procedure to find Fibonacci series. **(CO3)**
6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not**(CO3)**

## Week-8: CURSORS

**1.** Write a PL/SQL block that will display the name, dept no, salary of fist highest paid employees**.**
Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock bythe quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table. **(CO4)**
**2.** Write a PL/SQL block that will display the employee details along with salary using cursors. **(CO4)**
**3.** To write a Cursor to display the list of employees who are working as a Managers or Analyst. **(CO4)**
**4.** To write a Cursor to find employee with given job and deptno. **(CO4)**
**5.** Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the 'employee' table are updated. If none of the employee's salary is updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in 'employee' table**(CO4)**

**Week-9: CASE STUDY: BOOK PUBLISHING COMPANY**

A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications.
A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams**(CO5)**

**Week-10**: **CASE STUDY GENERAL HOSPITAL**

A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc.). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following.

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams**(CO5)**

**Week-11**: **CASE STUDY: CAR RENTAL COMPANY**

A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams**(CO5)**

**Week-12**: **CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM**

A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons.) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programs have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results.

For the above case study, do the following: **(CO5)**

1. Analyze the data required.
2. Normalize the attributes.
3. Create the logical data model i.e., ER diagrams.
4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required.
5. Insert values into the tables created (Be vigilant about Master- Slave tables).
6. Display the Students who have taken M.Sc course
7. Display the Module code and Number of Modules taught by each Lecturer.

8. Retrieve the Lecturer names who are not Module Leaders.
9. Display the Department name which offers 'English 'module.
10. Retrieve the Prerequisite Courses offered by every Department (with Department names).
11. Present the Lecturer ID and Name who teaches 'Mathematics'.
12. Discover the number of years a Module is aught.
13. List out all the Faculties who work for 'Statistics' Department.
14. List out the number of Modules taught by each Module Leader.
15. List out the number of Modules taught by a particular Lecturer.
16. Create a view which contains the fields of both Department and Module tables.(Hint- The fields like Module code, title, credit, Department code and its name).

Update the credits of all the prerequisite courses to 5. Delete the Module 'History' from the Module table.

**References:**

1. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008.

**Online Learning Resources/Virtual Labs:**

http://www.scoopworld.in http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 3 | | 3 | | | | | | | | 1 | |
| CO2 | 1 | 3 | | | 3 | | | | | | | | 1 | |
| CO3 | 3 | 2 | | 3 | 3 | | | | | | | | 2 | 2 |
| CO4 | 3 | 2 | | 3 | 3 | | | | | | | | | |
| CO5 | | | 3 | | 3 | 2 | | | | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|-----------------------------------------------|----------------------------|
| 1 | CO1: Apply | L3 | PO1<br>PO2<br>PO3<br>PO5 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop(L3)<br>PO5: Apply(L3) | 3<br>2<br>3<br>3 |
| 2 | CO2: Evalute | L5 | PO1<br>PO2<br>PO5 | PO1:Apply(L3)<br>PO3:Formulate(L6)<br>PO5:Create(L6) | 1<br>3<br>3 |
| 3 | CO3: Apply | L3 | PO1<br>PO2<br>PO4<br>PO5 | PO1:Apply(L3)<br>PO2:Review(L2)<br>PO4:Design(L6)<br>PO5:Create(L6) | 3<br>2<br>3<br>3 |
| 4 | CO4: Apply | L3 | PO1<br>PO2<br>PO4<br>PO5 | PO1:Apply(L3)<br>PO2:Review(L2)<br>PO4:Design(L6)<br>PO5:Create(L6) | 3<br>2<br>3<br>3 |
| 5 | CO5: Apply | L3 | PO3<br>PO5<br>PO6<br>PO12 | PO3:Design(L6)<br>PO5:Create(L6)<br>PO6:Thumb rule<br>PO12:Thumb rule | 3<br>3<br>3<br>3 |

**Justification Statements :**

**CO1: Apply** the DDL,DML Commands for manipulating the data

**Action Verb: Apply(L3)**
**PO1 Verb: Apply(L3)**
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2 Verb: Review(L2)**

CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)
**PO3 Verb: Develop(L3)**
CO1 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
**PO5 Verb: Apply(L3)**
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**CO2: Evaluate** the  simple mathematical operations using PL/SQL.
**Action Verb: Evaluate (L5)**
**PO1 Verb: Apply (L3)**
CO2 Action verb is is less than PO2 verb by two levels. Therefore, the correlation is low (1)
**PO2 Verb : Formulate(L6)**
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create(L6)**
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO3: Apply** the Triggers to automate the actions on database
**Action Verb: Apply(L3)**
**PO1 Verb: Apply (L3)**
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2 Verb: Review(L2)**
CO3 Action verb is is less than PO2 verb by one level. Therefore, the correlation is Medium(2)
**PO4 Verb: Design (L6)**
CO3 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create (L6)**
CO3 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO4: Apply** the cursors to access system memory in PL/SQL Programs.
**Action Verb: Apply (L3)**
**PO1 Verb: Apply (L3)**
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2 Verb: Review(L2)**
CO4 Action verb is is less than PO2 verb by one level. Therefore, the correlation is Medium(2)
**PO4 Verb: Design (L6)**
CO4 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create (L6)**
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO5: Apply** the Entity-Relationship for real time applications
**Action Verb: Apply (L3)**
**PO3 Verb: Design (L6)**
CO5 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create (L6)**
CO5 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
**PO6 Verb:Thumb rule**
By designing a solution for a problem it is easy to provide solution for any problem. So the correlation is medium(2)
**PO12: Verb:Thumb rule**
Modeling is a continuous learning activity for the user, the correlation is medium(2)

| Course Code | Year & Sem | Basics of Python Programming Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3605 | II-I | | 0 | 0 | 3 | 1.5 |

## Course Outcomes:

After studying the course, student will be able to

**CO1: Analyze** the basic concepts of Python Programming

**CO2: Apply** the loops and conditional statements of python using IDLE and programs.

**CO3: Analyze** the compound data using Lists, Tuples and dictionaries using functions.

**CO4: Apply** the development applications using python datatypes to read and write data from files.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Analyze | the basic concepts of Python Programming | | | L4 |
| **CO2** | Apply | the loops and conditional statements of python | using IDLE and programs. | | L3 |
| **CO3** | Analyze | the compound data using Lists, Tuples and dictionaries | using functions. | | L4 |
| **CO4** | Apply | the development applications | using python datatypes | to read and write data from files | L3 |
| **CO5** | Design | the solutions | using OOPs concepts. | for real world problems in python | L6 |

**CO5: Design** the solutions using OOPs concepts for real world problems in python.

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**List of Experiments:**

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all **(CO1)**
the operations present in a Scientific Calculator

2. Write a function that draws a grid like the following:**(CO1)**

```
+----+----+
|    |    |
|    |    |
|    |    |
+----+----+
|    |    |
|    |    |
|    |    |
+----+----+
```

3. Write a function that draws a Pyramid with # symbols**(CO1)**

```
     #
   # # #
 # # # # #
# # # # # # #
```

4. Using turtles concept draw a wheel of your choice**(CO1)**

5. Write a program that draws Archimedean Spiral**(CO1)**

6. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least Ten letters of the alphabet.**(CO1)**

7. The time module provides a function, also named time that returns the current Greenwich Mean Time in "the epoch", which is an arbitrary time used as a reference point. On UNIX systems, the
epoch is 1 January 1970.
>>> import time
>>>time.time()
1437746094.5735958

Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.**(CO1)**

8. Given n+r+1 <= 2r . n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above**(CO2)**

9. Write a program that evaluates Ackermann function**(CO2)**

10. The mathematician Srinivasa Ramanujan found an infinite series that can be used to generate a numerical approximation of $1/\pi$ :
Write a function called estimate_pi that uses this formula to compute and return an estimate of $\pi$.

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{k=0}^{\infty} \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

It should use a while loop to compute terms of the summation until the last term is smaller than 1e-15 (which is Python notation for 10 -15). You can check the result by comparing it to math.pi.**(CO2)**

11. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.**(CO2)**

12. Given a text of characters, Write a program which counts number of vowels, consonants and special characters.**(CO2)**

13. Given a word which is a string of characters. Given an integer say 'n', Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.**(CO2)**

14. Given rows of text, write it in the form of columns.**(CO2)**

15. Given a page of text. Count the number of occurrences of each latter (Assume case insensitivity and don't consider special characters). Draw a histogram to represent the same**(CO2)**

16. Write program which performs the following operations on list's. Don't use built-in functions**(CO3)**
a) Updating elements of a list
b) Concatenation of list's
c) Check for member in the list
d) Insert into the list
e) Sum the elements of the list
f) Push and pop element of list
g) Sorting of list
h) Finding biggest and smallest elements in the list
i) Finding common elements in the list

17. Write a program to count the number of vowels in a word.**(CO3)**

18. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.**(CO4)**

19. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Read the book you downloaded, skip over the header information at the beginning of the file, and process the rest of the words as before. Then modify the program to count the total number of words in the book, and the number of times each word is used. Print the number of different words used in the book. Compare different books by different authors, written in different eras.**(CO4)**

20. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Write a program that allows you to replace words, insert words and delete words from the file.**(CO4)**

21. Consider all the files on your PC. Write a program which checks for duplicate files in your PC and displays their location. Hint: If two files have the same checksum, they probably have the same contents.**(CO4)**

22. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Useobject oriented approach.**(CO5)**

23. Write a program illustrating the object oriented features supported by Python.**(CO5)**

24. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.**(CO5)**

25. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.**(CO5)**

26. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.( 0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)**(CO5)**

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 2 | | | | | | | | | | | |
| CO3 | 3 | 3 | 2 | 2 | | | | | 1 | | | 1 | | |
| CO4 | 3 | 2 | | | | | | | | | | | | |
| CO5 | | 1 | 3 | 3 | 3 | | | 2 | 1 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|
| 1 | CO1 : Analyze | L4 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Analyze(L4) | 3 |
| 2 | CO2 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO12 | PO12: Thumb rule | 2 |
| 3 | CO3 :Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 2 |
| | | | PO4 | PO4: Design (L6) | 2 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| 5 | CO5 : Design | L6 | PO2 | PO2: Analyze (L4) | 1 |
| | | | PO3 | PO3: Design (L6) | 3 |
| | | | PO4 | PO4: Design (L6) | 3 |
| | | | PO5 | PO5: Develop (L6) | 3 |
| | | | PO8 | PO8:  Thumb rule | 2 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 2 |

**Justification Statements :**

**CO1: Analyze the basic concepts of Python Programming**
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the loops and conditional statements of python using IDLE and programs**.
**Action Verb : Apply (L3)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO12: Thumb rule
For usage of the loops and conditional statements of python using IDLE is medium. Therefore the correlation is medium (2)

**CO3: Analyze the compound data using Lists, Tuples and dictionaries using functions.**

**Action Verb : Analyze(L4)**

PO1: Apply(L3)

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2:Analyze (L4)

CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by one level. Therefore the correlation is medium (2)

PO4: Design (L6)

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

PO9 : Thumb rule

Team work is required to Analyze the compound data using. Hence the correlation is low (1)

PO12: Thumb rule

Construct real time applications using functions can be life long learning. Therefore the correlation is low (1)

**CO4: Apply the development applications using python datatypes to read and write data from files.**
**Action Verb : Apply (L3)**

PO1: Apply(L3)

CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**CO5: Design the solutions using OOPs concepts for real world problems in python.**
**Action Verb : Design (L6)**

PO2: Analyze (L4)

CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

PO3: Design (L6)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Design (L6)

CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5: Develop(L6)

CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO8 : Thumb rule

IOT Applications can be used to make society better place. Therefore the correlation is medium(2)

PO9 : Thumb rule

Team work is required to Create BPP applications. Hence the correlation is low (1)

PO12: Thumb rule

In real time oops concepts are used to solve the societal problems. Therefore the correlation is medium (2)

| Course Code | Year & Sem | BASICS OF ELECTRICAL & ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AES0206 | II-I | **ENGINEERING LAB** | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Apply** the Kirchhoff's Laws and Superposition theorem for DC Circuits.

**CO2: Analyze** the performance of AC and DC Machines by various testing methods.

**CO3: Analyze** the speed of DC shunt motor using armature and field control methods.

**CO4: Analyze** the V-I Characteristics of PN and Zener diodes.

**CO5: Evaluate** the parameters of rectifiers with & without filters

**CO6: Analyze** the input and output characteristics of BJT and FET.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | **Apply** | The Kirchhoff's Laws & Superposition theorem for dc circuits | | | L3 |
| CO2 | **Analyze** | The performance of AC and DC Machines | by various testing methods. | | L4 |
| CO3 | **Analyze** | the speed of DC shunt motor | using armature and field control methods. | | L4 |
| CO4 | **Analyze** | the V-I Characteristics of PN and Zener diodes | | | L4 |
| CO5 | **Evaluate** | the parameters of rectifiers with & without filters | | | L5 |
| CO6 | **Analyze** | the input and output characteristics of BJT and FET. | | | L4 |

| List of Experiments: |
|---|
| **Part A: Electrical Engineering Lab** |
| 1. Verification of Kirchhoff laws-(CO1).<br>2. Verification of Superposition Theorem-(CO1).<br>3. Open circuit characteristics of a DC Shunt Generator-(CO2).<br>4. Speed control of DC Shunt Motor-(CO3).<br>5. OC & SC test of 1 – Phase Transformer-(CO2).<br>6. Brake test on 3 - Phase Induction Motor-(CO2).<br>**7.** Brake test on DC Shunt Motor-(CO2). |
| **Part B: Electronics Engineering Lab** |
| 1. PN Junction Diode Characteristics.(CO4)<br>2. Zener Diode Characteristics. (CO4)<br>3. Rectifiers (With and Without Filter). (CO5)<br>4. BJT Characteristics (CB Configuration). (CO6)<br>5. BJT Characteristics (CE Configuration). (CO6)<br>6. FET Characteristics (CS Configuration). (CO6)<br><br>Tools Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices. |

## Mapping of course outcomes with program outcomes

| Course Title | COs | Programme Outcomes(POs) & Programme Specific Outcomes(PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB | CO1 | 3 | | | 2 | | | | | 1 | | | | 2 | |
| | CO2 | 3 | | | 3 | | | | | 1 | | | | 1 | |
| | CO3 | 3 | | | 3 | | | | | 1 | | | | 1 | |
| | CO4 | 3 | 3 | | | | | | | | | | | | |
| | CO5 | 3 | 3 | | 3 | | | | | | | | | | |
| | CO6 | 3 | 3 | | 3 | | | | | | | | | | |

## Justification Table:

| CO | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| | Verb | BTL | | | |
| 1 | **Apply** | L3 | PO1, PO4, PO9 | PO1:Apply(L3) PO2:Analyze(L4) PO9:Thumb Rule | 3 2 1 |
| 2 | **Analyze** | L4 | PO1, PO4, PO9 | PO1:Apply(L3) PO2:Analyze(L4) PO9:Thumb Rule | 3 3 1 |
| 3 | **Analyze** | L4 | PO1, PO4, PO9 | PO1:Apply(L3) PO2:Analyze(L4) PO9:Thumb Rule | 3 3 1 |
| 4 | **Analyze** | L4 | PO1, PO2 | PO1: Apply (L3) PO2: Review (L2) | 3 3 |
| 5 | **Evaluate** | L5 | PO1, PO2, P04 | PO1: Apply (L3) PO2: Review (L2) P04: Analyze(L4) | 3 3 3 |
| 6 | **Analyze** | L4 | PO1, PO2, P04 | PO1: Apply (L3) PO2: Review (L2) P04: Analyze(L4) | 3 3 3 |

**CO1: Apply the Kirchhoff's Laws and Superposition theorem for DC Circuits.**
Action Verb: Apply (L3)
PO1: Apply (L3)
CO1 Action Verb is same as PO1 verb; Therefore correlation is high (3).
PO4: Analyze (L4)
CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO9: Using Thumb Rule, CO1 correlates to PO9 as low (1).
**CO2: Analyze the performance of AC and DC Machines by various testing methods.**
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4: Analyze (L4)
CO2 Action Verb is same as PO4 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO2 correlates to PO9 as low (1).
**CO3: Analyze the speed control of DC shunt motor.**
Action Verb: Analyze (L4)
PO1: Apply (L3)
C3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4: Analyze (L4)
CO3 Action Verb is same as PO4 verb; Therefore correlation is high (3).

PO9: Using Thumb Rule, CO3 correlates to PO9 as low (1).

**CO 4: Analyze** the V-I Characteristics of PN and Zener diodes.

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)

    CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3)

PO2 Verbs: Review (L2)

    CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO 5: Evaluate** the parameters of rectifiers without & with filters

**Action Verb: Evaluate (L5)**

PO1 Verbs: Apply (L3)

    CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

    CO5 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).

PO4 Verbs: Analyze (L4)

    CO5 Action Verb is equal to PO4 verb Therefore correlation is high (3).

**CO 6: Evaluate** the parameters of BJT and FET from their characteristics

**Action Verb: Evaluate (L5)**

PO1 Verbs: Apply (L3)

    CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

    CO6 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).

PO4 Verbs: Analyze (L4)

    CO6 Action Verb is equal to PO4 verb Therefore correlation is high (3).

| Course Code | Year & Sem | Client-Side Scripting | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ASC3601 | II-I | | 1 | 0 | 2 | 2 |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** The basic concepts of JavaScript programming for writing simple script in any web browser.

**CO 2: Apply** the different methods of JavaScript for solving complex problems.

**CO 3: Analyze** the web pages for real time applications by various events and forms in JavaScript.

**CO 4: Apply** the several objects for client-side model in JavaScript.

**CO 5: Evaluate** the functionalities of cookies and browser data in JavaScript.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | The basic concepts of JS | | for writing simple script in any web browser | L2 |
| **CO2** | **Apply** | The different methods in JS | | for solving complex problems | L3 |
| **CO3** | **Analyze** | The web pages | | for real time applications by various events and forms in JavaScript | L4 |
| **CO4** | **Apply** | The several objects | | for client-side model in JavaScript | L3 |
| **CO5** | **Evaluate** | the functionalities of cookies and browser data in JavaScript | | | L5 |

| UNIT - I | Basics of JavaScript Programming | 3+6 Hrs |
|---|---|---|

Features of JavaScript, Object Name, Property, Method, Dot Syntax, Main Event, Values and Variables, Operators and Expressions – Primary Expressions, Object and Array Initializers, Function Definition Expression, Property Access Expressions, Invocation Expressions, If Statement, if...else, if..elseif, Nested if Statement, Switch... Case Statement, Loop Statement – for Loop, for...in Loop, while Loop, do...while Loop, continue Statement, Querying and Setting Properties and Deleting Properties, Property Getters and Setters.

- WAP to print hello world
- WAP to use comments in JavaScript.
- WAP to add a noscript block.
- Write a Script in <head>...</head> section.
- Write a Script in <body>...</body> section.
- Write a Script in <body>...</body> and <head>...</head> sections.
- Write a Script using arithmetic, Comparison, Logical, Bitwise, and Assignment operators
- Write code to understand how the Conditional Operator and typeof operator works in JavaScript.
- Write code to understand the working of if statement, if...else statement, and if...else if... statement.
- Implement switch-case statement.
- Implement while loop, do-while and for loop in JavaScript.
- WAP to print the web browser's Navigator object using for loop.
- WAP To implement break, continue and label in JavaScript.
- Write code to call the function that displays the text message on clicking a button.

| UNIT - II | Array, Function and String | 3+6 Hrs |
|---|---|---|

Array – Declaring an Array, Initializing an Array, Defining an Array Elements, Looping an Array, Adding an Array Element, Sorting an Array Element, Combining an Array Elements into a String, Changing Elements of an Array, Objects as Associative Arrays, Function – Defining a Function, Writing a Function, Adding an Arguments, Scope of Variable and Arguments, Calling a Function – Calling a Function With or Without an Argument, Calling Function from HTML, Function Calling another Function, Returning the Value from a Function, String – Manipulate a String, Joining a String, Retrieving a Character from given Position, Retrieving a Position of Character in a String, Dividing Text, Copying a Sub-string, Converting String to Number and Numbers to String, Changing the Case of String, Finding a Unicode of a Character – charCodeAt(), fromCharCode().

- Write code to call the function that displays the text message on clicking a button.
- WAP to call a function that takes two parameters, name and age. Print the same.
- Define a function that takes two parameters and concatenates them before returning the resultant in the calling program.

| UNIT - III | Form and Event Handling | 3+6 Hrs |
|---|---|---|

Building Blocks of a Form, Properties and Methods of Form, Button, Text, Text Area, Checkbox, Radio Button, Select Element, Form Events – Mouse Event, Key Events, Form Objects and Elements, Changing Attribute Value Dynamically, Changing Option List Dynamically, Evaluating Checkbox Selection, Changing a Label Dynamically, Manipulating Form Elements, Intrinsic JavaScript Functions, Disabling Elements, Read Only Elements.

- Write code to implement the following events – onclick, onsubmit, onmouseover and onmouseout.
- Design a Registration form (include email id and password) and perform validation to all its fields.

| UNIT - IV | Objects | 3+6 Hrs |
|---|---|---|

Window Object, Math, Number, and Date Objects, Handling Strings Using Regular Expressions.
Implement Number, Date, Math, Boolean, Strings, Arrays, RegEx, and HTML DOM objects with all its properties and methods.

| UNIT - V | Cookies and Browser Data | 3+6 Hrs |
|---|---|---|

Cookies – Basic of Cookies, Reading a Cookie Value, Writing a Cookie Value, Creating a Cookies, Deleting a Cookies, Setting the Expiration Date of Cookie, Browser – Opening a Window, Giving the New Window Focus, Window Position, Changing the Content of Window, Closing a Window, Scrolling a Web Page, Multiple Windows at Once, Creating a Web Page in New Window, JavaScript in URLs, JavaScript Security, Timers, Browser Location and History.

- Set a customer name in an input cookie.
- WAP to get all the cookies.
- Extend the expiry date of a cookie by 1 Month.
- Delete a cookie by setting its expiry date to one month behind the current date.
- Do a page redirect using JavaScript at client side.
- Show an appropriate message to your site visitors before redirecting them to a new page. WAP with a time delay to load a new page.
- Redirect your site visitors onto a different page based on their browsers.
- Use an alert box to give a warning message.
- Implement a confirmation dialog box to take user's consent on any option.
- Use a prompt dialog box.
- Use of void is to purposely generate the undefined value.
- Demonstrates how to create an Object.
- Create an object with a User-Defined Function.
- Write code to add a function along with an object.
- Demonstrate with keyword in JavaScript.

| Textbooks: |
|---|

1. Javascript Beginners Guide, John Pollock, TMH, 4th Edition
2. JavaScript. Demystified,  JIM KEOGH , McGraw-Hill.

| Reference Books: |
|---|

1. JavaScript™ For Dummies,® 4th Edition, by Emily Vander Veer, Published by Wiley Publishing, Inc © 2005.
2. JavaScript for impatient programmers (beta), by Dr. Axel Rauschmayer © 2019.
3. Javascript: Beginners Guide on Javascript Programming, by Nick Goddard © 2016.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | 2 | | | | | | | 2 | 3 | |
| CO2 | 3 | 3 | | 2 | 3 | | | | | | | | 2 | |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | | 3 | | | 2 | |
| CO4 | 3 | 3 | 3 | 2 | 3 | | | | | | | 2 | 2 | |
| CO5 | 3 | 3 | 3 | 3 | 2 | | | | | | | 3 | 2 | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|---------------------------------------------|----------------------------|
| 1 | CO1: Understand | L2 | PO1<br>PO2<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO5: Apply(L3)<br>PO12: Thumb rule | 2<br>3<br>2<br>2 |
| 2 | CO2: Apply | L3 | PO1<br>PO2<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3) | 3<br>3<br>2<br>3 |
| 3 | CO3:Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO10 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO10: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| 4 | CO4: Apply | L3 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>3<br>2 |
| 5 | CO5: Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO11 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Create(L6)<br>PO11: Thumb rule | 3<br>3<br>3<br>3<br>2<br>3 |

**Justification Statements:**

**CO1: Understand** The basic concepts of JavaScript programming for writing simple script in any web browser.

**Action Verb : Understand (L2)**
**PO1: Apply(L3)**
CO1 Action verb is less than PO1 verb by one, Therefore the correlation is medium (2)
**PO2: Review(L2)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
**PO5: Apply(L3)**
CO1 Action verb is less than PO2 verb by one, Therefore the correlation is medium (2)
**PO12: Thumb rule**
To update the new feature in an application, need to upgrade for long period. Therefore, the correlation is medium (2)

**CO 2: Apply** the different methods of JavaScript for solving complex problems.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
**PO2: Identify(L3)**
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is less than PO4 verb. Therefore the correlation is medium(2)
**PO5: Apply(L3)**
CO3 Action verb is same as PO5 verb. Therefore, the correlation is High (3)


**CO 3:  Analyze** the web pages for real time applications by various events and forms in JavaScript.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO3 Action verb is greater than PO1 verb. Therefore, the correlation is High (3)
**PO2: Review (L2)**
CO3 Action verb is greater than PO2 verb. Therefore, the correlation is High (3)
**PO3: Develop (L3)**
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO3 Action verb is greater than PO5 verb. Therefore, the correlation is High (3)
**PO10: Thumb rule**
The web site should understand by user, so need to provide proper documents. Therefore, the correlation is high(3)

**CO4: Apply** the several objects for client-side model in JavaScript.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO4  Action verb is same as PO1 verb. Therefore the correlation is high (3)
**PO2: Review(L2)**
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop(L2)**
CO4 Action verb is same as PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze(L4)**
CO4  Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
**PO5: Apply(L3)**
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
**PO12: Thumb rule**
The design application needs to upgrade for future specific requirement. Therefore the correlation is medium (2)

**CO 5: Evaluate** the functionalities of cookies and browser data in JavaScript.
**Action Verb : Evaluate (L5)**
**PO1: Apply(L3)**
CO5  Action verb is  greater than PO1 verb. Therefore the correlation is high(3)
**PO2: Review (L2)**
CO5  Action verb is  greater than PO2 verb. Therefore the correlation is high(3)
**PO3: Develop (L3)**
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO5  Action verb is  greater than PO4 verb. Therefore the correlation is high(3)
**PO5: Create(L6)**
CO5 Action verb is less than PO5 verb by one level. Therefore the correlation is high (2)
**PO12: Thumb rule**
The team should be analyze the different kind of cookies. Improve the knowledge towards cookies Therefore the correlation is high(3)

| Course Code | Year & Sem | CONSTITUTION OF INDIA | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AMC9902 | II-I | | 3 | 0 | 0 | 0 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the historical background of the Constitution making and its importance for building a democratic India.

**CO2: Remember** the basic features of Indian Constitution

**CO3: Understand** the fundamental rights and duties for becoming a good citizen of India.

**CO4: Understand** the Powers and functions of Governor, President, and Judiciary.

**CO5: Understand** the functions of local administration bodies.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | the historical background of the Constitution making and its importance | for building a democratic India. | | L2 |
| CO2 | Remember | the basic features of Indian Constitution | | | L1 |
| CO3 | Understand | the fundamental rights and duties | for becoming a good citizen of India. | | L2 |
| CO4 | Understand | the Powers and functions | of Governor, President, and Judiciary. | | L2 |
| CO5 | Understand | the functions of local administration bodies | | | L2 |

| UNIT – I | | |
|---|---|---|
| History of Making of the Indian Constitution - History Drafting Committee, (Composition & Working) | | |

| UNIT – II | | |
|---|---|---|
| Philosophy of the Indian Constitution - Preamble Salient Features | | |

| UNIT – III | | |
|---|---|---|
| Contours of Constitutional Rights & Duties - Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties. | | |

| UNIT – IV | | |
|---|---|---|
| Organs of Governance -  Parliament – Composition -  Qualifications and Disqualifications - Powers and Functions - Executive, President, Governor - Council of Ministers -Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions. | | |

| UNIT – V | | |
|---|---|---|
| Local Administration - District's Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Panchayati raj: Introduction, PRI: Zilla Panchayat - Elected officials and their roles, CEO Zilla Panchayat: Position and role - Block level: Organizational Hierarchy (Different departments) - Village level: Role of Elected and Appointed officials - Importance of grass root democracy. | | |

**Textbooks:**

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

**CO-PO mapping justification:**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| 1 | 4 | 14 | 2 | **Understand** | L2 | PO6, PO12 | Thumb Rule Thumb Rule | 2 2 |
| 2 | 4 | 14 | 1 | **Remember** | L1 | PO6, PO7 | Thumb Rule Thumb Rule | 1 1 |
| 3 | 8 | **26** | **2** | **Understand** | L2 | PO8, PO12 | Thumb Rule Thumb Rule | 2 2 |
| 4 | 8 | **26** | **2** | **Understand** | L2 | PO6, PO12 | Thumb Rule Thumb Rule | 2 2 |
| 5 | 6 | **20** | **2** | **Understand** | L2 | PO6, PO12 | Thumb Rule Thumb Rule | 2 2 |
| | **30** | | | | | | | |

**CO1:** Understand the historical background of the Constitution making and its importance for building a democratic India.
**Action Verb: Understand (L2)**
CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO2:** Remember the basic features of Indian Constitution
**Action Verb: Remember (L1)**
CO2 Action Verb is Remember of BTL 1. Using Thumb rule, L1 correlates PO6 to PO12 as low (1).

**CO3:** Understand the fundamental rights and duties for becoming a good citizen of India.
**Action Verb: Understand (L2)**
CO3 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO4:** Understand the Powers and functions of Governor, President, and Judiciary.
**Action Verb: Understand (L2)**

CO4 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).
**CO5:** Understand the functions of local administration bodies.
**Action Verb: Understand (L2)**
CO5 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.

## (AUTONOMOUS)

## B.Tech

## (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

## (Effective for the batches admitted in 2020-2021)

### Semester IV (Second year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | PC | 20APC3606 | Computer Organization | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3607 | Computer Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3609 | Object Oriented Programming through Java | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | PC | 20APC3611 | Operating Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | HS | 20AHSMB01 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | HS | 20AHS9905 | Universal Human Values | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3608 | Computer Networks Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | PC Lab | 20APC3610 | Object Oriented Programming through Java Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 9 | PC Lab | 20APC3612 | Operating Systems Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 10 | SC | 20ASC3602 | Server Side Scripting | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| | | | Total credits | | | | 24.5 | 370 | 630 | 1000 |

**Community Service Project (Mandatory) for 6 weeks duration during summer vacation.**
(To visit the selected community to conduct survey (Socio-economic &amp; domain survey) and conduct sensitization/awareness program/activities at the end of IV- semester before commencement of V-semester and complete immersion programme also during V-Semester and submit report in V - semester. Assessment will be done at the end of V-Semester)

| Course Code | Year & Sem | Computer Organization | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3606 | II-II | **(common to CSE,CIC,CSE(DS))** | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the operational concepts and instruction set related to modern processors.

**CO2: Evaluate** the Arithmetic operations for understanding execution process.

**CO3: Understand** the hardware requirements of primary and secondary memories to store the data.

**CO4: Analyze** the Input/Output interfaces to connect multiple devices.

**CO5: Apply** the pipeline concepts to execute parallel tasks.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the Operational concepts and instruction set related | | to modern processors. | L2 |
| **CO2** | Evaluate | the Arithmetic operations | | for understanding execution process. | L5 |
| **CO3** | Understand | The hardware requirements of primary and secondary memories | | to store the data. | L2 |
| **CO4** | Analyze | the Input/Output interfaces | | to connect multiple devices. | L4 |
| **CO5** | Apply | the pipeline concepts | | to execute parallel tasks. | L3 |

| UNIT - I | Basic Structure of Computer, Machine Instructions and Programs | 9 Hrs |
|---|---|---|

Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.

Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.

| UNIT - II | Arithmetic, Basic Processing Unit | 9Hrs |
|---|---|---|

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.

Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, and Multi programmed Control.

| UNIT - III | The Memory System | 9 Hrs |
|---|---|---|

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

| UNIT - IV | Input/Output Organization | 9 Hrs |
|---|---|---|

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

| UNIT - V | Pipelining, Large Computer Systems | 9 Hrs |
|---|---|---|

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets.

Large Computer Systems: Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.

| **Textbooks:** |
|---|

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGraw Hill Education, 2013.

| **Reference Books:** |
|---|

1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.
2. Themes and Variations, Alan Clements, "Computer Organization and Architecture", CENGAGE Learning.
3. SmrutiRanjanSarangi, "Computer Organization and Architecture", McGraw Hill Education.

John P.Hayes, "Computer Architecture and Organization", McGraw Hill Education

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | 2 | | |
| CO2 | 3 | 3 | 3 | | | 2 | | | | | | 2 | 2 | |
| CO3 | 2 | 3 | | | | | | 2 | 2 | | | | | |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | 2 | | | | 2 | | 1 |
| CO5 | 3 | 3 | | | | | | 2 | 2 | | | | 2 | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 09 | 20% | 2 | CO1 :Understand | L2 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO12: Thumb rule | 2<br>3<br>2 |
| 2 | 09 | 20% | 2 | CO2 : Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO6<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO6: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>2 |
| 3 | 09 | 20% | 2 | CO3 : Understand | L2 | PO1<br>PO2<br>PO8<br>PO9 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO8: Thumb rule<br>PO9: Thumb rule | 2<br>3<br>2<br>2 |
| 4 | 09 | 20% | 2 | CO4 : Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO8<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO8: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>2<br>2 |
| 5 | 09 | 20% | 2 | CO5 : Apply | L3 | PO1<br>PO2<br>PO8<br>PO9 | PO1: Apply(L3)<br>PO2: Review (L2)<br>PO8: Thumb rule<br>PO9: Thumb rule | 3<br>3<br>2<br>2 |
| | 45 | 100 % | | | | | | |

## Justification Statements :

**CO1: Understand the operational concepts and instruction set related to modern processors.**
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)
**PO12: Thumb rule**
Identify the deficiencies and demonstrate the need of updating the computer components to meet desired requirements. Therefore the correlation is medium (2)

**CO2: Evaluate the Arithmetic operations for understanding execution process**
**Action Verb : Evaluate (L5)**
**PO1: Apply(L3)**
CO2 Action verb is greater than level PO1 verb by two level. Therefore the correlation is high (3)
**PO2: Review (L2)**
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
**PO3: Develop (L3)**
CO2 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
**PO6: Thumb rule**
For some of computer applications, Various arithmetic operations are evaluated for understanding execution process of computer systems. Therefore, the correlation is Medium (2)
**PO12: Thumb rule**

Identify the deficiencies and demonstrate the need of updating the computer instruction set to meet desired requirements. Therefore the correlation is medium(2)

**CO3: Understand the hardware requirements of primary and secondary memories to store the data.**
**Action Verb : Understand (L2)**
**PO1: Apply(L3)**
CO3  Action verb is less than PO1 verb level by one level. Therefore the correlation is moderate (2)
**PO2: Review (L2)**
CO3 Action verb is same as PO2 verb. Therefore the correlation is high (3)
**PO8 : Thumb rule**
Since ethical principles should be followed to while creating the primary and secondary memories. Therefore the correlation is medium(2)
**PO9 : Thumb rule**
Team work is required to understand and demonstrate the secondary memories in computer system. Hence the correlation is medium (2)

**CO4: Analyze the Input/Output interfaces to connect multiple devices.Action Verb : Analyze(L4)**
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO4  Action verb is greater than PO1 by one level. Therefore the correlation is high (3)
**PO2: Analyze (L4)**
CO4 Action verb is same as PO2 verb. Therefore the correlation is High(3)
**PO3: Develop (L3)**
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
**PO8: Thumb rule**
Since ethical principles shall be followed in creating quality input and output interfaces. Therefore the correlation is medium(2)
**PO12: Thumb rule**
Identify the deficiencies and demonstrate the need of updating the input and output interfaces to meet desired requirements. Therefore the correlation is medium(2)

**CO5: Apply the pipeline concepts to execute parallel tasks.**
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO5  Action verb is same as PO1. Therefore the correlation is high (3)
**PO2: Review (L2)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
**PO8 : Thumb rule**
Since ethical principles should be followed in solving problems caused in pipeline hazards. Therefore the correlation is medium(2)
**PO9 : Thumb rule**
Team work is required to provide the solutions caused due to pipeline hazards. Hence the correlation is medium (2)

| Course Code | Year & Sem | Computer Networks | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3607 | II–II | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understan**d the basics of data communications and networking by using OSI model.

CO2: **Apply** the Data link Layer functionalities to solve real world problems.

CO3: **Analyze** the various routing algorithms and protocols.

CO4: **Analyze** the Transport Layer services by using TCP and UDP protocols.

CO5: **Understand** the various services protocols offered by application layer.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | understand | the basics of data communications and networking by using OSI model. | | | L2 |
| **CO2** | Apply | The Data link Layer functionalities | | to solve real world problems. | L3 |
| **CO3** | Analyze | the various routing algorithms and protocols. | | | L4 |
| **CO4** | Analyze | the Transport Layer services | by using TCP and UDP protocols | | L4 |
| **CO5** | understand | The various services protocols offered by application layer | | | L2 |

| UNIT - I | | 9 Hrs |
|---|---|---|

**Introduction:** Data Communications, Networks, Network Types, Internet History, Standards and Administration.
**Network Models:** Protocol Layering, TCP/IP Protocol Suite, The OSI Model
**Introduction to Physical Layer**: Data and Signals, Transmission Impairment, Data Rate Limits, Performance.
Transmission Media: Introduction, Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet Switching

| UNIT - II | | 9Hrs |
|---|---|---|

**The Data Link Layer:** Introduction, Link layer addressing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction, Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol.
**Media Access control**: Random Access, Controlled Access, Channelization, Connecting devices and virtual LANs: Connecting Devices.

| UNIT - III | | 9 Hrs |
|---|---|---|

**The Network Layer:** Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking.
**The network layer in the Internet:** IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.

| UNIT - IV | | 9 Hrs |
|---|---|---|

**The Transport Layer:** The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.

| UNIT - V | | 9 Hrs |
|---|---|---|

**The Application Layer**: Introduction, Client-Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

**Textbooks:**

1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012.
2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2010.

**Reference Books:**

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. "Internetworking with TCP/IP – Principles, protocols, and architecture - Volume 1, Douglas E. Comer, 5th edition, PHI
3. "Computer Networks", 5E, Peterson, Davie, Elsevier.
4. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.
5. "Computer Networks and Internets with Internet Applications", Comer.

**Online Learning Resources:**

https://www.youtube.com/watch?v=O--rkQNKqls&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | 2 | |
| CO2 | 3 | 2 | | | | 1 | | | | | | | 2 | |
| CO3 | 3 | 3 | | 3 | 3 | 1 | | | | | | | 2 | |
| CO4 | 3 | 3 | | 3 | 3 | | | | | | | | 3 | 2 |
| CO5 | 2 | 1 | | | | | | | | | | | 1 | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|-----|------|------|-----|------|------|------|
| 1 | 15 | 23% | 3 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze (L4) | 2<br>1 |
| 2 | 10 | 15% | 2 | CO2 : Apply | L3 | PO1<br>PO2<br>PO6 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO6:Thumb rule | 3<br>2<br>1 |
| 3 | 15 | 23% | 3 | CO3 : Analyze | L4 | PO1<br>PO2<br>PO4<br>PO5<br>PO6 | PO1: Apply(L3)<br>PO2: Analyze L4)<br>PO4: Analyze (L4)<br>PO5:Apply(L3)<br>PO6:Thumb rule | 3<br>3<br>3<br>3<br>1 |
| 4 | 11 | 17% | 2 | CO4 :Analyze | L4 | PO1<br>PO2<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO4: Analyze (L4)<br>PO5:Apply(L3) | 3<br>3<br>3<br>3 |
| 5 | 15 | 23% | 3 | CO5 : Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze (L4) | 2<br>1 |
| | 66 | 100% | | | | | | |

**Justification Statements :**

**CO1:** understand the basics of data communications and networking by using OSI model.
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Analyze(L4)**
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2:** Apply Data link Layer functionalities to solve real world problems.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Analyze(L4)**
CO2 Action verb is less than PO2 verb by One levels. Therefore the correlation is medium (2)
**PO6: Thumb rule**
Data link Layer functionalities are useful for realtime applications.Therefore the correlation is (1)

**CO3:** Analyze various routing algorithms and protocols.
**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO3  Action verb is greater  than  PO1 verb. Therefore the correlation is high (3)
**PO2: Analyze(L4)**
CO3 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO4: Analyze(L4)**
CO3 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO3  Action verb is greater  than  PO5 verb. Therefore the correlation is high (3)
**PO6 : Thumb rule**
Various routing algorithms are useful for finding distance between routers in real life.Therefore the correlation is (1)

**CO4:** Analyze the Transport Layer services by using TCP and UDP protocols.
**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO4  Action verb is greater than PO1 verb by one level. Therefore the correlation is high (3)
**PO2: Analyze(L4)**
CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO4: Analyze(L4)**
CO4 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO5:  Apply(L3)**
CO4  Action verb is greater than PO5 verb by one level. Therefore the correlation is high (3)

 **CO5:** Understand various services protocols offered by application layer.
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO5 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Analyze(L4)**
CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

| Course Code | Year & Sem | Object Oriented Programming through Java | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3609 | II-II | **(common to CSE,CIC,CSE(DS))** | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the OOP concepts to apply basic java programming.

CO2: **Apply** the inheritance, packages, and interfaces to organize various java resources.

CO3: **Analyze** the exception handling to develop efficient and error free codes.

CO4: **Apply** the concepts of multithreading and collection frameworks to solve real world scenarios

CO5: **Apply** the concepts of applets and swings for making web and GUI based applications.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | The fundamentals of OOP concepts | | to design java programs. | L2 |
| **CO2** | Apply | the inheritance, packages, and interfaces | | to organize various java resources | L3 |
| **CO3** | Analyze | the exception handling | | to develop efficient and error free codes | L4 |
| **CO4** | Apply | the concepts of multithreading and collection frameworks | | to solve real world scenarios. | L3 |
| **CO5** | Apply | the concepts of applets and swings | | for making web and GUI based applications. | L3 |

| UNIT - I | | 9Hrs |
|---|---|---|

**Object Oriented Thinking**: History of Java, Java Buzzwords, Overview of OOP CLASSES AND Objects: Classes, Objects, Simple Java Program, Methods, Constructors, this Keyword, Garbage Collection, Data Types, Variables, Arrays, Operators, Control Statements Overloading of Methods and Constructors, Parameter Passing, Recursion, String Class and String handling methods.

| UNIT - II | | 9 Hrs |
|---|---|---|

**Inheritance:** Inheritance Basics, Using Super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Using final with Inheritance, Object Class.
**Packages:** Packages, Access Protection, Importing Packages.
**Interfaces:** Defining an Interface, Implementing Interface, Applying Interface, Variables in Interfaces, Interfaces can be extended.

| UNIT - III | | 8Hrs |
|---|---|---|

**Exception Handling:** Exception Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built in Exceptions, Creating Own Exception Sub Classes.
**Input and Output Operations**: I/O basics, reading console input, writing console output, the PrintWriter class, reading and writing files, automatically closing a file.
**Generic Programming** : Generic classes, generic methods, Bounded Types, Restrictions and Limitations.

| UNIT - IV | | 8 Hrs |
|---|---|---|

**Multithreading:** Java Thread Model, The Main Thread, Thread Life Cycle, Creating Thread and Multiple Threads, isAlive() and join(), Thread Priorities, Synchronization, Inter thread Communication, Suspending, Resuming and Stopping Threads.
**Collection Framework**: Collection Overview, Collection Interfaces: The Collection Interface, the List Interface, the Queue Interface, Collection Classes: Array List Class, Linked List Class, String Tokenizer, Scanner.

| UNIT - V | | 10Hrs |
|---|---|---|

**Applets:** Applet Basics, Life Cycle of an Applet, Simple Applet Display Methods, The HTML APPLET tag, Passing Parameters to Applets.
**Swing:** Introduction to Swing Model-View, Controller design pattern button, layout management, Swing Components.

**Textbooks:**

| Herbert Schildt, Java. The complete reference, TMH. 9thEdition, 2014 |
| Cay. S. Horstmann and Gary Cornell Core Java 2, Vol 2, Advanced Features, Pearson Education, 7thEdition, 2004 |

**Reference Books:**

1. J.Nino and F.A. Hosch, An Introduction to programming and OO design using Java, John Wiley & sons.
2. Y. Daniel Liang, Introduction to Java programming, Pearson Education 6th Edition
3. R.A. Johnson- Thomson, An introduction to Java programming and object oriented application development.
4. P. Radha Krishna, Object Oriented Programming through Java, University Press.

Online Learning Resources:

www.javatpoint.com

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | | 1 | 1 |
| CO2 | | 3 | 3 | 2 | 3 | | | | | | 3 | 3 | 1 | 1 |
| CO3 | 2 | 3 | 3 | 3 | 3 | | | | | | | | 1 | 1 |
| CO4 | 3 | 3 | | 2 | 3 | | 2 | | | | | | 1 | 1 |
| CO5 | | 3 | 3 | | 3 | | | | | | 3 | 3 | 1 | 1 |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| 1 | 16 | 19% | 2 | CO1 :Understand | L2 | PO1 PO2 | PO1: Apply(L3) PO2: Review(L2) | 2 3 |
| 2 | 18 | 21% | 3 | CO2 :Apply | L3 | PO2 PO3 PO4 PO5 PO11 PO12 | PO2: Review (L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb Rule PO12: Thumb Rule | 3 3 2 3 3 3 |
| 3 | 19 | 22% | 3 | CO3 :Analyze | L4 | PO1 PO2 PO3 PO4 PO5 | PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) | 2 3 3 3 3 |
| 4 | 18 | 21% | 3 | CO4 :Apply | L3 | PO1 PO2 PO4 PO5 PO7 | PO1: Apply(L3) PO2: Review (L2) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb Rule | 3 3 2 3 2 |
| 5 | 15 | 17% | 2 | CO5 :Apply | L3 | PO2 PO3 PO5 PO11 PO12 | PO2: Review (L2) PO3: Develop (L3) PO5: Apply(L3) PO11: Thumb Rule PO12: Thumb Rule | 3 3 3 3 3 |
| | 85 | 100% | | | | | | |

**Justification Statements :**

**CO1: Understand the OOP concepts to apply basic java programming.**
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the inheritance, packages, and interfaces to organize various java resources**

**Action Verb : Apply (L3)**

**PO2: Review (L2)**
CO2 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
**PO5: Apply (L3)**
CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
**PO11: Thumb rule**
Create some Java programs to solve real world problems. Therefore the correlation is high (3)
**PO12: Thumb rule**
Learn java programs to solve. Therefore the correlation is high (3)

**CO3: Analyze the exception handling to develop efficient and error free codes**
**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO3:  CO3 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2: Review (L2)**
CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**
CO3 Action verb is greater than PO3 verb by one level. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is same as PO4 verb. Therefore the correlation is high(3)
**PO5: Apply (L3)**
CO3 Action verb is greater than PO5 verb by one level. Therefore the correlation is high(3)

**CO4: Apply the concepts of multithreading and collection frameworks to solve real world scenarios**.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Review (L2)**
CO4 Action verb is greater than PO2 verb by one level. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
**PO5: Apply (L3)**
CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
**PO7: Thumb rule**
To solve some problems we use multithreading and collection frame works. Therefore the correlation is medium(2)

**CO5: Apply the concepts of  applets  and swings for making web and GUI based applications.**
**Action Verb :Apply  (L3)**
**PO2: Review (L2)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
**PO11: Thumb rule**
Java is used to design simple and enterprise applications so need for project management. Therefore the correlation is high(3)
**PO12: Thumb rule**
It is a programming language so new version available so we need to learn. Therefore the correlation is high(3)

| Course Code | Year & Sem | Operating Systems | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3611 | II-II | (common to CSE,CIC,AIDS,AIML,CSE(DS)) | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the basic concepts of Operating Systems and its services.

CO2: **Apply** the concepts of process synchronization and CPU scheduling by drawing Gantt chart

CO3: **Analyze** the methods to handle deadlock and memory management

CO4: **Evaluate** the various disk scheduling algorithms and file system interfaces

CO5: **Understand** the issues and goals of protection various security

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the basic concepts of Operating Systems and its services | | | L2 |
| **CO2** | Apply | the concepts of process synchronization & CPU scheduling | by drawing Gantt chart | | L3 |
| **CO3** | Analyze | the methods to handle deadlock and memory management | | | L4 |
| **CO4** | Evaluate | the various disk scheduling algorithms and file system interfaces | | | L5 |
| **CO5** | Understand | the various security issues and goals of protection | | | L2 |

| UNIT - I | | 9 Hrs |
|---|---|---|

**Operating Systems Overview**: Operating system functions, Operating system structure, operating systems Operations, protection and security, Computing Environments, Open- Source Operating Systems

**System Structures**: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.

**Processes:** Process concept, process Scheduling, Operations on processes, Inter process Communication, Examples of IPC systems.

| UNIT  - II | | 10Hrs |
|---|---|---|

**Threads:** overview, Multi-core Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.

**Process Synchronization:** The critical-section problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches.

**CPU Scheduling:** Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.

| UNIT - III | | 8Hrs |
|---|---|---|

**Memory Management:** Swapping, contiguous memory allocation, segmentation, paging, structure of the page table.

**Virtual memory:** demand paging, page-replacement, Allocation of frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory

**Deadlocks:** System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.

| UNIT - IV | | 9Hrs |
|---|---|---|

**Mass-storage structure:** Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation.

**File system Interface:** The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection.

**File system Implementation:** File-system structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.

| UNIT - V | | 8Hrs |
|---|---|---|

**I/O systems:** I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations.

| **Protection:** Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights, Capability- Based systems, Language – Based Protection |
|---|
| **Security:** The Security problem, Program threats, System and Network threats, Cryptography as a security tool, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer–security classifications. |

**Textbooks:**

1. Operating System Concepts, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Wiley, Eight Edition, 2018

**Reference Books:**

1. Operating systems by A K Sharma, Universities Press,
2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
3. Operating Systems, A.S.Godbole, Second Edition, TMH.
4. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
5. Operating Systems, R.Elmasri, A,G.Carrick and D.Levine, Mc Graw Hill.
6. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.

**Online Learning Resources:**

https://nptel.ac.in/courses/106/106/106106144/ http://peterindia.net/OperatingSystems.html

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | 2 | 1 | 1 |
| CO2 | 3 | 3 | | | | 2 | | | | | | 3 | 1 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | | 3 | | | | 2 | 2 | 2 |
| CO5 | 2 | 3 | | | | | | 3 | | | | 2 | 2 | 2 |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 1 | 16 | 19% | 2 | CO1 : Understand | L2 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO12: Thumb rule | 2<br>3<br>2 |
| 2 | 19 | 22% | 3 | CO2 :Apply | L3 | PO1<br>PO2<br>PO6<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO6: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>2<br>3 |
| 3 | 16 | 19% | 2 | CO3 :  Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2:  Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3) | 3<br>3<br>3<br>3<br>3 |
| 4 | 18 | 21% | 3 | CO4 :  Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO6<br>PO8<br>PO12 | PO1: Apply(L3)<br>PO2:  Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO6: Thumb rule<br>PO8: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>2<br>3<br>2 |
| 5 | 17 | 19% | 2 | CO5 : Understand | L2 | PO1<br>PO2<br>PO8<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO8: Thumb rule<br>PO12: Thumb rule | 2<br>3<br>3<br>2 |
| | 86 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand the basic concepts of Operating Systems and its services.**
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same as PO2 verb. Therefore the correlation is high(3)

**PO12: Thumb rule**

In today's world operating system services are updating, those services needs to understand. Therefore the correlation is medium (2)

## CO2: Apply the concepts of process synchronization & CPU scheduling by drawing gantt chart
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2 Verb : Review(L2)**

CO1 Action verb is greater than PO2 verb by one level. Therefore the correlation is high (3)

**PO6: Thumb rule**

Most of the scheduling algorithm were used to solve some of the societal problems like forming Queue line. Therefore the correlation is Moderate (2)

**PO12: Thumb rule**

Scheduling is the one of the daily activity done in many sectors. Therefore the correlation is High(3)

## CO3: Analyze the methods to handle deadlock and memory management
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**

CO3 Action verb is greater level as PO1 verb. Therefore the correlation is high (3)

**PO2: Review (L2)**

CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**

CO3 Action verb is greater than PO3 verb by one level. Therefore the correlation is high(3)

**PO4: Analyze (L4)**

CO3 Action verb is same as PO4 verb. Therefore the correlation is high(3)

**PO5: Apply(L3)**

CO3 Action verb is greater than PO5 verb by one level. Therefore the correlation is high(3)

## CO4: Evaluate the various disk scheduling algorithms and file system interfaces.
**Action Verb : Evaluate (L5)**
**PO1: Apply(L3)**

CO4 Action verb is greater level as PO1 verb. Therefore the correlation is high (3)

**PO2: Review (L2)**

CO4 Action verb is greater level as PO2 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high(3)

**PO4: Analyze (L4)**

CO4 Action verb is greater than PO4 verb by one level. Therefore the correlation is high(3)

**PO5: Apply(L3)**

CO4 Action verb is greater than PO5 verb. Therefore the correlation is high(3)

**PO6: Thumb rule**

Disk scheduling and file system interfaces are applied to provide solutions for E-Commerce database access . Therefore the correlation is medium (2)

**PO8: Thumb rule**

Since ethical principles shall be followed in file manipulations and data storage. Therefore the correlation is high(3)

**PO12: Thumb rule**

File manipulation of data and storage of data is playing major role in current scenario. Therefore, the correlation is medium (2)

## CO5: Understand the various security issues and goals of protection
**Action Verb : Understand (L2)**
**PO1: Apply(L3)**

CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**PO2: Review (L2)**

CO5 Action verb is same asPO2 verb. Therefore, the correlation is high(3)

**PO8 : Thumb rule**

Ethical principles should be followed for various security issues. Therefore the correlation is high(3)

**PO12: Thumb rule**

Security services and principles are keep on updating in the today's world. Therefore, the correlation is medium (2)

| Course Code | Year & Sem | MANAGERIAL ECONOMICS AND FINANCIAL | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AHSMB01 | II-II | ANALYSIS | 3 | 0 | 0 | 3 |

## Course Outcomes (CO):

After studying the course, student will be able to

**CO1: Understand** the fundamentals of managerial economics and demand concept.

**CO2: Understand** the production and cost concepts to optimize the output

**CO3: Analyze** the price output relationship in different markets.

**CO4: Evaluate** the capital budgeting techniques to invest in various projects.

**CO5: Analyze** the accounting statements to evaluate the financial performance of business entity.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | fundamentals of managerial economics | | | L2 |
| CO2 | Understand | production and cost concepts | | To optimize the output | L2 |
| CO3 | Analyze | price output relationship in various markets | | | L4 |
| CO4 | Evaluate | capital budgeting techniques | | To invest in various projects | L5 |
| CO5 | Analyze | accounting statements | | to evaluate the financial performance of business entity | L4 |

| UNIT - I | **Managerial economics** |
|---|---|
| Introduction – meaning, nature, significance, functions, and advantages, ME and its role in other fields. Demand **-** Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing forecasting, Methods. | |

| UNIT - II | **Production and Cost Analysis** |
|---|---|
| Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost& Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis. | |

| UNIT - III | **Business Organizations and Markets** |
|---|---|
| Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies. | |

| UNIT - IV | **Capital Budgeting** |
|---|---|
| Introduction to Capital, Sources of Capital. Short-term and Long-term Capital: Working capital, types, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), and Internal Rate Return (IRR) Method (simple problems). | |

| UNIT - V | **Financial Accounting and Analysis** |
|---|---|
| Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profitand Loss Account and Balance Sheet with simple adjustments). *Financial Analysis* - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability. | |

**Textbooks:**
1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

**Reference Books:**

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

**Online Learning Resources:**

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607

| COs | Programme Outcomes (POs) & Programme Specific Outcomes (PSOs) | | | | | | | | | | | | | |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | | | | | | | | | | | | | |
| CO2 | | 1 | | | | | | | | | | | | |
| CO3 | 3 | | | | | | | | | | | | | |
| CO4 | | 3 | | | | | | | | | | | | |
| CO5 | | 3 | | | | | | | | | | | | |

| Course Outcome (CO) | Percentage of contact hours over the total planned contact hours | CO: Action verb and BTL | Program Outcome(PO) | PO: Action verb and BTL | Level of correlation (0-3) |
|------|------|------|------|------|------|
| CO1 | 16% | understand | PO1 | Apply | 2 |
| CO2 | 22% | understand | PO2 | Analyse | 1 |
| CO3 | 22% | Analyse | PO1 | Apply | 3 |
| CO4 | 16% | Evaluate | PO2 | Analyse | 3 |
| CO5 | 22% | Analyse | PO2 | Analyse | 3 |

**Justification Statements:**

**CO1: Understand the fundamentals of Managerial economics and demand concept.**
**Action Verb: Understand (L2)**
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**CO2: Understand the Concept of Production and cost analysis.**
**Action Verb: Understand (L2)**
PO2: Analyze (L4)
CO2 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)

**CO3: Analyze the price output in various markets.**
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3)

**CO4: Evaluate the capital budgeting techniques.**
**Action Verb : Evaluate (L5)**
PO2: Analyse
CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3)

**CO5: Analyse the Accounting statements and evaluate the financial performance of business entity.**
Action Verb: Analyze (L4)
PO2: Analyze (L4)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)

| Course Code | Year & Sem | Universal Human Values | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AHS9905 | II-II | | 2 | 1 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the essentials of human values, self-exploration, happiness and prosperity for value added education.

CO2: **Analyze** the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.

CO3: **Apply** the nine universal human values in relationships for harmony in the family and orderliness in the society.

CO4: **Evaluate** the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.

CO5: **Apply** the holistic understanding of harmony on professional ethics through augmenting universal human order.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| *CO1* | **Understand** | the essentials of human values, self-exploration, happiness and prosperity for value added education | | | **L2** |
| *CO2* | **Analyze** | the harmony in the human being as sentient 'I' and the material 'Body' in various aspects. | | | **L4** |
| *CO3* | **Apply** | the nine universal human values in relationships for harmony in the family and orderliness in the society | | | **L3** |
| *CO4* | **Evaluate** | the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence | | | **L5** |
| *CO5* | **Apply** | the holistic understanding of harmony on professional ethics through augmenting universal human order. | | | **L3** |

## UNIT – 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current. scenario
- Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

    **Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.**

## UNIT II: Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

**Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.**

UNIT III: <u>Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship</u>.

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

**Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives**

UNIT IV: <u>Understanding Harmony in the Nature and Existence - Whole existence as Coexistence</u>

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
- Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

**Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.**

UNIT- V: <u>Implications of the above Holistic Understanding of Harmony on Professional Ethics.</u>

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations sum up.

**Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions Eg. To discuss the conduct as an engineer or scientist etc.**

**TEXT BOOKS**

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

**REFERENCE BOOKS:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. FSchumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

**Articulation matrix**

| Course Title | COs | Programme Outcomes (POs) & Programme Specific Outcomes (PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| Universal Human Values | CO1 | | | | | | | | 2 | | | | 12 | | |
| | CO2 | | | | | | | 3 | 3 | | | | | | |
| | CO3 | | | | | | 2 | 2 | 2 | | | | | | |
| | CO4 | | | | | | 3 | 3 | 3 | | | | 3 | | |
| | CO5 | | | | | | 2 | 2 | 2 | | | | 2 | | |

**Correlation matrix**

| CO | Lesson Plan (Hrs) | % | Correlation | Verb | BTL | Program Outcomes (PO) | PO(s): Action Verb and BTL (for PO1 to PO5) | Level of Correlation |
|---|---|---|---|---|---|---|---|---|
| 1 | 7 | 19.4 | 2 | **Understand** | 2 | PO8,PO12 | Thumb Rule | 2,2 |
| 2 | 8 | 22.2 | 3 | **Analyze** | 4 | PO7,PO8 | Thumb Rule | 3,3 |
| 3 | 7 | 19.4 | 2 | **Apply** | 3 | PO6,PO7,PO8 | Thumb Rule | 2,2,2 |
| 4 | 8 | 22.2 | 3 | **Evaluate** | 5 | PO6,PO7,PO8,PO12 | Thumb Rule | 3,3,3,3 |
| 5 | 7 | 19.4 | 2 | **Apply** | 3 | PO6,PO7,PO8,PO12 | Thumb Rule | 2,2,2,2 |

**Justification Statements:**

**CO1: Understand the essentials of human values, self-exploration, happiness and prosperity for value added education.**
**Action Verb: Understand (L2)**
CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO2: Analyze the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.**
**Action Verb: Analyze (L4)**
CO2 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).

**CO3: Apply the nine universal human values in relationships for harmony in the family and orderliness in the society.**
**Action Verb: Apply (L3)**
CO3 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2)

**CO4: Evaluate the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.**
**Action Verb:  Evaluate  (L5)**
CO4 Action Verb is Evaluate of BTL5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

**CO5: Apply the holistic understanding of harmony on professional ethics through augmenting universal human order.**
**Action Verb: Apply (L3)**
CO5 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

| Course Code | Year & Sem | COMPUTER NETWORKS LAB | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3608 | II-II | | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the error detection/correction techniques.

**CO2: Analyze** the methods to simulate data link layer protocols.

**CO3: Analyze** broadcast tree for the subnet masking.

**CO4: Apply** the routing algorithm for implementing network layer protocols.

**CO5: Analyze** the sending and receiving of packets by using NS2 simulator.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | the error detection/correction techniques | | | L2 |
| **CO2** | **Analyze** | the methods | | to simulate data link layer protocols | L4 |
| **CO3** | **Analyze** | broadcast tree | | for the subnet masking. | L4 |
| **CO4** | **Apply** | the routing algorithm | | for implementing network layer protocols. | L3 |
| **CO5** | **Analyze** | the sending and receiving of packets | by using NS2 simulator. | | L4 |

| **List of Experiments** |
|---|
| 1. Implementation of Error Detection / Error Correction Techniques**(CO1)** |
| 2. Implementation of Stop and Wait Protocol and sliding window**(CO1)** |
| 3. Implementation and study of Go-back-N and selective repeat protocols**(CO1)** |
| 4. Implementation of High Level Data Link Control**(CO2)** |
| 5. Write a socket Program for Echo/Ping/Talk commands. **(CO2)** |
| 6. To create scenario and study the performance of network with CSMA / CA protocol and comparewith CSMA/CD protocols. **(CO2)** |
| 7. Implementation of Link state routing algorithm**(CO3)** |
| 8. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing. **(CO2)** |
| 9. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP**(CO2)** |
| 10. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism. **(CO2)** |
| 11. Implement Dijsktra's algorithm to compute the shortest path through a network**(CO4)** |
| 12. Take an example subnet of hosts and obtain a broadcast tree for the subnet. **(CO3)** |
| 13. Implement distance vector routing algorithm for obtaining routing tables at each node. **(CO4)** |
| 14. Write a program for congestion control using Leaky bucket algorithm. **(CO4)** |
| 15. Do the following using NS2 Simulator**(CO5)** <br> a. NS2 Simulator-Introduction <br> b. Simulate to Find the Number of Packets Dropped <br> c. Simulate to Find the Number of Packets Dropped by TCP/UDP <br> d. Simulate to Find the Number of Packets Dropped due to Congestion <br> e. Simulate to Compare Data Rate& Throughput. <br> f. Simulate to Plot Congestion for Different Source/Destination <br> g. Simulate to Determine the Performance with respect to Transmission of Packets |

| **Reference Books:** |
|---|
| Shivendra S.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, ―TCP/IP Essentials A Lab-Based Approach‖, Cambridge University Press, 2004. |
| Cisco Networking Academy, ―CCNA1 and CCNA2 Companion  Guide‖, Cisco Networking Academy Program, 3rd edition, 2003. |
| Ns Manual, Available at: https://www.isi.edu/nsnam/ns/ns-documentation.html, 2011. |
| Elloitte Rusty Harold, ―Java Network Programming‖, 3rd edition, O'REILLY, 2011. |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | | | | | | | | | 2 | 2 |
| CO3 | 3 | 3 | 3 | | 3 | | | 3 | | | | | 2 | 2 |
| CO4 | 3 | 3 | | 2 | 3 | | | | | | | | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|
| 1 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 2<br>3 |
| 2 | CO2: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3)<br>PO4: Analyze (L4) | 3<br>3<br>3<br>3 |
| 3 | CO3: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO5<br>PO8 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3)<br>PO5: Apply (L3)<br>PO8: Thumb rule | 3<br>3<br>3<br>3<br>3 |
| 4 | CO4: Apply | L3 | PO1<br>PO2<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3) | 3<br>3<br>2<br>3 |
| 5 | CO5: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3)<br>PO4: Analyze (L4)<br>PO5: Apply (L3) | 3<br>3<br>3<br>3<br>3 |

**Justification Statements :**

**CO1: Understand** the error detection/correction techniques

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**PO2 Verb: Review(L2)**

CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)


**CO2: Analyze** the methods to simulate data link layer protocols .

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

**PO2: idetify(L3)**

CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop (L3)**

CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

**PO4: Analyze (L4)**

CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)


**CO3: Analyze** broadcast tree for the subnet masking.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO3 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

**PO2: idetify(L3)**

CO3 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop (L3)**
CO3 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
**PO5: Apply (L3)**
CO3 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)
**PO8: Thumb rule**
While designing Routing algorithms  one should follow ethical principles. Therefore, the correlation is high (3)

**CO4: Apply** the routing algorithm for implementing network layer protocols.
**Action Verb: Apply (L3)**
**PO1: Apply (L3)**
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2: idetify(L3)**
CO4 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium(2)
**PO5: Apply (L3)**
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**CO5: Analyze** the sending and receiving of packets by using NS2 simulator.
**Action Verb: Analyze (L4)**
**PO1: Apply (L3)**
CO5 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
**PO2: idetify(L3)**
CO5 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
**PO5: Apply (L3)**
CO5 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)

| Course Code | Year & Sem | OBJECT ORIENTED PROGRAMMING THROUGH JAVA | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3610 | II-II | **LAB** | 0 | 0 | 3 | 1.5 |

## Course Outcomes:

After studying the course, student will be able to

**CO1: Understand** the java compiler and learn how to use eclipse or net beans IDE.

**CO2: Apply** the class concepts for developing simple java applications.

**CO3: Apply** the oops concepts for implementing java programs.

**CO4: Analyze** the concepts of multithreading and collection frameworks for writing simple programs.

**CO5: Create** the applets and GUI based applications using swings.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the java compiler and learn how to use eclipse or net beans IDE. | | | L2 |
| **CO2** | Apply | the class concepts | | for developing simple java applications. | L3 |
| **CO3** | Apply | the oops concepts | | for implementing java programs. | L3 |
| **CO4** | Analyze | the concepts of multithreading and collection frameworks | | for writing simple programs. | L4 |
| **CO5** | Create | the applets and GUI based applications | using swings. | | L6 |

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| List of Experiments |
|---|
| **Week-1: (Unit-1)** <br><br> Installation of Java software, study of any integrated development environment, Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class and run it. <br><br> Practice Java Basic Programs on Classes and Objects.**(CO1)** <br> **Week-2: (Unit-1)** <br><br> Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Commute the bill amount using the following tariff. <br> If the type of the EB connection is domestic, calculate the amount to be paid as follows: <br><br> First 100 units - Rs. 1 per unit; 101-200 units - Rs. 2.50 per unit; 201 -500 units - Rs. 4 per unit; <br><br> 501 units - Rs. 6 per unit. If the type of the EB connection is commercial, calculate the amount to be paid as follows: First 100 units - Rs. 2 per unit; 101-200 units - Rs. 4.50 per unit; 201 -500 units - Rs. 6 per unit; > 501 units - Rs. 7 per unit. <br><br> Write a java program to illustrate the concept of class with method overloading. C) Write a java program to illustrate the concept of class with Constructors overloading. **(CO2)** <br> **Week-3:(Unit-2)** <br><br> a) Write a program to create a class named shape. It should contain 2 methods, draw() and erase() that prints "Drawing Shape" and "Erasing Shape" respectively. For this class, create three sub classes, |

Circle, Triangle and Square and each class should override the parent class functions - draw () and erase (). The draw() method should print "Drawing Circle", "Drawing Triangle" and "Drawing Square" respectively. The erase() method should print "Erasing Circle", "Erasing Triangle" and "Erasing Square" respectively. Create objects of Circle, Triangle and Square in the following way and observe the polymorphic nature of the class by calling draw() and erase() method using each object. Shape c=new Circle(); Shape t=new Triangle(); Shape s=new Square();

b) Write a Java Program to demonstrate inheritance &usage of super**(CO2)**

**Week-4:(Unit-2)**

Write a Java Program to implement multilevel inheritance. **(CO3)**
Write a Java program to implement the method overriding**(CO3)**
Write a Java program to implement dynamic method dispatch. **(CO3)**
**Week-5:(Unit-2)**

Write a Java program to implement abstract class. **(CO3)**
Write a Java Program to implement Packages. **(CO3)**
Write a Java Program to implement Access Protection in Packages. **(CO3)**
**Week-6:(Unit-2)**

Write a Java program to demonstrate interfaces. **(CO3)**
Write a Java program to implement the multiple inheritance using interfaces. **(CO3)**
**Week-7:(Unit-3)**

Write a Java program to implement the exception handling mechanism. **(CO3)**
Write a Java program to implement the nested try statement. **(CO3)**
Write a Java program to implement your own exception class. **(CO3)**
**Week-8:(Unit-3)**

Write a Java Program to demonstrate the following String Handlings. **(CO3)**
String Length& Concatenation.
Character Extraction.
String Comparison.
Searching and modifying String.
Write a Java Program to demonstrate String Buffer Class.
**Week-9:(Unit-4)**

Write a Java program for multi-thread implementation. **(CO4)**
Write a Java program to implement producer consumer problem using inter-thread communication mechanism. **(CO4)**
**Week-10:(Unit-4)**

Practice any two Programs on Collections. **(CO4)**
Practice any two Programs on String Tokenizer & Scanner. **(CO4)**
**Week-11:(Unit-5)**

Write a Java Program to develop an applet that displays a simple message. **(CO5)**
Develop an applet that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named ─Compute‖ is clicked. **(CO5)**
Write a java program to handle keyboard events. **(CO5)**
Write a java program to handle Mouse events**(CO5)**
**Week-12:(Unit-5)**

Write a Java Program to demonstrate AWT Label & Button. **(CO5)**
Write a Java Program to demonstrate JLabel, JTextField & JButton. **(CO5)**
Write a program to design a calculator using event driven programming paradigm of java**(CO5)**

**Reference Books:**
1. Herbert Schildt.Java. The complete reference, TMH. 9thEdition.
2. H.M.Dietel and P.J.Dietel, Java How to Program 6thEdition,PearsonEducation/PHI
3. Y.Daniel Liang, Introduction to Java programming, Pearson Education, 6thEdition.

| | 4. Cay Horstmann, Big Java, 2nd edition, Wiley Student Edition, Wiley India Private Limited. |
| --- |
| **Online Learning Resources/Virtual Labs:** |
| http://www.javatpoint.com |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | | 3 | | | 2 | | | | | | | | 3 | |
| **CO2** | | 3 | 3 | 2 | 3 | | | | | | | | 2 | |
| **CO3** | | | 3 | 2 | 3 | | | | | | | | 2 | 2 |
| **CO4** | | 3 | 3 | 3 | 3 | | | | | | | | 2 | 2 |
| **CO5** | | | 3 | | 3 | | | | | | | | 2 | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
| --- | --- | --- | --- | --- | --- |
| 1 | CO1 :Understand | L2 | PO2<br>PO5 | PO2: Review(L2)<br>PO5: Apply(L3) | 3<br>2 |
| 2 | CO2 :Apply | L3 | PO2<br>PO3<br>PO4<br>PO5 | PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3) | 3<br>3<br>2<br>3 |
| 3 | CO3: Apply | L3 | PO3<br>PO4<br>PO5 | PO3: Develop(L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3) | 3<br>2<br>3 |
| 4 | CO4: Analyze | L4 | PO2<br>PO3<br>PO4<br>PO5 | PO2: Analyze (L4)<br>PO3: Develop(L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3) | 3<br>3<br>3<br>3 |
| 5 | CO5 :Create | L6 | PO3<br>PO5 | PO3: Design (L6)<br>PO5: Create(L6) | 3<br>3 |
| | | | | | |

**Justification Statements :**

**CO1: Understand** the java compiler and learn how to use eclipse or net beans IDE.

**Action Verb : Understand(L2)**

PO2: Review(L2)

CO1 Action verb is same PO2 verb. Therefore the correlation is High(3)

PO5: Apply(L3)

CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)

**CO2: Apply** the class concepts for developing simple java applications.

**Action Verb : Apply (L3)**

PO2: Review(L2)

CO2 Action verb is greater than PO2 verb. Therefore the correlation is High(3)

**PO3: Develop (L3)**

CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO2 Action verb is less than PO4 verb by one levels. Therefore the correlation is medium (2)

**PO5: Apply (L3)**

CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**CO3: Apply** the oops concepts for implementing java programs.

**Action Verb : Apply(L3)**

PO3: Develop (L3)

CO3 Action verb is same level as PO3  verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)

PO5: Apply (L3)

CO3 Action verb is same as PO5 verb. Therefore the correlation is high(3)


**CO4: Analyze** the concepts of multithreading and collection frameworks for writing simple programs.

**Action Verb :Analyze (L4)**

PO2: Analyze (L4)

CO4 Action verb is same PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)

PO5: Apply (L3)

CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)


**CO5: Create** the applets and GUI based applications using swings.

**Action Verb : Create (L6)**

PO3: Design (L6)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO5: Create(L6)

CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)

| Course Code | Year & Sem | **Operating Systems Lab** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|---|
| 20APC3612 | II-II | | **0** | **0** | **3** | **1.5** |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the basic commands in UNIX operating systems.

**CO 2: Apply** the concepts of CPU scheduling algorithms to solve real time problems.

**CO 3: Apply** the concepts of process synchronization methods.

**CO 4: Analyze** the solutions for virtual memory and Deadlocks.

**CO 5: Analyze** various file system interfaces.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | the basic commands in UNIX operating system | | | L2 |
| **CO2** | **Apply** | the concepts of CPU scheduling algorithms | | to solve real time problems | L3 |
| **CO3** | **Apply** | the concepts of process synchronization methods | | | L3 |
| **CO4** | **Analyze** | the solutions | | for virtual memory and Deadlocks | L4 |
| **CO5** | **Analyze** | various file system interfaces | | | L4 |

| **List of Experiments to be implemented in C/Java** |
|---|
| 1. Practicing of Basic UNIX Commands.**(CO1)** |
| 2. Write programs using the following UNIX operating system calls Fork, exec, getpid, exit, wait, close, stat, opendir and readdir**(CO1)** |
| 3. Simulate UNIX commands like cp, ls, grep, etc., **(CO1)** |
| 4. Simulate the following CPU scheduling algorithms:  a) Round Robin b) SJF c) FCFS d) Priority**(CO2)** |
| 5. Simulate all file allocation strategies: a) Sequential b) Indexed c) Linked**(CO2)** |
| 6. Simulate MVT and MFT**(CO2)** |
| 7. Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG**(CO2)** |
| 8. Simulate Bankers Algorithm for Deadlock Avoidance**(CO3)** |
| 9. Simulate Bankers Algorithm for Deadlock Prevention**(CO3)** |
| 10. Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. ...**(CO4)** |
| 11. Simulate Paging Technique of memory management**(CO4)** |
| 12. Control the number of ports opened by the operating system with a) Semaphore b) monitors**(CO4)** |
| 13. Simulate how parent and child processes use shared memory and address space**(CO4)** |
| 14. Simulate sleeping barber problem**(CO4)** |
| 15. Simulate dining philosopher's problem**(CO4)** |
| 16. Simulate producer and consumer problem using threads (use java) **(CO4)** |
| 17. Simulate little's formula to predict next burst time of a process for SJF scheduling algorithm. **(CO4)** |
| 18. Develop a code to detect a cycle in wait-for graph**(CO5)** |
| 19. Develop a code to convert virtual address to physical address**(CO5)** |
| 20. Simulate how operating system allocates frame to process**(CO5)** |
| 21. Simulate the prediction of deadlock in operating system when all the processes announce their resource requirement in advance. **(CO5)** |
| References: |
| 1. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Eighth Edition, |

John Wiley.
2. "Operating Systems: Internals and Design Principles", Stallings, Sixth Edition–2009, Pearson Education
3. "Modern Operating Systems", Andrew S Tanenbaum, Second Edition, PHI.
4. "Operating Systems", S.Haldar, A.A.Aravind, Pearson Education.
5. "Principles of Operating Systems", B.L.Stuart, Cengage learning, India Edition.2013-2014
6. "Operating Systems", A.S.Godbole, Second Edition, TMH.
7. "An Introduction to Operating Systems", P.C.P. Bhatt, PHI.

Online Learning Resources/Virtual Labs:

https://www.cse.iitb.ac.in/~mythili/os/
http://peterindia.net/OperatingSystems.html

## Mapping of course outcomes with program outcomes

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | | | | 3 | | | | | | | | 2 | |
| CO2 | 3 | 3 | 3 | | 3 | | | | | | | 3 | 2 | |
| CO3 | 3 | 3 | 3 | | 3 | | | | | | | | | |
| CO4 | 2 | 2 | | 3 | 3 | | | | | | | | | |
| CO5 | 2 | | | | 3 | | | | | | | | | |

## Correlation matrix

| Unit No. | CO's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|-----------------------------------------------|----------------------------|
| 1 | CO1: Understand | L2 | PO5 | PO1: Apply(L3)<br>PO5: Create (L6) | 3<br>3 |
| 2 | CO2: Apply | L3 | PO1<br>PO2<br>PO3<br>PO5 | PO1: Apply(L3)<br>PO2: Formulate (L6)<br>PO3: Develop(L6)<br>PO5: Create (L6)<br>PO12:Thumb Rule | 3<br>3<br>3<br>3<br>3 |
| 3 | CO3: Apply | L3 | PO1<br>PO2<br>PO3<br>PO5 | PO1: Apply(L3)<br>PO2: Formulate (L6)<br>PO3: Develop(L6)<br>PO5: Create (L6) | 3<br>3<br>3<br>3 |
| 4 | CO4: Analyze | L4 | PO1<br>PO2<br>PO4<br>PO5 | PO1:Apply(L3)<br>PO2: Identify (L3)<br>PO4: Analyze (L4)<br>PO5: Create (L6) | 2<br>2<br>3<br>3 |
| 5 | CO5: Analyze | L4 | PO1<br>PO5 | PO1: Apply(L3)<br>PO5: Create (L6) | 2<br>3 |

## Justification Statements :

**CO1: Understand** the basic commands in UNIX operating systems.
**Action Verb: Understand (L2)**
**PO1 Verb: Apply (L3)**
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create (L3)**
CO1 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO2: Apply** the concepts of CPU scheduling algorithms to solve real time problems
**Action Verb: Apply (L3)**
**PO1 Verb: Apply (L3)**
CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2 Verb: Formulate(L6)**
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

**PO3 Verb: Develop (L6)**
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create (L6)**
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**PO12 Verb: Thumb rule**
Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

**CO3: Apply** the concepts of process synchronization methods.
**Action Verb: Apply(L3)**
**PO1 Verb: Apply (L3)**
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
**PO2 Verb: Formulate(L6)**
CO3 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
**PO3 Verb: Develop (L6)**
CO3 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create (L6)**
CO3 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO4: Analyze** the solutions for virtual memory and Deadlocks.
**Action Verb: Analyze (L4)**
**PO1 Verb: Apply (L3)**
CO4 Action verb is less than as PO1 verb by one level. Therefore, the correlation is medium (2)
**PO2 Verb: Idetify(L3)**
CO4 Action verb is less than as PO2 verb by one level. Therefore, the correlation is medium (2)
**PO4 Verb: Analyze (L4)**
CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
**PO5 Verb: Create (L6)**
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO5: Analyze** various file system interfaces.
**Action Verb: Analyze (L4)**
**PO1 Verb: Apply (L3)**
CO5 Action verb is less than as PO1 verb by one level. Therefore, the correlation is medium (2)
**PO5 Verb: Create (L6)**
CO5 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

| Course Code | Year & Sem | Server Side Scripting | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ASC3602 | II-II | **(common to CSE,CIC,AIDS,AIML)** | **1** | **0** | **2** | **2** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the perquisitions to connect MYSQL and Apache dynamically through PHP paradigm.

**CO2: Analyze** the working mechanism of different data media and cookies ,sessions in web browser.

**CO3: Understand** the SQL commands to get database connectivity with PHP

**CO4: Create** the simple mailing list using XML & JSON.

**CO5: Analyze** the performance of Apache and database tuning for optimization, securing webserver.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | the perquisitions | | to connect MYSQL and Apache dynamically through PHP paradigm | L2 |
| **CO2** | **Analyze** | the working mechanism of different data media and cookies ,sessions in web browser | | | L4 |
| **CO3** | **Understand** | the SQL commands | | to get database connectivity with PHP | L2 |
| **CO4** | **Create** | the simple mailing list | using XML & JSON | | L6 |
| **CO5** | **Analyze** | the performance of Apache and database tuning | | for optimization, securing webserver | L4 |

| UNIT - I | | 10 Hrs |
|---|---|---|

Getting Up and Running: Installation Quick Start Guide with XAMPP5 - Installing and Configuring MySQL - Installing and Configuring Apache - Installing and Configuring PHP -

PHP Language Structure: The Building Blocks of PHP - Flow Control Functions in PHP - Working with Functions - Working with Arrays - Working with Objects

1. Installation of XAMPP server
2. Write PHP code to print Hello World program
3. Demonstrate 8 basic data types in PHP.
4. Demonstrate the scope of variables declared in PHP code.
5. Demonstrate Arithmetic, Comparison, Logical (or Relational), Assignment and Conditional (or ternary) Operators.
6. Demonstrate if, elseif ...else and switch statements.
7. Demonstrate for, while, do – while, and for each loop.
8. Write code to create and access numeric arrays.
9. Demonstrate the usage of associative arrays.
10. Implement Multi-dimensional arrays
11. Create a multidimensional array of movies organized by genre. This should take the form of an associative array with genres as keys, such as Science Fiction, Action, Adventure, and so forth. Each of the array's elements should be an array containing movie names, such as Alien, Terminator 3, Star Wars, and so on. After creating your arrays, loop through them, printing the name of each genre and its associated movies.

| | | |
|---|---|---|
| 12. Create a function that accepts four string variables and returns a string that contains an HTML table element, enclosing each of the variables in its own cell. | | |

12. Create a function that accepts four string variables and returns a string that contains an HTML table element, enclosing each of the variables in its own cell.
13. Create a class called baseCalc() that stores two numbers as properties. Next, create a calculate() method that prints the numbers to the browser.
14. Create classes called addCalc(), subCalc(), mulCalc(), and divCalc() that inherit functionality from baseCalc() but override the calculate() method and print appropriate totals to the browser.

| **UNIT - II** | | 10 Hrs |
|---|---|---|

Working with Strings, Dates, and Time - Working with Forms - Working with Cookies and User Sessions - Working with Files and Directories - Working with Images

1. Create a feedback form that accepts a user's full name and an email address. Use case-conversion functions to capitalize the first letter of each name the user submits and print the result back to the browser. Check that the user's email address contains the @ symbol and print a warning otherwise.
2. Create an array of doubles and integers. Loop through the array, converting each element to a floating-point number with a precision of 2. Right-align the output within a field of 20 characters.
3. Create a birthday countdown script. Given form input of month, day, and year, output a message that tells the user how many days, hours, minutes, and seconds until the big day.
4. Create a calculator script that enables the user to submit two numbers and choose an operation (addition, multiplication, division, or subtraction) to perform on them.
5. Use hidden fields with the script you created in activity 1 to store and display the number of requests that the user submitted.
6. Create a script that uses session functions to track which pages in your environment the user has visited.
7. Create a new script that will list for the user all the pages he/she has visited within your environment, and when.
8. Create a form that accepts a user's first and second name. Create a script that saves this data to a file.
9. Create a script that reads the data file you created in the first activity. In addition to writing its contents to the browser (adding a tag to each line), print a summary that includes the number of lines in the file and the file's size.
10. Draw a New Image, shapes and lines.
11. Create a New Image with Color Fills.
12. Draw A Basic Pie Chart and 3D Pie Chart
13. Creating a New Image from an Existing Image.
14. Creating an Image from User Input.
15. Creating an Image with Custom Font and Text

| **UNIT - III** | **PHP with database connectivity** | 10 Hrs |
|---|---|---|

Understanding the Database Design Process - Learning Basic SQL Commands - Using Transactions and Stored Procedures in MySQL - Interacting with MySQL Using PHP

Write PHP code

1. to open and close a database connection.
2. to select a database. to select a database.
3. to create a table
4. to drop a database.
5. to drop a table
6. to insert record into employee table.
7. take input using HTML Form and insert records into table.
8. to display all the records from employee table.
9. to display all the records from employee table using mysql_fetch_assoc() function.
10. to display all the records from employee table using MYSQL_NUM argument.
11. to release cursor memory at the end of SELECT statement.
12. to display 10 records per page.
13. to take user input of employee ID and update employee salary.
14. to take user input of employee ID and delete an employee record from employee table.
15. Use SELECT INTO OUTFILE query for creating table backup.

| **UNIT - IV** | | 10 Hrs |
|---|---|---|

Managing a Simple Mailing List - Creating an Online Address Book - Creating a Simple Discussion Forum - Creating an Online Storefront - Creating a Shopping Cart Mechanism - Creating a Simple Calendar -

Restricting Access to Your Applications - Logging and Monitoring Web Server Activity - Application Localization - Working with XML and JSON

1. Common Functions in an Included File
2. Subscribe and Unsubscribe with manage.php
3. Send Mail to Your List of Subscribers
4. Modify the manage.php script to display the user's email as part of the response message for any action that is taken.
5. Modify the sendmymail.php script to add additional form fields that will correspond to section headings in the message string itself. Remember that when the form is submitted, those strings will have to be concatenated into one message string that is sent to the mail() function.

| UNIT - V | | 5 Hrs |
|---|---|---|

Apache Performance Tuning and Virtual Hosting - Setting Up a Secure Web Server - Optimizing and Tuning MySQL - Performing Software Upgrades - Using Application Frameworks

**Textbooks:**

1. Sams Teach Yourself PHP, MySQL and Apache All in One, by Julie C. Meloni, Pearson Education, Inc © 2012.

**Reference Books:**

1. Beginning PHP6, Apache, MySQL Web Development, by Timothy Boronczyk, Elizabeth Naramore,
2. Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass, Wiley Publishing, Inc © 2009
3. PHP 6 and MySQL 6 Bible, by Steve Suehring, Tim Converse, Joyce Park, Wiley Publishing, Inc © 2009.
4. PHP & MySQL Web Development All-in-One Desk Reference For Dummies, by Janet Valade with Tricia Ballad and Bill Ballad, Wiley Publishing, Inc © 2008.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | 2 | | | | | | | | 3 | |
| CO2 | 3 | 3 | | | 3 | | | | | | | 3 | 2 | |
| CO3 | 3 | 3 | 3 | 2 | | | | | | 2 | | | 2 | |
| CO4 | 3 | | 3 | 3 | 3 | | | | | | | 3 | 2 | |
| CO5 | 3 | 3 | 3 | 3 | 3 | | | 3 | | | | | 2 | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1: Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Review(L2) | 3 |
| | | | PO5 | PO5: Apply(L3) | 2 |
| 2 | CO2: Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Identify(L3) | 3 |
| | | | PO5 | PO5: Apply(L3) | 3 |
| | | | PO12 | PO12: Thumb rule | 3 |
| 3 | CO3: Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Review(L2) | 3 |
| | | | PO3 | PO3: Develop (L3) | 3 |
| | | | PO4 | PO4: Analyze (L4) | 2 |
| | | | PO10 | PO10: Thumb rule | 2 |
| 4 | CO4: Create | L6 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO3 | PO3: Develop (L3) | 3 |
| | | | PO4 | PO4: Analyze (L4) | 3 |
| | | | PO5 | PO5: Create(L6) | 3 |
| | | | PO12 | PO12: Thumb rule | 3 |
| 5 | CO5: Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Review(L2) | 3 |
| | | | PO3 | PO3: Develop (L3) | 3 |
| | | | PO4 | PO4: Analyze (L4) | 3 |
| | | | PO5 | PO5: Apply(L3) | 3 |
| | | | PO8 | PO8: Thumb rule | 3 |

**Justification Statements:**

**CO1: Understand** the perquisitions to connect MYSQL and Apache dynamically through PHP paradigm.

**Action Verb : Understand (L2)**

**PO1: Apply(L3)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is medium (2)

**PO2: Review(L2)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO5: Apply(L3)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is medium (2)

**CO2: Analyze** the working mechanism of different data media and cookies ,sessions in web browser.

**Action Verb : Analyze(L4)**

**PO1: Apply(L3)**

CO2 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

**PO2: Identify(L3)**

CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

**PO5: Apply(L3)**

CO2 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)

**PO12: Thumb rule**

The applications can be designed specifically for all kind of users and also increase session time out as per client requirement.so need to update frequently. Therefore the correlation is medium (2)

**CO3:Apply** the SQL commands to get database connectivity with PHP

**Action Verb : Apply(L3)**

**PO1: Apply(L3)**

CO3 Action verb is same PO1 verb , Therefore the correlation is high(3)

**PO2: Review(L2)**

CO3 Action verb is greater level by PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop (L3)**

CO3 Action verb is same as PO3 verb. Therefore the correlation high(3)

**PO4: Analyze(L4)**

CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)

**PO10: Thumb rule**

Effective communication is needed between user and database administrator to maintain log details. Therefore, the correlation is medium (2)

**CO4: Create** the simple mailing list using XML & JSON.

**Action Verb : Create(L6)**

**PO1: Apply(L3)**

CO4  Action verb is greater than PO1 verb. Therefore the correlation is high (3)

**PO3: Develop(L3)**

CO4  Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze(L4)**

CO4  Action verb is greater than PO4 verb. Therefore the correlation is high (3)

**PO5: Create(L6)**

CO4 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

**PO12: Thumb rule**

The developer need to upgrade all server concepts and JSON concepts for future developments. Therefore the correlation is high(3)

**CO5: Analyze** the performance of Apache and database tuning for optimization, securing webserver.

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO5  Action verb is  greater than PO1 verb. Therefore the correlation is high(3)

**PO2: Review (L2)**

CO5  Action verb is  greater than PO2 verb. Therefore the correlation is high(3)

**PO3: Develop (L3)**

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)

**PO5: Apply(L3)**

CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

**PO8: Thumb rule**

The team should follow some ethics for evaluate and Improving the performance .Therefore the correlation is high(3)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.**

**(AUTONOMOUS)**

**B.Tech**

**(COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

**(Effective for the batches admitted in 2020-2021)**

**Semester V (Third year)**

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | PC | 20APC3613 | Cryptography and Network Security | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3615 | Embedded Systems and Internet of Things | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3617 | Fundamentals of Blockchain Technology | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | OE-1 | 20AOE9926 <br><br> 20AOE0303 <br> 20APC0213 | Mathematical Modeling and Simulation Optimization Techniques Control Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | PE-1 | 20APE3601 <br> 20APE3602 <br> 20APE3603 | Software Engineering Distributed Database Automata Theory and Compiler Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | PC Lab | 20APC3614 | Cryptography and Network Security Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3616 | Embedded Systems and Internet of Things Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | SC | 20ASA0502 | Soft Skills | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 9 | MC | 20AMC9901 | Biology for Engineers | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| 10 | CSP | 20CSP3601 | Evaluation of Community Service Project | 0 | 0 | 0 | 1.5 | 100 | 0 | 100 |
| **Total credits** | | | | | | | **21.5** | **440** | **490** | **930** |

| Course Code | Year & Sem | CRYPTOGRAPHY AND NETWORK SECURITY | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3613 | III-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the basic Security and Cryptography concepts and techniques

CO2: **Analyze** the various cryptography algorithms for data encryption

CO3: **Analyze** the different MAC and HASH algorithms to authenticate a message

CO4: **Apply** the various security mechanisms for E-mail and IP security

CO5: **Analyze** the various security breaches in real world applications

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | The basic Security and Cryptography concepts and techniques | | | L2 |
| **CO2** | Analyze | The various cryptographic algoritms | | for data encryption | L4 |
| **CO3** | Analyze | The different MAC and HASH algorithms | | to authenticate a message | L4 |
| **CO4** | Apply | The security mechanism | | E-mail and IP security | L3 |
| **CO5** | Analyze | The various security breaches | | real world applications | L4 |

| UNIT – I | **Security Concepts and Cryptography Concepts and Techniques** | 12 Hrs |
|---|---|---|

**Security Concepts:** Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

**Cryptography Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks

| UNIT – II | **Symmetric key Ciphers & Asymmetric key Ciphers** | 10 Hrs |
|---|---|---|

**Symmetric key Ciphers:** Block Cipher principles &Algorithms (DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4,Location and placement of encryption function, **Key distribution Asymmetric key Ciphers:** Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman,ECC), Key Distribution

| UNIT – III | **Message Authentication Algorithms and Hash Functions** | 8 Hrs |
|---|---|---|

**Message Authentication Algorithms and Hash Functions:** Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack

| UNIT – IV | **E-Mail Security & IP Security** | 8 Hrs |
|---|---|---|

**E-Mail Security:** Pretty Good Privacy, S/MIME.

**IP Security:** IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, combining security associations, key management.

| UNIT – V | **Web Security, Virus and Firewalls, Case Studies on Cryptography and security** | 10 Hrs |
|---|---|---|

**Web Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders.

**Virus and Firewalls:** Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls**.**

**Case Studies on Cryptography and security:** Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections.

**Textbooks:**

1. William Stallings, "Cryptography and Network Security", 5th Edition, Pearson Education, 2011.
2. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Mc Graw Hill, 2010.
3. Bernard Menezes "Network Security and Cryptography", 1stEdition, CENGAGE Learning, 2010.

**Reference Books:**
1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 1 | 1 | 1 | 1 | 2 | | | | | | 2 | | |
| CO3 | 3 | 1 | 1 | 1 | 1 | | 2 | 2 | 1 | | | 2 | | 2 |
| CO4 | 3 | 2 | | | | | | 2 | | | | | | |
| CO5 | | 2 | 2 | 2 | 2 | | | 2 | 1 | | | 2 | 3 | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| 1 | 14 | 23% | 3 | CO1:Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2:  Review(L2) | 2<br>3 |
| 2 | 10 | 17% | 2 | CO2 : Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO6<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop(L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3)<br>PO6: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3<br>3 |
| 3 | 12 | 20% | 2 | CO3 : Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO7<br>PO8<br>PO9<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop(L3)<br>PO4: Analyze(L4)<br>PO5:  Apply(L3)<br>PO7: Thumb rule<br>PO8:  Thumb rule<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3 |
| 4 | 10 | 17% | 2 | CO4 : Apply | L3 | PO1<br>PO2<br>PO8 | PO1: Apply(L3)<br>PO2:  Review(L2)<br>PO8:  Thumb rule | 3<br>3<br>2 |
| 5 | 14 | 23% | 3 | CO5 :Analyze | L4 | PO2<br>PO3<br>PO4<br>PO5<br>PO8<br>PO9<br>PO12 | PO2: Review(L2)<br>PO3:  Develop(L3)<br>PO4:  Analyze(L4)<br>PO5:  Apply(L3)<br>PO8:  Thumb rule<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3<br>3 |
| | 60 | 100% | | | | | | |

**Justification Statements :**

CO1: **Understand** the basic Security and Cryptography concepts and techniques
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same as PO2 verb. Therefore the correlation is high(3)


CO2: **Analyze** the various cryptography algorithms for data encryption
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO2 Action verb is greater than PO1 verb .Therefore the correlation is high (3)
**PO2: Review(L2)**
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop(L3)**
CO2 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO2 Action verb is same as PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO2 Action verb is greater than PO5 verb .Therefore the correlation is high (3)
**PO6: Thumb rule**
For some of Security applications, Various Cryptographic algorithms were applied for societal needs. Therefore, the correlation is high(3)
**PO12: Thumb rule**
For some of Security applications, Various Cryptographic algorithms were analyzed. Therefore the correlation is high(3)


CO3: **Analyze** the different MAC and HASH algorithms to authenticate a message.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO2: Review(L2)**
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO3: Develop(L3)**
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is same as PO2 verb.  Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO7 : Thumb rule**
sustainable cybersecurity practices will mitigate risk and improve cyber resilience over a long run. Hence the correlation is high(3)
**PO8 : Thumb rule**
Since ethical principles should be followed to while authenticating a message. Therefore the correlation is high(3)
**PO9 : Thumb rule**
Team work is required between client and server to perform authentication. Hence the correlation is high(3)
**PO12 : Thumb rule**
For some of Security applications, Various Cryptographic algorithms were analysed. Therefore the correlation is high(3)
**CO4: Apply** the various security mechanisms for Email and IP security**.**
**Action Verb : Apply(L3)**
**PO1: Apply(L3)**
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Review(L2)**
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO8: Thumb rule**

Since ethical principles shall be followed in maintaining IP Security. Therefore the correlation is medium(2)

**CO5: Analyze** the various security breaches in real world applications.
**Action Verb : Analyze (L4)**
**PO2: Review(L2)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop(L3)**
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
**PO8 : Thumb rule**
Since ethical principles should be followed to analyze the security breaches. Therefore the correlation is high(3)
**PO9 : Thumb rule**
Team work is required between client and server to secure the data. Hence the correlation is high(3)
**PO12 : Thumb rule**
For some of Security applications, Various Cryptographic algorithms were analysed. Therefore the correlation is high(3)

| Course Code | Year & Sem | Embedded Systems and Internet of Things | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3615 | III-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the fundamental concepts and architecture of embedded systems.

CO2: **Analyze** the multiple architecture in embedded processors using ARM, TM4C families.

CO3: **Apply** the different interfacing concepts to integrate multiple devices form an Embedded System.

CO4: **Understand** the characteristics and design principles of Internet of things.

CO5: **Apply** the aurdino programming constructs to integrate multiple sensors and acurators.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the fundamental concepts and architecture of embedded systems. | | | L2 |
| **CO2** | Analyze | the multiple architecture in embedded processors | using ARM, TM4C families | | L4 |
| **CO3** | Apply | the different interfacing concepts | | to integrate multiple devices form an Embedded System. | L3 |
| **CO4** | Understand | the characteristics and design principles of Internet of things. | | | L2 |
| **CO5** | Apply | the aurdino programming constructs | | to integrate multiple sensors and acurators. | L3 |

| UNIT – I | Introduction To Embedded Systems | 9 |
|---|---|---|
| Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design | | |

| UNIT – II | Embedded Processor Architecture | 9 |
|---|---|---|
| CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, addressing modes and instruction set basics. | | |

| UNIT – III | Overview Of Microcontroller And Embedded Systems | 9 |
|---|---|---|
| Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System. | | |

| UNIT – IV | Introduction to IoT | 9 |
|---|---|---|
| Introduction to Internet of Things: Characteristics of IoT, Design principles of IoT, IoT Architecture and Protocols, Enabling Technologies for IoT, IoT levels and IoT vs M2M. IoT Design Methodology: Design methodology, Challenges in IoT Design, IoT System Management, IoT Servers – Sensors. | | |

| UNIT – V | Arduino in IoT | 9 |
|---|---|---|
| Basics of Arduino: Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins -Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino- Connecting LEDs with Arduino, Connecting LCD with Arduino – Tinkercad arduino simulation. | | |

**Textbooks:**

1. Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and the Internet of Things 4th ed. 2021 Edition by Peter Marwedel.
2. Embedded System A Complete Guide - 2020 Edition by Gerardus Blokdyk
3. Ti Tiva Arm Programming for Embedded Systems: Programming Arm Cortex-M4 Tm4c123g with C (Mazidi & Naimi Arm) Paperback, 2017.
   4. Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications, 2016 by Adeel Javed.

**Reference Books:**

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
3. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
4. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
5. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developers Guide", Morgan Kauffman/ Elsevier, 2006.

Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", VPT, 2014.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | 1 | 1 | 1 | | | | | | | 1 | 2 | |
| CO3 | 3 | 2 | | | | | | 2 | 1 | | | 1 | | |
| CO4 | 2 | 1 | | | | | | 1 | | | | | 2 | |
| CO5 | | 2 | | | | | | 2 | 1 | | | 1 | 2 | 1 |

**Correlation matrix**

| Unit No. | CO | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | | | |
| 1 | 16 | 21% | 3 | CO1 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | 14 | 19% | 2 | CO2 :Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | | | | PO3 | PO3: Design (L6) | 1 |
| | | | | | | PO4 | PO4: Design (L6) | 1 |
| | | | | | | PO5 | PO5: Create(L6) | 1 |
| | | | | | | PO12 | PO12: Thumb rule | 1 |
| 3 | 17 | 23% | 3 | CO3 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | | | | PO8 | PO8: Thumb rule | 2 |
| | | | | | | PO9 | PO9: Thumb rule | 1 |
| | | | | | | PO12 | PO12: Thumb rule | 1 |
| 4 | 13 | 17% | 2 | CO4 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | | | | PO2 | PO2: Analyze (L4) | 1 |
| | | | | | | PO8 | PO8: Thumb rule | 1 |
| 5 | 15 | 20% | 2 | CO5 :Apply | L3 | PO2 | PO2: Analyze (L4) | 2 |
| | | | | | | PO8 | PO8: Thumb rule | 2 |
| | | | | | | PO9 | PO9: Thumb rule | 1 |
| | | | | | | PO12 | PO12: Thumb rule | 1 |
| | 75 | 100% | | | | | | |

**Justification Statements :**

CO1: **Understand** the fundamental concepts and architecture of embedded systems.
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Analyze(L4)**
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

CO2: **Analyze** the multiple architecture in embedded processors using ARM, TM4C families.
**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO2  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Analyze (L4)**
CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO3: Design (L6)**
CO2 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
**PO4: Design (L6)**
CO2 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
**PO5: Create(L6)**
CO2 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)
**PO12: Thumb rule**
To Analyze multiple architecture in embedded processors needs multiple families. Therefore the correlation is low (1)


CO3: **Apply** the different interfacing concepts to integrate multiple devices form an Embedded System.
**Action Verb : Apply(L3)**
**PO1: Apply(L3)**
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2:Analyze (L4)**
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
**PO8 : Thumb rule**
Since ethical principles should be followed to create a Embedded System. Therefore the correlation is medium(2)
**PO9 : Thumb rule**
Team work is required to Apply different interfacing concepts. Hence the correlation is low (1)
**PO12: Thumb rule**
Integration of multiple devices to form an Embedded System needs high knowledge. Therefore the correlation is low (1)


CO4: **Understand** the characteristics and design principles of Internet of things.
**Action Verb : Understand(L2)**
**PO1: Apply(L3)**
CO4  Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2: Analyze (L4)**
CO4 Action verb is same level as PO2 verb. Therefore the correlation is low (1)
**PO8: Thumb rule**
Basics of Internet of things can be useful for society for awareness. Therefore the correlation is low(1)

CO5: **Apply** the aurdino programming constructs to integrate multiple sensors and acurators.
**Action Verb : Apply(L3)**
**PO2: Analyze (L4)**
CO5 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
**PO8 : Thumb rule**
Constructs to integrate multiple sensors for security. Therefore the correlation is medium(2)
**PO9 : Thumb rule**
Team work is required for Aurdino programming. Hence the correlation is low (1)
**PO12: Thumb rule**
In real time multiple sensors and acurators is continuously updating. Therefore the correlation is low (1)

| Course Code | Year & Sem | Fundamentals Of Blockchain Technology | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3617 | III-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the fundamentals of Digital money and Crypto currency for blockchain.

CO2: **Analyze** the types of market friction by using consensus algorithms in blockchain networks.

CO3: **Apply** the routes and methods of decentralization for blockchain ecosystem.

CO4: **Understand** the bitcoin, digital keys and wallets for bitcoin transactions.

CO5: **Apply** the steps for first blockchain application to check technical and non-technical limitations

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | The fundamentals of Digital money and Crypto currency | | for blockchain | L2 |
| **CO2** | Analyze | The types of market friction | by using consensus algorithms | in blockchain networks | L4 |
| **CO3** | Apply | The routes and methods of decentralization | | for blockchain ecosystem | L3 |
| **CO4** | Understand | The bitcoin, digital keys and wallets | | for bitcoin transactions. | L2 |
| **CO5** | Apply | The Steps for first blockchain application | | to check technical and non-technical limitations | L3 |

| UNIT – I | | 9 Hrs |
|---|---|---|

Money- Physical and Digital Money, How do we define money, History, Gold Standards, Fiat Currency and Intrinsic Value, Legal Tender, Currency Pegs, Quantitative Easing, How Are Interbank Payments Made?, E-Money Wallets, Cryptocurrencies, Digital Tokens

| UNIT – II | | 9 Hrs |
|---|---|---|

Introduction to Blockchain Technology - Growth, Distributed Systems, History, Types, Consensus, CAP theorem, How Blockchain Works, What Makes a Blockchain Suitable for Business?, Propelling Business with Blockchains, Recognizing Types of Market Friction, Moving Closer to Friction-Free Business Networks, What Are Blockchains Good For?, Initial Coin Offerings, Investing

| UNIT – III | | 9 Hrs |
|---|---|---|

Decentralization using Blockchain, Methods of Decentralization, Routes to Decentralization, Blockchain and full ecosystem decentralization, Decentralized Organizations, Platforms for decentralization

| UNIT – IV | | 9 Hrs |
|---|---|---|

Introducing Bitcoin – Bitcoin, Digital keys and addresses, Transactions, Blockchain, Mining, The bitcoin network, wallets, payments, innovation, installation

| UNIT – V | | 9 Hrs |
|---|---|---|

Blockchain in Action: Use Cases, Smart Contracts, Hyperledger, Ten Steps to Your First Blockchain application, Technical and non-technical limitations of the Blockchain,

**Textbooks:**

1. Antony Lewis, The Basics of Bitcoins and Blockchains, Published by Mango Publishing Group, a division of Mango Media Inc., 2018

2. Mastering Blockchain, Second Edition, Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir, Packt Publishing, 2018

3. Dr. Ravindhar Vadapallin, BLOCKCHAIN FUNDAMENTALS TEXT BOOK, Research Gate

4. Daniel Drescher, Blockchain basics a non-technical introduction in 25 steps, Apress publications, 2017

**Reference Books:**

1. Koshik Raj, Foundations of Blockchain: The pathway to cryptocurrencies and decentralized blockchain applications Paperback – 1 January 2019, Ingram Publishers
2. Bellaj Badr , Richard Horrocks , Xun (Brian) Wu, Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger Paperback – 30 November 2018, Packt Publishing Limited
3. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | 1 | 1 | 1 | | | | | | | 3 | 2 | |
| CO3 | 3 | 2 | 3 | 2 | | | | | 1 | | | 2 | | |
| CO4 | 2 | 1 | | | | | | | | | | | 2 | |
| CO5 | | 3 | 3 | 3 | 3 | | | | 3 | | | 3 | 2 | 1 |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| 1 | 13 | 20% | 2 | CO1 :Understand | L2 | PO1 PO2 | PO1: Identify(L3) PO2: Analyze(L4) | 2 1 |
| 2 | 14 | 22% | 3 | CO2 :Analyze | L4 | PO1 PO2 PO3 PO4 PO5 PO12 | PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO12: Thumb rule | 3 3 1 1 1 3 |
| 3 | 13 | 20% | 2 | CO3 : Apply | L3 | PO1 PO2 PO3 PO4 PO5 PO9 PO12 | PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Interpret (L2) PO9: Thumb rule PO12: Thumb rule | 3 2 3 2 1 2 |
| 4 | 13 | 20% | 2 | CO4 :Understand | L2 | PO1 PO2 | PO1: Apply(L3) PO2: Analyze (L4) | 2 1 |
| 5 | 12 | 18% | 2 | CO5 :Apply | L3 | PO2 PO3 PO4 PO5 PO9 PO12 | PO2: Analyze (L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO9: Thumb rule PO12: Thumb rule | 3 3 3 3 3 3 |
| | 65 | 100% | | | | | | |

**Justification Statements :**

**CO1: Understand the** fundamentals of Digital money and Crypto currency for block chain.
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Analyze(L4)**
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze the** types of market friction by using consensus algorithms in block chain networks.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**PO3: Design (L6)**

CO2 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)

**PO4: Design (L6)**

CO2 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)

**PO5: Create(L6)**

CO2 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)

**PO12: Thumb rule**

For some of Block Chain applications consensus algorithms are unique. Therefore the correlation is high (3)


**CO3: Apply the** routes and methods of decentralization for block chain ecosystem

**Action Verb : Apply (L3)**

**PO1: Apply(L3)**

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**PO3: Develop (L3)**

CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

**PO4: Interpret (L2)**

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

**PO9 : Thumb rule**

Team work is required for transaction management and recovery of failure transactions. Hence the correlation is low (1)

**PO12: Thumb rule**

In Block Chain routes and methods of decentralization are needed. Therefore the correlation is medium(2)


**CO4: Understand the** bitcoin, digital keys and wallets for bitcoin transactions.

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO4 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Analyze(L4)**

CO4 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)


CO5: **Apply** the steps for first blockchain application to check technical and non-technical
limitations

**Action Verb : Apply (L3)**

**PO2: Analyze (L4)**

CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**PO3: Design (L6)**

CO5 Action verb is same level as PO3.verb. Therefore the correlation is high (3)

**PO4: Design (L6)**

CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

**PO5: Create(L6)**

CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**PO9 : Thumb rule**

Team work is required for transaction management and recovery of failure transactions. Hence the correlation is high (3)

**PO12: Thumb rule**

In real time transaction management is continuously updating. Therefore the correlation is high(3)

| Course Code | Year & Sem | Mathematical Modeling and Simulation | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AOE9926 | III-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the various mathematical modeling techniques in dynamics.

**CO2: Analyze** the modeling in epidemics through system of ordinary differential equations of first order.

**CO3: Apply** the mathematical modeling of circular motion and motion of satellites.

**CO4: Analyze** the mathematical modeling through difference equations, functional equations and Integral equations.

**CO5: Apply** the simulation techniques in real life applications and probability distributions.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | Understand | the various mathematical modeling techniques in dynamics. | | | L2 |
| 2 | Analyze | the modeling in Epidemics through system of ordinary differential equations of first order. | | | L4 |
| 3 | Apply | the mathematical modeling of circular motion and motion of satellites. | | | L3 |
| 4 | Analyze | the mathematical modeling through difference equations, functional equations and Integral equations. | | | L4 |
| 5 | Apply | the simulation techniques | in real life applications and probability distributions. | | L3 |

| UNIT - I | Mathematical Modeling & Mathematical modeling Through Ordinary differential equations of First Order | 8 Hrs |
|---|---|---|
| **Mathematical modeling :** Need, Techniques, Classifications and Simple illustrations. <br> Mathematical modeling Through Ordinary differential equations of First Order : <br> Mathematical modeling Through differential equations; Linear growth and decay models; Non-Linear Growth and Decay models; Mathematical modeling in dynamics through ordinary differential equations of first order. | | |
| UNIT - II | Mathematical modeling Through System of Ordinary differential equations of First Order | 9 Hrs |
| Mathematical modeling in population dynamics; Mathematical modeling of Epidemics through system of ordinary differential equations of first order; Compartment models through Systems of ordinary differential equations; Mathematical modeling in dynamics through systems of ordinary differential equations of first order. | | |
| UNIT - III | Mathematical modeling Through Ordinary differential equations of Second Order | 8 Hrs |
| Mathematical modeling of Planetary motion ; Mathematical modeling of Circular motion and motion of satellites; Mathematical modeling through linear differential equations of second order. | | |
| UNIT - IV | Mathematical modeling Through Difference equations and | 9 Hrs |

| | Functional, Integral, Delay- Differential and Differential- Difference Equations | |
|---|---|---|

Need for Mathematical modeling Through Difference equations and simple models; Basic theory of Linear difference equations with constant coefficients; Mathematical modeling Through Difference equations in population dynamics and genetics; Mathematical modeling Through Difference equations in Probability theory.

Mathematical modeling Through Functional equations; Mathematical modeling Through Integral equations; Mathematical modeling Through Delay- Differential and Differential-Difference Equations

| UNIT - V | Simulation | 9 Hrs |
|---|---|---|

Bartering model, Basic optimization, Basic probability, Monte-Carlo simulation, Approaches to differential equation: Heun method, Local stability theory: Bernoulli Trials, General techniques for simulating continuous random variables, simulation from Normal and Gamma distributions, simulation from discrete probability distributions.

**Textbooks:**

1. J. N. Kapoor. Mathematical Modeling , NEW AGE INTERNATIONAL PUBLISHERS.
2. A. C. Fowler. Mathematical Models in Applied Sciences, Cambridge University Press.
3. J. N. Kapoor, Mathematical Modelling, Wiley Eastern Limited
4 . S.M. Ross, Simulation, India Elsevier Publication

**Reference Books:**

1. A.M.Law and W.D.Kelton.. Simulation Modeling and Analysis, T.M.H. Edition.
2. Edward A. Bender., An Introduction to Mathematical Modelling.

**Online Learning Resources:**

www.nptel.ac.in

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | | | |
| CO2 | | 3 | | | | | | | | | | | | |
| CO3 | 3 | | | | | | | | | | | | | |
| CO4 | | 3 | | | | | | | | | | | | |
| CO5 | 3 | | | | | | | | | | | | | |

**Correlation matrix**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | correlation | Verb | BTL | | | |
| 1 | 14 | 20 | 3 | Understand | L2 | PO2 | Analyze | 2 |
| 2 | 16 | 22.8 | 3 | Analyze | L3 | PO2 | Analyze | 3 |
| 3 | 10 | 14.2 | 2 | Apply | L5 | PO1 | Apply | 3 |
| 4 | 16 | 22.8 | 3 | Analyze | L4 | PO2 | Analyze | 3 |
| 5 | 14 | 20 | 3 | Apply | L3 | PO1 | Apply | 3 |

# Justification Statements :

**CO1:** Understand the various mathematical modeling techniques in dynamics.

**Action Verb: Understand (L2)**
PO2 Verb: **Analyze** (L4)
CO1 Action Verb is low level to PO2 verb by two levels; Therefore correlation is moderate (2).

**CO2:** Analyze the modeling in epidemics through system of ordinary differential equations of first order.

**Action Verb: Analyze (L4)**

PO2 Verb: Analyze (L4)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

**CO3:** Apply the mathematical modeling of circular motion and motion of satellites.

**Action Verb: Apply(L3)**

PO1 Verb: Apply (L3)

CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO4:** Analyze the mathematical modeling through difference equations, functional equations and Integral equations.
**Action Verb:  Analyze (L4)**

PO2 Verb: **Analyze (L4)**)

CO4 Action Verb level is equal to PO2 verb; Therefore correlation is moderate (3).

**CO5:** Apply the simulation techniques in real life applications and probability distributions.
**Action Verb: Apply (L3)**
PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

| Course Code | Year & Sem | **Optimization Techniques** | L | T | P | C |
|---|---|---|---|---|---|---|
| **20AOE0303** | III-I | | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Apply** the knowledge of vector design for optimizing the problems involved with single and multiple variables

**CO2: Apply** the mathematical procedure for solving the LPP and transportation models

**CO3: Understand** the unconstrained optimization techniques to solve models related to nonlinear programming

**CO4: Understand** the constrained optimization techniques to solve models related to nonlinear programming

**CO5: Apply** the decision making abilities in optimizing the dynamic programming models

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Apply | the knowledge of vector design for optimizing the problems involved with single and multiple variables | | in industry | **L3** |
| **CO2** | Apply | the mathematical procedure for solving the LPP and transportation models | | in logistic related fields | **L3** |
| **CO3** | Understand | the unconstrained optimization techniques to solve models related to nonlinear programming | | in industry | **L2** |
| **CO4** | Understand | the constrained optimization techniques to solve models related to nonlinear programming | | in industries | **L2** |
| **CO5** | Apply | the decision making abilities in optimizing the dynamic programming models | | in industrial management | **L3** |

| **UNIT - I** | | | |
|---|---|---|---|
| Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions. | | | |
| **UNIT - II** | | | |
| Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm. Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. | | | |
| **UNIT - III** | | | |
| Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method. | | | |
| **UNIT - IV** | | | |
| Constrained Nonlinear Programming: Characteristics of a constrained problem - classification – Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem. | | | |

| UNIT - V | |
|---|---|
| Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution. | |

**Textbooks:**

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.

2. H. S. Kasene &amp; K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

**Reference Books:**

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations
research 3rd edition, 2003.

2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.

3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd,
New Delhi, 2005.

**Online Learning Resources:**

https://www.youtube.com/watch?v=gw_ZEUjI9KM&list=PLYihddLF-CgZGDFVwB1v699kvl4FMeAr-

**Co po Mapping**

| Course Title | COs | Programme Outcomes (POs) & Programme Specific Outcomes (PSOs) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 |
| Optimization techniques 20AOE0303 | CO1 | 3 | | 3 | | | | | | | | | | 2 |
| | CO2 | 3 | | 3 | | 3 | | | | | | | | 2 |
| | CO3 | 2 | | 2 | | 2 | | | | | | | | 2 |
| | CO4 | 2 | 2 | | | | | | | | | | | 3 |
| | CO5 | 3 | 3 | | | 3 | | | | | | | | 2 |

**Correlation matrix**

| CO | CO Verb | BTL | Program Outcomes (PO) | PO(s): Action Verb and BTL (for PO1 to PO5) | Level of Correlation |
|---|---|---|---|---|---|
| 1 | CO1: Apply | L3 | PO1 | Apply (L3) | 3 |
| | | | PO3 | Develop (L3) | 3 |
| | | | PSO1 | TR | 2 |
| | | | PSO2 | TR | 2 |
| 2 | CO2: Apply | L3 | PO1 | Apply (L3) | 3 |
| | | | PO3 | Develop (L3) | 3 |
| | | | PO5 | Apply (L3) | 3 |
| | | | PSO1 | TR | 2 |
| | | | PSO2 | TR | 2 |
| 3 | CO3: Understand | L2 | PO1 | Apply (L3) | 2 |
| | | | PO3 | Develop (L3) | 2 |
| | | | PO5 | Apply (L3) | 2 |
| | | | PSO1 | TR | 2 |
| | | | PSO2 | TR | 2 |
| 4 | CO4: Understand | L2 | PO1 | Apply (L3) | 2 |
| | | | PO2 | Identify (L3) | 2 |
| | | | PSO1 | TR | 3 |
| | | | PSO2 | TR | 2 |
| 5 | CO5: Apply | L3 | PO1 | Apply (L3) | 3 |
| | | | PO2 | Identify (L3) | 3 |
| | | | PO5 | Apply (L3) | 3 |
| | | | PSO1 | TR | 2 |
| | | | PSO2 | TR | 2 |

**Justification Statements:**

**CO1: Apply** the knowledge of vector design for optimizing the problems involved with single and multiple variables

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO3 Verb: **Develop (L3)**

CO1: Action verb is same level as PO3 verb. Therefore, the correlation is high (3).

**CO2: Apply** the mathematical procedure for solving the LPP and transportation models.

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

CO2: Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO3 Verb: **Develop (L3)**

CO2: Action verb is same level as PO3 verb. Therefore, the correlation is high (3).

PO5 Verb: **Apply (L3)**

CO2: Action verb is same level as PO5 verb. Therefore, the correlation is high (3).

**CO3: Understand** the unconstrained optimization techniques to solve models related to nonlinear programming .

**Action Verb: Understand (L2)**

PO1 Verb: **Apply (L3)**

CO2: Action verb is lower level as PO1 verb. Therefore, the correlation is low (2).

PO3 Verb: **Develop (L3)**

CO2: Action verb is lower level as PO3 verb. Therefore, the correlation is low (2).

PO5 Verb: **Apply (L3)**

CO2: Action verb is lower level as PO5 verb. Therefore, the correlation is low (2).

**CO4: Understand** the constrained optimization techniques to solve models related to nonlinear programming .

**Action Verb: Understand (L2)**

PO1 Verb: **Apply (L3)**

CO1 Action verb is lower level as PO1 verb. Therefore, the correlation is low (2).

PO2 Verb: **Identify (L3)**

CO1: Action verb is lower level as PO2 verb. Therefore, the correlation is low (2).

**CO5: Apply** the decision making abilities in optimizing the dynamic programming models.

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO2 Verb: **Identify (L3)**

CO1: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).

PO5 Verb: **Apply (L3)**

CO5: Action verb is same level as PO5 verb. Therefore, the correlation is high (3).

| Course Code | Year & Sem | CONTROL SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|---|
| **20APC0213** | III-I | | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the mathematical modelling and transfer function of physical systems.

**CO2: Apply** the time response analysis to first order systems & controllers and their stability.

**CO3: Analyze** the stability of a system using Routh-Hurwitz criteria and root locus.

**CO4: Evaluate** the stability of a system using Bode and Nyquist plot methods.

**CO5: Apply** the state space analysis to study response of continuous system.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | The Mathematical Model And Transfer Function | | Of the Physical Systems. | L2 |
| **CO2** | Apply | Time response analysis | | to first order systems & controllers and study their stability. | L3 |
| **CO3** | Analyze | The stability of a system | using Routh-Hurwitz criteria and root locus. | | L4 |
| **CO4** | Evaluate | The stability of a system | using Bode and Nyquist plot methods. | | L5 |
| **CO5** | Apply | The State Space Analysis | | to Study Continuous System. | L3 |

| UNIT - I | CONTROL SYSTEMS CONCEPTS | |
|---|---|---|

Basic elements of control systems- open and close loop systems - Transfer function – Modelling of Electrical systems and mechanical systems – Block diagram reduction techniques – Signal flow graphs.

| UNIT - II | TIME RESPONSE ANALYSIS | |
|---|---|---|

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems Time domain specifications - Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

| UNIT - III | STABILITY ANALYSIS IN TIME DOMAIN | |
|---|---|---|

Stability - concept and definition, Characteristic equation – Location of poles – Routh Hurwitz criterion - Limitations of Routh's stability - The Root locus concept - construction of root loci-

| UNIT - IV | FREQUENCY RESPONSE ANALYSIS | |
|---|---|---|

Bode plot - Correlation between frequency domain and time domain specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots -Nyquist Plots- Phase margin and Gain Margin–Stability Analysis.

| UNIT - V | STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS | |
|---|---|---|

Concepts of state, state variables and state models - differential equations & Transfer function models - Transfer function from state model-State Transition Matrix and it's Properties-System response through State Space models-The concepts of controllability and observability, Duality between controllability and observability.

**Textbooks:**

1. Katsuhiko Ogata, "Modern Control Engineering", 5th edition, Prentice Hall of India Pvt. Ltd., 2010.
2. J. Nagrath and M. Gopal, "Control Systems Engineering" 5th edition, New Age International (P) Limited Publishers, 2007.

**Reference Books:**

1. M. Gopal, "Control Systems Principles & Design" 4th Edition, Mc Graw Hill Education, 2012.
2. B. C. Kuo and Farid Golnaraghi, "Automatic Control Systems" 8th edition, John Wiley and sons, 2003.
3. Joseph J Distefano III, "Feedback and Control Systems", Allen R Stubberud & Ivan Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Graham C. Goodwin, "Control System Design" Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Gene F. Franklin, "Feedback Control of Dynamic Systems", J.D. Powell and Abbas Emami- Naeini, 6th Edition, Pearson, 2010.

**Mapping of course outcomes with program outcomes**

| Course Title | COs | Programme Outcomes(POs) & Programme Specific Outcomes(PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CONTROL SYSTEMS | CO1 | 2 | 1 | | | | 1 | | | | | | | 3 | |
| | CO2 | 3 | 2 | 1 | | | 1 | | | | | | | 3 | |
| | CO3 | 3 | 3 | 1 | | | 1 | | | | | | | 3 | |
| | CO4 | 3 | 3 | 2 | | | 1 | | | | | | | 3 | |
| | CO5 | 3 | 2 | | | | 1 | | | | | | | 3 | |

**Correlation matrix**

| CO | CO | | | | | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | | |
| 1 | 17 | 22.6 | 3 | Understand | L2 | | PO1, PO2 PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule | 2 1 1 |
| 2 | 15 | 20 | 2 | Apply | L3 | | PO1, PO2 PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule | 3 2 1 |
| 3 | 14 | 18.6 | 2 | Analyze | L4 | | PO1, PO2 PO3 PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO3:Design(L6) PO6: Thumb Rule | 3 3 1 1 |
| 4 | 16 | 21.3 | 3 | Evaluate | L5 | | PO1, PO2 PO3 PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO3:Design(L6) PO6:Thumb Rule | 3 3 2 1 |
| 5 | 13 | 17.3 | 2 | Apply | L3 | | PO1, PO2 PO6 | PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule | 3 2 1 |
| | 75 | | | | | | | | |

**Justification Statements:**
**CO1:- Understand the mathematical modelling and transfer function of physical systems.**
Action Verb: Understand (L2)
PO1: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; therefore correlation is moderate (2).
PO2: Analyze (L4)
CO1 Action Verb is less than PO2 verb by two level; therefore correlation is low (1).
PO6: using thumb rule, CO1 correlation with PO6 is low (1)
**CO2:- Apply time response analysis to first order systems & controllers and study their stability.**

Action Verb: Apply (L3)

PO1: Apply (L3)

CO2 Action Verb is equal to PO1 verb; therefore correlation is High (3).

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; therefore correlation is moderate (2).

PO6: using thumb rule, CO2 correlation with PO6 is low (1)

**CO3:- Analyze the stability of a system using Routh-Hurwitz criteria and root locus.**

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO3 Action Verb is greater than PO1 verb by one level; therefore correlation is High (3).

PO2: Analyze (L4)

CO3 Action Verb is same as PO2 verb; therefore correlation is High (3).

PO3: Design (L6)

CO3 Action Verb is less than as PO3 verb by two level; therefore correlation is Low (1).

PO6: using thumb rule, CO3 correlation with PO6 is low (1)

**CO4:- Evaluate the stability of a system using Bode and Nyquist plot methods.**

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4 Action Verb is greater than PO1 verb by two level; therefore correlation is High (3).

PO2: Analyze (L4)

CO4 Action Verb is greater than PO2 verb by one level; therefore correlation is High (3).

PO3: Design (L6)

CO1 Action Verb is less than as PO3 verb by one level; therefore correlation is Moderate (2).

PO6: using thumb rule, CO4 correlation with PO6 is low (1)

**CO5:- Apply state space analysis to study response of continuous system.**

Action Verb: Apply (L3)

PO1: Apply (L3)

CO5 Action Verb is same PO1 verb; therefore correlation is High (3).

PO2: Analyze (L4)

CO5 Action Verb is less than PO2 verb by one level; therefore correlation is Moderate (2).

PO6: using thumb rule, CO5 correlation with PO6 is low (1)

| Course Code | Year & Sem | Software Engineering | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3601 | III-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the different Software Engineering Models

**CO2: Analyze** the Parameters and prerequisites of software project management.

**CO3: Analyze** the Design Methodologies of Software Project

**CO4: Apply** the Coding and Testing Methods for Quality Assurance of the Software project

**CO5: Analyze** the Software Quality Management Systems (standards) for reliability

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | The different Software Engineering Models | | | L2 |
| CO2 | Analyze | The Parameters and prerequisites of SPM | | | L4 |
| CO3 | Analyze | The Design Methodologies of Software Project | | | L4 |
| CO4 | Apply | The Coding and Testing Methods | | for Quality Assurance of the Software project | L3 |
| CO5 | Analyze | The Software Quality Management Systems (standards) | | for reliability | L4 |

| **UNIT - I** | | 9 Hrs |
|---|---|---|

**Introduction:** Evolution, Software Development Projects, Exploratory style of Software Development, Emergence, Notable Changes in Software Development Practices, Computer Systems Engineering

**Software Life Cycle Models:** A few basic concepts, Waterfall Model and its extensions, RAD, Agile Development Models, Spiral Model, Comparison

| **UNIT - II** | | 9Hrs |
|---|---|---|

**Software Project Management:** SPM complexities, Responsibility of a software Development Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO, Halstead's Software Science, Staffing Level-Estimation, Scheduling, Organization and Team Structures, Risk Management, Software Configuration Management

**Requirement Analysis and Specification:** Requirements Gathering and Analysis, SRS, Formal System Specification, Axiomatic Specification, Algebraic Specification, Executable Specification and 4GL

| **UNIT - III** | | 9 Hrs |
|---|---|---|

**Software Design:** Overview of the Design Process, Characterize good design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design

**Function-oriented Software Design:** Overview, Structured Analysis, Developing the DFD model of a system, Structured Design, Detailed Design and Review

**User Interface Design:** Characteristics, Basic Concepts, Types, Fundamentals of Component-based GUI Development, A UI Design Methodology

| **UNIT - IV** | | 9 Hrs |
|---|---|---|

**Object Modeling Using UML:** Unified Modeling Language (UML), UML Diagrams, Use Case Model, Class Diagrams, Interaction Diagrams, Activity Diagram, State Chart Diagram, Package, Component, and Deployment Diagrams

**Coding and Testing**: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-box Testing, Debugging, Program Analysis Tools, Integration Testing, Testing Object-oriented Programs, System Testing, Issues associated with Testing

| **UNIT - V** | | 9 Hrs |
|---|---|---|

**Software Reliability and Quality Management:** Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model, Other Important Standards, Six Sigma

**Software Reuse:** What can be reused, Issues, A Reuse Approach, Reuse at Organization level

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Emerging Trends:** Client-Server Software, Architectures, CORBA, COM, DCOM, SOA, SAAS |
| **Textbooks:** |
| 1. Fundamentals of Software Engineering, Rajib Mall, PHI Learning, 5th edition |
| 2. Software Engineering: A Practitioner's Approach, R S Pressman, McGraw Hill Education, 7th edition |
| **Reference Books:** |
| 1. Software Engineering, Ian Sommerville, Pearson Education, Tenth edition |
| 2. Pankaj Jalote's Software Engineering: A Precise Approach, Wiley publications |
| **Online Learning Resources:** |
| https://nptel.ac.in/courses/106/105/106105182/ |
| http://peterindia.net/SoftwareDevelopment.html |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | | | |
| CO2 | 3 | | | 3 | 3 | | | | | | | | 3 | |
| CO3 | 3 | | 3 | | | | | | | | | | 3 | |
| CO4 | 3 | | 3 | 2 | | | | | | | | | 2 | 2 |
| CO5 | 3 | | 3 | 3 | 3 | 2 | 2 | | | 2 | 2 | | 2 | 2 |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 1 | 9 | 20% | 2 | CO1 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| 2 | 9 | 20% | 2 | CO2 : Analyze | L4 | PO1 PO4 PO5 | PO1: Apply(L3) PO4: Analyze (L4) PO5:Apply(L3) | 3 3 3 |
| 3 | 9 | 20% | 2 | CO3 : Analyze | L4 | PO1 PO3 | PO1: Apply(L3) PO3: Develop (L3) | 3 3 |
| 4 | 9 | 20% | 2 | CO4 :Apply | L3 | PO1 PO3 PO4 | PO1: Apply(L3) PO3:  Develop (L3) PO4: Analyze (L4) | 3 3 2 |
| 5 | 9 | 20% | 2 | CO5 : Analyze | L4 | PO1 PO3 PO4 PO5 PO6 PO7 PO10 PO11 | PO1: Apply(L3) PO3:  Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6:Thumb rule PO7:Thumb rule PO10: Thumb rule PO11: Thumb rule | 3 3 3 3 2 2 2 2 |
| | 45 | 100 % | | | | | | |

**Justification Statements :**
**CO1: Understand the different Software Engineering Models**
**Action Verb : Understand(L2)**
**PO1: Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**CO2: Analyze the Parameters and prerequisites of Software project management**
**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO2  Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO2 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO2 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

**CO3:Analyze the Design Methodologies of Software Project**

**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO3.  Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**CO4:Apply the Coding and Testing Methods for Quality Assurance of the Software project**
**Action Verb : Apply(L3)**
**PO1: Apply(L3)**
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO4 Action verb is less than PO4 verb by one level.  Therefore the correlation is medium(2)

**CO5:Analyze the Software Quality Management Systems (standards) for reliability**
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
**PO6 : Thumb rule**
For  some software projects ,Various  projects are evaluated for understanding ,therefore the correlation is Medium(2)
**PO9 : Thumb rule**
Team work is required for software project, therefore the correlation  is Medium(2)
**PO11: Thumb rule**
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, therefore the correlation  is Medium(2)

| Course Code | Year & Sem | Distributed database | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3602 | III-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the theoretical and practical aspects of distributed database systems

**CO2: Analyze** the Query processing, Optimization and decomposition in Distributed database.

**CO3: Analyze** the Parallel architectures, Parallel query processing and optimization.

**CO4: Apply** the Reliability concepts and measures using fault-tolerance in distributed systems.

**CO5: Design** the Object Oriented Data Model for Inheritance, object identity, OODBMS and ORDBMS.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the theoretical and practical aspects | | of distributed database systems | L2 |
| **CO2** | Analyze | the Query processing,Optimization and decomposition | | in Distributed database | L4 |
| **CO3** | Analyze | the Parallel architectures, Parallel query processing and optimization | | to construct real time applications of Rasberry Pi | L4 |
| **CO4** | Apply | the Reliability concepts and measures | using fault-tolerance | in distributed systems | L3 |
| **CO5** | Design | the Object Oriented Data Model | | for Inheritance, object identity, OODBMS and ORDBMS | L6 |

| UNIT – I | Introduction | 9 |
|---|---|---|

**Introduction;** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas.

**Distributed DBMS Architecture:**

Architectural Models for Distributed DBMS, DDMBS Architecture.

**Distributed Database Design:**

Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.

| UNIT – II | Query processing and decomposition | 9 |
|---|---|---|

**Query processing and decomposition:**

Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data.

**Distributed query Optimization:**

Query optimization, centralized query optimization, distributed query optimization algorithms.

| UNIT – III | Parallel Database System | 9 |
|---|---|---|

Parallel architectures - Parallel query processing and optimization - load balancing – Parallel Measurement of database – Parallel Query Evaluation – database clusters.

| UNIT – IV | Distributed DBMS Reliability | 9 |
|---|---|---|

Reliability concepts and measures - fault-tolerance in distributed systems - failures in Distributed DBMS - local & distributed reliability protocols - site failures and network partitioning.

| UNIT – V | Distributed object Database Management Systems | 9 |
|---|---|---|

**Distributed object Database Management Systems:**

Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.

**Object Oriented Data Model:**

Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS.

**Textbooks:**

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

**Reference Books:**
1. 1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 1 | | |
| CO3 | 3 | 3 | 1 | 1 | | | | | 2 | | | 1 | | |
| CO4 | 3 | 2 | | | | | | 1 | | | | 1 | | |
| CO5 | | 3 | 3 | 3 | 3 | | | | 1 | | | 1 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|
| 1 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze(L4) | 2<br>1 |
| 2 | CO2 : Analyze | L4 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO12: Thumb rule | 3<br>3<br>1 |
| 3 | CO3 :Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO9<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO9: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>1<br>1<br>2<br>1 |
| 4 | CO4 :Apply | L3 | PO1<br>PO2<br>PO8<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO8: Thumb rule<br>PO12: Thumb rule | 3<br>2<br>1<br>1 |
| 5 | CO5 : Design | L6 | PO2<br>PO3<br>PO4<br>PO5<br>PO9<br>PO12 | PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5: Develop(L6)<br>PO9: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>1<br>1 |

**Justification Statements :**

**CO1: Understand the theoretical and practical aspects of distributed database systems**

**Action Verb : Understand(L2)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze the Query processing,Optimization and decomposition in Distributed database**.
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule

To Analyze the Query processing,Optimization and decomposition is life long learning. Therefore the correlation is low (1)

**CO3: Analyze the Parallel architectures, Parallel query processing and optimization.**
**Action Verb : Analyze(L4)**
PO1: Apply(L3)
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required to do Parallel query processing and optimization. Hence the correlation is medium (2)
PO12: Thumb rule
To Analyze the Parallel architectures can be life long learning. Therefore the correlation is low (1)

**CO4: Apply the Reliability concepts and measures using fault-tolerance in distributed systems.**
**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is less than PO2  verb by one level. Therefore the correlation is medium (2)
PO8: Thumb rule
To Apply the Reliability concepts and measures using fault-tolerance ethics are required. Therefore the correlation is low(1)
PO12: Thumb rule
To measure using fault-tolerance in distributed systems can be life long learning. Therefore the correlation is low (1)

**CO5: Design the Object Oriented Data Model for Inheritance, object identity, OODBMS and ORDBMS.**
**Action Verb : Design (L6)**
PO2: Analyze (L4)
CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Design (L6)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Develop(L6)
CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO9 : Thumb rule
Team work is required to Create Object Oriented Data Model. Hence the correlation is low (1)
PO12: Thumb rule
To Frequently Update Inheritance, object identity, OODBMS and ORDBMS is lifelong learning. Therefore the correlation is low (1)

| Course Code | Year & Sem | AUTOMATA THEORY & COMPILER DESIGN | L | T | P | C |
|---|---|---|---|---|---|---|
| **20APE3603** | **III - I** | | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the different Formal Language and Regular Expressions. for Conversion of regular expression to NFA, NFA to DFA.

**CO 2: Apply** the Bottom-up parsing for checking string acceptance.

**CO 3: Analyze** the different types of grammars by using Chomsky hierarchy.

**CO 4: Apply** the dynamic memory allocation for memory management.

**CO 5: Evaluate** the target code generation for three address statement.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | the different Formal Language and Regular Expressions | | for Conversion of regular expression to NFA, NFA to DFA | L2 |
| **CO2** | **Apply** | the Bottom-up parsing | | for checking string acceptance | L4 |
| **CO3** | **Analyze** | the different types of grammars | by using Chomsky hierarchy | | L3 |
| **CO4** | **Apply** | the dynamic memory allocation | | for memory management | L4 |
| **CO5** | **Evaluate** | the target code generation | | For three address statement | L5 |

| **UNIT – I** | | 9 |
|---|---|---|

Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools. Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing

| **UNIT – II** | | 9 |
|---|---|---|

Bottom-up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. Semantics: Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

| **UNIT – III** | | 9 |
|---|---|---|

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

| **UNIT – IV** | | 9 |
|---|---|---|

Run time storage: Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. Code optimization: Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

| **UNIT – V** | | 9 |
|---|---|---|

Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Blocks

| **Textbooks:** |
|---|

1. Introduction to Theory of computation. Sipser, 2nd Edition, Thomson.

2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education

| **Reference Books:** |
|---|

1. Modern Compiler Construction in C , Andrew W.Appel Cambridge University Press.

2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V. Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L. Torczon, ELSEVIER.
6. Introduction to Formal Languages and Automata Theory and Computation - Kamala Krithivasan and Rama R, Pearson.
7. Modern Compiler Design, D. Grune and others, Wiley-India.
8. A Text book on Automata Theory, S. F. B. Nasir, P. K. Srimani, Cambridge Univ. Press.
9. Automata and Language, A. Meduna, Springer.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 2 | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | 1 | | | 1 | | |
| CO4 | 3 | 3 | | | | | | | | | | | | |
| CO5 | | 3 | 2 | 2 | | | | | 1 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------------------|-----|----------------------|----------------------------------------------|----------------------------|
| 1 | CO1 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | CO2 : Apply | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO12 | PO12: Thumb rule | 2 |
| 3 | CO3 : Analyze | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO9 | PO9: Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Apply | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| 5 | CO5 : Evaluate | L5 | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 2 |
| | | | PO4 | PO4: Design (L6) | 2 |
| | | | PO9 | PO9: Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 2 |

**Justification Statements:**

**CO 1: Understand** the different Formal Language and Regular Expressions. for Conversion of regular expression to NFA, NFA to DFA.
**Action Verb : Understand (L2)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO 2: Apply** the Bottom-up parsing for checking string acceptance.
**Action Verb : Apply (L3)**
PO1 Verb : Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)

CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule
In Automata Parsing Techniques are life long learning. Therefore the correlation is medium(2)


**CO 3: Analyze** the different types of grammars by using Chomsky hierarchy.
**Action Verb : Analyze (L4)**
PO1: Apply(L3)
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required to implement different types of grammars Hence the correlation is low (1)
PO12: Thumb rule
Context Sensitive features can be life long learning. Therefore the correlation is low (1)

**CO 4: Apply** the dynamic memory allocation for memory management.
**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO 5: Evaluate** the target code generation for three address statement.
**Action Verb : Evaluate (L5)**
PO2: Analyze (L4)
CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is less than PO3 verb by one level. Therefore the correlation is medium (2)
PO4: Design (L6)
CO5 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO9 : Thumb rule
Team work is required for code generation. Hence the correlation is low (1)
PO12: Thumb rule
In real time DAG representation can be life long learning. Therefore the correlation is medium (2)

| Course Code | Year & Sem | Cryptography and Network Security Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3614 | **III-I** | | **0** | **0** | **3** | **1.5** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Apply** the cipher techniques to protect the data during transmission.

**CO2: Analyze** the DES, Blowfish and Rijndael security algorithms

**CO3: Apply** the different open source tools for network security and analysis

**CO4: Analyze** the steps to setup, configure and disable the Firewall.

**CO5: Evaluate** the various Security Models and Tools for data compression.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the cipher techniques | | to protect the data during transmission. | L2 |
| **CO2** | Analyze | the DES, Blowfish and Rijndael security algorithms | | | L4 |
| **CO3** | Apply | the steps to setup, configure and disable the Firewall | | | L3 |
| **CO4** | Apply | the Configuration and Implement Firewall | | | L3 |
| **CO5** | Evaluate | the various Security Models and Tools | | for data compression. | L5 |

**List of Experiments:**

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result. **(CO1)**

2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.**(CO1)**

3. Write a Java program to perform encryption and decryption using the following algorithms **(CO1)**

a. Ceaser cipher      b. Substitution cipher      c. Hill Cipher

4. Write a C/JAVA program to implement the DES algorithm logic. **(CO2)**

5. Write a C/JAVA program to implement the Blowfish algorithm logic. **(CO2)**

6. Write a C/JAVA program to implement the Rijndael algorithm logic. **(CO2)**

7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool. **(CO3)**

8. Write a Java program to implement RSA algorithm.**(CO3)**

9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.**(CO3)**

10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA. **(CO5)**

11. Calculate the message digest of a text using the MD5 algorithm in JAVA.**(CO5)**

12. a. How to setup firewall      **(CO4)**

    b. How to configure firewall

    c. How to disable firewall

13. How to configure PGP (Pretty Good Privacy) **(CO4)**

**References:**

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.

2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition

3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.

4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH

5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 1 | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | 1 | | | 1 | | |
| CO4 | 3 | 2 | | | | | | | | | | | | |
| CO5 | | 3 | 2 | 2 | 2 | | | | 1 | | | 1 | | |

## Correlation matrix

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|---------------------------------------------|----------------------------|
| 1 | CO1 : Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | CO2 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 3 | CO3 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO9 | PO9: Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| 5 | CO5 : Evaluate | L5 | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 2 |
| | | | PO4 | PO4: Design (L6) | 2 |
| | | | PO5 | PO5: Develop (L6) | 2 |
| | | | PO9 | PO9: Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |

**Justification Statements :**

**CO1: Apply** the cipher techniques to protect the data during transmission.
**Action Verb : Understand (L2)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze** the DES, Blowfish and Rijndael security algorithms
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO12: Thumb rule
To Analyze the various security algorithms is life long learning.Therefore the correlation is low(1)

**CO3: Apply** the different open source tools for network security and analysis

**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L6)
CO3 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO3 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required to Analyze for network security and analysis. Hence the correlation is low (1)
PO12: Thumb rule
Construct real time applications using different open source tools can be lifelong learning. Therefore the correlation is low (1)

**CO4: Analyze** the steps to setup, configure and disable the Firewall.
**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**CO5: Evaluate** the various Security Models and Tools for data compression.
**Action Verb : Develop (L6)**
PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Design (L6)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Develop(L6)
CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO9 : Thumb rule
Team work is required to Develop the Various Security Models. Hence the correlation is low (1)
PO12: Thumb rule
In real time Security Tools and Models need constant update in technology. Therefore the correlation is low (1)

| Course Code | Year & Sem | Embedded Systems and Internet of Things Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3616 | III - I | | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Evaluate** the configuration of GPIO ports in TM4C123GH6PM.

**CO2: Analyze** the interrupts and applications of TM4C123GH6PM peripherals.

**CO3: Analyze** the low power modes of TM4C123GH6PM.

**CO4: Apply** the different actuating systems and sensors in IOT .

**CO5: Analyze** the technologies like IOT, machine languages.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Evaluate | the configuration of GPIO ports in TM4C123GH6PM. | | | L5 |
| **CO2** | Analyze | the interrupts and applications | | of TM4C123GH6PM peripherals. | L4 |
| **CO3** | Analyze | the low power modes of TM4C123GH6PM. | | | L4 |
| **CO4** | Apply | the different actuating systems & sensors | | in IOT | L3 |
| **CO5** | Analyze | the technologies like IOT, machine languages | | | L4 |

**List of Experiments:**

1. Write a Embedded C Program for configuration of GPIO ports for Input and Output operation (blinking LED's, push button interface)**(CO1)**
2. Write a Embedded C Program for EK-TM4C123GXL Launchpad and associated timer TSR to toggle onboard LED using interrupt programming technique. **(CO1)**
3. Configure hibernation module of the TM4C123GH6PM microcontroller to place the device in low power state an hen to wake up the device on RTC (Real time Clock) Interrupt. **(CO1)**
4. Configure in –build ADC of TM4C123GH6PM microcontroller and interface the potentiometer with EK- TM4C123GXL Launchpad to observe corresponding 12-bit digital value. **(CO2)**
5. Learn and understand the generation of pulse width module (PWM) signal by configuring and programming the in-build PWM module of TM4C123GH6PM microcontroller. **(CO2)**
6. Learn and understand interfacing of accelerometer in sensor hub booster pack with EK-TM4C123GXL Launchpad using I2C.**(CO2)**
7. To control the LED through android app by using Arduino and Bluetooth HC05. **(CO3)**
8. Blink an LED with Arduino in Tinkercad **(CO3)**
9. Multiple LEDs & Breadboards with Arduino in Tinkercad**(CO3)**
10. Potentiometer with Arduino in Tinkercad**(CO3)**
11. Fading led with arduino analog output in Tinkercad**(CO3)**
12. RGB LED Color Mixing with Arduino in Tinkercad**(CO3)**
13. Digital Input with a Pushbutton with Arduino in Tinkercad**(CO4)**
14. Arduino Serial Monitor in Tinkercad**(CO4)**
15. PIR Motion Sensor with Arduino in Tinkercad**(CO4)**
16. Light Sensor (Photoresistor) With Arduino in Tinkercad
17. TMP36 Temperature Sensor with Arduino in Tinkercad**(CO5)**
18. Ultrasonic Distance Sensor in Arduino with Tinkercad.**(CO5)**

**References:**

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", VPT, 2014
3. Michael J. Pont, "Embedded C", Pearson Education, 2007.

| | 4. | Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition. |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 2 | | |
| CO3 | 3 | 3 | | | | | | | 1 | | | 1 | | |
| CO4 | 3 | 2 | | | | | | | | | | | | |
| CO5 | | 3 | 1 | | | | | | 1 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|---------------------------------------------|----------------------------|
| 1 | CO1 : Evaluate | L5 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze(L4) | 3 |
| 2 | CO2 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO12 | PO12: Thumb rule | 2 |
| 3 | CO3 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| 5 | CO5 : Analyze | L4 | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 2 |

**Justification Statements :**

**CO1: Evaluate** the configuration of GPIO ports in TM4C123GH6PM.
**Action Verb : Evaluate (L5)**
PO1 Verb : Apply(L3)
CO1 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**CO2: Analyze** the interrupts and applications of TM4C123GH6PM peripherals.
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule
To Analyze the control of all embedded Components is life long learning. Therefore the correlation is medium (2)

**CO3: Analyze** the low power modes of TM4C123GH6PM.
**Action Verb : Analyze (L4)**
PO1: Apply(L3)
CO3  Action verb is greateras PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is same as PO2 verb by one level. Therefore the correlation is high (3)
PO9 : Thumb rule
Team work is required to Analyze real time applications. Hence the correlation is low (1)
PO12: Thumb rule
To Apply the knowledge in real time applications can be life long learning. Therefore the correlation is low (1)

**CO4: Apply** the different actuating systems and sensors in IOT.
**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is less than PO2  verb by one level. Therefore the correlation is medium (2)

**CO5: Analyze** the technologies like IOT, machine languages.
**Action Verb : Analyze (L4)**
PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required to Analyze machine languages. Hence the correlation is low (1)
PO12: Thumb rule
In real time using the technologies like IOT, machine languages learning are needed. Therefore the correlation is medium (2)

| Course Code | Year & Sem | SOFT SKILLS LAB | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ASA0502 | III-I | | 1 | 0 | 2 | 2 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the importance of verbal and non-verbal skills

**CO2: Apply** the interpersonal and intrapersonal skills

**CO3: Apply** the grammatical structures to formulate sentences and correct word forms.

**CO4: Understand** the trust among people and develop employability skills

**CO5: Evaluate** the skills needed for approaching different types of interviews.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | **Understand** | the importance of verbal and non-verbal skills | | | L2 |
| 2 | **Apply** | the interpersonal and intrapersonal skills | | | L3 |
| 3 | **Apply** | the grammatical structures | to formulate sentences and correct word forms. | | L3 |
| 4 | **Understand** | the trust among people and develop employability skills | | | L2 |
| 5 | **Evaluate** | the skills needed | for approaching different types of interviews. | | L5 |

**UNIT – I:**

**Grammar:** Articles, Prepositions, Antonyms, Synonyms.

**Vocabulary:** Basics of Communication (Definition, Types of communication). Importance of body language in corporate culture, Body language ( Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage – Tone, pitch, pause & selection of words), Impromptu speeches.

Articles:
Web links: https://learnenglish.britishcouncil.org/grammar/a1-a2-grammar/articles-1
https://www.youtube.com/watch?v=ueEp6U8td1I
Prepositions:
Web links: https://www.grammarbook.com/grammar/probPrep.asp
Antonyms, Synonyms.
Web links: https://www.youtube.com/watch?v=-mLRoxWM8dI
https://www.youtube.com/watch?v=IEOrOPVMxiM

https://www.it.iitb.ac.in/~vijaya/ssrvm/worksheetscd/getWorksheets.com/Language%20Arts/syn_ant.pdf
Basics of Communication (Definition , Types of communication).
Web links: https://wikieducator.org/INTRODUCTION_TO_COMMUNICATION

Importance of body language in Corporate culture
Web links: https://www.forwardfocusinc.com/consciously-communicate/the-importance-of-body-language-in-the-workplace/

Body language ( Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage –Tone, pitch, pause & selection of words)
Web links: https://open.lib.umn.edu/communication/chapter/4-2-types-of-nonverbal-communication/
https://en.wikipedia.org/wiki/Nonverbal_communication
*Impromptu speeches.*
Web links: https://www.write-out-loud.com/impromptu-public-speaking-topics.html;

https://faculty.washington.edu/mcgarrit/COM220/online%20readings/sample%20critique.pdf

**UNIT – II** :

**Grammar:** Tenses, Idioms and Phrases, One word substitutes.
**Vocabulary:** Public speaking - *Oral presentations*, writing skills – *Short Essay writing and E- mail writing.*

Tenses

Web links: https://www.englisch-hilfen.de/en/grammar/english_tenses.htmj;
https://onlymyenglish.com/tenses/;
https://www.englishpage.com/verbpage/verbtenseintro.html;
https://www.englishclub.com/grammar/verb-tenses.htm

Idioms and Phrases:

Web links: https://www.britannica.com/list/7-everyday-english-idioms-and-where-they-come-from
https://eslexpat.com/english-idioms-and-phrases/;
https://onlineteachersuk.com/english-idioms/;

One word substitutes:

Web links: https://www.careerpower.in/one-word-substitution.html;
https://www.hitbullseye.com/Vocab/One-Word-Substitute-List.php;
https://englishan.com/one-word-substitution-set-1/;

Public speaking - *Oral presentations*

Web links:https://egyankosh.ac.in/bitstream/123456789/26773/1/Unit-14.pdf;
https://www.skillsyouneed.com/rhubarb/preparing-oral-presentations.html;
https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-methods-of-delivery/

Writing skills – *Short Essay writing and E-mail writing.*

Web links: https://www.kibin.com/essay-writing-blog/important-essay-writing-skills/
https://www.scribendi.com/academy/articles/academic_essay_writing_skills.en.html ;
https://www.microsoft.com/en-us/microsoft-365/business-insights-ideas/resources/improve-email-writing-skills;

## UNIT – III :

**Grammar :** Direct and Indirect speeches, Active and Passive voice, Drawing inferences (reading comprehensions and listening comprehensions)
**Vocabulary:** Leadership Skills – Negotiation skills - Team-building – *Debate.* Leadership Skills – Negotiation skills - Team-building

Direct and Indirect speeches:

Web links: https://onlymyenglish.com/direct-and-indirect-speech/
https://learnenglish.britishcouncil.org/grammar/b1-b2-grammar/reported-speech-1-statements
https://www.perfect-english-grammar.com/reported-speech.html

Active and Passive voice,

Web links: https://www.englishclub.com/grammar/passive-voice.htm
https://www.gingersoftware.com/content/grammar-rules/verbs/passive-voice/
https://nps.edu/web/gwc/revising-passive-voice-into-active-voice

Drawing inferences (reading comprehensions and listening comprehensions)

Web links: https://www.readingrockets.org/strategies/inference
https://www.thoughtco.com/making-inferences-3111201
https://www.comprehensionconnection.net/2019/03/exploring-difference-between-making.html

Vocabulary: Leadership Skills – Negotiation skills - Team-building – *Debate.*
Leadership Skills – Negotiation skills - Team-building

Web links: https://online.hbs.edu/blog/post/negotiation-skills
https://www.bumc.bu.edu/facdev-medicine/files/2014/08/BUSM-Leasership-training.pdf
https://in.indeed.com/career-advice/career-development/negotiation-skills
https://www.thebalancecareers.com/what-is-team-building-1918270

Debate:

Web links: https://noisyclassroom.com/debate-topics/
https://www.collegeessay.org/blog/debate-topics
https://www.edu.gov.mb.ca/k12/cur/socstud/frame_found_sr2/tns/tn-13.pdf

## UNIT – IV:

**Grammar:** Common errors,  Rearrangement of sentences.
**Vocabulary**:   Resume writing, Pre-interview preparation , Group discussion.

Common errors, Rearrangement of sentences:
Web links: https://www.letsstudytogether.co/sentence-arrangement-questions-pdf-for-banking-exams-ibps-sbi-po-and-clerk/
          https://www.youtube.com/watch?v=e8nO3zZzkZs


Vocabulary:   Resume writing, Pre-interview preparation , Group discussion.
Web links:  https://www.youtube.com/watch?v=PfJg-67smf4
            https://www.youtube.com/watch?v=-lXjbph22Fk

### UNIT – V:
**Grammar :**  Verbal ability tests.
**Vocabulary:**  Mock interviews, Post interview Etiquette.
Verbal ability tests.
Web links:  https://prepinsta.com/infosys-english-verbal-questions/
            https://www.indiabix.com/online-test/verbal-ability-test/random
            https://www.allindiaexams.in/online-test/online-general-english-test/61
Vocabulary:  Mock interviews, Post interview Etiquette.
Web links:   https://www.youtube.com/watch?v=ZOLCMa2QbdE
             https://www.ziprecruiter.com/blog/the-right-way-to-follow-up-after-a-job-interview/
             https://www.youtube.com/watch?v=KIoD19uoxt8

### References:

1. Barun K. Mitra, "Personality Development and Soft Skills", OXFORD Higher Education 2018.
2. Alka Wadkar, "Life Skills for Success", Sage publications 2016.
3. Robert M Sheffield, "Developing Soft Skills", Pearson, 2010.
4. Diana Booher, "Communicate with Confidence" Tata mcgraw hill, 1994.
5. B.N. Gosh, "Managing Soft skills for Personality development", Tata mcgraw hill 2012.
6. Michael Swan, "Practical English Usage", Oxford publications.
7. Raymond Murphy,  "English Grammar in Use",  Cambridge 5th Edition
8. Norman Lewis,  "Word Power Made Easy",   Penguin Publishers.
9. Advanced Grammar in Use A Self-Study Reference and Practice Book for Advanced Learners of  English 3rd   Edition , Cambridge

### Correlation of COs with the POs & PSOs

| Course Outcomes COs | Programme Outcomes(POs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | | | | | | 2 | | | | | | |
| CO2 | | | | | | | | | 2 | | | |
| CO3 | | | | | | | | | | 2 | | |
| CO4 | | | | | | | | | 2 | | | |
| CO5 | | | | | | | | | | | | 3 |

**\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated**

### CO-PO mapping justification:

| CO | Percentage of  contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO6to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | (Approx. Hrs) | % | corr | Verb | BTL | | | |
| **1** | 09 | 21 | 3 | **Understand** | L2 | PO6 | Thumb Rule | 2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **2** | 09 | 21 | 3 | **Apply** | **L3** | PO9 | Thumb Rule | 2 |
| **3** | 06 | 14 | **2** | **Apply** | **L3** | PO10 | Thumb Rule | 2 |
| **4** | 06 | 14 | **2** | **Understand** | **L2** | PO9 | Thumb Rule | 2 |
| **5** | 06 | 14 | **2** | **Evaluate** | **L5** | PO12 | Thumb Rule | 3 |

**CO1:** Understand the importance of verbal and non-verbal skills

**Action Verb: Understand (L2)**

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO2:** Apply the interpersonal and intrapersonal skills

**Action Verb: Apply (L3)**

CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2)

**CO3:** Apply grammatical structures to formulate sentences and correct word forms.
**Action Verb: Apply (L3)**

CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

**CO4:**   Understand trust among people and develop employability skills
**Action Verb: Understand (L2)**

CO4 Action Verb Understand is of BTL 3. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO5:** Evaluate the skills needed for approaching different types of interviews.
**Action Verb: Evaluate (L5)**

CO5 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
CSE-INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY (CIC)**

| Course Code | Year & Sem | BIOLOGY FOR ENGINEERS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AMC9901 | III-I | | 3 | 0 | 0 | 0 |

## Course Outcomes:

After studying the course, student will be able to

**CO1: Understand** the structure of cells and basics in living organisms

**CO2: Understand** the importance of various biomolecules and enzymes in living organisms

**CO3: Analyze** the functioning of physiology in respiratory system and digestive system.

**CO4: Understand** the DNA technology and gen cloning in living organisms.

**CO5: Apply** the biological principles in different technologies for the production of medicines and pharmaceuticals.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | Understand | the structure of cells and basics in living organisms | | | L2 |
| 2 | Understand | the importance of various biomolecules and enzymes | | in living organisms | L2 |
| 3 | Analyze | the functioning of physiology | | in respiratory system and digestive system | L4 |
| 4 | Understand | the DNA technology and gen cloning | | in living organisms | L2 |
| 5 | Apply | the biological principles in different technologies | for the production of medicines and pharmaceuticals | | L3 |

### Unit I: Introduction to Basic Biology                                      (10 hrs.)

 Evolution: Different patterns of evolution, Darwin's theory of evolution, Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes.   Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification, Tissue Engineering.

### Unit II: Introduction to Biomolecules                                      (10 hrs.)

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

### Unit III: Human Physiology                                      (09 hrs.)

Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle, Central Nerves System and Excretory system.

### Unit IV: Introduction to Molecular Biology and recombinant DNA Technology      (09 hrs.)

Prokaryotic gene and Eukaryotic gene structure.      DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

### Unit V: Application of Biology                                      (10 hrs.)

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, Properties and Classification of virus, Immune response to virus, Definitions-Pandemic, Epidemic and outbreak, pandemic alert system ranges, Prevention of pandemic disease and pandemic preparation.

### Text books:

1.    P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications
2.    U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

### Reference Books:

1.    N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.
2.    T Johnson, Biology for Engineers, CRC press, 2011

3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.
6. Richard Dawkins, River Out of Eden: A Darwinian View of Life

**Mapping of COs to POs and PSOs**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 2 | | | | | | | | |
| 2 | | | | | | 2 | | | | | | 2 | | |
| 3 | | | | | | 2 | | | | | | | | |
| 4 | | | | | | 2 | | | | | | | | |
| 5 | | | | | | 2 | | | | | | 2 | | |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**CO-PO mapping justification:**

| CO | Percentage of contact hours over the total planned contact hours | | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|---|
| | Register (Hrs) | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| 1 | 10 | | 20 | 2 | **Understand** | **L2** | PO6 | PO6: | 2 |
| 2 | 10 | | 20 | 2 | **Understand** | **L2** | PO6,PO12 | PO6: PO12: | 2,2 |
| 3 | 9 | | 18 | 1 | **Understand** | **L2** | PO6 | PO6 | 2 |
| 4 | 9 | | 18 | 1 | **Understand** | **L2** | PO6 | PO6 | 2 |
| 5 | 10 | | 20 | 2 | **Apply** | **L3** | PO6,PO12 | PO6: PO12: | 2,2 |
| | 48 | | | | | | | | |

**CO1: Understand the structure of cells and basics in living organisms**
**Action Verb: Understand (L2)**
CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO2: Understand the role of biomolecules in industry.**
**Action Verb: Understand (L2)**
CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 andpo12 as moderate (2).

**CO3: Understand the functioning of physiology in respiratory system and digestive system**
**Action Verb: Understand (L2)**
CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO4: Understand DNA technology in living organisms.**
**Action Verb: Understand (L2)**
CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO5: Apply the biological principles in different technologies for the production of medicines and pharmaceuticals.**
**Action Verb: Apply (L3)**
CO5 Action Verb is of BTL 3. Using Thumb rule, L2 correlates PO6 and PO12 as moderate (2).

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.**

**(AUTONOMOUS)**

**B.Tech**

**(COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

**(Effective for the batches admitted in 2020-2021)**

**Semester VI (Third year)**

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | PC | 20APC3618 | Cyber Security | 3 | 1 | 0 | 3 | 30 | 70 | 100 |
| 2 | PC | 20APC3620 | Advanced IoT Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | 20APC3622 | Building Private Block chain | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | PE-2 | 20APE3604 20APE3605 20APE3606 | Mobile Application Development Real time Operating System Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | PC Lab | 20APC3619 | Cyber Security Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 6 | PC Lab | 20APC3621 | Advanced IoT Programming Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC Lab | 20APC3623 | Building Private Block chain Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | SC | 20ASA0501 | Basics of Cloud Computing | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 9 | MC | 20AMC9904 | Professional Ethics and Human Values | 3 | 0 | 0 | 0 | 30 | 0 | 30 |
| | | | **Total credits** | | | | 18.5 | 340 | 490 | 830 |
| **Industrial/Research Internship (Mandatory) 2 Months during summer vacation** | | | | | | | | | | |

| Course Code | Year & Sem | Cyber Security | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3618 | III-II | | 3 | 1 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Analyze** the threats and risks in mobile devices with in context of cyber security.

CO2: **Apply** the different tools and methods in cyber-crime detection.

CO3: **Understand** the computer forensics life cycle for forensic lab setup.

CO4: **Apply** the different tools for examining hand-held devices to prove or disprove an allegation.

CO5: **Evaluate** the best forensic approaches for locating source of electronic evidence

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Analyze | The threats and risks in mobile devices | | with in context of cyber security. | L4 |
| **CO2** | Apply | The different tools and methods | in cyber crime detection. | | L3 |
| **CO3** | Understand | The computer forensics life cycle | | for forensic lab setup | L2 |
| **CO4** | Apply | the different tools for examining hand-held devices | to prove or disprove an allegation. | | L3 |
| **CO5** | Evaluate | the best forensic approaches | | for locating source of electronic evidence. | L5 |

| UNIT- I | | 9Hrs |
|---|---|---|
| Cybercrime: Mobile and Wireless devices-Trend mobility-authentication service security-Attacks on mobile phones-mobile phone security Implications for organizations- Organizational measurement for Handling mobile-Security policies and measures in mobile computing era. Cases. | | |
| **UNIT-II** | | 9Hrs |
| Tools and methods used in cyber crime-Proxy servers and Anonymizers – Phishing Password cracking-Key loggers and Spy wares-Virus and worms-Trojan Horse and Backdoors-Steganography-SQL Injection-Buffer overflow-Attacks on wireless network. Cases. | | |
| **UNIT-III** | | 9Hrs |
| Understanding computer forensic-Historical background of cyber forensic, Forensic analysis of e-mail-Digital forensic life cycle-Network forensic-Setting up a computer forensic Laboratory-Relevance of the OSI 7 Layer model to computer Forensic- Computer forensic from compliance perspectives. Cases. | | |
| **UNIT-IV** | | 8Hrs |
| Forensic of Hand –Held Devices-Understanding cell phone working characteristics- Hand-Held devices and digital forensic- Toolkits for Hand-Held device-Forensic of i-pod and digital music devices-Techno legal Challenges with evidence from hand-held Devices. Cases. | | |
| **UNIT-V** | | 10Hrs |
| Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications-Protecting people privacy in the organizations Forensic best practices for organizations. Cases. | | |

**Textbooks:**

1. Nina Godbole &SunitBelapure "Cyber Security", Wiley India, 2012.

**ReferenceBooks:**

1. Harish Chander, "cyber laws & IT protection", PHI learning pvt.ltd, 2012.
2. Dhiren R Patel, "Information security theory &practice",PHI learning pvt ltd,2010.
3. MS.M.K.Geetha&Ms.SwapneRaman"Cyber Crimes and Fraud Management, "MACMILLAN,2012. Pankaj Agarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.
4. Vivek Sood, Cyber Law Simplified, TMH, 2012.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | | | | | | | | | | | | 3 |
| CO2 | 3 | 2 | | | | | | | | | | 2 | | 3 |
| CO3 | 2 | 1 | | | | | | 1 | 1 | | | 1 | | 2 |
| CO4 | 3 | 2 | | | | | | 1 | | | | | | 3 |
| CO5 | | 3 | 2 | 2 | 2 | | | 2 | 1 | | | 1 | | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| 1 | 15 | 21% | 3 | CO1 : Analyze | L4 | PO1 PO2 | PO1: Identify(L3) PO2: Analyze(L4) | 3 3 |
| 2 | 17 | 24% | 3 | CO2 : Apply | L3 | PO1 PO2 PO12 | PO1: Apply(L3) PO2: Analyze (L4) PO12: Thumb rule | 3 2 2 |
| 3 | 12 | 17% | 2 | CO3 : Understand | L2 | PO1 PO2 PO8 PO9 PO12 | PO1: Apply(L3) PO2: Analyze (L4) PO8: Thumb rule PO9: Thumb rule PO12: Thumb rule | 2 1 1 1 1 |
| 4 | 14 | 20% | 2 | CO4 : Apply | L3 | PO1 PO2 PO8 | PO1: Apply(L3) PO2: Analyze (L4) PO8: Thumb rule | 3 2 1 |
| 5 | 13 | 18% | 2 | CO5 : Evulaute | L5 | PO2 PO3 PO4 PO5 PO8 PO9 PO12 | PO2: Analyze (L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8: Thumb rule PO9: Thumb rule PO12: Thumb rule | 3 2 2 2 2 1 1 |
| | 71 | 100% | | | | | | |

**Justification Statements :**

**CO1: Analyze the threats and risks in mobile devices with in context of cyber security.**
**Action Verb : Analyze (L4)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2 Verb : Analyze(L4)**
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the different tools and methods in cyber crime detection.**
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Analyze (L4)**
CO2 Action verb is less than PO2 verb by one levels. Therefore the correlation is medium (2)
**PO12: Thumb rule**
Different methods in cyber crime detection are updating. Therefore the correlation is medium (2)

**CO3: Understand the computer forensics life cycle for forensic lab setup.**
**Action Verb : Understand(L2)**
**PO1: Apply(L3)**
CO3  Action verb is less than PO1 verb by one levels. Therefore the correlation is medium (2)
**PO2:Analyze (L4)**
CO3 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
**PO8 : Thumb rule**
Since ethical principles should be followed to crate a forensic lab setup. Therefore the correlation is low(1)
**PO9 : Thumb rule**
Team work is required to Understand computer forensics. Hence the correlation is low (1)
**PO12: Thumb rule**
Computer forensics life cycle is constantly Evolving. Therefore the correlation is low (1)


**CO4: Apply the different tools for examining hand-held devices to prove or disprove an allegation.**
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Analyze (L4)**
CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
**PO8: Thumb rule**
Since different tools for examining hand-held devices to prove or disprove an allegation. Therefore the correlation is low(1)


**CO5: Evaluate the best forensic approaches for locating source of electronic evidence.**
**Action Verb : Evaluate(L5)**
**PO2: Analyze (L4)**
CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
**PO3: Design (L6)**
CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
**PO4: Design (L6)**
CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
**PO5: Create(L6)**
CO5 Action verb is less than PO5  verb by two levels. Therefore the correlation is low (1)
**PO8 : Thumb rule**
Since best forensic approaches are complex needed for society. Therefore the correlation is low (1)
**PO9 : Thumb rule**
Team work is required for locating source of electronic evidence. Hence the correlation is low (1)
**PO12: Thumb rule**
In real time best forensic approaches for locating  evidences is continuously updating. Therefore the correlation is low (1)

| Course Code | Year & Sem | ADVANCED IOT PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3620 | III-II | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the basic concepts of sensors and principles of IOT

**CO2: Analyze** the building blocks of Rasberry Pi to install Internet of Things Systems.

**CO3: Analyze** the various Sensor devices to construct real time applications of Rasberry Pi.

**CO4: Apply** the Rasberry pi programming syntaxes to assemble various sensor nodes.

**CO5: Apply** the IOT Technologies for various real time scenarios using Rasberry pi.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the basic concepts | | of sensors and principles of IOT | L2 |
| **CO2** | Analyze | building blocks of Rasberry Pi | | to install Internet of Things Systems | L4 |
| **CO3** | Analyze | various Sensor devices | | to construct real time applications of Rasberry Pi | L4 |
| **CO4** | Apply | Rasberry pi programming syntaxes | | to assemble various sensor nodes | L3 |
| **CO5** | Apply | the IOT Technologies | using Rasberry pi | for various real time scenarios | L3 |

| UNIT – I | Sensors | 9 Hrs |
|---|---|---|

Introduction to Sensors: Sensors, Criteria to choose a Sensor, Generation of Sensors. Optical Sources and Detectors: Electronic and Optical properties of semiconductor as sensors, LED, Semiconductor lasers, Fiber optic sensors, Thermal detectors, Photo multipliers, photoconductive detectors. Strain, Force, Torque and Pressure sensors: Strain gages, strain gage beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo-resistive and capacitive pressure sensor, optoelectronic pressure sensors, vacuum sensors.

| UNIT – II | Introduction to Raspberry Pi | 9 Hrs |
|---|---|---|

Basics of Raspberry Pi: Introduction to Raspberry pi, Installation of NOOBS on SD Card, Installation of Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi, Getting the static IP address of Raspberry Pi, Run a Program on Raspberry Pi, Installing the Remote Desktop Server, Pi Camera, Face Recognition using Raspberry Pi, Installation of I2C driver on Raspberry Pi, SPI (serial peripheral interface) with Raspberry Pi,

| UNIT – III | Sensors with Raspberry Pi | 9 Hrs |
|---|---|---|

Hosting Sensors with Raspberry Pi – Temperature Sensor Node – Building a Raspberry Temperature Sensor Node – Barometric Pressure Sensor Node – Building a Raspberry Barometric Pressure Sensor Node – Xbee Sensor Nodes  - Creating a Raspberry Pi Data Collector for Xbee Sensor Nodes

| UNIT – IV | Programming in Raspberry Pi | 9 Hrs |
|---|---|---|

Programming a Raspberry Pi: Play with LED and Raspberry Pi, Reading the digital input, Reading an edge triggered input, Interfacing of Relay with Raspberry Pi, Interfacing of Relay with Raspberry Pi, Interfacing of LCD with Raspberry Pi, Interfacing LCD with Raspberry Pi in I2C mode, Interfacing of DHT11 sensor with Raspberry Pi, Interfacing of ultrasonic sensor with Raspberry Pi, Interfacing of camera with Raspberry pi

| UNIT – V | Applications of IoT using Raspberry Pi | 9 Hrs |
|---|---|---|

Home Automation - Smart Cities - Energy, Retail Management – Logistics – Agriculture - Health and Lifestyle -  Industrial IoT - Legal challenges - IoT design Ethics - IoT in Environmental Protection.

**Textbooks:**

1. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, Internet of Things with Raspberry Pi and Arduino, CRC Press, 2019.

2. Beginning Sensor Networks with Arduino and Raspberry Pi by charles bell, Technology In Action,  A Press Publication, 2013.

3. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer, Fourth Edition, 2010.

**Reference Books:**

1. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi,2003.
2. Jan Holler and Vlasios Tsiatsis, From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence, Elsevier Ltd., 2014.
3. David Hanes and Gonzalo Salgueiro, IoT Fundamentals: Networking Technologies, Protocols, and Use   Cases
for the Internet of Things, Cisco Press, 2017.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 2 | 3 | | | | | | | | | | 1 | 2 | 1 |
| CO3 | 3 | 3 | 1 | 1 | | | | 2 | 1 | | | 1 | 2 | 1 |
| CO4 | 3 | 2 | | | | | | 1 | | | | | 2 | 1 |
| CO5 | | 2 | 3 | 3 | 3 | | | 2 | 1 | | | 3 | | |

**Correlation matrix**

| Unit No. | CO | | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
| | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 18 | 33% | 3 | CO1 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | 10 | 18% | 2 | CO2 :Understand | L4 | PO1 | PO1: Apply(L3) | 2 |
| | | | | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | | | | PO12 | PO12: Thumb rule | 1 |
| 3 | 9 | 16% | 2 | CO3 :Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | | | | PO3 | PO3: Design (L6) | 1 |
| | | | | | | PO4 | PO4: Design (L6) | 1 |
| | | | | | | PO8 | PO8:  Thumb rule | 2 |
| | | | | | | PO9 | PO9:  Thumb rule | 1 |
| | | | | | | PO12 | PO12: Thumb rule | 1 |
| 4 | 8 | 15% | 2 | CO4 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | | | | PO8 | PO8:  Thumb rule | 1 |
| 5 | 10 | 18% | 2 | CO5 : Apply | L3 | PO2 | PO2: Analyze (L4) | 2 |
| | | | | | | PO3 | PO3: Design (L6) | 3 |
| | | | | | | PO4 | PO4: Design (L6) | 3 |
| | | | | | | PO5 | PO5: Create(L6) | 3 |
| | | | | | | PO8 | PO8:  Thumb rule | 2 |
| | | | | | | PO9 | PO9:  Thumb rule | 1 |
| | | | | | | PO12 | PO12: Thumb rule | 3 |
| | 55 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand the basic concepts of sensors and principles of IOT**

**Action Verb : Understand(L2)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze** the building blocks of Rasberry Pi to install Internet of Things Systems.
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2 Verb : Analyze(L4)

CO1 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

PO12: Thumb rule

For some building blocks of Rasberry Pi to we need to install Internet of Things Systems. Therefore the correlation is low (1)

**CO3: Analyze the various Sensor devices to construct real time applications of Rasberry Pi.**
**Action Verb : Analyze(L4)**

PO1: Apply(L3)

CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2:Analyze (L4)

CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)

PO4: Design (L6)

CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)

PO8 : Thumb rule

Real time applications of  Rasberry Pi can be useful. Therefore the correlation is medium(2)

PO9 : Thumb rule

Team work is required to Analyze various Sensor devices. Hence the correlation is low (1)

PO12: Thumb rule

Construct real time applications can be life long learning. Therefore the correlation is low (1)

**CO4: Apply the Rasberry pi programming syntaxes to assemble various sensor nodes.**
**Action Verb : Apply (L3)**

PO1: Apply(L3)

CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO4  Action verb is less than PO2  verb by one level. Therefore the correlation is medium (2)

PO8: Thumb rule

Rasberry pi programming syntaxes are required to assemble various sensor nodes. Therefore the correlation is low(1)

**CO5: Apply the IOT Technologies for various real time scenarios using Rasberry pi.**
**Action Verb : Apply (L3)**

PO2: Analyze (L4)

CO5  Action verb is less than PO2  verb by one level. Therefore the correlation is medium (2)

PO3: Design (L6)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Design (L6)

CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5: Create(L6)

CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO8 : Thumb rule

IOT Applications can be used to make society better place. Therefore the correlation is medium(2)

PO9 : Thumb rule

Team work is required to Create IOT applications. Hence the correlation is low (1)

PO12: Thumb rule

In real time Home Automation, Smart components are used in daily life. Therefore the correlation is high (3)

| Course Code | Year & Sem | Building Private Blockchain | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3622 | III-II | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the basics of blockchain and multichain models

CO2: **Apply** the P2P and DAPPs trade for a private Blockchain using multichain

CO3: **Analyze** the Hyper ledger fabric components and Chain code design.

CO4: **Understand** the Financial software & systems in block chain and trade/supply chains.

CO5: **Analyze** the blockchain for Government and public distribution system to provide privacy and security.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | basics of blockchain models and multichain | | | L2 |
| **CO2** | Apply | the P2P and DAPPs trade | using multichain | for a private Blockchain | L3 |
| **CO3** | Analyze | the Hyper ledger fabric components and Chain code design. | | | L4 |
| **CO4** | Understand | the Financial software & systems | in block chain and trade/supply chains. | | L2 |
| **CO5** | Analyze | blockchain for Government and public distribution system | | to provide privacy and security | L4 |

| UNIT – I | INTRODUCTION TO BLOCKCHAIN | 9 |
|---|---|---|

What is Block chain? Basic ideas behind Blockchain, how it is changing the landscape of digitalization, Uses of Blockchain. Abstract Models for BLOCKCHAIN - GARAY model - RLA Model, what is Multichain? Objective of Multichain, Features of Multichain, Uses of Multichain, Process of mining in Multichain technology, Analyse Multichain platform, why it is better than other open platforms Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hash chain to Blockchain, Basic consensus mechanisms

| UNIT – II | CONSENSUS & DAPPS | 9 |
|---|---|---|

Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains (DAPPS) - Characteristics of Decentralized application, Setting up a Private Blockchain, Multiple configurable Blockchains using Multichain Deployment scenarios of Multichain, Centralized currency settlement, Bond issuance and peer-to-peer trading Consumerfacing rewards scheme in Decentralized Applications

| UNIT – III | HYPERLEDGER FABRIC | 9 |
|---|---|---|

Hyperledger Fabric (A): Decomposing the consensus process , Hyperledger fabric components, Chain code Design and Implementation Hyperledger Fabric (B): Beyond Chain code: fabric SDK and Front End (b) Hyperledger composer tool

| UNIT – IV | USECASE MODEL – PRIVACY BLOCKCHAIN | 9 |
|---|---|---|

Use case 1: Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance Use case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.

| UNIT – V | USECASE MODEL – BLOCKCHAIN DIGITAL IDENTITY | 9 |
|---|---|---|

Use case 3: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain

**Textbooks:**

1. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015

| 2. Melanie Swa "Blockchain", First Edition, O'Reilly Jan 2015 |
|---|
| **Reference Books:** |
| 1. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric<br>2. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html |
| **Online Learning Resources** |
| https://www.udemy.com/course/build-blockchain/ |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | 1 | | | | | | | 3 | | |
| CO3 | 3 | 3 | 1 | 1 | 1 | | | | 3 | | | 3 | 2 | 1 |
| CO4 | 2 | 1 | | | | | | | | | | 2 | 2 | 1 |
| CO5 | | 3 | 1 | 1 | 1 | | | | 3 | | | 3 | 2 | 2 |

**Correlation matrix**

| Unit No. | CO | | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|---|
| | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | | | | |
| 1 | 12 | 33% | 3 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze(L4) | 2<br>1 |
| 2 | 8 | 22% | 3 | CO2 :Apply | L3 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5: Create(L6)<br>PO12: Thumb rule | 3<br>2<br>1<br>1<br>1<br>3 |
| 3 | 4 | 11% | 1 | CO3 :Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO9<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5: Create(L6)<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>1<br>1<br>1<br>3<br>3 |
| 4 | 8 | 22% | 3 | CO4 :Understand | L2 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO12: Thumb rule | 2<br>1<br>2 |
| 5 | 4 | 11% | 1 | CO5 :Analyze | L4 | PO2<br>PO3<br>PO4<br>PO5<br>PO9<br>PO12 | PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5: Create(L6)<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>1<br>1<br>1<br>3<br>3 |
| | 36 | 100% | | | | | | |

**Justification Statements :**

**CO1: Understand** the basics of blockchain models and multichain.
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Analyze(L4)**
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Apply** the P2P and DAPPs trade for a private Blockchain using multichain

**Action Verb : Apply (L3)**
**PO1: Apply(L3**)
CO2  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Analyze (L4)**
CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
**PO3: Design (L6)**

CO2 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
**PO4: Design (L6)**
CO2 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
**PO5: Create(L6)**
CO2 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)
**PO12: Thumb rule**
Create a private Blockchain using multichain deployment needs life long learning. Therefore the correlation is high (3)

CO3: **Analyze** the Hyper ledger fabric components and Chain code design.
**Action Verb : Analyze  (L4)**
**PO1: Apply(L3)**
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2:Analyze (L4)**
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
**PO3: Design (L6)**
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
**PO4: Design (L6)**
CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
**PO5: Create(L6)**
CO3 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)
**PO9 : Thumb rule**
Team work is required for Analysing Hyper ledger fabric in block chain. Hence the correlation is high (3)
**PO12: Thumb rule**
Chaincode design is a life long learning. Therefore the correlation is high (3)

CO4: **Understand** the Financial software & systems in block chain and trade/supply chains.
**Action Verb : Understand (L2)**
**PO1: Apply(L3)**
CO4  Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2: Analyze (L4)**
CO4 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
**PO12: Thumb rule**
Trade/suppy chains is a life long learning. Therefore the correlation is medium (2)

CO5: **Analyze** the blockchain for Government and public distribution system to provide privacy and security.
**Action Verb : Analyze (L4)**
**PO2: Analyze (L4)**
CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
**PO3: Design (L6)**
CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
**PO4: Design (L6)**
CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
**PO5: Create(L6)**
CO5 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)
**PO9 : Thumb rule**
Team work is required to provide privacy and security. Hence the correlation is high (3)
**PO12: Thumb rule**
In real time Government and public distribution system is life long learning. Therefore the correlation is high (3)

| Course Code | Year & Sem | Mobile Application Development | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3604 | III-II | | 3 | 0 | 0 | 3 |

## Course Outcomes:

After studying the course, student will be able to

**CO1: Understand** knowledge on mobile platforms and mobile user interface design requirements
**CO2: Analyze** various android application design essentials for app development
**CO3: Create** user interfaces by analyzing user requirements and data persistence
**CO4: Create** mobile applications for messaging, location-based services and networking
**CO5: Analyze** mobile applications and publish in different mobile platforms by using Android Studio

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms Level |
|---|---|---|---|---|---|
| CO1 | Understand | knowledge on mobile platforms | | mobile user interface design requirements | L2 |
| CO2 | Analyze | various android application | | design essentials for App development | L4 |
| CO3 | Create | user interfaces by analyzing user requirements and data persistance | using android studio | | L6 |
| CO4 | Create | Mobile applications for messaging | using android studio | location-based services and networking | L6 |
| CO5 | Analyze | mobile applications and publish in different mobile platforms | by using Android Studio | | L4 |

| UNIT - I | | 9 Hrs |
|---|---|---|

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation,Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

**1.Setting Up the Development Environment**
    1.1 Download/Install the SDK
    1.2 Download/Install the Eclipse Plugin
    1.3 Download/Install the SDK Platform Components

**2. Test the android development environment by performing the following operations.**
    2.1. Add the sample application to a project in Android studio.
    2.2. Create an Android Virtual Device (AVD) for sample project.
    2.3. Create a launch configuration for sample project.
    2.4. Run a sample application in Android Emulator.

| UNIT - II | | 9Hrs |
|---|---|---|

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies,Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

**3.Create "Hello World" Application**

**4. Develop a program which will implement Sub menu in android application.**

**5. Develop a program to implement Context menu (Floating List of Menu Items) in android application.**

| UNIT - III | | 9 Hrs |
|---|---|---|

ADVANCED USER INTERFACE AND DATA PERSISTENCE Basic views, Picker views, List view, Image view, Menus with views, Web view, saving and loading user preferences, Persisting data to files, Creating and using databases.

**6. Develop a program to implement the List View in android application.**

**7. Creating the Application Choosing Options (i) CheckBox (ii) RadioButton**

**8. Develop application by using Linear Layout Views with different attributes.**

| UNIT - IV | | 9 Hrs |
|---|---|---|

MESSAGING, LOCATION-BASED SERVICES, AND NETWORKING SMS messaging, sending e-mail, displaying maps, getting location data, monitoring a location, Consuming web services using HTTP

**9. Develop a program to implement a Custom Button and handle the displayed message on button click**

**10. Develop a program to implement the Table layout in View Group that displays child View elements in rows**
**and columns.**

| UNIT - V | | 9 Hrs |
|---|---|---|

ANDROID SERVICES, PUBLISHING ANDROID APPLICATIONS: Services, Communication between a service and an activity, Binding activities to services, Threading, Preparing for publishing, Deploying APK files. Building the app in android debugging an android app.

**11. Develop a program to show how to use Date picker control of ADK in android applications.**

**12. Develop a program to insert, delete, display, and update the employee details in Android APP**

**Textbooks:**

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. J. F. DiMarzio, Beginning Android Programming with Android Studio, Wiley India, 4 thEdition, 2017.
3. Wei – Meng Lee, Beginning Android 4 Application Development, Wrox, 2017.
4. Jeff McWherter and Scott Gowell, Professional Mobile Application Development,Wiley India, 1 stEdition, 2012.

**Reference Books:**

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition:
4. Neils Smyth, Android Stduio Development Essentials, Creative Space Independent publishing platform, 7 th Edition 2016.
5. Paul Deital and Harvey Deital, Android How to Program,Detial associates pu

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | | 2 | | | | | | | | 2 | 2 |
| CO2 | 3 | 3 | 3 | | 3 | | | | | | | | 3 | |
| CO3 | 3 | | 3 | | 3 | | | | 3 | 3 | | | | 2 |
| CO4 | | 3 | 3 | 3 | 3 | | | | | 3 | | | | 2 |
| CO5 | | | 3 | | 3 | | | | | | 3 | 3 | | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) : Action Verb and BTL (for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1: Understand | L2 | PO1<br>PO2<br>PO3<br>PO5 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO3: Design(L6)<br>PO5: Apply(L3) | 2<br>2<br>2<br>2 |
| 2 | CO2: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO5 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO3: Design(L6)<br>PO5: Apply(L3) | 3<br>3<br>2<br>3 |
| 3 | CO3: Create | L6 | PO1<br>PO3<br>PO5<br>PO9<br>PO10 | PO1: Apply(L3)<br>PO3: Design(L6)<br>PO5: Create(L6)<br>PO9: Thumb Rule<br>PO10: Thumb Rule | 3<br>3<br>3<br>3 |
| 4 | CO4: Create | L6 | PO2<br>PO3<br>PO4<br>PO5<br>PO10 | PO2: Apply(L3)<br>PO3: Design(L6)<br>PO4: Analyze(L4)<br>PO5: Create(L6)<br>PO10: Thumb Rule | 3<br>3<br>3<br>3<br>3 |
| 5 | CO5: Analyze | L4 | PO3<br>PO5<br>PO11<br>PO12 | PO3: Develop(L3)<br>PO5: Create(L6)<br>PO11: Thumb Rule<br>PO12: Thumb Rule | 3<br>2<br>3<br>3 |

**Justification Statements:**

**CO1: Understand** knowledge on mobile platforms, mobile user interface design requirements
**Action Verb: Understand (L2)**
**PO1 Verb: Apply (L3)**
CO1 Action verb is lesser than as PO1 verb. Therefore, the correlation is medium (2)
**PO2 Verb: Identify (L2)**
CO1 Action verb is lesser than as PO2 verb. Therefore, the correlation is medium (2)
**PO3 Verb: Design (L2)**
CO1 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
**PO5 Verb: Apply (L2)**
CO1 Action verb is lesser than as PO5 verb. Therefore, the correlation is medium (2)


**CO2: Analyze** various android application design essentials for app development
**Action Verb: Analyze (L4)**
**PO1: Apply (L3)**
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
**PO2: Identify(L3)**
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
**PO3: Design(L6)**
CO2 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
**PO5: Apply (L3)**
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)


**CO3: Create** user interfaces by analyzing user requirements and data persistance
**Action Verb: Create(L6)**
**PO1: Apply (L3)**
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
**PO3: Design(L6)**
CO3 Action verb is same as PO3 verb. Therefore, the correlation is medium (3)
**PO5: Create(L6)**

CO3 Action verb is same as PO5 verb. Therefore, the correlation is medium (3)
**PO9: Thumbrule**
CO3 To bulid better application as a team member or a leader, so the correlation is high (3)
**PO10: Thumbrule**
CO3 Communicate effectively by Creating and maintaining databases, so the correlation is high (3)


**CO4: Create** mobile applications for messaging , location-based services and networking
**Action Verb: Create(L6)**
**PO2: Apply (L3)**
CO4 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
**PO3: Design(L6)**
CO4 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO4: Analyze(L4)**
CO4 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
**PO5: Create(L6)**
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
**PO10: Thumbrule**
CO4 Location based services by using different mobile applications, so the correlation is high (3)


**CO5: Analyze** mobile applications and publish in different mobile platforms by using Android Studio
**Action Verb: Analyze(L4)**
**PO3: Develop(L3)**
CO5 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
**PO5: Create(L6)**
CO5 Action verb is lesser than as PO5 verb. Therefore, the correlation is medium (2)
**PO11: Thumbrule**
CO5 Based on user requirements creating applications for multidisciplinary environments, so the correlation is high (3)
**PO12: Thumbrule**
CO5 For maintaining long life applications gradual updates are necessary, so the correlation is high (3)

| Course Code | Year & Sem | REAL TIME OPERATING SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3605 | III-II | **(common to CSE,CIC)** | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the real time scheduling problems by using various approaches.

CO2: **Apply** the clock-driven scheduling approach for making decisions.

CO3: **Analyze** the Priority-Driven Scheduling algorithms for implementing periodic Tasks.

CO4: **Analyze** the Scheduling Aperiodic and Sporadic Jobs in Priority Driven Systems.

CO5: **Evaluate** the various priority protocols and Scheduling algorithms.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the real time scheduling problems | by using various approaches | | L2 |
| **CO2** | Apply | the clock-driven scheduling approach | | for making decisions | L3 |
| **CO3** | Analyze | the Priority-Driven Scheduling algorithms | | for implementing periodic Tasks | L4 |
| **CO4** | Analyze | the Scheduling Aperiodic and Sporadic Jobs | | in Priority Driven Systems | L4 |
| **CO5** | Evaluate | the various priority protocols and Scheduling algorithms | | | L5 |

| UNIT - I | | 9 Hrs |
|---|---|---|

**Typical Real time Applications:** Digital control, High-level control, Signal processing, other Real-time Applications.

**Hard versus Soft Real-Time Systems:** Jobs and processors, Release time, deadlines and Timing constraints, Hard and soft timing constraints, Hard Real time systems, Soft Real-time Systems.

**A Reference Model of Real Time Systems:** Processors and resources, Temporal parameters of Real time workload, periodic task model, precedence constraints and data dependency, Functional parameter, Resource Parameters of Jobs and Parameters of Resources, Scheduling Hierarchy.

**Commonly used Approaches to real time Scheduling:** Clock-Driven Approach, Weighted Round-Robin Approach, Priority driven Approach, Dynamic vs Static Systems, Effective release time and deadlines, Optimality of the EDF and LST algorithms, Nonoptimality of the EDF and LST algorithms, Challenges in validating timing constraints in priority driven System, Off line vs On line scheduling, summary.

| UNIT - II | | 9Hrs |
|---|---|---|

**Clock-Driven Scheduling:** Notations and Assumptions, static, Timer-Driven scheduler, General Structure of the Cyclic Scheduler, Improving the average response time of Aperiodic Jobs, Scheduling sporadic Jobs, Practical considerations and generalizations, Algorithm for generating Static Schedules, Pros and cons of Clock-driven scheduling, summary.

| UNIT - III | | 9 Hrs |
|---|---|---|

**Priority-Driven Scheduling of periodic Tasks :** Static Assumption, Fixed-priority vs Dynamic-priority Algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM Algorithms, A Schedulability test for Fixed-priority tasks with Short Response time, A Schedulability test for Fixed-priority tasks with arbitrary Response time, Sufficient Schedulability conditions for the RM and DM Algorithms, summary.

| UNIT - IV | | 9 Hrs |
|---|---|---|

**Scheduling Aperiodic and Sporadic Jobs in Priority Driven Systems:** Assumptions and approaches, Diferrable servers, Sporadic Servers, Constant utilization, total bandwidth and weighted fair –Queueing servers, Slack stealing in Dead-line Driven System, Stack stealing in Fixed-priority systems, Scheduling of sporadic jobs, Real-time performance for jobs with soft timing constraints, A two-level scheme for Integrated scheduling.

| UNIT - V | | 9 Hrs |
|---|---|---|

**Resources and Resource access control:** Assumptions on Resources and their usage, Effects of Resource contention and resource access control, Non Preemptive critical section, Basic Priority inheritance protocol, Basic Priority ceiling protocol, Stack
–based, Priority ceiling protocol, Use of priority ceiling protocol in Dynamic priority systems, pre-emption ceiling protocol, Controlling accesses to Multiple unit Resources, Controlling concurrent accesses to data objects.

Multiprocessor Scheduling, Resource access control, and Synchronization: Model of Multiprocessor and Distributed Systems, Task assignment, Multiprocessor Priority ceiling protocol, Elements of Scheduling Algorithms for End-to-End Periodic Tasks, Schedulability of Fixed-priority End-to-End periodic Tasks, End to End tasks in heterogeneous Systems, Predictability and validation of Dynamic Multiprocessor Systems, Summary.

**Textbooks:**

1. "Real-Time Systems" by Jane W.S Liu, Pearson Edition, 2006.

**Reference Books:**

1.   Real-Time Systems: Scheduling, Analysis, and Verification, Cheng, A. M. K.: Wiley, 2002.
2.   Z.: Scheduling in Real-Time Systems, by Cottet, F., Delacroix, J., Kaiser, C., Mammeri John Wiley & Sons, 2002.
3.   Real-Time Systems, C. M., Shin, K. G. McGraw-Hill, Krishna 1997.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 2 |
| CO4 | 3 | 3 | | 3 | 3 | | | | | | | | | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | | |

**Correlation matrix**

| Unit No. | CO | | Program | PO(s) :Action Verb and | Level of |
|----------|---------------------|-----|----------------|--------------------------|---------------------|
| | Co's Action verb | BTL | Outcome (PO) | BTL(for PO1 to PO12) | Correlation (0-3) |
| 1 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 2<br>3 |
| 2 | CO2: Apply | L3 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO12: Thumb rule | 3<br>3<br>2 |
| 3 | CO3: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3) | 3<br>3<br>3<br>3<br>3 |
| 4 | CO4: Analyze | L4 | PO1<br>PO2<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO4: Analyze (L4)<br>PO5: Apply(L3) | 3<br>3<br>3<br>3 |
| 5 | CO5: Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3) | 3<br>3<br>3<br>3<br>3 |

**Justification Statements :**

**CO1: Understand** the real time scheduling problems by using various approaches.
**Action Verb : Understand (L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is Medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high(3)

**CO2: Apply** the clock-driven scheduling approach for making decisions.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
**PO2: Review(L2)**
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)
**PO12: Thumb rule**
The clock-driven scheduling approach is useful for making decisions in real time applications.Therefore the correlation is medium (2)


**CO3: Analyze** the Priority-Driven Scheduling algorithms for implementing periodic Tasks.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
**PO2: Review (L2)**
CO3 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO3 Action verb is greater than PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO3 Action verb is greater than PO5 verb. Therefore the correlation is high(3)

**CO4: Analyze** the Scheduling Aperiodic and Sporadic Jobs in Priority Driven Systems.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO4  Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO2: Review(L2)**
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO4 Action verb is same level as PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high(3)

**CO5: Evaluate**  the various priority protocols and Scheduling algorithms.
**Action Verb : Evaluate  (L5)**
**PO1: Apply(L3)**
CO5  Action verb is  than PO1 verb. Therefore the correlation is high(3)
**PO2: Review (L2)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is  greater than PO3 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO5 Action verb is  greater than PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO5 Action verb is  greater than PO5 verb. Therefore the correlation is high (3)

| Course Code | Year & Sem | Design and Analysis of Algorithms | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3606 | III-II | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Apply** the Divide and conquer method to solve various problems.

CO2: **Apply** the greedy and dynamic programming methods to solve real time problems.

CO3: **Evaluate** the various problems using traversal, backtracking and searching techniques.

CO4: **Apply** the branch and bound methods to solve minimization problems.

CO5: **Analyze** the P, NP, NP hard and NP complete problems for solving reduction problems.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Apply | The Divide and conquer method | | to solve various problems | L3 |
| **CO2** | Apply | The greedy and dynamic programming methods | | to solve real time problems. | L3 |
| **CO3** | Evaluate | The various problems | Using traversal, backtracking and searching techniques. | | L5 |
| **CO4** | Apply | The branch and bound methods | | to solve minimization problems | L3 |
| **CO5** | Analyze | The P, NP, NP hard , NP complete problems | | for solving reduction problems | L4 |

| UNIT - I | | 9Hrs |
|---|---|---|

**Introduction:** What is an Algorithm, Algorithm specification, Performance analysis.

**Divide and Conquer:** General method, Binary Search, Finding the maximum and minimum, Merge sort, Quick Sort, Selection sort, Stressen's matrix multiplication.

| UNIT - II | | 9 Hrs |
|---|---|---|

**Greedy Method:** General method, Knapsack problem, Job Scheduling with Deadlines, Minimum cost Spanning Trees, Optimal storage on tapes, Single-source shortest paths.

**Dynamic programming:** General Method, Multistage graphs, All-pairs shortest paths, Optimal binary search trees, 0/1 knapsack, The traveling sales person problem.

| UNIT - III | | 9 Hrs |
|---|---|---|

**Basic Traversal and Search Techniques:** Techniques for binary trees, Techniques for Graphs, Connected components and Spanning trees, Bi-connected components and DFS

**Back tracking:** General Method, 8 – queens problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Knapsack Problem.

| UNIT - IV | | 8 Hrs |
|---|---|---|

**Branch and Bound:** The method, Travelling salesperson, 0/1 Knapsack problem, Efficiency Considerations.

**Lower Bound Theory:** Comparison trees, Lower bounds through reductions – Multiplying triangular matrices, inverting a lower triangular matrix, computing the transitive closure.

| UNIT - V | | 10Hrs |
|---|---|---|

**NP – Hard and NP – Complete Problems:** NP Hardness, NP Completeness, Consequences of beingin P, Cook's Theorem, Reduction Source Problems, Reductions: Reductions for some known problems

**Textbooks:**

2. "Fundamentals of Computer Algorithms", Ellis Horowitz, S. Satraj Sahani and Rajasekhran, 2nd edition, University Press.2014,

3. "Design and Analysis of Algorithms", Parag Himanshu Dave, Himanshu Bhalchandra Dave, Pearson Education, Second Edition, 2009.

**Reference Books:**

1. "Introduction to Algorithms", second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, PHI Pvt. Ltd./ Pearson Education.

|   |   |
|---|---|
| 2. | "Introduction to Design and Analysis of Algorithms A strategic approach", R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill. |
| 3. | "Design and Analysis of algorithms", Aho, Ullman and Hopcroft, Pearson education. |

**Online Learning Resources:**

nptel videos

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 |   |   |   |   |   |   |   |   |   | 2 | 3 |   |
| CO2 | 3 | 3 |   |   |   | 2 |   |   |   |   |   | 2 | 2 |   |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 |   |   |   |   |   | 2 | 2 |   |
| CO4 | 3 | 3 |   |   |   |   |   |   |   |   |   | 2 | 2 |   |
| CO5 | 3 | 3 | 3 | 3 | 3 |   |   |   |   |   |   | 2 | 2 |   |

**Correlation matrix**

| Unit No. | CO | | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|-----|-----|-------------|------------------|-----|------------------------|---------------------------------------------|----------------------------|
|   | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL |   |   |   |
| 1 | 17 | 23% | 3 | CO1: Apply | L3 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO12: Thumb rule | 3<br>3<br>2 |
| 2 | 16 | 22% | 3 | CO2: Apply | L3 | PO1<br>PO2<br>PO6<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO6: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>2<br>2 |
| 3 | 16 | 22% | 3 | CO3: Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO6<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO6: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>2<br>2 |
| 4 | 13 | 18% | 2 | CO4: Apply | L3 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO12: Thumb rule | 3<br>3<br>2 |
| 5 | 12 | 15% | 2 | CO5: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>2 |
|   | 74 | 100 % |   |   |   |   |   |   |

**Justification Statements :**

**CO1: Apply** the Divide and conquer method to solve various problems.

**Action Verb : Apply (L3)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is same level of PO1 verb by one level. Therefore, the correlation is High (3)
**PO2 Verb : Review(L2)**
CO1 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
**PO12: Thumb rule**
Divide and conquer strategy is applied to solve various problems, where the work is distributed to many members to complete that task. Therefore the correlation is medium (2)

**CO2: Apply** the greedy and dynamic programming methods to solve real time problems.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
**PO2: Review(L2)**
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)

**PO6: Thumb rule**
Greedy and dynamic programming concepts were applied to solve traffic problems and finding best route to the destination. Therefore, the correlation is medium (2)
**PO12: Thumb rule**
Finding optimal solution to a real world problems is a continuous activity. Therefore the correlation is medium (2)

**CO3: Evaluate** the various problems using traversal, backtracking and searching techniques.
**Action Verb : Evaluate (L5)**
**PO1: Apply(L3)**
CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
**PO2: Review (L2)**
CO3 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)
**PO3: Develop (L3)**
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO3 Action verb is greater than PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO3 Action verb is greater than PO5 verb. Therefore the correlation is high(3)
**PO6 : Thumb rule**
backtracking and searching techniques were applied for GPS. Therefore, the correlation is medium (2)
**PO12: Thumb rule**
backtracking and searching techniques will give optimal solutions to various problems. Therefore, the correlation is medium (2)

**CO4: Apply** the branch and bound methods to solve minimization problems.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO4  Action verb is same level of PO1 verb. Therefore the correlation is high (3)
**PO2: Review(L2)**
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
**PO12: Thumb rule**
Lower bound techniques were applied to minimize cost of finding best routes. Therefore the correlation is medium(2)

**CO5: Analyze** the P, NP, NP hard and NP complete problems for solving reduction problems.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO5  Action verb is  greater than PO1 verb. Therefore the correlation is high(3)
**PO2: Review (L2)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is  greater than PO3 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO5 Action verb is  same as PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO5 Action verb is  greater than PO5 verb. Therefore the correlation is high (3)
**PO12: Thumb rule**
In research oriented purpose P, NP concepts can be applied. Therefore the correlation is medium (2)

| Course Code | Year & Sem | Cyber Security Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| **20APC3619** | **III - II** | | **0** | **0** | **3** | **1.5** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Analyze** the security issues in networks and computers to secure an IT infrastructure

**CO2: Apply** the counter attack incident response for incident response methodology.

**CO3: Analyze** the security incidents to Interpret and forensically investigate.

**CO4: Apply** the Extracting Browser Artifacts for Recovery of Deleted Files using Forensics Tools.

 **CO5: Analyze** the forensic tools to collect evidences of a computer crime

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Analyze | the security issues in networks and computers | | to secure an IT infrastructure | L4 |
| **CO2** | Apply | the counter attack incident response | | for incident response methodology. | L3 |
| **CO3** | Analyze | the security incidents | | to Interpret and forensically investigate | L4 |
| **CO4** | Apply | the Extracting Browser Artifacts | using Forensics Tools | for Recovery of Deleted Files | L3 |
| **CO5** | Analyze | the forensic tools to collect evidence of a computer crime | | | L4 |

**Laboratory Experiments**

1. How to protect personal computer system by creating User Accounts with Passwords and types of User Accounts for safety and security. **(CO1)**
2. How to provide the security to the Microsoft word document by remove Password option. **(CO1)**
3. How to protect and secure databases. **(CO1)**
4. How to make strong passwords and write down the steps to crack passwords techniques. **(CO2)**
5. Write down the steps to hack a strong password. **(CO2)**
6. Implement the Signature Scheme - Digital Signature Standard Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w) **(CO2)**
7. How to Recover Deleted Files using Forensics Tools**(CO4)**
8. To study the steps for hiding and extract any text file behind an image file/ Audio file using Command prompt.**(CO4)**
9. How to Extracting Browser Artifacts. **(CO4)**
10. How to View Last Activity of Your PC.**(CO3)**
11. Find Last Connected USB on your system (USB Forensics). **(CO5)**
12. Comparison of two Files for forensics investigation by Compare IT software. **(CO3)**
13. Live Forensics Case Investigation using Autopsy. **(CO5)**

**Textbooks:**

1. Nina Godbole &SunitBelapure "Cyber Security", Wiley India, 2012.

**Reference Books:**

1. Harish Chander, "cyber laws & IT protection", PHI learning pvt.ltd, 2012.
2. Dhiren R Patel, "Information security theory &practice",PHI learning pvt ltd,2010.
3. MS.M.K.Geetha&Ms.SwapneRaman"Cyber Crimes and Fraud Management, "MACMILLAN,2012.
4. Pankaj Agarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.
5. Vivek Sood, Cyber Law Simplified, TMH, 2012.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | | | | | | | | | | | 3 | |
| CO2 | 3 | 2 | | | | | | | | | | 1 | 2 | |
| CO3 | 3 | 3 | 1 | 1 | | | | | 1 | | | 1 | 2 | |
| CO4 | 3 | 2 | | | | | | | | | | | 2 | |
| CO5 | | 3 | 1 | 1 | | | | | 1 | | | 2 | | |

## Correlation matrix

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|
| 1 | CO1 : Analyze | L2 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze(L4) | 3 |
| 2 | CO2 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 3 | CO3 :Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| 5 | CO5 : Analyze | L4 | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 2 |

## Justification Statements :

**CO1: Analyze** the security issues in networks and computers to secure an IT infrastructure
**Action Verb : Analyze (L4)**

PO1 Verb : Apply(L3)
CO1 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply** the counter attack incident response for incident response methodology.
**Action Verb : Apply (L3)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO12: Thumb rule

For usage of counter attack incident response for incident response methodology is life long learning. Therefore the correlation is low (1)


**CO3: Analyze** the security incidents to Interpret and forensically investigate.
**Action Verb : Analyze(L4)**
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required to forensically investigate. Hence the correlation is low (1)
PO12: Thumb rule
To Analyze the security incidents to Interpret can be life long learning. Therefore the correlation is low (1)


**CO4: Apply** the Extracting Browser Artifacts for Recovery of Deleted Files using Forensics Tools.
**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)


**CO5: Analyze** the forensic tools to collect evidences of a computer crime
**Action Verb : Analyze (L4)**
PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required to collect evidence of a computer crime. Hence the correlation is low (1)
PO12: Thumb rule
In real time to Analyze the forensic tools needs constant update in technology. Therefore the correlation is medium (2)

| Course Code | Year & Sem | Advanced IoT Programming Lab | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC3621 | III - II | | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the different types of Sensors and study their functionality in IoT

**CO2: Apply** the skills in connecting peripherals to Arduino/Raspberry Pi for data exchange.

**CO3: Analyze** the Cloud platform to upload any type of sensor data.

**CO4: Analyze** the GSM and GPS connection to micro controllers and Data Management in IoT.

**CO5: Create** the IoT working system for involving prototyping, programming and data analysis.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the different types of Sensors and study their functionality in IoT | | | L2 |
| **CO2** | Apply | the skills in connecting peripherals | | to Arduino/Raspberry Pi for data exchange. | L3 |
| **CO3** | Analyze | the Cloud platform | | to upload any type of sensor data. | L4 |
| **CO4** | Analyze | the GSM and GPS connection | | to micro controllers and Data Management in IoT. | L4 |
| **CO5** | Create | the IoT working system | | for involving prototyping, programming and data analysis. | L6 |

**List of Experiments:**

1. Introduction to Raspberry Pi platform and programming **(CO1)**

2. Measuring Temperature, Pressure, and Humidity in real time using Sensors using Raspberry Pi. **(CO1)**

3. Study the Light, Distance, Motion, Accelerometer, Position Data using Sensors using Raspberry Pi. **(CO2)**

4. Log Data using Raspberry PI and upload to the cloud platform ( using Tkinter) **(CO2)**

5. Develop an IoT application using Raspberry Pi for fire alarm. **(CO3)**

6. Develop an IoT application to measure soil moisture, air and water quality using Raspberry Pi. **(CO3)**

7. Develop an IoT application using Raspberry Pi to monitor heartbeat, blood pressure, etc. of a person and to upload health information to cloud **(CO3)**

8. Build Smart Parking application using IoT Platform **(CO4)**

a) Monitored Parameters: Vehicle detection

b) Function1: Provide information to user about free space in parking slots

9. Build Smart Home system using IoT Platform **(CO5)**

a) Monitored Parameters: People presence, Outside ambient conditions, IAQ parameters

b) Function1: Control Home appliances through manual application control

c) Function2: Intelligently control appliances based on monitoring parameters

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | | | | | | | | | | | | |
| **CO2** | 3 | 2 | | | | | | | | | | 1 | | |
| **CO3** | 3 | 3 | 3 | 3 | | | | | 1 | | | 1 | | |
| **CO4** | 3 | 3 | | | | | | | | | | | | |
| **CO5** | | 3 | 3 | 3 | 3 | | | | 1 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1 : Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | CO2 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 3 | CO3 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Develop (L3) | 3 |
| | | | PO4 | PO4: Analyze (L4) | 3 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| 5 | CO5 : Design | L6 | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 3 |
| | | | PO4 | PO4: Design (L6) | 3 |
| | | | PO5 | PO5: Develop (L6) | 3 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 2 |

**Justification Statements :**

**CO1: Understand** the different types of Sensors and study their functionality in IoT **Action Verb : Understand (L2)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Apply** the skills in connecting peripherals to Arduino/Raspberry Pi for data exchange.
**Action Verb : Apply (L3)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO12: Thumb rule
To Apply the skills in connecting peripherals to Arduino/Raspberry Pi for data exchange. Therefore the correlation is low (1)

**CO3: Analyze** the Cloud platform to upload any type of sensor data.
**Action Verb : Analyze (L4)**
PO1: Apply(L3)
CO3  Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2:Analyze (L4)

CO3 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)

PO9 : Thumb rule

Team work is required to analyze any sensor data. Hence the correlation is low (1)

PO12: Thumb rule

To Develop a Cloud platform can be life long learning. Therefore the correlation is low (1)

**CO4: Analyze** the GSM and GPS connection to micro controllers and Data Management in IoT.

**Action Verb : Analyze (L4)**

PO1: Apply(L3)

CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO5: Create** the IoT working system for involving prototyping, programming and data analysis.

**Action Verb : Create (L6)**

PO2: Analyze (L4)

CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

PO3: Design (L6)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Design (L6)

CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5: Develop(L6)

CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO9 : Thumb rule

Team work is required for involving prototyping, programming and data analysis. Hence the correlation is low (1)

PO12: Thumb rule

In real time complete working IoT system needs constant update in technology. Therefore the correlation is medium (2)

| Course Code | Year & Sem | BUILDING PRIVATE BLOCKCHAIN LAB | L | T | P | C |
|---|---|---|---|---|---|---|
| **20APC3623** | **III - II** | | **0** | **0** | **3** | **1.5** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Analyze** the mechanism of Bitcoin, Hyperledger and Multichain Blockchain platforms

**CO2: Analyze** the importance of consensus in transactions to store data in Blockchain.

**CO3: Apply** the smart contracts deployment on Ethereum to setup a private Blockchain.

**CO4**: **Create** the business network using Hyperledger Composer

**CO5: Create** the Blockchain for various use cases.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Analyze | the mechanism of Bitcoin, Hyperledger and Multichain Blockchain platforms | | | L4 |
| **CO2** | Analyze | the importance of consensus in transactions | | to store data in Blockchain. | L4 |
| **CO3** | Apply | the smart contracts deployment on Ethereum | | to setup a private Blockchain. | L3 |
| **CO4** | Create | the business network | using Hyperledger Composer | | L6 |
| **CO5** | Create | the Blockchain | | for various use cases | L6 |

**Laboratory Experiments**

1. Create a Simple Blockchain. **(CO1)**
2. Building and Deploying Multichain private **(CO1)**
3. Deposit some Ether in your MetaMask accounts. **(CO2)**
4. Create several accounts and make some transactions between these accounts **(CO2)**
5. Creating a Business Network using Hyperledger **(CO3)**
6. Creating a Business Network using Hyperledger – II **(CO3)**
7. Implementation of Use case – 1: Blockchain in Financial Software and Systems **(CO4)**
8. Implementation of Use case – 2: Blockchain for Government. **(CO4)**
9. Building a Private Ethereum Network. **(CO5)**
10. Deploying Smart Contract & Security **(CO5)**

**Reference Books:**

1. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
2. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits –
3. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | | | | | | | | | | | | |
| **CO2** | 3 | 3 | | | | | | | | | | 2 | | |
| **CO3** | 3 | 2 | 1 | 1 | | | | | 1 | | | 1 | | |
| **CO4** | 3 | 3 | | | | | | | | | | | | |
| **CO5** | | 3 | 3 | 3 | 3 | | | | 1 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
|   |   |   | PO2 | PO2: Analyze(L4) | 3 |
| 2 | CO2 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
|   |   |   | PO2 | PO2: Analyze (L4) | 3 |
|   |   |   | PO12 | PO12: Thumb rule | 2 |
| 3 | CO3 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
|   |   |   | PO2 | PO2: Analyze (L4) | 2 |
|   |   |   | PO3 | PO3: Design (L6) | 1 |
|   |   |   | PO4 | PO4: Design (L6) | 1 |
|   |   |   | PO9 | PO9:  Thumb rule | 1 |
|   |   |   | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Design | L6 | PO1 | PO1: Apply(L3) | 3 |
|   |   |   | PO2 | PO2: Analyze (L4) | 3 |
| 5 | CO5 : Develop | L6 | PO2 | PO2: Analyze (L4) | 3 |
|   |   |   | PO3 | PO3: Design (L6) | 3 |
|   |   |   | PO4 | PO4: Design (L6) | 3 |
|   |   |   | PO5 | PO5: Develop (L6) | 3 |
|   |   |   | PO9 | PO9:  Thumb rule | 1 |
|   |   |   | PO12 | PO12: Thumb rule | 2 |

**Justification Statements :**

**CO1: Analyze** the mechanism of Bitcoin, Hyperledger and Multichain Blockchain platforms
**Action Verb : Analyze (L4)**

PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Analyze** the importance of consensus in transactions to store data in Blockchain.
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule
For consensus in transactions to know how transactions are stored is life long learning. Therefore the correlation is medium (2)

**CO3: Apply** the smart contracts deployment on Ethereum to setup a private Blockchain.
**Action Verb : Apply(L3)**
PO1: Apply(L3)
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L6)

CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required to Setup your own private Blockchain. Hence the correlation is low (1)
PO12: Thumb rule
To Deploy smart contracts on Ethereum can be life long learning. Therefore the correlation is low (1)

**CO4**: **Create** the business network using Hyperledger Composer
**Action Verb : Design(L6)**
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is same level as PO2 verb. Therefore the correlation is high (3)


**CO5: Create** the Blockchain for various use cases.
**Action Verb : Develop (L6)**
PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Design (L6)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Develop(L6)
CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO9 : Thumb rule
Team work is required to various use cases. Hence the correlation is low (1)
PO12: Thumb rule
To Develop the Blockchain needs constant update in technology. Therefore the correlation is medium (2)

| Course Code | Year & Sem | Basics of Cloud Computing | L | T | P | C |
|---|---|---|---|---|---|---|
| **20ASA0501** | III-II | | **1** | **0** | **2** | **2** |

**Course Outcomes:**

After studying the course, student will be able to

    CO1: **Understand** the various basic concepts related to cloud computing technologies.

    CO2: **Understand** the cloud architecture and service delivery models

    CO3: **Analyze** the need for cloud service providers in a cloud environment.

    CO4: **Design** the various virtualization tools such as Virtual Box, VMware workstation.

    CO5: **Analyze** the security issues in cloud services and disaster management

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | various basic concepts related | | to cloud computing technologies | L2 |
| **CO2** | Understand | cloud architecture and service delivery models | | | L2 |
| **CO3** | Analyze | the need for cloud service providers | | in a cloud environment | L4 |
| **CO4** | Design | the various virtualization tools such as Virtual Box, VMware workstation | | | L6 |
| **CO5** | Analyze | the security issues in cloud services and disaster management | | | L4 |

**UNIT I:**

**Cloud Computing Fundamentals:** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, a Service Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models, Challenges Ahead, and Historical Developments.

1. To study in detail about cloud computing.

2. Working of Google Drive to make spreadsheet and notes.

3. Installation and Configuration of Just cloud.

4. Working in Cloud9 to demonstrate different language.

**UNIT II:**

**Cloud Architecture, programming model:** NIST reference architecture, architectural styles of cloud applications, deployment models-public, private, hybrid, community; Types of cloud computing: utility computing, cluster; computing Cloud services: Amazon, Google, Azure, online services Applications of cloud computing

1. Install Google App Engine. Create hello world app and other simple web applications using Python/java.

2. Deployment and Configuration options in Google Cloud

3. Deployment and Configuration options in Microsoft Azure

**UNIT III:**

**Cloud Service Models:** Defining Clouds for the Enterprise- Storage-as-a-Service, Databases- as-Service, Platform-as-a-Service, Pros and Cons of PaaS, Infrastructure-as-a-Service. Pros and Cons of IaaS, Software as a Service, Pros and Cons of SaaS, Other Cloud Service Models.

Programs on SaaS

1. Create an word document of your class time table and store locally and on the cloud with doc,and pdf format . (use www.zoho.com anddocs.google.com)

2. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula DA=10% OF BASIC HRA=30% OF BASIC PF=10% OF BASIC IF BASIC<=3000 12% OF BASIC IF BASIC>3000 TAX=10% OF BASIC IF BASIC<=1500 =11% OF BASIC IF BASIC>1500 AND BASIC<=2500 =12% OF BASIC IF BASIC>2500 (

3. use www.zoho.com and docs.google.com) NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX

4. Prepare a ppt on cloud computing –introduction, models, services, and architecture PPT should contain explanations, images and at least 20 pages (use www.zoho.com and docs.google.com)

5. Create your resume in a neat format using Google and zoho cloud

Programs on PaaS

1. Write a Google app engine program to generate n even numbers and deploy it to google cloud

2. Google app engine program multiply two matrices

3. Write a Google app engine program to display nth largest no from the given list of numbers and deploy it into Google cloud

## UNIT IV:

**Cloud resource virtualization:** Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, Full vs. Para - virtualization, virtual machine monitor/hypervisor. Virtual machine basics, taxonomy of virtual machines, process vs. system virtual machines.

1. Install Virtual box/VMware Workstation with different flavours of Linux or windows OS on top of windows7 or 8.

2. Install a C compiler in the virtual machine created using virtual box and executes Simple Programs

## UNIT V:

**Security:** Disaster Recovery, Privacy Design, Data Security, Network Security, Compromise Response Disaster Recovery, Disaster Recovery, Planning, Cloud Disaster Management.

**Case Study:** PAAS (Face book, Google App Engine), AWS Case Study: Amazon.com

## Text Books:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014

2. Cloud Computing – Web Based Applications That Change the way you Work and ColLaboratoryorate Online – Michael Miller, Pearson Education.

3. Cloud Application Architectures, 1st Edition by George Reese O'Reilly Media.

## Reference Books:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.

2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.

## Online Learning Resources:

https://nptel.ac.in/courses/106105167

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | | | | | | | | | | | 3 | |
| CO2 | 2 | 2 | | | 2 | | | | | | | | 2 | |
| CO3 | 2 | 2 | | 3 | 1 | | | | 1 | 1 | | | 2 | |
| CO4 | 3 | | | 2 | 3 | | | | 2 | | | | 2 | |
| CO5 | | 1 | 1 | 3 | | 1 | 1 | 1 | | | | 1 | 2 | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Identify(L3) | 2<br>2 |
| 2 | CO2 :Understand | L2 | PO1<br>PO2<br>PO5 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO5: Apply(L3) | 2<br>2<br>2<br>2 |
| 3 | CO3 :Analyze | L4 | PO1<br>PO2<br>PO4<br>PO5<br>PO9<br>PO10 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO4: Analyze(L4)<br>PO5: Create(L6)<br>PO9: Thumb rule<br>PO10: Thumb rule | 3<br>3<br>3<br>1<br>1<br>1 |
| 4 | CO4 :Design | L6 | PO3<br>PO4<br>PO5<br>PO9 | PO3: Design (L6)<br>PO4: Interpret(L5)<br>PO5: Create(L6)<br>PO9: Thumb rule | 3<br>3<br>3<br>2 |
| 5 | CO5 :Analyze | L4 | PO2<br>PO3<br>PO4<br>PO6<br>PO7<br>PO8<br>PO12 | PO2: Formulate(L6)<br>PO3: Design (L6)<br>PO4: Analyze(L4)<br>PO6: Thumb rule<br>PO7: Thumb rule<br>PO8: Thumb rule<br>PO12: Thumb rule | 1<br>1<br>1<br>3<br>1<br>1<br>1 |
| | | | | | |

**Justification Statements :**

**CO1: Understand the various basic concepts related to cloud computing technologies.**
**Action Verb : Understand(L2)**
PO1 Verb : Apply(L3)
    CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Identify(L3)
    CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**CO2: Understand the cloud architecture and service delivery models**
**Action Verb : Understand(L2)**
PO1: Apply(L3)
CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2: Identify(L3)
CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO5: Apply(L3)
CO2 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)

**CO3: Analyze the need for cloud service providers in a cloud environment**
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb by one level. Therefore the correlation is high (3)
PO2: Identify (L3)
CO3 Action verb is greater than PO2 verb by one level. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is same PO2 verb. Therefore the correlation is high (3)
PO5: Create(L6)
CO3 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required between cloud provider and consumers. Hence the correlation is low (1)
PO10: Thumb rule
Effective communication is required , reports to be generated between cloud users and providers.
Therefore the correlation is low (1)

**CO4: Design the various virtualization tools such as Virtual Box, VMware workstation.**

Action Verb : Design (L6)
PO3: Design (L6)
CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Interpret (L5)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO5: Create(L6)
CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO9: Thumb rule
Team work is required between cloud provider and consumers in multi disciplinary activities. Therefore the correlation is medium(2)

**CO5: Analyze the security issues in cloud services and disaster management**
Action Verb : Analyze (L4)
PO2: Formulate (L6)
CO5 Action verb is less than two levels as PO2 verb. Therefore the correlation is low(1)
PO3: Design (L6)
CO5 Action verb is less than two levels as PO2 verb. Therefore the correlation is low(1)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO6 : Thumb rule
Since ethical principles should be followed to create a cloud and providing services to cloud. Therefore the correlation is low(1)
PO7 : Thumb rule
Since ethical principles should be followed to create a cloud and providing services to cloud. Therefore the correlation is low(1)
PO8 : Thumb rule
Team work is required between cloud consumers and providers. Hence the correlation is low (1)
PO12: Thumb rule
For some of real world applications we use cloud services. Therefore the correlation is low (1)

| Course Code | Year & Sem | PROFESSIONAL ETHICS AND HUMAN VALUES | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AMC9904 | III-II | | 3 | 0 | 0 | 0 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the sustained happiness through identifying the essentials of human values and skills.

**CO2: Understand** the importance of Values and Ethics in their personal lives and professional careers.

**CO3: Understand** the rights and responsibilities as an employee, team member and a global citizen.

**CO4: Understand** the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

**CO5: Understand** appropriate technologies and management patterns to create harmony in professional and personal life.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **1** | **Understand** | The sustained happiness | through identifying the essentials of human values and skills | | **L2** |
| **2** | **Understand** | the importance of Values and Ethics | | in their personal lives and professional careers. | **L2** |
| **3** | **Understand** | the rights and responsibilities | as an employee, team member and a global citizen. | | **L2** |
| **4** | **Understand** | the importance of trust, mutually satisfying human behavior and enriching interaction with nature. | | | **L2** |
| **5** | **Understand** | appropriate technologies and management patterns | | to create harmony in professional and personal life. | **L2** |

| UNIT - I | | 9 Hrs |
|---|---|---|

Introduction to Human Values: Need, basic Guidelines, Content and Process for Value Education, Self Exploration - 'Natural Acceptance' and Experiential Validation. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities. Understanding Happiness and Prosperity correctly.

| UNIT - II | | 9Hrs |
|---|---|---|

Understanding Harmony in the Family and Society: Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect ( Samman) as the foundational values of relationship. Understanding the harmony in the society ( society being an extension of family). Visualizing a universal harmonious order in society - Undivided Society ( Akhand Samaj), Universal Order ( Sarvabhaum Vyawastha) - from family to world family!

| UNIT - III | | 9 Hrs |
|---|---|---|

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

| UNIT - IV | | 9 Hrs |
|---|---|---|

Professional Practices in Engineering: Work Place Rights & Responsibilities, Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and

responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

| UNIT - V | | 9 Hrs |
|---|---|---|

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Depletion, Pollution, Ethics in Manufacturing and Marketing, Media Ethics, War Ethics, Bio Ethics, Intellectual Property Rights.

**Textbooks:**

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Professional Ethics: R. Subramanian, Oxford University Press, 2015. 3.Ethics in Engineering Practice & Research,
   Caroline Whitbeck, 2e, Cambridge University Press 2015.

**Reference Books:**

1.Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.
2.Ivan IIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
3.Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S PritchaMichael J Rabins, 4e , Cengage learning,
   2015.
4.Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

**Online Learning Resources:**

https://www.youtube.com/watch?v=9LSEBK03CiY&list=PLysZquKdjuWSv87TaE7pByn5TE_e46O2C

### Mapping of COs to POs and PSOs

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | 2 |
| 2 | | | | | | | | 2 | 2 | | | |
| 3 | | | | | | 2 | | | 2 | | | |
| 4 | | | | | | 2 | | 2 | | | | |
| 5 | | | | | 1 | | 2 | | | | | 2 |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

### CO-PO mapping justification:

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| **1** | **8** | 27 | 2 | **Understand** | **L2** | PO12 | Thumb Rule | 2 |
| **2** | **8** | 26 | 2 | **Understand** | **L2** | PO8, PO9 | Thumb Rule Thumb Rule | 2 2 |
| **3** | **4** | 13 | **2** | **Understand** | **L2** | PO6, PO9 | Thumb Rule Thumb Rule | 2 2 |
| **4** | **5** | 17 | **2** | **Understand** | **L2** | PO6, PO8 | Thumb Rule Thumb Rule | 2 2 |
| **5** | **5** | 17 | **2** | **Understand** | **L2** | PO5, PO7, PO12 | PO5 : APPLY Thumb Rule Thumb Rule | 1 2 2 |

**CO1:** Understand sustained happiness through identifying the essentials of human values and skills.

**Action Verb: Understand (L2)**

CO1 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO2:** Understand the importance of Values and Ethics in their personal lives and professional careers.
**Action Verb: Understand (L2)**
CO2 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO3:** Understand the rights and responsibilities as an employee, team member and a global citizen.
**Action Verb: Understand (L2)**
CO3 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO4:** Understand the importance of trust, mutually satisfying human behavior and enriching interaction with nature.
**Action Verb: Understand (L2)**
CO4 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO5:** Understand appropriate technologies and management patterns to create harmony in professional and personal life.
**Action Verb: Understand (L2)**
CO5 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).
CO5 Action Verb is understand of BTL 2. Using action verb apply, L2 correlates PO5 as low (1).

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI – 517 520.

## (AUTONOMOUS)

### B.Tech- (COMPUTER SCIENCE AND ENGINEERING - INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

### (Effective for the batches admitted in 2020-2021)

### Semester VII (Fourth year)

| Sl. No | Category | Course Code | Course Title | Hours per week | | | Credits | CIE | SEE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | | | |
| 1 | PE-3 | 20APE3607 20APE3608 20APE3609 | Block chain Technologies and Use Cases Crypto currencies Fundamentals of Bit Coin Technology | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | PE-4 | 20APE3610 20APE3611 20APE3612 | Cyber Security Risk Management and Mitigation Cloud Security Offensive and Defensive Cyber Security Techniques | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | PE-5 CBCC | 20APE3613 20APE3614 20APE3615 | Data Analytics Software Project Management Linux Environment System | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | JOE/OE-2 | 20AOE3602 20AOE3603 20AOE3604 | Information Retrieval Techniques Soft Computing Principles of Data science | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | OE-3 | 20APE0407 20APEO411 20APE0415 20APC0425 20APE0417 20APC0323 | Digital Image Processing Embedded Systems Wireless Communications Analog and Digital IC Application Sensor Networks Operations Research | 3 3 3 3 3 3 | 0 0 0 1 0 0 | 0 0 0 0 0 0 | 3 3 3 3 3 3 | 30 | 70 | 100 |
| 6 | HE | 20AOE0302 20AOE9901 20AHSMB02 | Management Science English for Research Paper Writing Entrepreneurship Development | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 7 | SA | 20ASA3601 | Ethical Hacking | 1 | 0 | 2 | 2 | 100 | 0 | 100 |
| 8 | PR | 20APR3601 | Evaluation of Industry Internship(III-II Summer Internship) | 0 | 0 | 0 | 3 | 100 | 0 | 100 |
| | | | Total credits | | | | 23 | 380 | 420 | 800 |

| Course Code | Year & Sem | BLOCKCHAIN TECHNOLOGIES AND USECASES | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3607 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the Blockchain network architecture: public, private, and consortium.

**CO2: Analyze** the Blockchain consensus algorithms and Protocols for Transaction processing and validation.

**CO3: Apply** the Transparency and traceability in the supply chain using blockchain in logistics and provenance tracking.

**CO4: Analyze** the Tokenization of real-world assets for identitying solutions in Blockchain Case studies of DeFi projects.

**CO5: Apply** the Blockchain-based solutions for Preventing voter fraud - Healthcare and Medical Records.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the Blockchain network architecture | | public, private, and consortium | L2 |
| **CO2** | Analyze | the Blockchain consensus algorithms and Protocols | | Transaction processing and validation | L4 |
| **CO3** | Apply | the Transparency and traceability in the supply chain | using blockchain in logistics and provenance tracking | | L3 |
| **CO4** | Analyze | the Tokenization of real-world assets | for identitying solutions | in Blockchain Case studies of DeFi projects | L4 |
| **CO5** | Apply | the Blockchain-based solutions | | for Preventing voter fraud - Healthcare and Medical Records | L3 |

| UNIT - I | Blockchain Architecture and Infrastructure | 9Hrs |
|---|---|---|

Blockchain network architecture: public, private, and consortium - Smart contracts and their role in blockchain - Blockchain platforms and frameworks – Ethereum - Hyperledger- Scalability and performance considerations.

| UNIT - II | Blockchain Data Structures and Algorithms | 9Hrs |
|---|---|---|

Merkle trees and their use in blockchain - Blockchain data storage and retrieval - Blockchain consensus algorithms and Protocols - Transaction processing and validation in blockchain – Block Broadcasting .

| UNIT - III | Blockchain Usecaseand Supply Chain Management | 9Hrs |
|---|---|---|

Blockchain Usecase - Blockchain applications in supply chain - Transparency and traceability in the supply chain - Use cases of blockchain in logistics and provenance tracking - Smart contracts for automating supply chain processes Unit-4: Decentralized Finance (DeFi) and Identity Solutions.

| UNIT - IV | Decentralized finance and Identity Solutions | 9Hrs |
|---|---|---|

Introduction to decentralized finance (DeFi) - Decentralized exchanges and liquidity protocols - Lending, borrowing, and yield farming on DeFi platforms - Tokenization of real-world assets - Case studies of DeFi projects - Blockchain-based identity solutions - Self-sovereign identity and digital identity verification - Identity and access management on the blockchain - Use cases of blockchain in KYC (Know Your Customer) processes

| UNIT - V | Voting Systems and Healthcare Systems | 9 Hrs |
|---|---|---|

Blockchain for secure and transparent voting systems - Use cases of blockchain in electoral processes - Decentralized governance and decision-making on the blockchain - Blockchain-based solutions for Preventing voter fraud - Healthcare and Medical Records - Blockchain applications in healthcare data management - Secure and interoperable medical records on the blockchain - Privacy and consent management in healthcare blockchain systems. - Use cases of blockchain in clinical trials and drug supply chain management.

| Textbooks: |
|---|
| Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher Year, A-press Publisher First Edtion, and ISBN:978-1484226032**,** 2017. |
| **Reference Books:** |
| **1.** "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts by Imran bazir, 2nd Edition,Packt Publishing, ISBN-978-1788839044 ,2018. |

2. "Blockchain: Blueprint for a New Economy" by Melanie Swan Year, O Reily Media Publisher, First Edition, ISBN: 978-1491920497, 2015.
3. "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World" by Don Tapscott, Alex Tapscott Portfolio Penguin Publisher, ISBN:978-0241237854 Year, 2016.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 1 | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | 1 | | | 1 | | |
| CO4 | 3 | 3 | | | | | | 1 | | | | | | |
| CO5 | | 2 | 1 | 1 | | | | 2 | 2 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | CO2 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 3 | CO3 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO9 | PO9: Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO8 | PO8: Thumb rule | 1 |
| 5 | CO5 : Apply | L3 | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO8 | PO8: Thumb rule | 2 |
| | | | PO9 | PO9: Thumb rule | 2 |
| | | | PO12 | PO12: Thumb rule | 2 |
| | | | | | |

**Justification Statements:**

**CO1: Understand the Blockchain network architecture: public, private, and consortium**.

**Action Verb: Understand(L2)**

PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO2 Verb: Analyze(L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)

## CO2: Analyze the Blockchain consensus algorithms and Protocols for Transaction processing and validation.
**Action Verb: Analyze (L4)**

PO1 Verb: Apply(L3)

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: Analyze(L4)

CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO12: Thumb rule

Blockchain consensus algorithms and Protocols needs lifelong updating. Therefore, the correlation is low (1)

## CO3: Apply the Transparency and traceability in the supply chain using blockchain in logistics and provenance tracking
**Action Verb: Apply (L3)**

PO1: Apply(L3)

CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is higher level as PO2 verb. Therefore, the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by two levels. Therefore, the correlation is low (1)

PO4: Design (L6)

CO3 Action verb is less than PO4 verb by two levels. Therefore, the correlation is low (1)

PO5: Create(L6)

CO3 Action verb is less than PO5 verb by two levels. Therefore, the correlation is low (1)

PO9: Thumb rule

Team work is required to Analyze various supply chain logistics. Hence the correlation is low (1)

PO12: Thumb rule

Design the use cases can be lifelong learning. Therefore, the correlation is low (1)

## CO4: Analyze the Tokenization of real-world assets for identifying solutions in Blockchain Case studies of DeFi projects.
**Action Verb: Analyze (L4)**

PO1: Apply(L3)

CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO8: Thumb rule

Identifying the solutions for Tokenization of real-world assets. Therefore, the correlation is low (1)

## CO5: Apply the Blockchain-based solutions for Preventing voter fraud - Healthcare and Medical Records.
**Action Verb: Apply (L3)**

PO2: Analyze (L4)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by two levels. Therefore, the correlation is low (1)

PO4: Design (L6)

CO3 Action verb is less than PO4 verb by two levels. Therefore, the correlation is low (1)

PO8: Thumb rule

Find different solutions for avoiding the frauds in healthcare and medical records. Therefore, the correlation is medium (2)

PO9: Thumb rule

Team work is required to Analyze various Solutions. Therefore, the correlation is medium (2)

PO12: Thumb rule

Finding solutions for different problems as lifelong. Therefore, the correlation is medium (2)

| Course Code | Year & Sem | CRYPTO CURRENCIES | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3608 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the crypto principles, encryption technology and crypto currencies.

CO2: **Apply** the mining algorithms using consensus mechanisms for mining pools.

CO3: **Analyze** the types of crypto currency wallets to secure crypto assets.

CO4: **Evaulate** the market trends and strategies for crypto trading.

CO5: **Analyze** the AML Regulations and legal challenges for crypto currencies.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the crypto principles, encryption technology and crypto currencies. | | | L2 |
| **CO2** | Apply | the mining algorithms | using consensus mechanisms | for mining pools. | L3 |
| **CO3** | Analyze | the types of crypto currency wallets | | to secure crypto assets. | L4 |
| **CO4** | Evaulate | the market trends and strategies | | for crypto trading. | L5 |
| **CO5** | Analyze | the AML Regulations and legal challenges | | for crypto currencies. | L4 |

| UNIT - I | Introduction to cryptocurrencies | 9Hrs |
|---|---|---|

History and evolution of cryptocurrencies - Blockchain technology and decentralized ledger systems - Cryptographic principles and security in cryptocurrencies - Popular cryptocurrencies: Bitcoin, Ethereum, etc.

| UNIT - II | Cryptocurrency Mining and Consensus Mechanisms | 9Hrs |
|---|---|---|

Cryptocurrency mining process - Mining algorithms and mining hardware - Consensus mechanisms: Proof-of-Work (PoW), Proof-of-Stake (PoS), etc. - Mining pools and their significance

| UNIT - III | Cryptocurrency Wallets and Security | 9Hrs |
|---|---|---|

Types of cryptocurrency wallets: hardware, software, paper wallets, etc - Public and private keys in cryptocurrencies - Wallet security measures: two-factor authentication, cold storage, etc. - Best practices for securing cryptocurrency assets.

| UNIT - IV | Cryptocurrency Trading and Investment strategies | 9Hrs |
|---|---|---|

Cryptocurrency market analysis and trends - Trading strategies: day trading, swing trading, etc - Risk management in cryptocurrency investments - Initial Coin Offerings (ICOs) and token sales

| UNIT - V | Regulatory and Legal Aspects of Cryptocurrencies | 9Hrs |
|---|---|---|

Government policies and regulations surrounding cryptocurrencies - Taxation and accounting considerations for cryptocurrencies - Anti-money laundering (AML) regulations - Legal challenges and future prospects of cryptocurrencies.

**Textbooks:**

"Cryptocurrency: The Ultimate Guide to The World of Cryptocurrency and How I Became a Crypto Millionaire in 6 Months" by Neil Hoffman, ISBN: 978-1393501619, Tenzy Publisher - First Edition, 2019.

**Reference Books:**

1. "Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond" by Chris Burniske and Jack Tatar, McGraw Hill; 1st edition, ISBN: 978-1260026672, 2017.
2. "Cryptocurrency: How Bitcoin and Digital Money are Challenging the Global Economic Order" by Paul Vigna and Michael J. Casey, ISBN: 9781250065636, St. Martin's Publisher, First Edition, 2015.

**Online Learning Resources:**

https://www.youtube.com/watch?v=1YyAzVmP9xQ

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | | | | | | | | | | | | 2 | |
| CO2 | 3 | 2 | | | | | | | | | | 1 | 2 | |
| CO3 | 3 | 3 | 3 | 2 | | | | 2 | 1 | | | 1 | 2 | |
| CO4 | 3 | 3 | | | | | | 1 | | | | | 2 | 2 |
| CO5 | | 3 | 1 | 1 | 1 | | | 2 | 1 | | | 1 | | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|------|------|------|------|------|------|------|
| 1 | 9 | 20% | 2 | CO1: Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| 2 | 9 | 20% | 2 | CO2 Apply | L3 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO12: Thumb rule | 3<br>2<br>1 |
| 3 | 9 | 20% | 2 | CO3 :Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO8<br>PO9<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3: Develop (L3)<br>PO4: Interpret (L5)<br>PO8: Thumb rule<br>PO9: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>2<br>1<br>1 |
| 4 | 9 | 20% | 2 | CO4 : Evaulate | L5 | PO1<br>PO2<br>PO8 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO8: Thumb rule | 3<br>3<br>1 |
| 5 | 9 | 20% | 2 | CO5 :Analyze | L4 | PO2<br>PO3<br>PO4<br>PO5<br>PO8<br>PO9<br>PO12 | PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5: Create(L6)<br>PO8: Thumb rule<br>PO9: Thumb rule<br>PO12: Thumb rule | 3<br>1<br>1<br>1<br>2<br>1<br>1 |
| | 74 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand the fundamental crypto principles, encryption technology and popular crypto   currencies.**
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**CO2: Apply the mining algorithms using consensus mechanisms for mining pools.**
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Analyze (L4)**
CO2 Action verb is less than PO2 verb by one levels. Therefore the correlation is medium (2)
**PO12: Thumb rule**
For some of mining algorithms using consensus mechanisms needs complexity. Therefore the correlation is low (1)

**CO3: Analyze the types of crypto currency wallets to secure crypto assets.**
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**

CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2:Analyze (L4)**

CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**

CO3 Action verb is higher level as PO3 verb. Therefore the correlation is high (3)

**PO4: Interpret (L5)**

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

**PO5: Create(L6)**

CO3 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)

**PO8 : Thumb rule**

Since ethical principles should be followed to crate a wallet. Therefore the correlation is medium(2)

**PO9 : Thumb rule**

Team work is required for mining pools and crypto assets. Hence the correlation is low (1)

**PO12: Thumb rule**

Analyze types of crypto currency needs experience. Therefore the correlation is low (1)


**CO4: Evaulate the market trends and strategies for crypto trading.**

**Action Verb : Evaulate (L5)**

**PO1: Apply(L3)**

CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**PO8: Thumb rule**

Evaluating market trends and strategies has risk involvement. Therefore the correlation is low(1)


**CO5: Analyze the AML Regulations and legal challenges for crypto currencies**

**Action Verb : Analyze (L4)**

**PO2: Analyze (L4)**

CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

**PO3: Design (L6)**

CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)

**PO4: Design (L6)**

CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)

**PO5: Create(L6)**

CO5 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)

**PO8 : Thumb rule**

Anti-Money Laundering needs to be learned for society. Therefore the correlation is medium(2)

**PO9 : Thumb rule**

Team work is required for Analyze AML Regulations. Hence the correlation is low (1)

**PO12: Thumb rule**

In real time legal challenges for crypto currencies is continuously updating. Therefore the correlation is low (1)

| Course Code | Year & Sem | FUNDAMENTALS OF BITCOIN TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3609 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the fundamentals of Bitcoin, Wallets, sending and receiving bitcoin.

**CO2: Analyze** the process of Bitcoin transactions using blockchain mining to add blocks in Block chain.

**CO3: Apply** the process of Compile and run using Bitcoin Core API to retrieve information about the client.

**CO4: Analyze** the different node types in the Bitcoin network and Peer-to-Peer Authentication and Encryption in Transaction Pools.

**CO5: Apply** the security principles for developing and securing Bitcoin systems.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the fundamentals of Bitcoin, Wallets, sending and receiving bitcoin | | | L2 |
| **CO2** | Analyze | the process of Bitcoin transactions | using blockchain mining | to add blocks in Block chain | L4 |
| **CO3** | Apply | the process of Compile and run | using Bitcoin Core API | to retrieve information about the client | L3 |
| **CO4** | Analyze | the different node types in the Bitcoin network and Peer-to-Peer Authentication and Encryption | | in Transaction Pools | L4 |
| **CO5** | Apply | the security principles | | for developing and securing Bitcoin systems | L3 |

| UNIT - I | Introduction | 9Hrs |
|---|---|---|

What Is Bitcoin? - History of Bitcoin - Bitcoin Uses, Users, and Their Stories - Getting Started - Choosing a Bitcoin Wallet - Getting Your First Bitcoin - Finding the Current Price of Bitcoin - Sending and Receiving Bitcoin.

| UNIT - II | How Bitcoin Works | 9Hrs |
|---|---|---|

Transactions, Blocks, Mining, and the Blockchain - Bitcoin Overview - Bitcoin Transactions - Transaction Inputs and Outputs - Transaction Chains - Making Change - Common Transaction Forms - Constructing a Transaction - Getting the Right Inputs - Creating the Outputs - Adding the Transaction to the Ledger - Bitcoin Mining - Mining Transactions in Blocks.

| UNIT - III | Bitcoin Core: The Reference Implementation | 9Hrs |
|---|---|---|

Bitcoin Development Environment - Compiling Bitcoin Core from the Source Code - Selecting a Bitcoin Core Release - Configuring the Bitcoin Core Build - Building the Bitcoin Core Executables - Running a Bitcoin Core Node - Running Bitcoin Core for the First Time - Configuring the Bitcoin Core Node - Bitcoin Core Application Programming Interface (API) - Getting Information on the Bitcoin Core Client Status - Exploring and Decoding Transactions - Exploring Blocks - Using Bitcoin Core's Programmatic Interface - Alternative Clients, Libraries, and Toolkits - C/C++ - JavaScript - Java - Python - Ruby – Go.

| UNIT - IV | The Bitcoin Network | 9Hrs |
|---|---|---|

Peer-to-Peer Network Architecture - Node Types and Roles - The Extended Bitcoin Network - Bitcoin Relay Networks - Network Discovery - Full Nodes - Exchanging "Inventory" - Simplified Payment Verification (SPV) Nodes - Bloom Filters - How Bloom Filters Work - How SPV Nodes Use Bloom Filters - SPV Nodes and Privacy - Encrypted and Authenticated Connections -Tor Transport  - Peer-to-Peer Authentication and Encryption - Transaction Pools.

| UNIT - V | Bitcoin Security | 9Hrs |
|---|---|---|

Security Principles - Developing Bitcoin Systems Securely - The Root of Trust - User Security Best Practices - Physical Bitcoin Storage - Hardware Wallets - Balancing Risk -Diversifying Risk - Multisig and Governance –Survivability

| Textbooks: |
|---|

*Mastering Bitcoin* Programming the Open Blockchain by Andreas M. Antonopoulos; O'Reilly Media publisher, Second Edition, ISBN · 9781449374044, 2014.

**Reference Books:**

1. The Basics of Bitcoins and Blockchains by Antony Lewis ISBN: 978-1642503432, Two Rivers Distribution publisher, 2019.
2. The Bitcoin Standard: The Decentralized Alternative to Central Banking by SaifedeanAmmous, WILEY publication, ISBN:978-1119473862, 2018.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 2 | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | 1 | | |
| CO4 | 3 | 3 | | | | | | | | | | | | |
| CO5 | | 2 | 1 | 1 | | | | | | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------------------|-----|------|----------------------------|------|
| 1 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze(L4) | 2<br>1 |
| 2 | CO2 : Analyze | L4 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO12: Thumb rule | 3<br>3<br>2 |
| 3 | CO3 : Apply | L3 | PO1<br>PO2<br>PO3<br>PO4<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO12: Thumb rule | 3<br>2<br>1<br>1<br>1 |
| 4 | CO4 : Analyze | L4 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze (L4) | 3<br>3 |
| 5 | CO5 : Apply | L3 | PO2<br>PO3<br>PO4<br>PO12 | PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO12: Thumb rule | 2<br>1<br>1<br>2 |
| | | | | | |

**Justification Statements :**

**CO1: Understand the fundamentals of Bitcoin, Wallets, sending and receiving bitcoin**

**Action Verb : Understand(L2)**
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze the process of Bitcoin transactions using blockchain mining to add blocks in Block chain**.
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule

The process of Bitcoin transactions using blockchain mining is life long learning. Therefore the correlation is medium (2)

**CO3: Apply the process of Compile and run using Bitcoin Core API to retrieve information about the client.**
**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO12: Thumb rule
Compile and run using Bitcoin Core API can be life long learning. Therefore the correlation is low (1)

**CO4: Analyze the different node types in the Bitcoin network and Peer-to-Peer Authentication and Encryption in Transaction Pools.**
**Action Verb : Analyze (L4)**
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO5: Apply the security principles for developing and securing Bitcoin systems.**
**Action Verb : Apply (L3)**
PO2: Analyze (L4)
CO5 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L6)
CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO12: Thumb rule
In real time security principles for developing Bitcoin needs constant update. Therefore the correlation is medium (2)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**
**(AUTONOMOUS)**
**CSE- INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY(CIC)**

| Course Code | Year & Sem | CYBER SECURITY RISK MANAGEMENT AND MITIGATION | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3610 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the key concepts and frameworks of Cyber security risk management.

**CO2: Analyze** the threats, and vulnerabilities using Risk assessment methodologies for evaluating Cyber security risks.

**CO3: Analyze** the effective risk mitigation strategies and controls.

**CO4: Apply** the relevant Cyber security regulations and compliance requirements.

**CO5: Analyze** the response plans and adapt to emerging trends in Cyber security risk management.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | the key concepts and frameworks | | of Cyber security risk management | L2 |
| CO2 | Analyze | the threats, and vulnerabilities using Risk assessment methodologies | | for evaluating Cyber security risks | L4 |
| CO3 | Analyze | The effective risk mitigation strategies and controls | | | L4 |
| CO4 | Apply | the relevant Cyber security regulations and compliance requirements | | | L3 |
| CO5 | Analyze | the response plans and adapt to emerging trends | | in Cyber security risk management | L4 |

| UNIT - I | Introduction to Cyber security Risk Management | 9Hrs |
|---|---|---|

Overview of Cyber security risk management concepts and frameworks - Understanding the threat landscape and evolving cyber threats - Roles and responsibilities in Cyber security risk management.

| UNIT - II | Risk Assessment and Analysis | 9Hrs |
|---|---|---|

Risk assessment methodologies and approaches - Identifying and evaluating Cyber security risks, threats, and vulnerabilities - Risk measurement and prioritization techniques.

| UNIT - III | Risk Mitigation Strategies and Controls | 9Hrs |
|---|---|---|

Selection and implementation of risk mitigation strategies - Cyber security controls and their role in risk reduction - Best practices for risk treatment and control implementation.

| UNIT - IV | Compliance and Regulatory Frameworks | 9Hrs |
|---|---|---|

Overview of Cyber security regulations and standards - Compliance requirements and implications for risk management - Privacy considerations and data protection regulations.

| UNIT - V | Incident Response and Emerging Trends | 9 Hrs |
|---|---|---|

Incident response planning and management - Incident response lifecycle and key components - Emerging trends in Cyber security risk management.

**Textbooks:**

Principles of Incident Response & Disaster Recovery by by Herbert Mattord (Author), Michael Whitman (Author), ISBN : 978-0357508329, Course Technology Publisher., 2021.

**Reference Books:**

1. Managing Risk and Information Security: Protect to Enable, Second Edition by Malcolm W. Harkins, Apress Publisher, ISBN: 9781484214558, 2016.
2. Cyber Laws, Regulations and Frauds in BFSI sector
3. The CERT Guide to System and Network Security Practices by by Julia H. Allen , Addition Wesley Publisher, ISBN-978-0201737233, 2001.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 2 | | |
| CO3 | 3 | 3 | 3 | 3 | | | | | 1 | | | 1 | | |
| CO4 | 3 | 2 | | | | | | | | | | | | |
| CO5 | | 3 | 1 | 1 | | | | | 1 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|------|------|-----|------|------|------|
| 1 | CO1 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | CO2 : Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO12 | PO12: Thumb rule | 2 |
| 3 | CO3 :Design | L6 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 3 |
| | | | PO4 | PO4: Design (L6) | 3 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| 5 | CO5 : Analyze | L4 | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 2 |
| | | | | | |

**Justification Statements :**

**CO1: Understand** the key concepts and frameworks of Cyber security  risk management.
**Action Verb : Understand(L2)**

PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze** the threats, and vulnerabilities using Risk assessment methodologies for evaluating Cyber security  risks.
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule
For some key concepts and frameworks of Cyber security is life long learning. Therefore the correlation is medium(2)

**CO3: Design** and implement effective risk mitigation strategies and controls.

**Action Verb : Design(L6)**

PO1: Apply(L3)

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2:Analyze (L4)

CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is higher level as PO3 verb. Therefore the correlation is high (3)

PO4: Design (L6)

CO3 Action verb is higher level as PO4 verb. Therefore the correlation is high (3)

PO9 : Thumb rule

Team work is required to implement risk mitigation strategies. Hence the correlation is low (1)

PO12: Thumb rule

Construct effective risk controls can be life long learning. Therefore the correlation is low (1)

**CO4: Apply** the relevant Cyber security  regulations and compliance requirements.

**Action Verb : Apply (L3)**

PO1: Apply(L3)

CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO4  Action verb is less than PO2  verb by one level. Therefore the correlation is medium (2)

**CO5: Analyze** the response plans and adapt to emerging trends in Cyber security  risk management.

**Action Verb : Analyze (L4)**

PO2: Analyze (L4)

CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

PO3: Design (L6)

CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)

PO4: Design (L6)

CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)

PO5: Create(L6)

CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO9 : Thumb rule

Team work is required for Cyber Security Risk management applications. Hence the correlation is low (1)

PO12: Thumb rule

In real time adapting to emerging trends is life long learning. Therefore the correlation is medium (2)

| Course Code | Year & Sem | CLOUD SECURITY | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3611 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the Cloud computing fundamentals for Cloud Architecture, Service Models and Design

**CO2: Analyze** the potential security risks and vulnerabilities, data breaches in cloud environments

**CO3: Design** and implement effective security controls for Data protection and encryption techniques using Network security and segmentation**.**

**CO4: Apply** the industry best practices using Virtualization security for securing cloud infrastructure, platforms, and applications.

**CO5: Analyze** the International data privacy laws for Auditing and certification frameworks

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | the Cloud computing fundamentals | | for Cloud Architecture, Service Models and Design | L2 |
| CO2 | Analyze | the potential security risks and vulnerabilities, data breaches | | in cloud environments | L4 |
| CO3 | Design | and implement effective security controls for Data protection and encryption techniques | | using Network security and segmentation | L6 |
| CO4 | Apply | the industry best practices | using Virtualization security | for securing cloud infrastructure, platforms, and applications | L3 |
| CO5 | Analyze | the International data privacy laws | | for Auditing and certification frameworks | L4 |

| UNIT – I | Introduction to Cloud Computing and Security | 9Hrs |
|---|---|---|

Cloud computing fundamentals – Cloud Architecture, Service Models and Design - Security challenges in cloud environments – Legal, Compliance & Industry Standards.

| UNIT - II | Cloud Security Risks and Threats | 9Hrs |
|---|---|---|

Risk assessment in cloud environments - Common security risks and vulnerabilities - Data breaches and privacy concerns - Insider threats and external attacks.

| UNIT - III | Security Controls and Best Practices for Cloud Environments | 9Hrs |
|---|---|---|

Identity and access management in the cloud - Data protection and encryption techniques - Network security and segmentation - Secure cloud application development.

| UNIT - IV | Securing Cloud Infrastructure and Platforms | 9Hrs |
|---|---|---|

Virtualization security - Cloud provider security controls - Secure configuration and hardening -Security monitoring and incident response

| UNIT - V | Compliance and Legal Considerations in Cloud Security | 9 Hrs |
|---|---|---|

Regulatory compliance in cloud environments - International data privacy laws - Auditing and certification frameworks - Cloud provider contracts and SLAs

**Textbooks:**

"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" Author: Tim Mather, Subra Kumaraswamy, Shahed Latif Publisher: O'Reilly Media, 2019.

**Reference Books:**

2. "Cloud Security: A Comprehensive Guide to Secure Cloud Computing" by Ronald L. Krutz, Russell Dean Vines, Eight Edition, 2019.
3. "Cloud Computing: Concepts, Technology, and Architecture" by Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Second Edition, 2018
4. "Cloud Computing Security: Foundations and Challenges" by John R. Vacca, Third Edition, 2022.
5. "Cloud Security and Privacy: Principles and Practice" by NIST (National Institute of Standards and Technology) Special Edition, Wiley Publisher 2017.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | 1 | | | | 1 | | |
| CO3 | 3 | 3 | 3 | 3 | | | | | 1 | | | 1 | | |
| CO4 | 3 | 2 | | | | | | | | | | | | |
| CO5 | | 3 | 1 | 1 | | | | 1 | 1 | | | 1 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|-----|-----|-----|-----|-----|-----|
| 1 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze(L4) | 2<br>1 |
| 2 | CO2 : Analyze | L4 | PO1<br>PO2<br>PO8<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO8 : Thumb rule<br>PO12: Thumb rule | 3<br>3<br>1<br>1 |
| 3 | CO3 :Design | L6 | PO1<br>PO2<br>PO3<br>PO4<br>PO9<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO9: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>1<br>1 |
| 4 | CO4 :Apply | L3 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze (L4) | 3<br>2 |
| 5 | CO5 : Analyze | L4 | PO2<br>PO3<br>PO4<br>PO8<br>PO9<br>PO12 | PO2: Analyze (L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO8: Thumb rule<br>PO9: Thumb rule<br>PO12: Thumb rule | 3<br>1<br>1<br>1<br>1<br>1 |

**Justification Statements :**

**CO1: Understand the Cloud computing fundamentals for Cloud Architecture, Service Models and Design**

**Action Verb : Understand(L2)**

PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze the potential security risks and vulnerabilities, data breaches in cloud environments.**
**Action Verb : Analyze (L4)**
PO1 Verb : Apply(L3)

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO8 : Thumb rule
Protection from Data breachers in cloud environments are needed in today's times. Therefore the correlation is low(1)
PO12: Thumb rule
Analyzing security risks and vulnerabilities is life long learning. Therefore the correlation is low (1)

## CO3: Design and implement effective security controls for Data protection and encryption techniques using Network security and segmentation.
### Action Verb : Design (L6)
PO1: Apply(L3)
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is higher level as PO3 verb. Therefore the correlation is high (3)
PO4: Design (L6)
CO3 Action verb is higher level as PO4 verb. Therefore the correlation is high (3)
PO9 : Thumb rule
Team work is required to implement encryption strategies. Hence the correlation is low (1)
PO12: Thumb rule
Construct effective security controls for Data protection can be life long learning. Therefore the correlation is low (1)

## CO4: Apply the industry best practices using Virtualization security for securing cloud infrastructure, platforms, and applications.
### Action Verb : Apply (L3)
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is less than PO2  verb by one level. Therefore the correlation is medium (2)

## CO5: Analyze the International data privacy laws for Auditing and certification frameworks.
### Action Verb : Analyze (L4)
PO2: Analyze (L4)
CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)
PO8 : Thumb rule
Real time applications of frameworks are useful. Therefore the correlation is low(1)
PO9 : Thumb rule
Team work is required for Auditing and Certification. Hence the correlation is low (1)
PO12: Thumb rule
In real time adapting International Data privacy laws is life long learning. Therefore the correlation is low (1)

| Course Code | Year & Sem | OFFENSIVE AND DEFENSIVE CYBER SECURITY TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3612 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1. Understand** the security posture and incident response process steps

**CO2. Apply** the best cyber strategies for best cyber practices

**CO3. Understand** the various cyber security kill chain process steps

**CO4. Evaluate** the various reconnaissance tools for both external and internal security

**CO5. Analyze** the various attacks involved in compromising a system and mobile phones

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | security posture and incident response process steps | | | L2 |
| CO2 | Apply | the best cyber strategies | | for best cyber practices | L3 |
| CO3 | Understand | various cyber security kill chain process steps | | | L2 |
| CO4 | Evaluate | various reconnaissance tools | | For both external and internal security | L5 |
| CO5 | Analyze | various attacks involved in compromising a system and mobile phones | | | L4 |

| UNIT - I | Security Posture and Incident Response | 9Hrs |
|---|---|---|

The Current Threat Landscape – The Credential – Authentication and Authorization - Apps – challenges – Enhancing Security Posture – The Incident Response Process – Handling an Incident – Post Incident Activity – Incident Response in the Cloud.

| UNIT - II | Cyber Strategy | 9Hrs |
|---|---|---|

Introduction – Why do we need to build a Cyber strategy? – How to build a Cyber Strategy – Best Cyber Attack Strategies – Best Cyber Defense Strategies.

| UNIT - III | Understanding the Cyber Security Kill Chain | 9Hrs |
|---|---|---|

Introducing the Cyber kill chain – Reconnaisance – Weaponization – Exfiltration – Threat Life Cycle Management – Tools used in the Cyber kill Chain Phases.

| UNIT - IV | Reconnaissance | 9Hrs |
|---|---|---|

External Reconnaissance – Nmap, Shodan, Recon-ng, the Harvestor, Maltego- Web Browser Enumeration Tools – Builtwith, Wappalyzers, What web, Web Developer Toolbar - Internal Reconnaissance – Port Scanner – Network Mapping – SNMP Remuneration – Password Cracking.

| UNIT - V | Compromising the System | 9 Hrs |
|---|---|---|

Analyzing Current Trends – Phishing – Exploiting a Vulnerability – Zero day – Performing the Steps to Compromise a System – Mobile Phone attacks.

| **Textbooks:** |
|---|

1.Cybersecurity – Attack and Defense Strategies: Improve your security posture to mitigate risks and prevent attackers from infiltrating your system, 3rd Edition, Packet Publisher, 2020.

| **Reference Books:** |
|---|

1. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" by DafyddStuttard and Marcus Pinto, Wiley Publication, Second Edition 2020.
2. "Network Security Assessment: Know Your Network" by Chris McNab, O'Reilly Media Publisher, Third Edition 2016.
3. "Metasploit: The Penetration Tester's Guide" by David Kennedy, Jim O'Gorman, Devon Kearns, and Mati Aharoni, No Starch Press Publication, First Edition, 2011.

| **Online Learning Resources:** |
|---|

https://www.youtube.com/watch?v=gAnG9yVMaYQ

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | | | | | | | | | | | 2 | |
| CO2 | 3 | 3 | | 2 | 3 | | | 2 | | | | 1 | 2 | |
| CO3 | 2 | 2 | | 1 | 2 | | | | | | | 2 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 2 | | 1 | | | | 1 | 2 | 2 |
| CO5 | | 3 | | 3 | 3 | 2 | | 1 | 1 | | | 2 | 2 | 2 |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 16 % | 2 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Identify(L3) | 2<br>2 |
| 2 | 17 | 21 % | 3 | CO2:Apply | L3 | PO1<br>PO2<br>PO4<br>PO5<br>PO8<br>PO12 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO4: Analyze (L4)<br>PO5:  Apply(L3)<br>PO8: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>2<br>3<br>2<br>1 |
| 3 | 16 | 20 % | 2 | CO3:Understand | L2 | PO1<br>PO2<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO12: Thumb rule | 2<br>2<br>1<br>2<br>2 |
| 4 | 19 | 23 % | 3 | CO4:Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO6<br>PO8<br>PO12 | PO1: Apply(L3)<br>PO2: Formulate (L6)<br>PO3: Develop (L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3)<br>PO6:  Thumb rule<br>PO8:  Thumb rule<br>PO12: Thumb rule | 3<br>2<br>3<br>3<br>3<br>2<br>1<br>1 |
| 5 | 17 | 21 % | 3 | CO5:Analyze | L4 | PO2<br>PO4<br>PO5<br>PO6<br>PO8<br>PO9<br>PO12 | PO2: Identify(L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3)<br>PO6: Thumb rule<br>PO8:  Thumb rule<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>2<br>1<br>1<br>2 |
| | 82 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand security posture and incident response process steps**
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Identify(L3)**
CO1 Action verb is less than PO2 verb by one level.Therefore the correlation is medium (2)

**CO2: Apply the best cyber strategies for best cyber practices**
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Identify(L3)**
CO2  Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
**PO5: Apply(L3)**

CO2  Action verb is same level as PO5 verb. Therefore the correlation is high (3)
**PO8 : Thumb rule**
For selecting best cyber strategies for cyber practices we use ethical principles. Therefore the corelation is medium (2).
**PO12: Thumb rule**
Lifelong learners adapt to new paradigms for selecting best cyber strategies. Therefore corelation is low (1)


**CO3: Understand various cyber security kill chain process steps**
**Action Verb : Understand (L2)**
**PO1: Apply(L3)**
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Identify(L3)**
CO3 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
**PO12: Thumb rule**
lifelong learning and professional development to stay abreast of new attack techniques, emerging vulnerabilities, and evolving best practices in cyber defense.


**CO4: Evaluate various reconnaissance tools for both external and internal security**
**Action Verb : Evaluate(L5)**
**PO1: Apply(L3)**
CO4  Action verb is greater than PO1 verb . Therefore the correlation is high(3)
**PO2: Formulate (L6)**
CO4  Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
**PO3: Develop (L3)**
CO4  Action verb is greater than PO3  verb . Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO4  Action verb is greater than PO4  verb . Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO4  Action verb is same level  PO5 verb . Therefore the correlation is high(3)
**PO6: Thumb rule**
Since to address security issues in society and providing security we use various tools. Therefore the correlation is medium(2)
**PO8: Thumb rule**
Some ethical principles shall be followed in providing security for data. Therefore the correlation is low(1)
**PO12: Thumb rule**
To provide External and Internal security we need continuous learning. Therefore the correlation is low(1)


**CO5: Analyze various attacks involved in compromising a system and used in mobile phones**
**Action Verb : Analyze (L4)**
**PO2: Identify(L3)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO4: Analyze(L4)**
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
**PO6 : Thumb rule**
Engineers play a crucial role in safeguarding individuals and organizations from these threats.Therefore the correlation is medium(2)
**PO8 : Thumb rule**
Since ethical principles should be followed to provide security. Therefore the correlation is medium(2)
**PO9 : Thumb rule**
Team work is required between software developers, network engineers, cybersecurity specialists. Hence the correlation is low (1)
**PO12: Thumb rule**
Engineers must engage in lifelong learning and professional development to stay abreast of new attack techniques, Therefore the correlation is medium(2)

| Course Code | Year & Sem | DATA ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3613 | IV-I | (Common to CSE, CIC, AIDS) | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the basic concepts of R programming to perform statistical analysis.

CO2: **Analyze** the Data Analytics by using Machine Learning algorithms like regression, multiple linear regression for estimation.

CO3: **Apply** the linear model framework for Data Analytics using regression, linear models.

CO4: **Evaluate** the simulation methods, optimization methods, forecasting analysis and survival analysis by using case studies.

CO5: **Apply** the various analytics for real time applications.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the basic concepts of R programming | | to perform statistical analysis. | L2 |
| **CO2** | Analyze | the Data Analytics | By using Machine Learning algorithms like regression, multiple linear regression. | For estimation | L4 |
| **CO3** | Apply | the linear model framework | By using regression, linear models | for Data Analytics | L3 |
| **CO4** | Evaluate | the simulation methods, optimization methods, forecasting analysis and survival analysis | By using case studies | | L5 |
| **CO5** | Apply | The various analytics | | for real time applications. | L3 |

| UNIT – I | An overview of R | 10 Hrs |
|---|---|---|

**An overview of R**, Vectors, factors, univariate time series, Data frames, matrices, Functions, operators, loops, Graphics, Revealing views of the data, Data summary, Statistical analysis questions, aims, and strategies; Statistical models, Distributions: models for the random component, Simulation of random numbers and random samples, Model assumptions

| UNIT – II | Basic concepts of estimation | 9 Hrs |
|---|---|---|

**Basic concepts of estimation,** Confidence intervals and tests of hypotheses, Contingency tables, One-way unstructured comparisons, Response curves, Data with a nested variation structure, Resampling methods for standard errors, tests, and confidence intervals, Theories of inference, Regression with a single predictor, multiple linear regressions.

| UNIT – III | Exploiting the linear model framework | 9 Hrs |
|---|---|---|

**Exploiting the linear model framework:** Levels of a factor – using indicator variables, Fitting multiple lines, Polynomial regression, Methods for passing smooth curves through data, Smoothing with multiple explanatory variables, Generalized linear models, Logistic multiple regression, Logistic models for categorical data, Poisson regression, Additional notes on generalized linear models, Models with an ordered categorical or categorical response, Survival analysis, Transformations for count data, Time series models.

| UNIT – IV | Simulation | 8 Hrs |
|---|---|---|

**Simulation -** Motivating Examples, Simulation Modeling Method, case study. Introduction to optimization – Introduction, Methods in Optimization- Linear Programming, Integer Programming—Enforcing Integrality Restrictions on Decision Variables, Nonlinear Optimization Models. Forecasting Analytics - Methods and Quantitative Approaches of Forecasting, Applied Forecasting Analytics Process, Applications, Evaluating Forecast Accuracy. Survival Analysis – Introduction, Motivating Business Problems, Methods of Survival Analysis, case study

| UNIT – V | Applications | 9 Hrs |
|---|---|---|

**Applications:** Retail Analytics, Marketing Analytics, Financial Analytics, Social Media and Web Analytics, Healthcare Analytics

**Textbooks:**

1. Data Analysis and Graphics Using R – an Example-Based Approach, John Maindonald, W. John Braun, Third Edition, 2010

2. Essentials of Business Analytics An Introduction to the Methodology and its Applications, Bhimasankaram Pochiraju, Sridhar Seshadri, Springer, 2019, https://doi.org/10.1007/978-3-319-68837-4

**Reference Books:**

1. Data Analytics Using R Paperback, Seema Acharya, McGraw Hill Education, Apr 2018

2. R for Everyone: Advanced Analytics and Graphics Paperback, Jared P. Lander, Pearson Education, 2018

4. Business Analytics for Decision Making, Regi Mathew, First Edition, Pearson Paperback, 2020

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | 3 | | | | | | 3 | | |
| CO3 | 3 | 2 | | | | 2 | | | | | | | 2 | |
| CO4 | 3 | 3 | 2 | 2 | 2 | | | 3 | | | | | 2 | |
| CO5 | 3 | 2 | | | | | | | | | | 2 | | |

**Correlation matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 23% | 3 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze(L4) | 2<br>1 |
| 2 | 12 | 19% | 2 | CO2: Analyze | L4 | PO1<br>PO2<br>PO6<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze(L4)<br>PO6:Thumb Rule<br>PO12:Thumb Rule | 3<br>3<br>3<br>3 |
| 3 | 15 | 25% | 3 | CO3: Apply | L3 | PO1<br>PO2<br>PO6 | PO1: Apply(L3)<br>PO2: Analyze(L4)<br>PO6:Thumb Rule | 3<br>2<br>2 |
| 4 | 15 | 25% | 3 | CO4: Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO8 | PO1: Apply(L3)<br>PO2: Analyze(L4)<br>PO3: Design (L6)<br>PO4: Design (L6)<br>PO5: Create(L6)<br>PO8:Thumb Rule | 3<br>3<br>2<br>2<br>2<br>3 |
| 5 | 5 | 8% | 1 | CO3: Apply | L3 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2: Analyze(L4)<br>PO12:Thumb Rule | 3<br>2<br>2 |
| | 61 | 100 % | | | | | | |

**Justification Statements :**
**CO1: Understand** the basic concepts of R programming
**Action Verb: Understand (L2)**
**PO1: Apply (L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)
**PO2: Analyze (L4)**
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Analyze** the Data Analytics by using Machine Learning algorithms like regression, multiple linear regression for estimation.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO2 Action verb is greater than PO1 verb.Therefore the correlation is high(3)

**PO2: Analyze (L4)**

CO2 Action verb is same as PO2 verb . Therefore the correlation is high(3)

**PO6: Thumb rule**

By using estimation concepts, the programmers are able to solve engineering problems using machine learning algorithms. Therefore the correlation is high(3)

**PO12: Thumb rule**

Data Analytics estimation concepts are used for solving complex problems. Therefore the correlation is high(3)

**CO3: Apply** the linear model framework for Data Analytics using regression, linear models.

**Action Verb : Apply(L3)**

**PO1: Apply(L3)**

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is moderate (2)

**PO12: Thumb rule**

Linear models are used to create framework for generating hypotheses Therefore the correlation is moderate (2)

**CO4: Evaluate** the simulation methods, optimization methods, forecasting analysis and survival analysis by using case studies.

**Action Verb : Evaluate(L5)**

**PO1: Apply(L3)**

CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO3: Design (L6)**

CO4 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)

**PO4: Design (L6)**

CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)

**PO5: Create(L6)**

CO4 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)

**PO8: Thumb rule**

Since ethical principles shall be followed in performing simulation, optimization and analysis. Therefore the correlation is high(3)

**CO5: Apply** the various analytics for real time applications**.**

**Action Verb : Apply (L3)**

**PO1: Apply(L3)**

CO5 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO5 Action verb is less than PO2 verb by one level. Therefore the correlation is moderate (2)

**PO12: Thumb rule**

For real time applications, Data Analytics concepts are used. Therefore the correlation is moderate (2)

| Course Code | Year & Sem | SOFTWARE PROJECT MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3614 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the purpose and importance of project management

**CO2: Evaluate** the economics for improving software project quality

**CO3: Analyze** the phases and process of software project management life cycle

**CO4: Analyze** process workflows and responsibilities

**CO5: Apply** process control and instrumentation for CCPDS-R

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the purpose and importance of project management | | | L2 |
| **CO2** | Evaluate | The economics | | for improving software project quality | L5 |
| **CO3** | Analyze | the phases and process of software management life cycle | | | L4 |
| **CO4** | Analyze | process workflows and responsibilities | | | L4 |
| **CO5** | Apply | process control and instrumentation | | for CCPDS-R | L3 |

| UNIT – I | Conventional Software Management | 9 Hrs |
|---|---|---|

**Conventional Software Management:** The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation

| UNIT – II | Improving Software Economics | 9 Hrs |
|---|---|---|

**Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.
**The old way and the new:** The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process

| UNIT – III | Life cycle phases | 9 Hrs |
|---|---|---|

**Life cycle phases:** Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective.

| UNIT – IV | Work Flows of the process | 9 Hrs |
|---|---|---|

**Work Flows of the process:** Software process workflows, Inter Trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments.
**Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Interaction planning process, Pragmatic planning.
**Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building Blocks, The Project Environment

| UNIT – V | Project Control and Process instrumentation | 9 Hrs |
|---|---|---|

**Project Control and Process instrumentation:** The server care Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation.
**Tailoring the Process:** Process discriminates, Example. Future Software Project Management: Modern Project Profiles Next generation Software economics, modern Process transitions.
**Case Study:** The Command Center Processing and Display System-Replacement (CCPDS-R)

**Textbooks:**

1.      Software Project Management, Walker Royce, Pearson Education.
2.      Software Project Management, Bob Hughes & Mike Cotterell, fourth edition,Tata Mc- Graw Hill

**Reference Books:**

1. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O"Reilly, 2006
2. Head First PMP, Jennifer Greene & Andrew Stellman, O"Reilly,2007
3. Software Engineering Project Managent, Richard H. Thayer & Edward Yourdon, second edition,Wiley India, 2004.
4. Agile Project Management, Jim Highsmith, Pearson education, 2004
5. The art of Project management, Scott Berkun, O"Reilly, 2005.
6. Software Project Management in Practice, Pankaj Jalote, Pearson Education,2002

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | | | | | | | | | | 2 | | | |
| CO2 | 3 | 3 | 3 | | | | | | 3 | | 3 | | | |
| CO3 | 2 | 2 | | | | | | | 3 | | 3 | | | |
| CO4 | 2 | 2 | | 3 | | | | | 3 | | 3 | | | |
| CO5 | 3 | 3 | | 2 | | | | | | | 2 | | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|---------------------------------------------|----------------------------|
| 1 | CO1 :Understand | L2 | PO1<br>PO11 | PO1: Apply(L3)<br>PO11: Thumb rule | 2<br>2 |
| 2 | CO2 : Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO9<br>PO11 | PO1: Apply(L3)<br>PO2: Analyze (L4)<br>PO3:Apply(L3)<br>PO9: Thumb rule<br>PO11: Thumb rule | 3<br>3<br>3<br>3<br>3 |
| 3 | CO3 : Analyze | L4 | PO1<br>PO2<br>PO9<br>PO11 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO9: Thumb rule<br>PO11: Thumb rule | 3<br>3<br>3<br>3 |
| 4 | CO4 : Analyze | L4 | PO1<br>PO2<br>PO4<br>PO9<br>PO11 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO4: Analyze (L4)<br>PO9: Thumb rule<br>PO11: Thumb rule | 3<br>3<br>3<br>3<br>3 |
| 5 | CO5 :  Apply | L3 | PO1<br>PO2<br>PO4<br>PO11 | PO1: Apply(L3)<br>PO2:  Identify (L3)<br>PO4: Analyze (L4)<br>PO11: Thumb rule | 3<br>3<br>2<br>2 |

**Justification Statements:**

**CO1:** Understand the purpose and importance of project management

**Action Verb: Understand (L2)**

PO1: Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO11: Thumb rule

To understand the purpose and importance of project management, knowledge on projects and management principles are required.  Therefore the correlation is medium (2)

**CO2:** Evaluate the economics for improving software project quality

**Action Verb: Evaluate (L5)**

PO1: Apply(L3)

CO2  Action verb is more than  PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO2 Action verb is more than PO2 verb. Therefore the correlation is high (3)
PO3: Apply(L3)
CO2 Action verb is more than PO3 verb. Therefore the correlation is high (3)
PO9: Thumb rule
To evaluate the economics for improving software project quality, teamwork and individual performance is required. Therefore the correlation is high(3)
PO11: Thumb rule
To evaluate the economics for improving software project quality, knowledge on projects and management principles are required. Therefore the correlation is high(3).

**CO3:** Analyze the phases and process of software project management life cycle

### Action Verb : Analyze (L4)

PO1: Apply(L3)
CO3 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO3 Action verb is more than PO2 verb. Therefore the correlation is high (3)
PO9: Thumb rule
To analyze the phases and process of software project management life cycle, teamwork and individual performance is required. Therefore the correlation is high (3)
PO11: Thumb rule
To analyze the phases and process of software project management life cycle, knowledge on projects and management principles are required. Therefore the correlation is high (3)

**CO4:** Analyze process workflows and responsibilities

### Action Verb : Analyze(L4)

PO1: Apply( L3)
CO4 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO4 Action verb is more than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO9: Thumb rule
To analyze process workflows and responsibilities, teamwork and individual performance is required. Therefore the correlation is high(3).
PO11: Thumb rule
To analyze process workflows and responsibilities, knowledge on projects and management principles are required. Therefore the correlation is high(3).

**CO5:** Apply process control and instrumentation for CCPDS-R

### Action Verb : Apply (L3)

PO1: Apply( L3)
CO5 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO5 Action verb is same  as PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is less than  PO4 verb by one level. Therefore the correlation is medium (2)
PO11: Thumb rule
To apply process control and instrumentation for CCPDS-R, knowledge on projects and management principles are required.  Therefore the correlation is medium (2).

| Course Code | Year & Sem | Linux Environment System | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE3615 | IV-I | **(Common to CSE, CIC, AIDS)** | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the introductory concepts of LINUX operating system .

**CO2: Analyze** the procedure to install LINUX operating system.

**CO3: Apply** the procedure to configure various privileges for the user and system.

**CO4: Analyze** the various commands through console window.

**CO5: Evaluate** the file system services in real time applications.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the introductory concepts of LINUX operating system | | | L2 |
| **CO2** | Analyze | the procedure to install LINUX operating system | | | L4 |
| **CO3** | Apply | the procedure to configure various privileges | | for the user and system | L3 |
| **CO4** | Analyze | the various commands | through console window | | L4 |
| **CO5** | Evaluate | the file system services | | in real time applications | L5 |

| UNIT – I | INTRODUCTION TO LINUX OPERATING SYSTEM | 9 Hrs |
|---|---|---|

**INTRODUCTION TO LINUX OPERATING SYSTEM:** Introduction and Types of Operating Systems, Linux Operating System, Features, Architecture Of Linux OS and Shell Interface, Linux System Calls, Linux Shared Memory Management, Device and Disk Management in Linux, Swap space and its management. File System and Directory Structure in Linux. Multi-Processing, load sharing and Multi-Threading in Linux, Types of Users in Linux, Capabilities of Super Users and equivalents.

| UNIT – II | INSTALLING LINUX AS A SERVER | 9 Hrs |
|---|---|---|

**INSTALLING LINUX AS A SERVER** : Linux and Linux Distributions ; Major differences between various Operating Systems (on the basis of: Single Users vs Multiusers vs Network Users; Separation of the GUI and the Kernel; Domains; Active Directory;).

**INSTALLING LINUX IN A SERVER CONFIGUARTION :** Before Installation; Hardware; Server Design ;Dual-Booting Issues; Modes of Installation; Installing Fedora Linux; Creating a Boot Disk; Starting the Installation; **GNOME AND KDE:** The History of X Windows; The Downside; Enter GNOME; About GNOME ; Starting X Windows and GNOME; GNOME Basics; The GNOME Configuration Tool.

| UNIT – III | INSTALLING SOFTWARE | 9 Hrs |
|---|---|---|

**INSTALLING SOFTWARE :** The Fedora Package Manager; Installing a New Package using dpkg and RPM; Querying a Package; Uninstalling a Package using dpkg and RPM; Compiling Software; Getting and Unpacking the Package; Looking for Documentation; Configuring the Package; Compiling Your Package; Installing the Package, Driver Support for various devices in linux. MANAGING USERS: Home Directories ;Passwords; Shells; Stratup Scripts; Mail; User Databases; The / etc /passwd File; The / etc / shadow File; The / etc /group File; User Management Tools; Command-Line User Management; User LinuxConf to Manipulate Users and Groups; SetUID and SetGID Programs.

| UNIT – IV | THE COMMAND LINE | 9Hrs |
|---|---|---|

**THE COMMAND LINE :** An Introduction to BASH, KORN, C, A Shell etc. ; BASH commands: Job Control; Environment Variables; Pipes; Redirection; Command-Line Shortcuts; Documentation Tools; The man Command; the text info System; File Listings; Owner ships and permissions; Listing Files; File and Directory Types; Change Ownership; Change Group; Change Mode ; File Management and Manipulation;

Process Manipulation; Miscellaneous Tools; Various Editors Available like: Vi and its modes, Pico, Joe and emacs, Su Command. BOOTING AND SHUTTING DOWN: LILO and GRUB; Configuring LILO; Additional LILO options; Adding a New Kernel to Boot ; Running LILO; The Steps of Booting; Enabling and disabling Services.

| UNIT – V | FILE SYSTEMS | 9 Hrs |
|---|---|---|

**FILE SYSTEMS:** The Makeup File Systems; Managing File Systems; Adding and Partitioning a Disk; Network File S ystems; Quota Management; CORE SYSTEM SERVICES: The init Service; The inetd and xinetd Processess; The syslogd Daemon; The cron Program. PRINTING : The Basic of lpd; Installing LPRng; Configuring /etc/printcap; The /ETC/lpd.perms File; Clients of lpd, Interfacing Printer through Operating System.

### Textbooks:

1. Linux Administration: A Beginner's Guide by Steve Shah , Wale Soyinka, ISBN 0072262591 (0-07-226259-1), McGraw-Hill   Education.
2. Unix Shell Programming, Yashavant P. Kanetkar, BPB Publications, 2003.
3. UNIX Concepts and Applications by Sumitabha Das Tata McGraw-Hill, 2006.
4. Operating System Concepts 8th edition, by Galvin Wiley Global Education, 2012.

### Reference Books:

1. Unix operating system, by Grace Todino, John Strang, Jerry D. Peek Oreily publications 1993.
2. Operating System Concepts 8th edition, by Galvin Wiley Global Education, 2012.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | 2 | | |
| CO3 | 3 | 3 | | 2 | 3 | | | | | | | | | |
| CO4 | 3 | 3 | | | | | | | | | | 2 | | |
| CO5 | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | 2 | 2 |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Review(L2) | 2<br>3 |
| 2 | CO2: Analyze | L4 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2:  Review(L2)<br>PO12: Thumb rule | 3<br>3<br>2 |
| 3 | CO3: Apply | L3 | PO1<br>PO2<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2:  Review(L2)<br>PO4: Analyze (L4)<br>PO5: Apply(L3) | 3<br>3<br>2<br>3 |
| 4 | CO4: Analyze | L4 | PO1<br>PO2<br>PO12 | PO1: Apply(L3)<br>PO2:  Review(L2)<br>PO12: Thumb rule | 3<br>3<br>2 |
| 5 | CO5: Evaluate | L5 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Review(L2)<br>PO3: Develop (L3)<br>PO4: Analyze (L4)<br>PO5: Apply(L3)<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>2 |

**Justification Statements :**

**CO1: Understand** the introductory concepts of LINUX operating system
**Action Verb : Understand (L2)**
**PO1 Verb : Apply(L3)**

CO1 Action verb is Less than PO1 verb by one level. Therefore, the correlation is Medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high(3)


**CO2: Analyze** the procedure to install LINUX operating system.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO2 Action verb is greater than  PO1 verb. Therefore, the correlation is high (3)
**PO2: Review(L2)**
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)
**PO12: Thumb rule**
Installations of operating systems are a continuous activity. Therefore the correlation is medium (2)


**CO3: Apply** the procedure to configure various privileges for the user and system.
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO3 Action verb is same level as of PO1 verb. Therefore, the correlation is High (3)
**PO2: Review (L2)**
CO3 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)
**PO4: Analyze (L4)**
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
**PO5: Apply(L3)**
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high(3)


**CO4: Analyze** the various commands through console window.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO4  Action verb is greater than PO1 verb. Therefore the correlation is high (3)
**PO2: Review(L2)**
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
**PO12: Thumb rule**
Various commands using console window useful in future enhancements. Therefore the correlation is medium(2)


**CO5: Evaluate** the file system services in real time applications.
**Action Verb : Evaluate (L5)**
**PO1: Apply(L3)**
CO5  Action verb is  greater than PO1 verb. Therefore the correlation is high(3)
**PO2: Review (L2)**
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO5 Action verb is  greater than PO3 verb. Therefore the correlation is high(3)
**PO4: Analyze (L4)**
CO5 Action verb is  greater than PO4 verb. Therefore the correlation is high(3)
**PO5: Apply(L3)**
CO5 Action verb is  greater than PO5 verb. Therefore the correlation is high (3)
**PO12: Thumb rule**
File system services usage is a continuous process . Therefore the correlation is medium (2)

| Course Code | Year & Sem | Information Retrieval Techniques | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AOE3602 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the information retrieval search engine framework and explore its capabilities.

**CO2: Understand** different models to acquire knowledge and pre-processing of web page.

**CO3: Analyze** appropriate methods of classification or clustering.

**CO4: Design** the web retrieval using search engines.

**CO5: Analyze** different techniques of recommender system.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | Utilize the information of retrieval models | | Search Engine Framework | **L2** |
| **CO2** | Understand | document vector space and probabilistic models | | Web Page | **L2** |
| **CO3** | Analyze | Various supervised and un supervised learning methods | | Machine Learning Algorithms | **L4** |
| **CO4** | Design | Operate on various search engine systems | Search Engines | | **L4** |
| **CO5** | Analyze | To understand search engine functionality | Data Models | | **L4** |

| UNIT - I | Information Retrieval | 9 Hrs |
|---|---|---|

**Information Retrieval** – Early Developments – The IR Problem – The User_s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

| UNIT - II | MODELING AND RETRIEVAL EVALUATION | 9Hrs |
|---|---|---|

**MODELING AND RETRIEVAL EVALUATION** : Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

| UNIT - III | TEXT CLASSIFICATION AND CLUSTERING | 9 Hrs |
|---|---|---|

**TEXT CLASSIFICATION AND CLUSTERING**: A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

| UNIT - IV | WEB RETRIEVAL AND WEB CRAWLING | 9 Hrs |
|---|---|---|

**WEB RETRIEVAL AND WEB CRAWLING**: The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

| UNIT - V | RECOMMENDER SYSTEM | 9 Hrs |
|---|---|---|

RECOMMENDER SYSTEM : Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

**Textbooks:**

| | |
|---|---|
| 1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011. 2. Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook‖, First Edition, 2011. | |
| **Reference Books:** | |
| 1. C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval, Cambridge University Press, 2008. 2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010. | |

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | | | | | | | | | | | | |
| CO2 | 2 | 2 | | | 2 | | | | | | | | | |
| CO3 | 2 | 2 | | 3 | 1 | | | | 1 | | | | | |
| CO4 | 2 | | 3 | 2 | | | | | | | | | | |
| CO5 | 1 | | 1 | 3 | | 1 | | 1 | | | | 1 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|---------------------------------------------|----------------------------|
| 1 | CO1: Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Identify(L3) | 2<br>2 |
| 2 | CO2: Understand | L2 | PO1<br>PO2<br>PO5 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO5: Apply(L3) | 2<br>2<br>2 |
| 3 | CO3: Analyze | L4 | PO1<br>PO2<br>PO4<br>PO9 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO4: Analyze(L4)<br>PO9:  Thumb rule | 2<br>2<br>3<br>1 |
| 4 | CO4: Design | L4 | PO3<br>PO4 | PO3: Design (L6)<br>PO4: Interpret(L5) | 3<br>2 |
| 5 | CO5: Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO6<br>PO8<br>PO12 | PO2: Formulate(L6)<br>PO3: Design (L6)<br>PO4: Analyze(L4)<br>PO6:  Thumb rule<br>PO8:  Thumb rule<br>PO12:  Thumb rule | 1<br>1<br>3<br>1<br>1<br>1<br>1 |

**Justification Statements:**

**CO1: Understand the information retrieval search engine framework and explore its capabilities.**

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Identify(L3)**

CO1 Action verb is less than PO2  verb by one level. Therefore the correlation is medium (2)

**CO2: Understand different models acquire knowledge and pre-processing of web page.**

**Action Verb : Understand(L2)**

**PO1: Apply(L3)**

CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2: Identify(L3)**

CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**PO5: Apply(L3)**
CO2 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)
**CO3: Analyze appropriate methods of classification or clustering.**
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO3 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2: Identify (L3)**
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
**PO4: Analyze (L4)**
CO3 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO5: Create(L6)**
CO3 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)
**PO9 : Thumb rule**
Finding solution to real world problems. Hence the correlation is low (1)

  **CO4**: **Design the web retrieval using search engines.**
**Action Verb: Design (L6)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO3: Design (L6)**
CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
**PO4: Interpret (L5)**
CO4 Action verb is greater than PO4 verb by one level. Therefore the correlation is high(3)
**CO5: Analyze different techniques of recommender system.**
**Action Verb : Analyze (L4)**
**PO2: Formulate (L6)**
CO5 Action verb is less than two levels as PO2 verb. Therefore the correlation is low(1)
**PO3: Design (L6)**
CO5 Action verb is less than two levels as PO2 verb. Therefore the correlation is low(1)
**PO4: Analyze (L4)**
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
**PO6 : Thumb rule**
Since ethical principles should be followed to create a recommender systems and services to users. Therefore the correlation is low(1)
**PO8 : Thumb rule**
Team work is required between recommender system users and providers. Hence the correlation is low (1)
**PO12: Thumb rule**
For some of real world applications we use recommender systems to provide services. Therefore the correlation is low (1)

| Course Code | Year & Sem | Soft Computing | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AOE3603 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the paradigms of soft computing techniques to make intelligent Systems

CO2: **Understand** the common algorithms to discover hidden patterns or data groupings without the need for human intervention

CO3: **Apply** the encoding techniques (binary, real-valued, permutation) for representing solutions in genetic algorithms

CO4: **Apply** the fuzzy logic concepts to model and solve real-world problems characterized by uncertainty or ambiguity.

CO5: **Evaluate** the impact of parameter tuning and optimization strategies on the effectiveness of hybrid models.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | soft computing techniques | | Design intelligent Systems | **L2** |
| **CO2** | **Understand** | common algorithms | discover hidden patterns or data groupings | without the need for human intervention | **L2** |
| **CO3** | **Apply** | encoding techniques | | representing solutions in genetic algorithms | **L3** |
| **CO4** | **Apply** | fuzzy logic concepts | | to model and solve real-world problems characterized by uncertainty or ambiguity. | **L3** |
| **CO5** | **Evaluate** | impact of parameter tuning and optimization strategies | | the effectiveness of hybrid models. | **L5** |

| UNIT - I | INTRODUCTIONTO SOFT COMPUTING AND SUPERVISED LEARNING NETWORKS | 9 Hrs |
|---|---|---|

**Introduction to Soft Computing:**Neural networks, Application scope of neural networks, Fuzzy logic, Genetic algorithm, Hybrid systems, Softcomputing.
**Artificial Neural Networks:** Fundamentals, Basic Models, Terminologies, Linear Separability, Hebb network.
**Supervised Learning Networks:** Perceptron Networks- Theory, Perceptron learning rule, Architecture, Flowchart for training process, Perceptron training algorithm for single and multiple output classes, Perceptron network testing algorithm; Back-Propagation Network - Theory, Architecture, Flow chart for training process, Training algorithm, Learning factors of back-propagation network, Testing algorithm for back-propagation network.

| UNIT - II | UNSUPERVISED LEARNING NETWORKS | 9Hrs |
|---|---|---|

Fixed weight competitive nets – Maxnet, Mexican Hat Net, Hamming network; Kohonenself-organizing feature maps – Theory, Architecture, Flowchart, Training algorithm; Learning vector quantization – Theory, Architecture, Flowchart, Training algorithm, Variants; Counter propagation networks – Theory, Full counter propagation Net, Forward-only counter propagation Net; Adaptive resonance theory network – Fundamental architecture, Fundamental operating principle, Fundamental algorithm.

| UNIT - III | GENETIC ALGORITHMS | 9 Hrs |
|---|---|---|

Genetic algorithms- Biological background, Traditional optimization and search techniques, Genetic algorithm and search space, Genetic algorithms vs. traditional algorithms, Basic terminologies in genetic algorithm, Simple GA, General genetic algorithm, Operators in genetic algorithm, Stopping condition for genetic algorithm flow, Constraints in genetic algorithm, Problem solving using genetic algorithm, Adaptive genetic algorithms, Hybrid genetic algorithms, Advantages and limitations of genetic algorithm, Applications of genetic algorithm.

| UNIT - IV | FUZZY LOGIC | 9 Hrs |
|---|---|---|

Introduction to fuzzy logic, Classical sets, Fuzzy sets, Membership function – Features, Fuzzification, Methods of membership value assignments; Fuzzy arithmetic and measures–Fuzzy arithmetic, Extension principle, Fuzzy measures, Measures of fuzziness, Fuzzy integrals; Fuzzy rule base and approximation reasoning -Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Compound rules, Aggregation of fuzzy rules, Fuzzy reasoning, Fuzzy inference systems, Overview of fuzzy expert system; Fuzzy decision making, Fuzzy logic control systems.

| UNIT - V | HYBRID SOFT COMPUTING TECHNIQUES AND APPLICATIONS | 9 Hrs |
|---|---|---|

**Hybrid Soft Computing Techniques:** Genetic neuro hybrid systems, Genetic fuzzy hybrid and fuzzy genetic hybrid systems.

**Applications of Soft Computing:** Optimization of traveling salesman problem using genetic algorithm approach, Genetic algorithm-based internet search technique, Soft computing-based hybrid fuzzy controllers, Soft computing-based rocket engine control

**Textbooks:**

1. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, Wiley, 3rd Edition, 2019.

**Reference Books:**

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms:Synthesis and Applications, PHI Learning Private Ltd, 2011.
2. Udit Chakraborty, Samir Roy, Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Pearson, 2013.
3. Saroj Kaushik, Sunita Tewari, Soft Computing: Fundamentals, Techniques and Applications, McGraw Hill, 2018.Engines, The MIT Press, 2010.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | | | |
| CO2 | 2 | 3 | | 3 | 3 | | | | | | | 2 | | |
| CO3 | 3 | 3 | | 3 | 3 | | | | | | | 2 | | |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | 2 | | | | | | |
| CO5 | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|
| 1 | CO1 :Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Review(L2) | 3 |
| 2 | CO2 : Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Review(L2) | 3 |
| | | | PO4 | PO4:Interpret(L2) | 3 |
| | | | PO5 | PO5:Apply(L3) | 2 |
| 3 | CO3 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Review (L2) | 3 |
| | | | PO4 | PO4: Interpret (L2) | 3 |
| | | | PO5 | PO5: Apply(L3) | 3 |
| | | | PO12 | PO12: Thumb rule | 2 |
| 4 | CO4 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Review (L2) | 3 |
| | | | PO3 | PO3: Develop (L3) | 3 |
| | | | PO4 | PO4: Interpret (L2) | 3 |
| | | | PO5 | PO5: Apply(L3) | 3 |
| | | | PO8 | PO8: Thumb rule | 2 |
| 5 | CO5 : Evaluate | L5 | PO1 | PO1: Apply (L3) | 3 |
| | | | PO2 | PO2: Review(L2) | 3 |
| | | | PO3 | PO3: Develop (L3) | 3 |
| | | | PO4 | PO4: Analyze(L3) | 3 |
| | | | PO5 | PO5:Apply(L3) | 3 |
| | | | PO12 | PO12:Thumb Rule | 2 |

**Justification Statements :**

**CO1: Understand** the paradigms of soft computing techniques to create/Design intelligent Systems

**Action Verb: Understand(L2)**
**PO1 Verb:Apply(L3)**
CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Review(L2)**
CO1 Action verb is same level as PO2 verb . Therefore the correlation is high(3)


**CO2: Understand** the common algorithms to discover hidden patterns or data groupings without the need for human intervention
**Action Verb : Understand(L2)**
**PO1: Apply(L3)**
CO2  Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)
**PO2: Review (L2)**
CO2 Action verb is grater than PO2 verb. Therefore the correlation is high (3)
**PO4: Interpret (L2)**
CO2 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L1)**
CO2 Action verb is less than as PO5 verb by one level. Therefore the correlation is medium(3)


**CO3: Apply the** encoding techniques (binary, real-valued, permutation) for representing solutions in genetic algorithms
**Action Verb : Apply(L3)**
**PO1: Apply(L3)**
CO3  Action verb is  same as than PO1 verb. Therefore the correlation is high (3)
**PO2: Review (L2)**
CO3 Action verb is greater than as PO2 verb. Therefore the correlation is high (3)
**PO4: Interpret (L2)**
CO3 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO3 Action verb is same as PO5 verb. Therefore the correlation is high (3)
**PO12: Thumb rule**
In Soft Computing,the encoding techniques are used to generate solutions using genetic algorithms. Therefore the correlation is medium (2)


**CO4: Apply the** fuzzy logic concepts to model and solve real-world problems characterized by uncertainty or ambiguity
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO4  Action verb is same as PO1 verb. Therefore the correlation is high (3)
**PO2: Review (L2)**
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
**PO3: Develop (L3)**
CO4 Action verb is same as PO3 verb. Therefore the correlation is high (3)
**PO4: interpret (L2)**
CO4 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO4 Action verb is same as PO5 verb. Therefore the correlation is high(3)
**PO8: Thumb rule**
The fuzzy logic is used to solve the societal problems by following professional ethics. Therefore the correlation is medium(2)


**CO5: Evaluate** the impact of parameter tuning and optimization strategies on the effectiveness of hybrid models.
**Action Verb : Evaluate (L5)**
**PO1: Apply(L3)**

CO4  Action verb is greater than PO1 verb. Therefore the correlation is high (3)

**PO2: Review (L2)**

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high(3)

**PO3: Develop (L3)**

CO5 Action verb is greater than as PO3 verb. Therefore the correlation is high(3)

**PO4: Analyze (L4)**

CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)

**PO5: Apply(L3)**

CO5 Action verb is greater than as PO5 verb. Therefore the correlation is high (3)

**PO12: Thumb rule**

We can rate the impact of parameter tuning and optimization strategies on the effectiveness of hybrid models. Therefore the correlation is medium (2)

| Course Code | Year & Sem | Principles of Data Science | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AOE3604 | IV-I | **(Common to CSE, CIC)** | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the different levels of Data and Steps in Data Science.

**CO2: Apply** the basics of probability models for data exploration.

**CO3: Analyze** the basics of statistics models for data exploration.

**CO4: Analyze** the different data visualization techniques.

**CO5: Analyze** the suitable model for real time applications.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | The Different levels of Data and Steps in Data Science | | | L2 |
| **CO2** | **Apply** | The basics of probability models | | for data exploration | L3 |
| **CO3** | **Analyze** | The basics of statistics models | | for data exploration | L4 |
| **CO4** | **Analyze** | The different data visualization techniques | | | L4 |
| **CO5** | **Analyze** | the suitable model | | for real time applications | L4 |

| UNIT – I | Introduction to Data Science | 9 Hrs |
|---|---|---|

Structured versus unstructured data, Quantitative and qualitative data, The four levels of data: Nominal level, Ordinal level, Interval level, and Ratio level, The five steps of Data Science: Ask an interesting question, obtain the data, explore the data, model the data, communicate and visualize the results, Explore the data.

| UNIT – II | Mathematics | 10 Hrs |
|---|---|---|

**Mathematics:** Vectors and matrices, Arithmetic symbols, Graphs, Logarithms/exponents, Set theory, Linear algebra. Probability: Basic definitions, Probability, Bayesian versus Frequentist, Compound events, Conditional Probability, The rules of probability, Collectively exhaustive events, Bayes theorem, Random variables.

| UNIT – III | Statistics | 9 Hrs |
|---|---|---|

**Statistics:** Obtaining data, Sampling data, Measuring Statistics, The Empirical rule, Point estimates, Sampling distributions, Confidence intervals, Hypothesis tests.

| UNIT – IV | Identifying effective and ineffective visualizations | 9 Hrs |
|---|---|---|

**Identifying effective and ineffective visualizations:** Scatter plots, Line graphs, Bar charts, Histograms, Box plots. Graphs and Statistics lie: Correlation versus causation, Simpson's paradox, Verbal Communication, Thewhy/how/what strategy of presenting.

| UNIT – V | Applications of Data Science | 9 Hrs |
|---|---|---|

**Applications of Data Science-** Technologies for visualisation, Bokeh (Python), recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

**Textbooks:**

1. Sinan Ozdemir, "Principles of Data Science", Packt, 2016.
2. "Algorithms for Data Science", 1st edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016

**Reference Books:**

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
2. G. Jay Kerns, "Introduction to Probability and Statistics Using R", First Edition.
3. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 1st Edition, 2014.
4. Doing Data Science: Straight Talk From The Frontline, 1st edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
5. Mining of Massive Datasets, 2nd edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge
   University Press, 2014

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | 2 | |
| CO2 | 3 | 3 | | | | 2 | | | | | | 3 | 2 | |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | 3 | | | 3 | 2 | |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | 2 |
| CO5 | | 3 | 3 | 3 | 3 | | | | 3 | | | 3 | 2 | 2 |

**Correlation matrix**

| Unit No. | CO | | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---------|------------------|-----|-------------|------------------|-----|------|-----|
| | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | | | |
| 1 | 14 | 23% | 3 | CO1 :Understand | L2 | PO1<br>PO2 | PO1: Apply(L3)<br>PO2: Analyze(L4) | 2<br>1 |
| 2 | 10 | 17% | 2 | CO2 :  Apply | L3 | PO1<br>PO2<br>PO6<br>PO12 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO6: Thumb rule<br>PO12: Thumb rule | 3<br>3<br>2<br>2 |
| 3 | 12 | 20% | 2 | CO3 : Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO9<br>PO12 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO3: Develop(L3)<br>PO4:  Analyze(L4)<br>PO5:  Apply(L3)<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3<br>3 |
| 4 | 10 | 17% | 2 | CO4 :  Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5<br>PO12 | PO1: Apply(L3)<br>PO2: Identify(L3)<br>PO3:  Develop(L3)<br>PO4:  Analyze(L4)<br>PO5:  Apply(L3)<br>PO12:  Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| 5 | 14 | 23% | 3 | CO5 : Analyze | L4 | PO2<br>PO3<br>PO4<br>PO5<br>PO9<br>PO12 | PO2:  Identify(L3)<br>PO3:  Develop(L3)<br>PO4:  Analyze(L4)<br>PO5: Apply(L3)<br>PO9:  Thumb rule<br>PO12: Thumb rule | 3<br>3<br>3<br>3<br>3<br>3 |
| | 60 | 100 % | | | | | | |

**Justification Statements :**

**CO1: Understand the** different levels of Data and Steps in Data Science
**Action Verb : Understand(L2)**
**PO1 Verb : Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
**PO2 Verb : Analyze(L4)**
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Apply the basics of probability models for data exploration**
**Action Verb : Apply (L3)**
**PO1: Apply(L3)**
CO2  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
**PO2: Identify(L3)**
CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
**PO6: Thumb rule**
For some of data exploration applications, Various probabilistic models were applied  to address societal and environmental concerns. Therefore, the correlation is Medium (2)
**PO12: Thumb rule**

For some of data exploration applications, new probability models should be explored for applying on new trends of data. Therefore the correlation is Medium (2)

**CO3: Analyze** the basics of statistics models for data exploration.
**Action Verb : Analyze (L4)**
**PO1: Apply(L3)**
CO3  Action verb is greater than PO1 verb level by one level. Therefore the correlation is high (3)
**PO2: Identify(L3)**
CO3 Action verb is greater than PO2 verb level by one level. Therefore the correlation is high (3)
**PO3: Develop(L3)**
CO3 Action verb is greater than PO3 verb level by one level. Therefore the correlation is high (3)
**PO4: Analyze(L4)**
CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO3 Action verb is greater than PO5 verb level by one level. Therefore the correlation is high (3)
**PO9 : Thumb rule**
Team work is required create multiple probability models for data exploration. Hence the correlation is high (3)
**PO12 : Thumb rule**
For some of data exploration applications, new statistical models should be explored for applying on new trends of data. Therefore the correlation is high (3)

**CO4: Analyze** the different data visualization techniques.
**Action Verb : Analyze(L4)**
**PO1: Apply(L3)**
CO4  Action verb is greater than PO1 verb level by one level. Therefore the correlation is high (3)
**PO2: Identify(L3)**
CO4 Action verb is greater than PO2 verb level by one level. Therefore the correlation is high (3)
**PO3: Develop(L3)**
CO4 Action verb is greater than PO3 verb level by one level. Therefore the correlation is high (3)
**PO4: Analyze(L4)**
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO4 Action verb is greater than PO5 verb level by one level. Therefore the correlation is high (3)
**PO12 : Thumb rule**
For some of data exploration applications, new visualization techniques should be explored for applying on new trends of data. Therefore the correlation is high(3)

**CO5: Analyze** the suitable model for real time applications.
**Action Verb : Analyze(L4)**
**PO2: Identify(L3)**
CO5 Action verb is greater than PO2 verb level by one level. Therefore the correlation is high (3)
**PO3: Develop(L3)**
CO5 Action verb is greater than PO3 verb level by one level. Therefore the correlation is high (3)
**PO4: Analyze(L4)**
CO5 Action verb is same as PO4 verb. Therefore the correlation is high (3)
**PO5: Apply(L3)**
CO5 Action verb is greater than PO5 verb level by one level. Therefore the correlation is high (3)
**PO9 : Thumb rule**
Team work is required build model for real time applications. Hence the correlation is high(3)
**PO12 : Thumb rule**
For some of data exploration applications, models should be created for new trends of data. Therefore the correlation is high(3)

| Course Code | Year & Sem | Digital Image Processing | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE0407 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the fundamental concepts of digital image processing

CO2. **Analyze** the images in frequency domain using image transforms

CO3. **Apply** the techniques for image enhancement in spatial and frequency domains

CO4. **Analyze** various image restoration and image segmentation techniques

CO5. **Evaluate** different coding methods for image compression to save memory & bandwidth.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the fundamental concepts of digital image processing | | | L2 |
| **CO2** | Analyze | the images in frequency domain | using image transforms | | L4 |
| **CO3** | Apply | the techniques for image enhancement | | in spatial and frequency domains | L3 |
| **CO4** | Analyze | the various image restoration and image segmentation techniques**.** | | | L4 |
| **CO5** | Evaluate | the different coding methods | for image compression | to save memory & bandwidth | L5 |

| UNIT - I | | 15Hrs |
|---|---|---|

**IMAGE PROCESSING FUNDAMENTALS:** Introduction to Digital Image processing – Example fields of its usage- Fundamental steps in ImageProcessing, Components of general image processing system, Image sensing and Acquisition–image Modeling- Sampling, Quantization and Digital Image representation - Basic relationships between pixels, -Mathematicaltools/ operations applied on images-imaging geometry

| UNIT - II | | 14Hrs |
|---|---|---|

**IMAGE TRANSFORMS:**

Discrete Fourier Transform- Discrete Cosine Transforms- Discrete Sine Transform,Walsh-HadamardTransforms- Haar Transform-Hotelling Transform, Comparison of properties of the above.

| UNIT - III | | 15Hrs |
|---|---|---|

**IMAGE ENHANCEMENT TECHNIQUES:** Background enhancement by point processing Histogram processing, Spatial filtering, Enhancement infrequency Domain, Image smoothing, Image sharpening, Color image enhancement

| UNIT - IV | | 16Hrs |
|---|---|---|

**IMAGE RESTORATION:** Degradation model, Algebraic approach to restoration–Inverse filtering–Least Mean Square filters, ConstrainedLeast square restoration, Blind Deconvolution.

**IMAGE SEGMENTATION:** Edge detection-,Edge linking, Threshold based segmentation methods–Region based Approaches –Template matching–use of motion in segmentation.

| UNIT - V | | 15Hrs |
|---|---|---|

**IMAGE COMPRESSION:** Redundancies in Images - Compression models, Information theoretic perspective- Fundamental coding theorem. Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding, Image Formats and compression standards.

**Textbooks:**

1. R.C .Gonzalez & R.E. Woods, "Digital Image Processing", Addison Wesley/Pearson education, 3rd Edition, 2010.
2. A.K.Jain,"Fundamentals of Digital Image processing",PHI.

| Reference Books: |
| --- |
| 1. Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, "Digital Image processing using MATLAB", Tata McGrawHill, 2010. |
| 2. Sjayaraman,SEsakkirajan,TVeerakumar,"DigitalImageprocessing",TataMcGrawHill |
| 3. WilliamK.Pratt,"DigitalImageProcessing",JohnWilely,3rdEdition,2004. |
| **Online Learning Resources:** |
| nptel videos |

## Mapping of course outcomes with program outcomes

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | 2 | | | | | | 1 | | |
| CO2 | 2 | 1 | | | | | | | | | | | | |
| CO3 | 3 | | 3 | | 3 | 2 | 1 | | | | | 2 | | |
| CO4 | 3 | | | 3 | 3 | 2 | 1 | | | | | 3 | | |
| CO5 | 3 | 2 | 2 | | | 2 | | | | | | 2 | | |

## Correlation matrix

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 20% | 2 | Understand | L2 | PO1, PO2, PO6, PO12, | PO1: Apply (L3)<br>PO2: Review (L2)<br>PO6:Thumb rule<br>PO12:Thumb rule | 2<br>3<br>2<br>1 |
| 2 | 14 | 19% | 2 | Analyze | L4 | PO1, PO2 | PO1: Apply (L3)<br>PO2: Formulate(L6) | 3<br>1 |
| 3 | 15 | 20% | 2 | Apply | L3 | PO1, PO3, PO5, PO6, PO7, PO12 | PO1: Apply(L3)<br>PO3: Develop(L3)<br>PO5: Apply(L3)<br>PO6:Thumb rule<br>PO7:Thumb rule<br>PO12:Thumb rule | 3<br>3<br>3<br>2<br>1<br>2 |
| 4 | 16 | 21% | 3 | Analyze | L4 | PO1, PO4, PO5, PO6, PO7, PO12 | PO1: Apply(L3)<br>PO4: Analyze(L4)<br>PO5: Apply(L3)<br>PO6:Thumb rule<br>PO7:Thumb rule<br>PO12:Thumb rule | 3<br>3<br>3<br>2<br>1<br>3 |
| 5 | 15 | 20% | 2 | Evaluate | L5 | PO1, PO2, PO3, PO6, PO12 | PO1: Apply(L3)<br>PO2: Formulate(L6)<br>PO3: Develop (L6)<br>PO6:Thumb rule<br>PO12:Thumb rule | 3<br>2<br>2<br>2<br>2 |
| | 75 | 100% | | | | | | |

**Justification Statements :**

**CO1: Understand the fundamental concepts of digital image processing.**
**Action Verb: Understand (L2)**
PO1 Verbs: Apply (L3)CO1 Action Verb is less than PO1 verb by one level. Therefore, the correlation is medium (2).
PO2 Vers: Review (L2)CO1 Action Verb is in the same level of less than PO2 verb. Therefore, the correlation is high (3).
PO6:  CO1 using Thumb rule, L2 correlates PO6 as medium (2).
PO12: CO1 using Thumb rule, L1 correlates PO12 as low (1).
**CO2:  Analyze the images in frequency domain using image transforms.**
**Action Verb: Analyze(L4)**

PO1 Verbs: Apply (L3)CO2 Action Verb is more than the PO1 verb. Therefore,the correlation is high (3).

PO2 Verbs: Formulate(L6)CO2 Action Verb is less than the PO2 verb by two levels.Therefore,the correlation is low (1).

**CO3: Apply the techniques for image enhancement in spatial and frequency domains.**

**Action Verb: Apply(L3)**

PO1 Verbs: Apply (L3)CO3 Action Verb is equal to PO1 verb. Therefore,the correlation is high (3).

PO3 Verb: Develop(L3)CO3 Action Verb level is in the same level of PO3 verb. Therefore,the correlation is high (3).

PO5 Verb: Apply (L3)CO3 Action Verb is equal to PO5 verb. Therefore, the correlation is high (3).

PO6: CO3 using Thumb rule, L2 correlates PO6 as medium (2).

PO7: CO3 using Thumb rule, L1 correlates PO7 as low (1).

PO12: CO3 using Thumb rule, L3 correlates PO12 as medium (2).

**CO4: Analyze various image restoration and image segmentation techniques.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)CO4 Action Verb is more than the PO1 verb.Therefore,the correlation is high (3).

PO4 Verb: Formulate (L4)CO4 Action Verb level is equal to PO4 verb. Therefore,the correlation is high (3).

PO5 Verbs: Develop (L3)CO4 Action Verb is more than the PO5 verb.Therefore, correlation is high (3).

PO6: CO4 using Thumb rule, L2 correlates PO6 as medium (2).

PO7: CO4 using Thumb rule, L1 correlates PO7 as low (1).

PO12: CO4 using Thumb rule, L4 correlates PO12 as high (3).

**CO5: Evaluate different coding methods for image compression to save memory & bandwidth.**

**Action Verb: Evaluate (L5)**

PO1 Verb: Apply (L3)CO5 Action verb is more than the PO1 verb. Therefore, the correlation is high (3).

PO2 verb: Formulate (L6)CO5 Action verb is less than the PO2 verb by one level. Therefore, the correlation is medium(2).

PO3 verb: Develop (L6)CO5 Action verb is less than the PO3 verb by one level. Therefore, the correlation is medium (2)

PO6: CO5 using Thumb rule, L2 correlates PO6 as medium (2).

PO12: CO5 using Thumb rule, L3 correlates PO12 as medium (2).

| Course Code | Year & Sem | EMBEDDED SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE0411 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the fundamental concepts of embedded systems, programming languages and tools.

CO2: **Analyze** the architecture of TM4C, instruction set, and its addressing modes for developing embedded systems.

CO3: **Understand** the microprocessor interfacing concepts and the design cycle for embedded systems

CO4:**Analyze the** microcontroller internal blocks for basic programming of embedded system

CO5: **Analyze** the real-world embedded communication protocols enabling microcontrollers to interact with external sensors and actuators.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | **Understand** | The fundamental concepts of Embedded systems. | | | L2 |
| **CO2** | **Analyze** | The architecture of TM4C, instruction set, and its addressing modes | . | For Developing embedded systems | L4 |
| **CO3** | **Understand** | The microprocessor interfacing concepts and the design cycle | | | L2 |
| **CO4** | **Analyze** | The microcontroller internal blocks | For basic programming of embedded system | | L4 |
| **CO5** | **Analyze** | The real-world embedded communication protocols | Enabling Microcontrollers to interact with external sensors and actuators. | | L4 |

| UNIT - I | INTRODUCTION TO EMBEDDED SYSTEMS | 9 Hrs |
|---|---|---|

Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

| UNIT - II | EMBEDDED PROCESSOR ARCHITECTURE | 9Hrs |
|---|---|---|

CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, addressing modes and instruction set basics.

| UNIT - III | OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS | 9 Hrs |
|---|---|---|

Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.

| UNIT - IV | MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING | 9 Hrs |
|---|---|---|

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

| UNIT - V | EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS | 9 Hrs |
|---|---|---|

Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C.Case Study: Tiva based embedded system application using the interface protocols for communication with external devices "Sensor Hub Booster Pack" Embedded Networking fundamentals, IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API. Case Study: Tiva based Embedded Networking Application: "Smart Plug with Remote Disconnect and Wi-Fi Connectivity"

**Textbooks:**

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.

2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Create space publications ISBN-13: 978-1477508992

3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-0070667640, 9780070667648

**Reference Books:**

1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors

2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop

3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015

## Mapping of course outcomes with program outcomes

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | 2 | 1 | | | | | | | | | | |
| CO2 | 2 | 2 | 2 | 2 | 2 | | | | | | | | | |
| CO3 | 2 | 2 | 2 | 3 | 2 | | | | | | | | | |
| CO4 | 2 | 2 | 2 | 1 | 2 | | | | | | | | | |
| CO5 | 2 | 2 | 2 | 1 | 2 | | | | | | | | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|----------|------------------|-----|----------------------|---------------------------------------------|----------------------------|
| 1 | CO1 :Understand | L2 | PO1<br>PO2<br>PO3<br>PO4 | PO1: Apply(L3)<br>PO2 : Identify (L3)<br>PO3: Develop (L3)<br>PO4 : Analyze (L4) | 2<br>2<br>2<br>1 |
| 2 | CO2 : Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO 3: Develop (L3)<br>PO4: Interpret (L2)<br>PO5: Apply(L3) | 2<br>2<br>2<br>2<br>2 |
| 3 | CO3 : Understand | L2 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO 3: Develop (L3)<br>PO4: Interpret (L2)<br>PO5: Apply(L3) | 2<br>2<br>2<br>3<br>2 |
| 4 | CO4 :Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO 3: Develop (L3)<br>PO4: Interpret (L2)<br>PO5: Apply(L3) | 2<br>2<br>2<br>1<br>2 |
| 5 | CO5 : Analyze | L4 | PO1<br>PO2<br>PO3<br>PO4<br>PO5 | PO1: Apply(L3)<br>PO2: Identify (L3)<br>PO 3: Develop(L3)<br>PO4: Interpret (L2)<br>PO5: Apply(L3) | 2<br>2<br>2<br>1<br>2 |

**Justification Statements :**

CO1: **Understand** the fundamental concepts of embedded systems, programming languages and tools.

**Action Verb: Understand(L2)**

**PO1 Verb:Apply(L3)**

CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb :Identify (L3)**

CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is medium (2)

**PO3Verb :Develop  (L3)**

CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is moderate (2)

**PO4 Verb : Analyze (L4)**

CO1 Action verb is greater than PO1 verb by two level. Therefore the correlation is low (1)


**CO2:Analyze** the architecture of TM4C, instruction set, and its addressing modes for developing embedded systems.

**Action Verb : Analyze(L4)**

**PO1: Apply(L3)**

CO2  Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)

**PO2 Verb : Identify (L3)**

CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)

**PO 3 Verbs: Develop  (L3)**

CO1 Action Verb is greater than PO 3 verb by onelevel; therefore correlation is moderate (2).

**PO4: Interpret (L2)**

CO2 Action verb is greater than PO4 verb by two levels. Therefore the correlation is moderate (2)

**PO5: Apply(L3)**

CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)


**CO3: Understand** the microprocessor interfacing concepts and the design cycle for embedded systems

**Action Verb :Understand(L2)**

**PO1: Apply(L3)**

CO3  Action verb is greaterthan PO1 verb by one level. Therefore the correlation is moderate (2)

**PO2 Verb : Identify (L3)**

CO3 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate (2)

**PO 3 Verbs: Develop (L3)**

CO1 Action Verb is greater than PO 3 verb by one level; therefore correlation is moderate (2).

**PO4: Interpret (L2)**

CO3 Action verb is samePO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

CO3 Action verb is same as PO5 verb by one level. Therefore the correlation is moderate (2)


**CO4: Analyze** microcontroller internal blocks for basic programming of embedded system

**Action Verb :Analyze(L4)**

**PO1: Apply(L3)**

CO4  Action verb is  greater than PO1 verb by one level. Therefore the correlation is moderate(2)

**PO2 Verb : Identify (L3)**

CO Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO 3 Verbs: Develop (L3)**

CO4 Action Verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO4: Interpret (L2)**

CO4 Action verb is greater than PO4 verb by two levels. Therefore the correlation is low (1)

**PO5: Apply(L3)**

CO4 Action verb is same as PO5 verb by one level. Therefore the correlation is moderate (2)


**CO5:Analyze** real-world embedded communication protocols enabling microcontrollers to interact with external sensors

**Action Verb :Analyze (L4)**

**PO1: Apply(L3)**

CO5  Action verb is  greater than PO1 verb by one level. Therefore the correlation is moderate (2)

**PO2 Verb : Identify (L3)**

CO5 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO 3 Verbs: Develop (L3)**

CO5 Action Verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO4: Interpret (L2)**

CO5 Action verb is greater than PO4 verb by two levels. Therefore the correlation is low (1)

**PO5: Apply(L3)**

CO5 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate (2)

| Course Code | Year & Sem | WIRELESSCOMMUNICATIONS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APE0415 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the effective bandwidth utilization to accommodate large number of mobile users by using various accessing techniques.

CO2: **Analyze** networking considerations, practical networking approaches with mobile data services.

CO3: **Understand** WAP architecture and services, WML scripts.

CO4: **Analyze** the protocols used in wireless LAN technologies.

CO5: **Apply** Various services in mobile data networks and HIPER LAN.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Bloom slevel |
|---|---|---|---|---|---|
| CO1 | Understand | The effective bandwidth utilization to accommodate large number of mobile users | | using various accessing techniques | L2 |
| CO2 | Analyze | Networking considerations, practical networking approaches with mobile data services. | | | L4 |
| CO3 | Understand | WAP architecture and services, WML scripts | | | L2 |
| CO4 | Analyze | the protocols used in wireless LAN technologies | | | L4 |
| CO5 | Apply | Various services in mobile data networks and HIPER LAN | | | L3 |

| **UNIT–I** | **INTRODUCTIONTOWIRELESSCOMMUNICATIONSANDMULTIPLEACCESSTECHNIQUES** | 9Hrs |
|---|---|---|

**INTRODUCTIONTOWIRELESSCOMMUNICATIONSANDMULTIPLEACCESSTECHNIQUES:**
Evolution of mobile radio communications, examples of Wireless Communication systems, comparison of common
Wireless Communication systems, Multiple access techniques: Introduction, FDMA, TDMA, Spread Spectrum, Multiple Access, SDMA, Packet radio, Packet radio protocols, CSMA protocols, Reservation protocols.

| **UNIT –II** | **WIRELESSNETWORKINGANDDATASERVICES** | 9Hrs |
|---|---|---|

**WIRELESSNETWORKINGANDDATASERVICES:**
Wireless Networking: Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks. Data Services: Dataservices, CCS, BISDN and ATM, Signalling System No7

| **UNIT–III** | **MOBILEIPANDWIRELESSACCESSPROTOCOL** | 9Hrs |
|---|---|---|

**MOBILEIPANDWIRELESSACCESSPROTOCOL:**
**MobileIP:** Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling. WAP: WAP Architecture, overview, WMLscripts, WAPservice, WAP session protocol.

| **UNIT–IV** | **WIRELESSLANTECHNOLOGYANDBLUETOOTH** | 9Hrs |
|---|---|---|

**WIRELESSLANTECHNOLOGYANDBLUETOOTH:**
Wireless LAN: Infrared LANs, Spread spectrum LANs, Narrow bank micro wave LANs, IEEE802.11 Protocol architecture and services. Bluetooth: Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol.

| **UNIT –V** | **MOBILEDATANETWORKSANDHIPERLAN** | 9Hrs |
|---|---|---|

**MOBILEDATANETWORKSANDHIPERLAN:**
Mobile Data Networks: GPRS and higher datarates, Short messaging service in GSM, HIPERLAN: HIPERLAN-1.

| **Textbooks:** |
|---|

1. WirelessCommunications,Principles,Practice–
TheodoreS.Rappaport,PHI,2ndEd.,2002.2.WirelessCommunicationandNetworking
2. WirelessCommunicationandNetworking–WilliamStallings,PHI,2003.
3. PrinciplesofWirelessNetworks–KavehPahLavenandP.KrishnaMurthy,PearsonEducation,2002.

**ReferenceBooks:**

1.WirelessDigitalCommunications–KamiloFeher,PHI,1999.

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 2 | | | | 2 | | | | | | 2 |
| CO2 | | 3 | | | | 3 | | | | | | 3 |
| CO3 | 3 | | | | | 2 | | | | | | 2 |
| CO4 | | 2 | | | | 3 | | | | | | 3 |
| CO5 | 3 | | | | | 2 | | | | | | 2 |

| CO | CO | | | | | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|----|----|----|----|----|----|----|----|----|----|
| | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | | |
| 1 | 13 | 22 | 2 | Understand | L2 | PO1 PO2 PO6 PO12 | PO1:Apply (L3) PO2:Identify (L3) PO6 PO12 | 3 2 2 2 |
| 2 | 12 | 20 | 3 | Analyze | L4 | PO2 PO6 PO12 | PO2: Identify (L3) PO6 PO12 | 3 3 3 |
| 3 | 11 | 18 | 2 | **Understand** | L2 | PO1 PO6 PO12 | PO1:Apply(L3) PO6 PO12 | 3 2 2 |
| 4 | 12 | 20 | 2 | **Analyze** | L4 | PO2 PO6 PO12 | PO2: Identify (L3) PO6 PO12 | 2 3 3 |
| 5 | 12 | 20 | 2 | **Apply** | L3 | PO6 PO6 PO12 | PO6: Apply (L3) PO6 P12 | 2 2 2 |
| | 60 | | | | | | | |

**CO1:** Understand the effective bandwidth utilization to accommodate large number of mobile users by using various accessing techniques.

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

> CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO2 Verbs: Review (L2)

> CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

PO6 from thumb rule L2 correlation is moderate (2)

PO12 from thumb rule L2 correlation is moderate (2)

**CO2:** Analyze networking considerations, practical networking approaches with mobile data services.

**Action Verb: Analyze (L4)**

PO2 Verbs: Identify (L3)

     CO2 Action Verb is greater than PO2 verb; Therefore correlation is high (3).

PO6 from thumb rule L4 the correlation is high (3)

PO12 from thumb rule L4 the correlation is high (3)

**CO3:** Understand WAP architecture and services, WML scripts.

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

     CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO6 from thumb rule L2 correlation is moderate (2)

PO12 from thumb rule L2 correlation is moderate (2)

**CO4:** Analyze the protocols used in wireless LAN technologies.

**Action Verb: Analyze (L4)**

PO2 Verb: Identify (L3)

     CO4 Action Verb is less than  PO2 verb; Therefore correlation is moderate(2).

PO6  from thumb rule L4 the correlation is high (3)

PO12  from thumb rule L4 the correlation is high (3)

**CO5:** Apply Various services in mobile data networks and HIPER LAN.

**Action Verb: Apply (L3)**

PO6 Verb: Apply (L3)

     CO5 Action verb is greater to PO1 verb; therefore the correlation is high (3).

PO6 from thumb rule L2 correlation is moderate (2)

PO12 from thumb rule L2 correlation is moderate (2)

| Course Code | Year & Sem | ANALOG AND DIGITAL IC APPLICATIONS | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC0425 | IV-I | | 3 | 1 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the basics of operational amplifier and its applications.
**CO2: Analyze** the Multivibrator circuits using IC555, A/D and D/A converters.
**CO3: Analyze** the operation of various filters, oscillators and waveform generators using Op-amp.
**CO4: Evaluate** the static and dynamic electrical behavior of CMOS logic families.
**CO5: Understand** the logic families of integrated circuits using TTL and CMOS.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | basics of operational amplifier and its applications. | _ | | L2 |
| CO2 | Analyze | Multivibrator circuits, | using IC555 | D/A & A/D converters | L4 |
| CO3 | Analyze | operation of various filters, oscillators and waveform generators | using Op-amp | | L4 |
| CO4 | Evaluate | static and dynamic electrical behavior of CMOS logic families | _ | | L5 |
| CO5 | Understand | logic families of integrated circuits | using TTL and CMOS | | L2 |

| UNIT - I | | 17Hrs |
|---|---|---|

OP-AMP CHARACTERISTICS:
Basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics - DC and AC characteristics, 741 Op-amp and its features, modes of operation-inverting, non-inverting, differential. Basic applications of Op-amp, instrumentation amplifier, AC amplifier, V to I and I to V converters, sample & Hold circuits, multiplier and divider, Differentiator and Integrator, Comparators, Schmitt trigger, multivibrator.

| UNIT - II | | 12Hrs |
|---|---|---|

TIMERS, D-A AND A-D CONVERTERS: Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC specifications.

| UNIT - III | | 12Hrs |
|---|---|---|

ACTIVE FILTERS & OSCILLATORS: Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation- RC, Wien, and quadrature type, waveform generators- triangular, sawtooth, square wave and VCO.

| UNIT - IV | | 10Hrs |
|---|---|---|

CMOS LOGIC: introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families.

| UNIT - V | | 12Hrs |
|---|---|---|

INTIGRATED CIRCUITS: Classification, Chip size and circuit complexity, Classification of integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector o/ps, Tristate TTL, MOS & CMOS open drain and tri- state outputs, CMOS transmission gate, IC interfacing-TTL driving CMOS & CMOS driving TTL.

**Textbooks:**

**1. Linear Integrated Circuits – D.RoyChowdhury, New Age International (p) Ltd, 2nd Edition., 2003.**

**2. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.**

**Online Learning Resources:**

nptel videos

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | 2 | | | | | | | | | | | |
| CO2 | 3 | 3 | 3 | | | | | | | | | | | |
| CO3 | 3 | 3 | 3 | 3 | | | | | | | | | | |
| CO4 | 3 | 3 | 3 | | | | | | | | | | | |
| CO5 | 2 | 3 | 2 | | | | | | | | | | | |

**Correlation Matrix**

| Unit No. | CO Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 17 | 27 | 3 | Understand | L2 | PO1, PO2, PO3 | PO1: Apply (L3)<br>PO2: Identify (L3)<br>PO3: Develop(L3) | 2<br>2<br>2 |
| 2 | 12 | 19 | 2 | Analyze | L4 | PO1, PO2, PO3, | PO1: Apply (L3)<br>PO2: Identify (L3)<br>PO3: Develop (L3) | 3<br>3<br>3 |
| 3 | 12 | 19 | 2 | Analyze | L4 | PO1, PO2, PO3,PO4 | PO1: Apply (L3)<br>PO2: Identify (L3)<br>PO3: Develop (L3)<br>PO4: Analyze (L4) | 3<br>3<br>3<br>3 |
| 4 | 10 | 16 | 2 | Evaluate | L5 | PO1, PO2, PO3, | PO1: Apply (L3)<br>PO2: Identify (L3)<br>PO3: Develop (L3) | 3<br>3<br>3 |
| 5 | 12 | 19 | 2 | Understand | L2 | PO1, PO2, PO3, | PO1: Apply (L3)<br>PO2: Review (L2)<br>PO3: Develop (L3) | 2<br>3<br>2 |
| | 63 | 100 | | | | | | |

**Justification Statements:**

**CO 1: Understand the basics of operational amplifier and its applications. Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO2 Verbs: Identify (L3) CO1 Action Verb is less than PO2 verb by one level;Therefore correlation is moderate (2).

PO3 Verbs: Develop (L3 CO1 Action Verb is less than PO3 verb by one level; Therefore correlation is moderate (2).

**CO2: Analyze the Multivibrator circuits using IC555, A/D and D/A converters.Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3) CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verbs: Identify (L3) CO2 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).

PO3 Verbs: Develop (L3) CO2 Action Verb is greater than PO3 verb by one level; Therefore correlation is high (3).

**CO3: Analyze the operation of various filters, oscillators and waveform generators using Op-amp Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3) CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verb: Identify (L3) CO3 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).

PO3 Verb: Develop (L3) CO3 Action Verb is greater than PO3 verb by one level; Therefore correlation is high (3).

PO4 Verb: Analysis (L4) CO3 Action Verb is equal to PO4 verb ; Therefore correlation is high (3).

**CO4: Evaluate the static and dynamic electrical behavior of CMOS logic families. Action Verb: Evaluate (L5)**

PO1 Verbs: Apply (L3) CO4 Action Verb is greater than PO1 verb by two level; Therefore correlation is high (3).

PO2 Verb: Identify (L3) CO4 Action Verb is greater than PO2 verb by two level; Therefore correlation is high (3).

PO3 Verb: Develop (L3) CO4 Action Verb is greater than PO2 verb by two level; Therefore correlation is high (3).

**CO5: Understand the logic families of integrated circuits using TTL and CMOS.**
**Action Verb: Understand (L2)**

PO1 Verb: Apply (L3) CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO2 verb: Review (L2) CO5 Action verb is equal to PO2 verb therefore the correlation is high (3).

PO3 verb: Develop (L3) CO5 Action verb is less than PO3 verb by one level: Therefore the correlation is moderate (2).

| Course Code | Year & Sem | SENSOR NETWORKS | L | T | P | C |
|---|---|---|---|---|---|---|
| **20APE0417** | IV-I | | **3** | **0** | **0** | **3** |

**Course Outcomes:**

After studying the course, student will be able to

CO1. **Understand** the concepts of Converters and Sensor data acquisition systems

CO2: **Understand** the concepts of Sensor Measurements for Structural Monitoring

CO3: **Apply** the concepts of commonly used sensing technologies and algorithms

CO4: **Analyze** the concepts of piezoelectric transducers for assessing and monitoring infrastructures

CO5: **Analyze** the concepts of Fiber optic sensors for assessing and monitoring infrastructures

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the concepts of Converters and Sensor data acquisition systems | | | L2 |
| **CO2** | Understand | the concepts of Sensor Measurements for | | Structural Monitoring | L2 |
| **CO3** | Apply | The concepts of commonly used sensing technologies and algorithms | | | L3 |
| **CO4** | Analyze | The concepts of piezoelectric transducers for | | assessing and monitoring infrastructures | L4 |
| **CO5** | Analyze | The concepts of Fiber optic sensors | | assessing and monitoring infrastructures | L4 |

**Unit-1 Sensor data acquisition systems and architectures**

Introduction, General measurement system, Analog-to-digital converter architectures-Different types of ADCs– parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC Digital-to-Analog Conversion-Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R- 2R DAC, Data acquisition systems-Analog Systems-Digital Systems

**Unit-II Sensors and Sensing Technology for Structural Monitoring**

Introduction, Sensor Types, Sensor Measurements in Structural Monitoring- Structural Responses- Environmental Quantities- Operational Quantities- Typical Quantities for Bridge Monitoring- Fibre Optic Sensors- Classification of Fibre Optic Sensors- Typical Fibre Optic Sensors in SHM- Fibre Optic Sensors for Structural Monitoring- Wireless Sensors- Components of Wireless Sensors- Field Deployment in Civil Infrastructure-Case Study

**Unit-III Commonly used sensors for civil infrastructures and their associated algorithms**

Introduction, commonly used sensing technologies- Displacement-Strain-Acceleration-Environment-Prevalence of commonly used sensors in SHM systems- Associated algorithms- Displacement sensors-Strain gages- Accelerometers- Environmental measurements- Examples of continuous monitoring systems

**Unit-IV Piezoelectric transducers for assessing and monitoring civil infrastructures**

Introduction, Principle of piezoelectricity, Piezoelectric materials and the fabrication of piezoelectric transducers, Piezoelectric transducers for SHM applications, Bonding effects, Limitations of piezoelectric transducers, SHM techniques using piezoelectric transducers

**Unit-V Fiber optic sensors for assessing and monitoring civil infrastructures**

Introduction, Optical fiber concepts, Sensing mechanisms, Sensor packaging, Cables, connectors, and splicing, Common optical fiber sensors- Coherent interferometers, Low-coherence interferometers, Fiber Bragg gratings, Brillouin and Raman scattering distributed sensors

**Text Books:**

"Sensor Technologies for Civil Infrastructures", Volume 1 Sensing Hardware and Data CollectionMethods for Performance Assessment Woodhead Publishing in Civil and Structural Engineering Ming L. Wang Jerome P. Lynch Hardcover ISBN: 9780857094322

2. "Wireless Sensor Networks for Civil Infrastructure Monitoring: A Best Practice Guide"ICE Publishing David Rodenas-Herráiz, Kenichi Soga, Paul R A Fidler and Nicholas de Battista

**References:**

1.      Ghatak A and Thyagarajan K. (1998) Introduction to Fiber Optics; Cambridge University Press: Cambridge, UK.

2.      Barthorpe, R.J. and Worden, K. (2009) Sensor Placement Optimization. Encyclopaedia of Structural Health Monitoring, Boller, Chang and Fujino (ed.), John Wiley & Sons, Chichester, UK.

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1: Understand-L2 | 2 | 2 | 2 | | | | | | | | | | | |
| CO2: Understand-L2 | 2 | 3 | 2 | | | | | | | | | | | |
| CO3: Apply-L3 | 3 | 2 | 3 | | 3 | | | | | | | | | |
| CO4: Analyze-L4 | 3 | 3 | 3 | 3 | 3 | 2 | | | | | | 1 | | |
| CO5: Analyze-L4 | 3 | 3 | 3 | 3 | 3 | 2 | | | | | | 1 | | |

**Correlation matrix**

| Unit No. | CO | | | | | | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|---|
| | Lesson plan(Hrs) | % | Correlation | Co's Action verb | BTL | | | | |
| 1 | 14 | 18 | 2 | Understand | L2 | | PO1,PO2,PO3 | PO1: Apply (L3) | 2 |
| | | | | | | | | PO2: Identify-L3 | 2 |
| | | | | | | | | PO3:Develop-L3 | 2 |
| 2 | 17 | 22 | 3 | Understand | L2 | | PO1,PO2,PO3 | PO1: Apply (L3) | 2 |
| | | | | | | | | PO2: Review-L2 | 3 |
| | | | | | | | | PO3:Develop-L3 | 2 |
| 3 | 16 | 20 | 2 | Apply | L3 | | PO1,PO2,PO3,PO5 | PO1: Apply (L3) | 3 |
| | | | | | | | | PO2: Analyze-L4 | 2 |
| | | | | | | | | PO3:Develop-L3 | 3 |
| | | | | | | | | PO5:Apply-L3 | 3 |
| 4 | 14 | 18 | 2 | Analyze | L4 | | PO1,PO2,PO3 PO4,PO5,PO6,PO12 | PO1: Apply (L3) | 3 |
| | | | | | | | | PO2: Identify-L3 | 3 |
| | | | | | | | | PO3:Develop-L3 | 3 |
| | | | | | | | | PO4:Analyze-L4) | 3 |
| | | | | | | | | PO5:Apply-L3 | 3 |
| | | | | | | | | PO6:ThumbRule | 2 |
| | | | | | | | | PO12:ThumbRule | 1 |
| 5 | 16 | 20 | 2 | Analyze | L4 | | PO1,PO2,PO3 PO4,PO5,PO6 PO12 | PO1: Apply (L3) | 3 |
| | | | | | | | | PO2: Identify-L3 | 3 |
| | | | | | | | | PO3:Develop-L3 | 3 |
| | | | | | | | | PO4:Analyze-L4) | 3 |
| | | | | | | | | PO5:Apply-L3 | 3 |
| | | | | | | | | PO6:ThumbRule | 2 |
| | | | | | | | | PO12:ThumbRule | 1 |
| | 77 | | | | | | | | |

**Justification Statements :**
**CO1: Understand the concepts of Converters and Sensor data acquisition systems**
**Action Verb: Understand (L2)**
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify(L3)
CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO3 Verb: Develop (L3)
CO1 Action Verb is less than PO3 verb by one level; Therefore correlation is Moderate(2).
**CO2: Understand the concepts of Sensor Measurements for Structural Monitoring**
**Action Verb: Understand (L2)**
PO1 Verbs: Apply (L3)
CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Review (L2)
CO2 Action Verb is equal to PO2 verb ; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO2 Action Verb is less than PO3 verb by one level; Therefore correlation is Moderate(2).
**CO3: Apply the concepts of commonly used sensing technologies and algorithms**
**Action Verb: Apply (L3)**
PO1 Verbs: Apply (L3)
CO3 Action Verb is equal to PO1 verb ; Therefore correlation is high (3).
PO2 Verb: Analyze(L4)
CO3 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO3 Verb: Develop (L3)
CO3 Action Verb is equal to PO3 verb ; Therefore correlation is high (3).
PO5 verb: Apply (L3)
CO3 Action verb is equal to PO5 verb therefore the correlation is high (3).
**CO4: Analyze the concepts of piezoelectric transducers for assessing and monitoring infrastructures**
**Action Verb: Analyze (L4)**
PO1 Verbs: Apply (L3)
CO4 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO2 Verb: Identify(L3)
CO4 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO4 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO4 Action Verb is equal to PO4 verb ; Therefore correlation is high (3).
PO5 verb: Apply (L3)
CO4 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO6: CO4 using thumb rule Correlates PO6 as moderate (2).
PO12: CO4 using thumb rule  Correlates PO12 as low (1).
**CO5: Analyze the concepts of Fiber optic sensors for assessing and monitoring infrastructures**
**Action Verb: Analyze (L4)**
PO1 Verbs: Apply (L3)
CO5 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO2 Verb: Identify(L3)
CO5 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO5 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO5 Action Verb is equal to PO4 verb ; Therefore correlation is high (3).
PO5 verb: Apply (L3)
CO5 Action Verb is grater than PO1 verb ; Therefore correlation is high (3).
PO6: CO5 using thumb rule Correlates PO6 as moderate (2).
PO12: CO5 using thumb rule  Correlates PO12 as low (1).

| Course Code | Year & Sem | Operations Research | L | T | P | C |
|---|---|---|---|---|---|---|
| 20APC0323 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Apply** the knowledge of operations research in solving linear programming problems

**CO2: Apply** the mathematical procedure for solving the transportation and assignment models related to real world problems

**CO3: Evaluate** the decisions to replace the items that deteriorate with time and to solve the game theory models

**CO4: Analyze** the available resources based on the priority in solving the sequencing problems

**CO5: Analyze** the simulation tools to develop the queuing and other relevant models

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Apply | the knowledge of operations | | research in solving linear programming problems | L3 |
| CO2 | Apply | the mathematical procedure for solving the transportation and assignment models | | related to real world problems | L3 |
| CO3 | Evaluate | the decisions to replace the items that deteriorates with time and | | to solve the game theory models | L5 |
| CO4 | Analyze | the available resources based on the priority | | in solving sequencing problems | L4 |
| CO5 | Analyze | the simulation tools to develop the queuing and other relevant | | | L3 |

**Unit I:**
**Introduction***: Definition, Basic OR models & Applications of OR

**Linear Programming:** Introduction, Formulation of Linear Programming (L P) problems, Graphical method of solving LP problem, simplex method, Artificial variable Technique, Degeneracy in L PP's, Duality, unbounded, infeasible and multiple optimum solution.

**Unit II:**
**Transportation Models:** Finding an initial feasible solution – North West Corner method, Least cost method, Vogel's Approximation Method; Finding the optimal solution using MODI method, Special cases in Transportation problems – Unbalanced Transportation problem, Degeneracy in transportation problem, multiple optimal solutions, prohibited routes.

**Assignment problems:** Hungarian method of Assignment problem, maximization in Assignment problem, unbalanced Assignment problem, prohibited Assignments, multiple optimum solutions

**Unit III:**
**Game Theory:** Introduction, Two-person zero sum games, Maxi-min and Mini-max principles, Principle of dominance, solution of mixed strategy problems, Graphical method for 2 x n and m x 2 games

**Replacement Models:** Introduction, replacement of items that deteriorate gradually ignoring change in money value, replacement of items that deteriorate considering

change in money value with time, replacement of items that fail suddenly – Individual replacement policy, Group replacement policy

## Unit IV:

**Sequencing Models:** Introduction, General Assumptions, Priority rules for job sequencing (Single machine Scheduling), Measures of Performance- Average Completion Time, Average Lateness; Processing n jobs thorough 2 machines, Processing n jobs through 3machines, Processing n jobs thorough m machines, Processing 2 jobs through m machines.

## Unit V:

**Queuing Theory:** Introduction, Single Channel – Poisson arrivals – Exponential service times with infinite population & finite population, Multi-channel – Poisson arrivals – Exponential service times with infinite population

**Simulation:** Introduction, Definition, Types of Simulation, Monte-Carlo Simulation, Pseudo Random Numbers, Mid-square Method of Generating Random Numbers, Application of simulation to inventory control and queuing problems.

**Text Books:**

1. S.D. Sarma, Operations Research, Kedarnnath, Ramnath& Co.,Meerut
2. N.D. Vohra, Quantitative Techniques in Management, TMH Publishers, New Delhi

**Reference Books:**

1. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi
2. Prem Kumar Gupta and Hira, Operations Research, S. Chand Publishers, New Delhi

**Articulation Matrix**

| Course Title | COs | Programme Outcomes (POs) & Programme Specific Outcomes (PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| Operations Research | CO1 | 3 | 3 | 3 | | | | | | | | | | 2 | 2 |
| | CO2 | 3 | 3 | 3 | | | | | | | | | | 1 | 2 |
| | CO3 | 3 | 3 | 3 | 1 | | | | | | | | | 2 | 2 |
| | CO4 | 3 | 3 | | | | | | | | | | | 2 | 2 |
| | CO5 | | 3 | 3 | | 3 | | | | | | | | 2 | 2 |

**Correlation Matrix**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | correlation | Verb | BTL | | | |
| 1 | 9 | 15 | L2 | Apply | L3 | PO1 | Apply (L3) | 3 |
| | | | | | | PO2 | Formulate (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| 2 | 19 | 31 | L3 | Apply | L3 | PO1 | Apply (L3) | 3 |
| | | | | | | PO2 | Identify (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| 3 | 14 | 23 | L3 | Evaluate | L5 | PO1 | Apply (L3) | 3 |
| | | | | | | PO2 | Identify (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| | | | | | | PO4 | Design (L6) | 1 |
| 4 | 8 | 13 | L2 | Analyze | L4 | PO1 | Apply (L3) | 3 |
| | | | | | | PO2 | Identify (L3) | 3 |
| 5 | 10 | 16 | L2 | Analyze | L4 | PO2 | Apply (L3) | 3 |
| | | | | | | PO3 | Develop (L3) | 3 |
| | | | | | | PO5 | Apply (L3) | 3 |

**Justification Statements:**

**CO1: Apply** the knowledge of operations research in solving linear programming problems

Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO2 Verb: **Formulate (L3)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3).

PO3 Verb: **Develop (L3)**

CO1: Action verb is same level as PO3 verb. Therefore, the correlation is high (3).


**CO2: Apply** the mathematical procedure for solving the transportation and assignment models related to real world problems.

Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**

CO2: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO2: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Apply (L3)**

CO2: Action verb is same level as PO3 verb. Therefore, the correlation is high (3)


**CO3: Evaluate** the decisions to replace the items that deteriorate with time and to solve the game theory models.

Action Verb: Evaluate (L5)

PO1 Verb: **Apply (L3)**

CO3: Action verb is same (greater) level as PO1 verb. Therefore, the correlation is high (3).

PO2 Verb: **Identify (L3)**

CO3: Action verb is same (greater) level as PO2 verb. Therefore, the correlation is high (3).

PO3 Verb: **Develop (L3)**

CO3: Action verb is same (greater) level as PO3 verb. Therefore, the correlation is high (3).

PO4 Verb: **Design (L6)**

CO3: Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).

**CO4: Analyze** the available resources based on the priority in solving the sequencing problems.
Action Verb: Analyze (L4)
PO1 Verb: **Apply (L3)**
CO4: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO4: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**CO5: Analyze** the simulation tools to develop the queuing and other relevant models
Action Verb: Analyze (L4)
PO2 Verb: **Apply (L3)**
CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).
PO3 Verb: **Develop (L3)**
CO5: Action verb is same level as PO3 verb. Therefore, the correlation is high (3).
PO5 Verb: **Apply (L3)**
CO5: Action verb is same level as PO5 verb. Therefore, the correlation is high (3).

| Course Code | Year & Sem | Management science | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AOE0302 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the management principles to take the decisions in all levels for productivity

**CO2: Analyse** the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety

**CO3: Apply** the mathematical knowledge to identify the shortest routes to achieve the goals set by the management and to improve the quality of the products in an industry

**CO4: Understand** the materials requirement to minimize the inventory costs and to maximize the profit

**CO5: Apply** the knowledge of the human resources principles in motivating the workers in the industry

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | **Understand** | the management principles to take the decisions in all levels for productivity | | In industry | L2 |
| CO2 | **Analyse** | the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety | | in manufacturing - | L4 |
| CO3 | **Apply** | the mathematical knowledge to identify the shortest routes to achieve the goals set by the management and to improve the quality of the products in an industry | | In industry | L3 |
| CO4 | **Understand** | the materials requirement to minimize the inventory costs and to maximize the profit | | in industries | L2 |
| CO5 | **Apply** | the knowledge of the human resources principles in motivating the workers in the industry | | In recruitment of manpower | L3 |

| UNIT – I | **CONCEPTS OF MANAGEMENT AND ORGANISATION** | 12 Hrs |
|---|---|---|

**CONCEPTS OF MANAGEMENT AND ORGANISATION:** Functions of management, evolution of management thought, Taylor's scientific management, fayol's principles of management, Hertzberg's Maslow's hierarchy of human needs, theory x and y, Hawthorne experiment, morale, motivation, working environmental conditions, systems approach to management**.**

| UNIT – II | **PLANT LOCATION & WORK STUDY** | 10 Hrs |
|---|---|---|

**PLANT LOCATION:** Definition, factors affecting the plant location, comparison of rural and urban sites, methods for selection of plant- matrix approach. Plant layout - definition, objectives, types of plant layout, various data analysing forms travel chart.

**WORK STUDY:** Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts, difference between micro motion and memo motion studies. Work measurement- definition, time study, steps involved, equipment, different methods of performance

rating, allowances, standard time calculation. Work Sampling - definition, steps involved, standard time calculations, and differences with time study

| UNIT – III | INTRODUCTION TO PERT / CPM | 8 Hrs |
|---|---|---|

**INTRODUCTION TO PERT / CPM:** Project management, network modelling-probabilistic model, various types of activity times estimation, programme evaluation review techniques, critical path, probability of completing the project, deterministic model, critical path method (CPM), critical path calculation, crashing of simple of networks.

**INSPECTION AND QUALITY CONTROL:** Types of inspections, statistical quality control, techniques, variables and attributes, assignable and non-assignable causes, variable control charts, and R charts, attributes control charts, p charts and c charts. Acceptance sampling plan, single sampling and double sampling plans, OC curves. Introduction to TQM - quality circles, ISO 9000 series procedures.

| UNIT – IV | MATERIALS MANAGEMENT | 8 Hrs |
|---|---|---|

**MATERIALS MANAGEMENT:** Objectives, inventory functions, types, associated costs, inventory classification techniques-ABC and VED analysis. Inventory control systems, continuous review system, periodical review system. Stores management and stores records. Purchase management, duties of purchase of manager, associated forms.

| UNIT – V | INTRODUCTION TO HUMAN RESOURCE MANAGEMENT | 10 Hrs |
|---|---|---|

**INTRODUCTION TO HUMAN RESOURCE MANAGEMENT:** Functions of HRM, job evaluation, different types of evaluation methods. Job description, merit rating, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, selling, marketing mix, product life cycle.

| Textbooks: |
|---|

1.      O. P. Khanna (2004), Industrial Engineering and Management, Dhanpat Rai, New Delhi

| Reference Books: |
|---|

1.Stoner, Freeman (2005), Gilbert, Management, 6th edition, Pearson Education, New Delhi.
2.Panner Selvam (2004), Production and Operations Management, Prentice Hall of India, New Delhi.
3.Ralph M. Barnes (2004), Motion and Time Studies, John Wiley and Sons.

**Mapping of course outcomes with program outcomes**

| Course Title | COs | Programme Outcomes (POs) & Programme Specific Outcomes (PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| Management science 20AOE0302 | CO1 | 2 | | | 1 | | | | | | | | | | |
| | CO2 | 3 | | | 3 | 3 | | | | | | | | | |
| | CO3 | 3 | 3 | | 1 | | | | | | | | | | |
| | CO4 | 2 | 2 | | 2 | | | | | | | | | | |
| | CO5 | 3 | 3 | | | | | | | | | | | | |

**Correlation matrix**

| CO | | | Program Outcomes (PO) | PO(s): Action Verb and BTL (for PO1 to PO5) | Level of Correlation |
|---|---|---|---|---|---|
| **1** | **Understand** | **L2** | PO1 | Apply (L3) | 2 |
| | | | PO4 | Design (L6) | 1 |
| **2** | **Analyse** | **L4** | PO1 | Apply (L3) | 3 |
| | | | PO4 | Analyse (L4) | 3 |
| | | | PO5 | Apply (L3) | 3 |
| **3** | **Apply** | **L3** | PO1 | Apply (L3) | 3 |
| | | | PO2 | Identify (L3) | 3 |
| | | | PO4 | Design (L6) | 1 |
| **4** | **Understand** | **L2** | PO1 | Apply (L3) | 2 |
| | | | PO2 | Identify (L3) | 2 |
| | | | PO4 | Interpret (L2) | 2 |
| **5** | **Apply** | **L3** | PO1 | Apply (L3) | 3 |
| | | | PO2 | Identify (L3) | 3 |

**Justification Statements:**
**CO1: Understand** the management principles to take the decisions in all levels for productivity
Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**
CO1 Action verb is same (lower) level as PO1 verb. Therefore, the correlation is low (2).
PO4 Verb: **Design (L6)**
CO1 Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).
**CO2: Analyze** the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety.
Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**
CO2: Action verb is same (greater) level as PO1 verb. Therefore, the correlation is high (3).
PO4 Verb: **Analyse (L4)**
CO2: Action verb is same level as PO4 verb. Therefore, the correlation is high (3).
PO5 Verb: **Apply (L3)**
CO2: Action verb is same (greater) level as PO5 verb. Therefore, the correlation is high (3).
**CO3: Apply** the mathematical knowledge to identify the shortest routes to achieve the goals set by the management and to improve the quality of the products in an industry.
Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**
CO3: Action verb is same level as PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: **Identify (L3)**
CO3: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).
PO4 Verb: **Design (L6)**
CO3: Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).
**CO4: Understand** the materials requirement to minimize the inventory costs and to maximize the profit.
Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**
CO3: Action verb is same (lower) level as PO1 verb. Therefore, the correlation is low (2).
PO2 Verb: **Identify (L3)**
CO3: Action verb is same (lower) level as PO2 verb. Therefore, the correlation is low (2).
PO4 Verb: **Interpret (L2)**
CO3: Action verb is same level as PO4 verb. Therefore, the correlation is low (2).
**CO5: Apply** the knowledge of the human resources principles in motivating the workers in the industry.
Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**
CO5: Action verb is same level as PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: **Identify (L3)**
CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).

| Course Code | Year & Sem | English For Research Paper Writing | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AOE9901 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the writing skills and level of readability.

CO2: **Apply** the rules, principles for writing abstract and introduction part of research article.

CO3: **Apply** the right methods to write the review of literature, results and conclusions.

CO4: **Apply** the special skills for writing a title, abstract, review and introduction of literature.

CO5: **Apply** the key skills for results in discussion and conclusion.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| 1 | Understand | the writing skills and level of readability | | | L2 |
| 2 | Apply | the rules, principles | for writing abstract and introduction part of research article | | L3 |
| 3 | Apply | the right methods | to write the review of literature, results and conclusions | | L3 |
| 4 | Apply | the special skills. | for writing a title, abstract, review and introduction of literature | | L3 |
| 5 | Apply | the key skills | for results in discussion and conclusion. | | L3 |

**Unit -1**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

**Unit -2**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

**Unit -3**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

**Unit – 4**

Key skills for writing a title– an abstract – an introduction – review of literature

**Unit:5**

Key skills for writing methodology – results – discussions – conclusions.

**References:**

1.Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3.Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.

4.AdrianWallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

**Mapping of COs to POs and PSOs**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | 2 | | 2 |
| 2 | | | | | 3 | | | | | 2 | | |
| 3 | | 2 | | | | | | | | | | 2 |
| 4 | | | | | | | | | | 2 | | |
| 5 | | | | | | | | | | 2 | | 2 |

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**CO-PO mapping justification:**

| CO | Percentage of contact hours over the total planned contact hours | | | CO | | Program Outcome (PO) | PO(s): Action verb and BTL (for PO1 to PO5) | Level of Correlation (0-3) |
|---|---|---|---|---|---|---|---|---|
| | Lesson Plan (Hrs) | % | corr | Verb | BTL | | | |
| 1 | 15 | 20 | **2** | **Understand** | **L2** | PO10, PO12 | Thumb Rule Thumb Rule | 2, 2 |
| 2 | 18 | 23 | **3** | **Apply** | **L3** | PO5, PO10 | Thumb Rule Thumb Rule | 2, 1 |
| 3 | 14 | 18.4 | **2** | **Apply** | **L3** | PO2, PO12 | Thumb Rule Thumb Rule | 2, 2 |
| 4 | 14 | 18.4 | **2** | **Apply** | **L3** | PO10 | Thumb Rule | 2 |
| 5 | 14 | 18.4 | **2** | **Apply** | **L3** | PO10, PO12 | Thumb Rule Thumb Rule | 2, 2 |
| | 76 | | | | | | | |

**CO1: Understand writing skills and level of readability.**
**Action Verb: Understand (L2)**
CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

**CO2: Apply the rules, principles for writing abstract and introduction part of research article.**
**Action Verb: Apply (L3)**
CO2 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).
CO2 Action Verb is Apply of BTL 3. Using Action verb, Modern Tool usage L3 correlates PO5, CO level is two less than PO, so correlation is low(1).

**CO3: Apply the right methods to write the review of literature, results and conclusions.**
**Action Verb: Apply (L3)**
CO3 Action Verb is Apply of BTL 3. Using Action verb, Problem Analysis L3 correlates PO2, CO level is one less than PO, so Correlation is Moderate (2)
CO3 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2)

**CO4:** Apply special skills for writing a title, abstract, review and introduction of literature.
**Action Verb: Apply (L3)**
CO4 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

**CO5: Apply key skills for results in discussion and conclusion.**
**Action Verb: Apply (L3)**
CO5 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

| Course Code | Year & Sem | ENTREPRENEURSHIP DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|---|
| 20AHSMB02 | IV-I | | 3 | 0 | 0 | 3 |

**Course Outcomes:**

After studying the course, student will be able to

CO1. **Understand** the concept and process of Entrepreneurship to develop entrepreneurial skills
CO2. **Analyze** the different feasibility studies to start a new enterprise.
CO3. **Analyze** the various sources of finance to entrepreneurs.
CO4. **Analyze** the role of central government and state government in promoting women Entrepreneurship.
CO5. **Analyze** the role of incubations in fostering startups.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| CO1 | Understand | the concept and process of Entrepreneurship | | to develop entrepreneurial skills | L2 |
| CO2 | Analyze | the different feasibility studies | | to start a new enterprise | L4 |
| CO3 | Analyze | the various sources of finance to entrepreneurs | | | L4 |
| CO4 | Analyze | the role of central government and state government | | in promoting women Entrepreneurship | L4 |
| CO5 | Analyze | the role of incubations | | in fostering startups | L4 |

**Unit-1 Introduction to Entrepreneurship**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**Unit-II Formulation of Business Idea**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

**Unit-III Financial Aspects of Promotion**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development.

**Unit-IV Women Entrepreneurship**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

**Unit-V Startups and Incubation**

Startups – Definition, Role of startups in India, Governmental initiatives to foster entrepreneurship across sectors. Funding opportunities for startups. Business Incubation and its benefits, Pre-Incubation and Post - Incubation process.

**Textbooks:**
1. D F Kuratko and T V Rao, "Entrepreneurship" - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013.

**References:**
1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.Janakiram and M.Rizwanaǁ "Entrepreneurship Development: Text & Cases", Excel Books, 2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

**Online Learning Resources:**
1. Entrepreneurship-Through-the-Lens-of-venture Capital
2. http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship
3. http://nptel.ac.in/courses/122106032/Pdf/7_4.pd
4. http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurship/50

**Mapping of course outcomes with program outcomes**

| Course Title | COs | Programme Outcomes (POs) & Programme Specific Outcomes (PSOs) | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| ENTREPRENEURSHIP DEVELOPMENT | CO1 | 2 | | | | | | | | | | | | | |
| | CO2 | | | 3 | 3 | | | | | | 3 | | | | |
| | CO3 | 3 | | | | | | | | | | 3 | | | |
| | CO4 | 3 | | | | | | | | | | | | | |
| | CO5 | 3 | | | | | | | | | | | | | |

| Course Outcome (CO) | Percentage of contact hours over the total planned contact hours | CO: Action verb and BTL | Program Outcome(PO) | PO: Action verb and BTL | Level of correlation (0-3) |
| --- | --- | --- | --- | --- | --- |
| CO1 | 18.86 | Understand | PO1 | Apply (L3) | 2 |
| CO2 | 18.86 | Analyze | PO3 | Apply (L3) | 3 |
| | | | PO4 | Apply (L3) | 3 |
| | | | PO10 | Thumb Rule | 3 |
| CO3 | 20.75 | Analyze | PO1 | Apply (L3) | 3 |
| | | | PO11 | Thumb Rule | 3 |
| CO4 | 18.86 | Analyze | PO1 | Apply (L3) | 3 |
| CO5 | 22.64 | Analyze | PO1 | Apply (L3) | 3 |

**Justification Statements:**

**CO1: Understand** the concept and process of Entrepreneurship to develop entrepreneurial skills

**Action Verb: Understand (L2)**

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**CO2: Analyze** the different feasibility studies to start a new enterprise.
**Action Verb: Analyze (L4)**
PO3: Apply (L3)
CO2 Action verb is more than PO3 verb. Therefore, the correlation is High (3)
PO4: Apply (L3)
CO2 Action verb is more than PO4 verb. Therefore, the correlation is High (3)
PO10: Thumb Rule
As using thumb rule CO2 correlates with PO10. Therefore, the correlation is High (3)

**CO3: Analyze** the various sources of finance to entrepreneurs.
**Action Verb: Analyze (L4)**
PO1: Apply (L3)
CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is High (3)
PO11: Thumb Rule
CO3 Action verb blooms level 4 correlates with PO11. Therefore, the correlation is High (3)

**CO4: Analyze** the role of central government and state government in promoting women Entrepreneurship**.**
**Action Verb: Analyze (L4)**
PO1: Apply (L3)
CO4 Action verb is more than PO1 verb by one level. Therefore, the correlation is High (3)

**CO5: Analyze** the role of incubations in fostering startups**.**
**Action Verb: Analyze (L4)**
PO1: Apply (L3)
CO5 Action verb is more than PO1 verb. Therefore, the correlation is High (3)

| Course Code | Year & Sem | ETHICAL HACKING | L | T | P | C |
|---|---|---|---|---|---|---|
| 20ASA3601 | **IV-I** | | **1** | **0** | **2** | **2** |

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the concepts of ethical hacking in securing systems and networks

**CO2: Apply** the password cracking techniques to gain unauthorized access to systems

**CO3: Analyze** the installation and configuration of Trojans and backdoors for testing purposes.

**CO4: Apply** the protective measures using web applications against session hijacking.

**CO5: Analyze** the different types of malware and their functionalities.

| CO | Action Verb | Knowledge Statement | Condition | Criteria | Blooms level |
|---|---|---|---|---|---|
| **CO1** | Understand | the benefits and limitations of ethical hacking | | in securing systems and networks | L2 |
| **CO2** | Apply | the password cracking techniques | | to gain unauthorized access to systems | L3 |
| **CO3** | Analyze | the installation and configuration | for testing purposes. | of Trojans and backdoors | L4 |
| **CO4** | Apply | the protective measures | using web applications | against session hijacking | L3 |
| **CO5** | Analyze | the different types of malware and their functionalities | | | L4 |

| UNIT - I | Introduction | 9Hrs |
|---|---|---|

Introduction: Hacking, Types of Hacking/Hackers, Cybercrime, Types of cybercrime, Hacker Mind set, Threats, Concept of ethical hacking, , Phases involved in hacking, Role of Ethical Hacking, Common Hacking Methodologies, Profiles of Hackers, Benefits of Ethical Hacking, Limitations of Ethical Hacking.

**Programs:**
1. Exploring different types of hackers and their motivations.
2. Investigating real-world cybercrime cases and analyzing the impact.
3. Conducting a threat assessment for a given scenario and identifying potential vulnerabilities.
4. Examining the concept of ethical hacking and its role in cybersecurity.

Analyzing common hacking methodologies and understanding the benefits and limitations of ethical hacking.

| UNIT - II | System Hacking | 9Hrs |
|---|---|---|

System hacking, Types of System hacking, hacking tools, Computer Hole, Hacking Process, Various methods of password cracking, Remote Password Guessing, Role of eavesdropping, Keystroke Loggers, Types of Keystroke Loggers, Detection, Prevention and Removal.

**Programs:**
1. Demonstrating password cracking techniques using tools like John the Ripper or Hashcat.
2. Conducting a remote password guessing attack on a vulnerable system.
3. Implementing and testing keystroke loggers to capture user activity.
4. Detecting and removing system backdoors using tools like Netcat.

Exploring countermeasures for preventing system hacking and enhancing system security.

| UNIT - III | Trojans | 9Hrs |
|---|---|---|

Trojans, Backdoors, Viruses, and Worms: Trojans and Backdoors, Overt and Covert Channels, Types of Trojans, Reverse-Connecting Trojans, Netcat Trojan ,Indications of a Trojan Attack, Wrapping, Trojan Construction Kit and Trojan Makers, Counter measure Techniques in Preventing Trojans, Trojan-Evading Techniques, System File Verification Sub objective to Trojan Countermeasures Viruses and

Worms, Difference between a Virus and a Worm, Types of Viruses, Understand Antivirus Evasion Techniques, Understand Virus Detection Methods.

**Programs:**
1. Setting up a Trojan and backdoor on a test system and understanding their functionalities.
2. Analyzing different types of Trojans and their usage in cyber attacks.
3. Identifying indications of a Trojan attack and implementing detection techniques.
4. Exploring antivirus evasion techniques and understanding virus detection methods.

Investigating Trojan countermeasures and developing strategies to prevent Trojan attacks.

| UNIT - IV | Session Hijacking | 9Hrs |
|-----------|-------------------|------|

Understanding Session Hijacking, Phases involved in Session, Hijacking, Types of Session Hijacking, and Session Hijacking Tools.

**Programs:**
1. Conducting a session hijacking attack using tools like Wireshark or Ettercap.
2. Identifying different types of session hijacking and understanding their phases.
3. Analyzing session hijacking tools and their functionalities.
4. Demonstrating countermeasures to prevent session hijacking attacks.

Assessing the security of web applications and implementing measures to protect against session hijacking.

| UNIT - V | Internet Security Analysis | 9 Hrs |
|----------|---------------------------|-------|

Introduction, What is Malware Analysis? The Goals of Malware Analysis. Malware Analysis Techniques. Basic Static Analysis, Basic Dynamic Analysis, Advanced Static Analysis, Advanced Dynamic Analysis, Types of Malware, General Rules for Malware Analysis, Malware Functionality, Downloaders and Launchers, Backdoors, Reverse Shell, RATs, Botnets, RATs and Botnets Compared, Credential Stealers, INA Interception, Hash Dumping, Keystroke Logging, Persistence Mechanisms, Trojanized System, Binaries, DLL Load-Order Hijacking, Privilege Escalation Using SeDebug Privilege, Covering Its Tracks-User-Mode Rootkits, IAT Hooking, Inline Hooking, Tools for malware analysis, ApateDNS, Autoruns, BinDiff, BinNavi, Deep Freeze.

**Programs:**
1. Performing basic static and dynamic analysis of malware samples using tools like IDA Pro or OllyDbg.
2. Analyzing different types of malware, such as downloaders, backdoors, or RATs.
3. Exploring techniques for malware detection and functionality analysis.
4. Investigating persistence mechanisms used by malware and developing countermeasures.
5. Utilizing tools like ApateDNS, Autoruns, or BinDiff for malware analysis and forensic investigations.

**Textbooks:**

"CEH Certified Ethical Hacker All-in-One Exam Guide, Fourth Edition" by Matt Walker, McGraw-Hill Education Publisher, 4th Edition (2019)

**Reference Books:**
1. "Metasploit: The Penetration Tester's Guide" by David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni, No Starch Press Publisher, 1st Edition (2011)
2. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" by DafyddStuttard, Marcus Pinto Publisher: Wiley, 2nd Edition (2011)

"Hacking: The Art of Exploitation" by Jon Erickson, No Starch Press Publisher, 2nd Edition (2008).

**Mapping of course outcomes with program outcomes**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | | | | | | | | | | 1 | | |
| CO3 | 3 | 3 | 1 | | | | | | 1 | | | 1 | | |
| CO4 | 3 | 2 | | | | | | | | | | | | |
| CO5 | | 3 | 1 | 1 | | | | 2 | 1 | | | 2 | | |

**Correlation matrix**

| Unit No. | Co's Action verb | BTL | Program Outcome (PO) | PO(s) :Action Verb and BTL(for PO1 to PO12) | Level of Correlation (0-3) |
|-----|-----|-----|-----|-----|-----|
| 1 | CO1 : Understand | L2 | PO1 | PO1: Apply(L3) | 2 |
| | | | PO2 | PO2: Analyze(L4) | 1 |
| 2 | CO2 : Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 3 | CO3 :Analyze | L4 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 1 |
| 4 | CO4 :Apply | L3 | PO1 | PO1: Apply(L3) | 3 |
| | | | PO2 | PO2: Analyze (L4) | 2 |
| 5 | CO5 : Analyze | L4 | PO2 | PO2: Analyze (L4) | 3 |
| | | | PO3 | PO3: Design (L6) | 1 |
| | | | PO4 | PO4: Design (L6) | 1 |
| | | | PO8 | PO8 : Thumb rule | 2 |
| | | | PO9 | PO9:  Thumb rule | 1 |
| | | | PO12 | PO12: Thumb rule | 2 |

**Justification Statements :**

**CO1: Understand** the benefits and limitations of ethical hacking in securing systems and networks
**Action Verb : Understand (L2)**

PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2: Apply** the password cracking techniques to gain unauthorized access to systems
**Action Verb : Apply (L3)**
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO12: Thumb rule
For cracking techniques to gain unauthorized access to systems is life long learning. Therefore the correlation is low (1)

**CO3: Analyze** the installation and configuration of Trojans and backdoors for testing purposes.
**Action Verb : Analyze(L4)**
PO1: Apply(L3)
CO3  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO9 : Thumb rule
Team work is required for testing purposes. Hence the correlation is low (1)
PO12: Thumb rule
Configuration of Trojans and backdoors can be life long learning. Therefore the correlation is low (1)

**CO4: Apply** the protective measures using web applications against session hijacking.
**Action Verb : Apply (L3)**
PO1: Apply(L3)
CO4  Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4  Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**CO5: Analyze** the different types of malware and their functionalities.
**Action Verb : Analyze (L4)**
PO2: Analyze (L4)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
PO4: Design (L6)
CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
PO8 : Thumb rule
Ethical hacking protects user data in society providing security. Hence the correlation is medium (2)
PO9 : Thumb rule
Team work is requited to constantly protect data from malware. Hence the correlation is low (1)
PO12: Thumb rule
Analyze the different types of malware.is life long learning. Therefore the correlation is medium (2)