



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES  
(AUTONOMOUS)**

Venkatapuram (V), Karakambadi Road, Renigunta (M), Tirupati – 517 520

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**COURSE STRUCTURE and SYLLABI**

**Under AK23 Regulation**

For the students admitted into

B. Tech., Regular Four Year **Computer Science and Engineering (IoT and Cyber Security including Blockchain Technology)** Degree Programme

From the Academic Year 2023-24

&

B. Tech., Lateral Entry Scheme

From the Academic Year 2024-25

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Approved by AICTE, New Delhi & Permanent Affiliation to JNTUA, Anantapuramu.  
Recognized under sections 2(f) & 12(B) of UGC Act 1956. A few programmes Accredited by NBA-New Delhi.  
Accredited by NAAC in grade "A"-Bangalore & IEI Kolkata. A-Grade awarded by AP Knowledge Mission.

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)  
(Effective for the batches admitted in 2023-24)**

**INDUCTION PROGRAM - Semester I (First year)**

S. No	Course Name	Category	L-T-P-C
1	Physical Activities--Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counseling	MC	2-0-2-0
3	Orientation to all branches –career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch—corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills –focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

**Semester I (First year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits C	CIE	SEE	Total
				L	T / CLC	P				
1	HM	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	BS	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	BS	23ABS9904	Linear Algebra and Calculus	2	1	0	3	30	70	100
4	ES	23AES0101	Basic Civil and Mechanical Engineering	2	1	0	3	30	70	100
5	ES	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and wellness, Yoga and Sports	0	0	1	0.5	50	-	50
<b>Total</b>				<b>10</b>	<b>04</b>	<b>11</b>	<b>19.5</b>	<b>320</b>	<b>630</b>	<b>950</b>

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**Semester II (First year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	BS	23ABS9905	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
3	ES	23AES0201	Basic Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
6	PC	23APC0501	Data Structures	2	1	0	3	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical and Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0502	Data Structures Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts and Guides/Community Service	0	0	1	0.5	50	-	50
<b>Total</b>				<b>09</b>	<b>04</b>	<b>15</b>	<b>20.5</b>	<b>320</b>	<b>630</b>	<b>950</b>

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**Semester III (Second year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	BS	23ABS9913	Discrete Mathematics and Graph Theory	2	1	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	2	1	0	3	30	70	100
3	PC	23APC0503	Digital Logic and Computer Organization	2	1	0	3	30	70	100
4	PC	23APC0504	Advanced Data Structures and Algorithms Analysis	2	1	0	3	30	70	100
5	PC	23APC0506	Object-Oriented Programming Through JAVA	2	1	0	3	30	70	100
6	PC	23APC0505	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0507	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	1	2	2	30	70	100
9	MC	23AMC9901	Environmental Science	2	0	0	-	30	-	30
<b>Total</b>				<b>12</b>	<b>06</b>	<b>08</b>	<b>20</b>	<b>270</b>	<b>560</b>	<b>830</b>

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**Semester IV (Second year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	HM	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	BS	23ABS9917	Number Theory and Applications	2	1	0	3	30	70	100
3	PC	23APC0510	Operating Systems	2	1	0	3	30	70	100
4	PC	23APC0508	Database Management Systems	2	1	0	3	30	70	100
5	PC	23APC3601	Computer Networks	2	1	0	3	30	70	100
6	PC	23APC3602	Computer Networks and OS Lab	0	0	3	1.5	30	70	100
7	PC	23APC0509	Database Management Systems Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0503	Full Stack Development-1	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking and Innovation	0	1	2	2	30	70	100
<b>Total</b>				<b>10</b>	<b>06</b>	<b>10</b>	<b>21</b>	<b>270</b>	<b>630</b>	<b>900</b>
<b>Mandatory Community Service Project Internship of 08 weeks duration during summer vacation</b>										

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**Semester V (Third Year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	PC	23APC3603	Internet of Things	2	1	0	3	30	70	100
2	PC	23APC3604	Introduction to Cyber Security	2	1	0	3	30	70	100
3	PC	23APC3605	Cyber Crimes & Digital Forensics	2	1	0	3	30	70	100
4	PE-I	23APE3601 23APE3602 23APE3603 23APE3604	1. Software Engineering 2. Wireless Sensor Networks 3. Artificial Intelligence 4. Cryptography and Network Security	2	1	0	3	30	70	100
5	OE-I		OPEN ELECTIVE-I	2	1	0	3	25	75	100
6	PC	23APC3606	Internet of Things Lab	0	0	3	1.5	30	70	100
7	PC	23APC3607	Cyber Security Lab	0	0	3	1.5	30	70	100
8	SC	23ASC9901	Soft skills	0	1	2	2	30	70	100
9	ES	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	ES	23AES0504	Introduction to Quantum Technologies and Applications	2	1	0	3	30	70	100
11	INTRN	23APR3601	Community Service Project	-	-	-	2	100	00	100
<b>Total</b>				<b>12</b>	<b>07</b>	<b>10</b>	<b>26</b>	<b>395</b>	<b>705</b>	<b>1100</b>
<b>Mandatory Community Service Project Internship of 08 weeks duration during summer vacation</b>										

**Open Elective – I**

<b>S. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1.	23AOE0101	Green Buildings	CIVIL
2.	23AOE0102	Construction Technology and Management	
3.	23AOE0201	Electrical Safety Practices and Standards	EEE
4.	23AOE0301	Sustainable Energy Technologies	ME
5.	23AOE0401	Electronic Circuits	ECE
6.	23AOE9901	Mathematics for Machine Learning and AI	Mathematics
7.	23AOE9906	Materials Characterization Techniques	Physics
8.	23AOE9911	Chemistry of Energy Systems	Chemistry
9.	23AOE9915	English for Competitive Examinations	Humanities
10.	23AOEMB01	Entrepreneurship and New Venture Creation	MBA

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**Semester VI (Third year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	PC	23APC3608	Big data Analytics for IoT	2	1	0	3	30	70	100
2	PC	23APC3609	Cloud Computing	2	1	0	3	30	70	100
3	PC	23APC3610	Blockchain Technology	2	1	0	3	30	70	100
4	PE-II	23APE3605 23APE3606 23APE3607 23APE3608	1. DevOps 2. Applied Cryptography 3. Automata Theory and Compiler Design 4. Machine Learning	2	1	0	3	30	70	100
5	PE-III	23APE3609 23APE3610 23APE3611 23APE3612	1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Security Assessment and Risk Analysis	2	1	0	3	30	70	100
6	OE-II		OPEN ELECTIVE-II	2	1	0	3	25	75	100
7	PC	23APC3611	Cloud Computing Lab	0	0	3	1.5	30	70	100
8	PC	23APC3612	Blockchain Technology Lab	0	0	3	1.5	30	70	100
9	SC	23ASC3601	Full Stack Development-2	0	1	2	2	30	70	100
10	SC	23ASC3602	Technical Workshop	-	-	-	-	-	-	-
11	Audit	23AMC9902	Technical Paper Writing and IPR	2	0	0	-	30	-	30
<b>Total</b>				<b>14</b>	<b>07</b>	<b>08</b>	<b>23</b>	<b>295</b>	<b>635</b>	<b>930</b>

**NOTE: Workshop can be conducted either in III-I or III-II and participation certificate with 90% or above of attendance should be submitted to Examination Section before III-II regular exam notification released.**

**Open Elective – II**

<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1.	23AOE0101	Green Buildings	CIVIL
2.	23AOE0102	Construction Technology and Management	
3.	23AOE0202	Renewable Energy Sources	EEE
4.	23AOE0302	Automation and Robotics	ME
5.	23AOE0402	Digital Electronics	ECE
6.	23AOE9902	Optimization Techniques	Mathematics
7.	23AOE9903	Mathematical Foundation of Quantum Technologies	
8.	23AOE9907	Physics Of Electronic Materials And Devices	Physics
9.	23AOE9912	Chemistry Of Polymers and Applications	Chemistry
10.	23AOE9916	Academic Writing and Public Speaking	Humanities

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**Semester VII (Fourth year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	PC	23APC3613	IoT Applications development on Cloud Platform	2	1	0	3	30	70	100
2	MC-II	23AHMMB02 23AHMMB03 23AHMMB04	1. Business Ethics and Corporate Governance 2. E-Business 3. Management Science	2	0	0	2	30	70	100
3	PE-IV	23APE3613 23APE3614 23APE3615 23APE3616	1. Deep Learning 2. Malware Analysis and Reverse Engineering 3. Crypto Currency 4. Network Management Systems and Operations	2	1	0	3	30	70	100
4	PE-V	23APE3617 23APE3618 23APE3619 23APE3620	1. Cyber Laws and Security Policies 2. Intrusion Detection and Prevention System 3. Metaverse 4. Augmented Reality / Virtual Reality	2	1	0	3	30	70	100
5	OE-III		OPEN ELECTIVE-III	2	1	0	3	25	75	100
6	OE-IV		OPEN ELECTIVE-IV	2	1	0	3	25	75	100
7	SC	23ASC3603	Ethical Hacking	0	1	2	2	30	70	100
8	MC	23AMC9903	Gender Sensitization	2	0	0	-	30	00	30
9	INTRN	23APR3602	Industry Internship	-	-	-	2	100	00	100
<b>Total</b>				<b>14</b>	<b>06</b>	<b>02</b>	<b>21</b>	<b>330</b>	<b>500</b>	<b>830</b>

**Open Elective – III**

<b>S. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1	23AOE0105	Building Materials and Services	CIVIL
2	23APE0103	Environmental Impact Assessment	
3	23AOE0203	Smart Grid Technologies	EEE
4	23AOE0303	3D Printing Technologies	ME
5	23APC0412	Microprocessors and Microcontrollers	ECE
6	23AOE9904	Wavelet transforms and its applications	Mathematics
7	23AOE9908	Smart Materials And Devices	Physics
8	23AOE9909	Introduction to Quantum Mechanics	
9	23AOE9913	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
10	23AOE9917	Employability Skills	Humanities

**Open Elective – IV**

<b>S. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1	23AOE0106	Geo-Spatial Technologies	CIVIL
2	23AOE0107	Solid Waste Management	
3	23AOE0204	Electric Vehicles	EEE
4	23AOE0304	Total Quality Management	ME
5	23AOE0403	Transducers and Sensors	ECE
6	23AOE9905	Financial Mathematics	Mathematics
7	23AOE9910	Sensors And Actuators for Engineering Applications	Physics
8	23AOE9914	Chemistry of Nano materials and Applications	Chemistry
9	23AOE9918	Literary Vibes	Humanities

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**Semester VIII (Fourth year)**

<b>S.No.</b>	<b>Category</b>	<b>Course Code</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>CIE</b>	<b>SEE</b>	<b>TOTAL</b>
1	Industry Internship	23APR3603	Industry Internship (Long Term)	0	0	12	4	100	00	100
2	Project Work	23APR3604	Project Work	0	0	12	8	60	140	200
			TOTAL	<b>00</b>	<b>00</b>	<b>24</b>	<b>12</b>	<b>160</b>	<b>140</b>	<b>300</b>

**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)**

**Eligibility for Honors Degree Registration:**

A student is eligible to register for Honors program in the fourth semester, provided the results of the first three semesters have been declared. The student must have an average CGPA of 7.0 or above, with no backlogs in any of the semesters. Upon meeting these criteria, the student may be allowed to register by the end of the third semester and can take a maximum of two Honor-related subjects per semester from the fourth semester onwards.

**Restrictions on Course Selection:**

A student shall not be allowed to choose Open Electives, Minor courses that have content substantially similar to those already covered in their primary major program.

**Course and Credit Requirements for Honors Degree:**

Students may select courses from a list approved by the Board of Studies (BoS), choosing either 3-credit or 4-credit courses based on their availability on the SWAYAM-NPTEL platform. To complete an honor, students must earn a minimum of 18 credits through theory courses by successfully passing the selected courses.

<b>S. No</b>	<b>SUB.CODE</b>	<b>COURSE NAME</b>	<b>WEEKS</b>	<b>CREDITS</b>
1	23AHN3601	Introduction To Industry 4.0 And Industrial Internet Of Things	12 Weeks	3
2	23AHN3602	Privacy and Security in Online social media	12 Weeks	3
3	23AHN3603	Reinforcement Learning	12 Weeks	3
4	23AHN3604	Introduction to Large Language Models (LLMs)	12 Weeks	3
5	23AHN3605	Deep Learning	12 Weeks	3
6	23AHN3607	Cyber Security and Privacy	12 Weeks	3
7	23AHN3608	Edge Computing	12 Weeks	3
8	23AHN3609	Responsible & Safe AI Systems	12 Weeks	3
9	23AHN3610	Practical Cyber Security for Cyber Security Practitioners	12 Weeks	3
10	23AHN3611	Computer Vision	12 Weeks	3
11	23AHN3612	Real-Time Systems	12 Weeks	3
12	23AHN3613	Artificial Intelligence: Knowledge Representation And Reasoning	12 Weeks	3
13	23AHN3614	Business Intelligence & Analytics	12 Weeks	3
14	23AHN3615	Systems and Usable Security	12 Weeks	3
15	23AHN3616	Quantum Algorithms and Cryptography	12 Weeks	3
16	23AHN3617	Foundation of Cloud IoT Edge ML	12 Weeks	3
		<b>TOTAL</b>		<b>18</b>

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**B. Tech program in COMPUTER SCIENCE AND ENGINEERING (IoT and Cyber Security including  
Blockchain Technology)**

**MINORS DEGREE in Cyber Security and Blockchain Technology Offered to CE/EEE/ME/ECE**

**Eligibility for Minor Degree Registration:**

A student is eligible to register for Minor program in the fourth semester, provided the results of the first three semesters have been declared. The student must have an average CGPA of 7.0 or above, with no backlogs in any of the semesters. Upon meeting these criteria, the student may be allowed to register by the end of the third semester and can take a maximum of two Minor-related subjects per semester from the fourth semester onwards.

**Restrictions on Course Selection:**

A student shall not be allowed to choose Open Electives or Honors courses that have content substantially similar to those already covered in their primary major program.

**Course and Credit Requirements for Minor Degree:**

Students may select courses from a list approved by the Board of Studies (BoS), choosing either 3-credit or 4-credit courses based on their availability on the SWAYAM-NPTEL platform. To complete a Minor, students must earn a minimum of 18 credits—15 credits through theory courses and 3 credits for a Minor project—by successfully passing the selected courses.

<b>S. No</b>	<b>SUB.CODE</b>	<b>COURSE NAME</b>	<b>WEEKS</b>	<b>CREDITS</b>
1	23AMN3601	Operating System Fundamentals	12 Weeks	3
2	23AMN3602	Introduction to Internet of Things	12 Weeks	3
3	23AMN3603	Blockchain and its Applications	12 Weeks	3
4	23AMN3604	Cloud Computing	12 Weeks	3
5	23AMN3605	Cyber Security and Privacy	12 Weeks	3
6	23AMN3607	Computer Networks and Internet Protocols	12 Weeks	3
7	23AMN3608	Foundation of Cloud IoT Edge ML	12 Weeks	3
8	23AMN3609	Foundations of Cyber Physical Systems	12 Weeks	3
9	23AMN3610	Cryptography and Network Security	12 Weeks	3
10	23AMN3611	Ethical Hacking	12 Weeks	3
11	23AMN3612	Data Analytics with Python	12 Weeks	3
12	23AMN3613	Minor Project (Mandatory)		3
		<b>TOTAL</b>		<b>18</b>

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**Semester I (First year)**

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits C	CIE	SEE	Total
				L	T / CLC	P				
1	HM	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	BS	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	BS	23ABS9904	Linear Algebra and Calculus	2	1	0	3	30	70	100
4	ES	23AES0101	Basic Civil and Mechanical Engineering	2	1	0	3	30	70	100
5	ES	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and wellness, Yoga and Sports	0	0	1	0.5	50	-	50
<b>Total</b>				<b>10</b>	<b>04</b>	<b>11</b>	<b>19.5</b>	<b>320</b>	<b>630</b>	<b>950</b>



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI  
(Autonomous)**

(Effective for the batches admitted from 2023-24)

**Year: I B.Tech**

**(Common to all branches)**

Semester: I

Subject Code 23AHM9901	Subject Name <b>Communicative English</b>	L 2	T 0	P 0	Credit: 2	CLC: 0
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Pre-Requisites	Communicative English	Semester	<b>I &amp; I</b>
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**Course Outcomes (CO):** Student will be able to

- CO1:** Understand reading / listening texts and to write summaries based on global comprehension of these texts. **(Listening & Reading)**
- CO2:** Apply grammatical structures to formulate sentences and correct word forms. **(Grammar)**
- CO3:** Analyze discourse markers to speak clearly on a specific topic in formal and informal conversations. **(Speaking)**
- CO4:** Analyze a coherent paragraph interpreting graphic elements, figure/graph/chart/table **(Read & Write)**
- CO5:** Create a coherent essay, letter writing, report writing and design a resume. **(Writing)**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	reading / listening texts and to write summaries based on global comprehension of these texts.			L2
2	Apply	grammatical structures to formulate sentences and correct word forms			L3
3	Analyze	Analyze discourse markers to speak clearly on a specific topic in formal and informal conversations...			L4
4	Analyze	coherent paragraph interpreting a graphic elements.			L4
5	Create	coherent essay, letter writing, report writing and design a resume			L6

**UNIT I**

**Lesson: HUMAN VALUES: Gift of Magi (Short Story)**

**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:** Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

**Grammar:** Parts of Speech, Basic Sentence Structures-forming questions

**Vocabulary:** Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

**UNIT II**

**Lesson: NATURE: The Brook by Alfred Tennyson (Poem)**

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

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

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

**Writing:** Structure of a paragraph - Paragraph writing (specific topics) **Grammar:** Cohesive devices - linkers, use of articles and zero article;

prepositions. **Vocabulary:** Homonyms, Homophones, Homographs.

**UNIT III**

**Lesson: BIOGRAPHY: Elon Musk**

**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, Note-making, paraphrasing

**Grammar:** Verbs - tenses; subject-verb agreement.

**Vocabulary:** Compound words, Collocations

#### UNIT IV

**Lesson: INSPIRATION: The Toys of Peace by Saki**

**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, Resumes, Cover letters

**Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice

**Vocabulary:** Words often confused, Jargons

#### UNIT V

**Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)**

**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

**Reading:** Reading comprehension.

**Writing:** Writing structured essays on specific topics.

**Grammar:** Editing short texts -identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

**Vocabulary:** Idiom and phrases & Phrasal verbs

#### Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1<sup>st</sup> Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

#### Reference Books:

1. Dubey, Sham Ji& Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.
5. SUP | 978-93-92184-99-4 | Communication English (JNTU) - Dr. V. B. Chithra

#### WEB RESOURCES:

#### GRAMMAR:

1. [www.bbc.co.uk/learningenglish](http://www.bbc.co.uk/learningenglish)
2. <https://dictionary.cambridge.org/grammar/british-grammar/>
3. [www.eslpod.com/index.html](http://www.eslpod.com/index.html)
4. <https://www.learngrammar.net/>
5. <https://english4today.com/english-grammar-online-with-quizzes/>
6. <https://www.talkenglish.com/grammar/grammar.aspx>

#### VOCABULARY

1. <https://www.youtube.com/c/DailyVideoVocabulary/videos>
2. [https://www.youtube.com/channel/UC4cmBAit8i\\_NJZE8qK8sfpA](https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA)

### Correlation of COs with the POs & PSOs for B.Tech

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1									2		
CO2								2	2		
CO3									3		
CO4									3		
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 PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	12	22	3	Understand	L2	PO9	Thumb Rule	2
2	12	22	3	Apply	L3	PO8,PO9	Thumb Rule	2,2
3	10	18	2	Analyze	L4	PO9	Thumb Rule	3
4	10	18	2	Analyze	L4	PO9	Thumb Rule	3
5	10	18	2	Create	L6	PO9	Thumb Rule	3

**CO1:** Understand reading / listening text and to write summaries based on global comprehension of these texts.

**Action Verb: Understand (L2)**

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 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 PO11 as moderate (2) & (2)

**CO3: Analyze discourse markers to speak clearly on a specific topic in Formal and informal Conversations.**

**Action Verb: Analyze (L4)**

CO3 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

**CO4: Analyze a coherent paragraph interpreting graphic elements, figure/graph/chart/table (Read & Write)**

**Action Verb: Analyze (L4)**

CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L6 correlates PO6 to PO11 as high (3).

**CO5: Create a coherent essay, letter writing, report writing and design a resume.(Writing)**

**Action Verb: Create(L6)**

CO5 Action Verb Create is of BTL 6. Using Thumb rule, L5 correlates PO6 to PO1 as high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI**  
(Autonomous)

(Effective for the batches admitted from 2023-24)

**Year: I B.Tech**  
**AI&ML)**

**(Semester: I CSE, CIC, CSD& EEE) (Semester: II ECE, AI&DS &**

<b>Subject Code:</b> 23ABS9901	<b>Subject Name:</b> Chemistry	L	T/CLC	P	Credits:3
		2	1	0	

Course Outcomes (CO): At the end of the course students will be able to

- 1. Understand** the interaction of energy levels between atoms and molecules
- 2. Apply** the principle of Band diagrams in the conductors and semiconductors
- 3. Apply** the electrochemical principles to the construction of batteries, fuel cells and sensors
- 4. Analyze** the preparation and mechanism of plastics, Elastomers and conducting polymers
- 5. Analyze** the separation of liquid mixtures using instrumental methods.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	the interaction of energy levels		between atoms and molecules	L2
2	<b>Apply</b>	principle of Band diagrams	conductors and semiconductors		L3
3	<b>Apply</b>	electrochemical principles to the construction of batteries, fuel cells and sensors			L3
4	<b>Analyze</b>	preparation and mechanism of plastics, Elastomers and conducting polymers			L4
5	<b>Analyze</b>	the separation of liquid mixtures	using instrumental methods		L4

**UNIT I: Structure and Bonding Models**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of  $\Psi$  and  $\Psi^2$ , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O<sub>2</sub> and CO, etc.  $\pi$ -molecular orbitals of butadiene and benzene, calculation of bond order.

**UNIT II: Modern Engineering materials**

**Semiconductors:** Introduction, basic concept, application

**Super conductors:** Introduction basic concept, applications.

**Super capacitors:** Introduction, Basic Concept-Classification – Applications.

**Nano materials:** Introduction, classification, properties and applications of Fullerenes, carbon Nano tubes and Graphines nanoparticles.

**UNIT III Electrochemistry and Applications**

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

**Electrochemical sensors** – potentiometric sensors with examples, amperometric sensors with examples.

**Primary cells** – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

**UNIT IV Polymer Chemistry**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

**Plastics** –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

**Elastomers**–Buna-S, Buna-N–preparation, properties and applications.

**Conducting polymers** – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Poly Lactic Acid (PLA).

## UNIT V Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

### Textbooks:

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. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition
4. Seven Hills | 978-93-94122-28-4 | Chemistry (JNTU) - Dr. N. Devenna

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	2										
2	3										
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)
	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	Apply	L3	PO2	PO1: Apply (L3)	3
4	10	13	20.3	3	Analyze	L4	PO2	PO2: Analyze (L4)	3
5	10	12	18.7	3	Analyze	L4	PO1	PO2: Analyze (L4)	3

#### CO1: Understand the fundamentals of 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 electrochemical principles to construct batteries

##### Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

#### CO3: Apply electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors

##### Action Verb: Apply (L3)

PO2 Verb: Apply (L3)

CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

#### CO4: Analyze the preparation and mechanism of polymers

##### Action Verb: Analyze (L4)

PO2 Verb: Analyze (L4)

CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

#### CO5: Analyze the identification of individual components

##### Action Verb: Analyze (L4)

PO1 Verb: Analyze (L4)

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



Year : I Semester : I

Branch of Study : Common to

All

<b>Subject Code:</b> 23ABS9904	<b>Subject Name: Linear Algebra and Calculus</b>	<b>L</b> <b>2</b>	<b>T/CLC</b> <b>1</b>	<b>P</b> <b>0</b>	<b>Credits</b> <b>3</b>	
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**Course Outcomes (CO):**

Student will be able to

- CO1. **Analyze** the matrix algebraic techniques for engineering applications.
- CO2. **Understand** the concept of Eigen values, Eigen vectors and quadratic forms.
- CO3. **Analyze** the mean value theorems for real time applications.
- CO4. **Apply** the concepts of partial differentiation to functions of several variables.
- CO5. **Apply** the multivariable integral calculus for computation of Area and Volume.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Analyze</b>	the matrix algebraic techniques	for engineering applications.		<b>L4</b>
2	<b>Understand</b>	the concept of eigen values, eigen vectors and quadratic forms.	-		<b>L2</b>
3	<b>Analyze</b>	the mean value theorems	for real time applications.		<b>L4</b>
4	<b>Apply</b>	the concept of Maxima and Minima	to functions of several variables.		<b>L3</b>
5	<b>Apply</b>	the multivariable integral calculus	for computation of Area and volume.		<b>L3</b>

**Unit I: Matrices**

**12hrs**

Rank of a matrix by Echelon form, Normal form, Cauchy-Binet formula (without proof). Inverse of Non-singular matrices by Gauss-Jordan method, system of linear equations: solving system of Homogeneous and Non-homogeneous equations by Gauss Elimination method, Jacobi and Gauss Seidel Iteration methods.

**Unit II: Eigen values, Eigen vectors and Orthogonal Transformation**

**9hrs**

Eigen values, Eigen vectors and their properties, Diagonalization of a matrix, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and Nature of the Quadratic forms, Reduction of quadratic form to canonical forms by Orthogonal Transformation.

**Unit III: Calculus**

**9hrs**

Mean Value Theorems: Rolle's theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof), problems and applications on the above theorems.

**Unit IV: Partial differentiation and Applications (Multi Variable Calculus)**

**10hrs**

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables, Jacobians, Functional dependence, Maxima and Minima of functions of two variables, method of Lagrange multipliers.

**Unit V: Multiple Integrals**

**10hrs**

Double integrals, triple integrals change of order of integration, change of Variables to polar, Cylindrical and Spherical coordinates, Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**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. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 25th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)
6. S | 978-93-91421-57-1 | Linear Algebra & Calculus (JNTU) - Dr. M. C. Raju

**Mapping of COs to POs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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		correlation	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%		Verb	BTL			
1	10	14	2	Analyze	L4	PO2	Analyze	3
2	15	21.4	3	Understand	L2	PO2	Apply	2
3	15	21.4	3	Analyze	L4	PO2	Analyze	3
4	16	22.8	3	Apply	L3	PO1	Apply	3
5	14	20	3	Apply	L3	PO1	Apply	3

**CO1:** Analyze the matrix algebraic techniques that are needed for engineering applications.

**Action Verb: Analyze(L4)**

PO2 Verbs: Analyze (L4)

CO1 Action Verb is equal to PO2 verb ; Therefore correlation is high (3).

**CO2:** Understand the concept of eigen values, eigen vectors and quadratic forms.

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

CO2 Action Verb is low level to PO1 verb by one level; Therefore correlation is moderate (2).

**CO3:** Analyze the mean value theorems for real life problems.

**Action Verb: Analyze (L4)**

PO1 Verb: Analyze (L4)

CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

**CO4:** Apply the concept of Maxima and Minima of functions of several variables.

**Action Verb: Apply (L3)**

PO2 Verb: Apply (L3)

CO4 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO5:** Apply the multivariable integral calculus for computation of area and volume.

**Action Verb: Apply(L3)**

PO1 Verb: Apply (L3)

CO5 Action verb is high level to PO1 verb; therefore the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	Basic Civil and Mechanical Engineering	L	T	P	C
23AES0101	I-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society

CO2: Apply the methods of surveying in finding the measurements on Earth surface

CO3: Understand the importance of transportation, water resources and environmental engineering

CO4: Understand the applications and role of various materials in Mechanical Engineering.

CO5: Understand the different manufacturing processes and the basics of thermal engineering with its applications.

CO6: Understand the working of different mechanical power transmission systems, power plants and applications of robotics.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Various sub-divisions of Civil Engineering		Role in ensuring better society	L2
CO2	Apply	Methods of surveying	Finding the measurements	On Earth surface	L3
CO3	Understand	Importance of transportation, water resources and environmental engineering			L2
CO4	Understand	applications and role of various materials in Mechanical Engineering			L2
CO5	Understand	different manufacturing processes and the basics of thermal engineering with its applications			L2
CO6	Understand	working of different mechanical power transmission systems, power plants and applications of robotics			L2

**BASICS OF CIVIL ENGINEERING (PART-A)**

**UNIT I**

**Basics of Civil Engineering:**

Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

**UNIT II**

**Surveying:** Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

**UNIT III**

**Transportation Engineering:** Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

**Water Resources and Environmental Engineering:**

Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology-Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

**Textbooks:**

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition

**Reference Books:**

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38<sup>th</sup> Edition
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10<sup>th</sup> Edition
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012
6. SPH | 978-93-93196-63-7 | Basic Civil & ME (JNTU) - Dr. S. Krishnaiah

**PART-B**  
**BASICS OF MECHANICAL ENGINEERING**

**UNIT I**

**Introduction to Mechanical Engineering:** Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Engineering Materials** - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

**UNIT II**

**Manufacturing Processes:** Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

**Thermal Engineering** – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

**UNIT III**

**Power plants** – working principle of Steam, Diesel, Hydro, Nuclear power plants.

**Mechanical Power Transmission** - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

**Introduction to Robotics** - Joints & links, configurations, and applications of robotics.

**Textbooks:**

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India)Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

**Reference Books:**

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.

**Mapping of COs to POs**

COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2					2						
CO2	3	2				2							
CO3	2	2					2						
CO4	2					2							
CO5	2						2						
CO6	2				2		2						

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

**CO-PO mapping justification:**

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	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L3) Thumb Rule	2 2 2
2	12/33	34	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L3) Thumb Rule	2 2 2
4	9/30	30	3	Understand	L2	PO1 PO6	Identify-L3 Thumb Rule	2 2
5	12/30	40	3	Understand	L2	PO1 PO7	Identify-L3 Thumb Rule	2 2
6	9/30	30	3	Understand	L2	PO1 PO5 PO7	Apply(Identify)-L3 Apply-L3 Thumb Rule	2 2 2

**Justification Statements:**

**CO1:** Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

**Action Verb: Understand (L2)**

PO1 Verb: **Apply (L3)**

CO1 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze(L4)**

CO1 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO7 Verb: **Thumb Rule**

CO1 correlates medium with PO7. Therefore, the correlation is medium (2)

**CO2:** Apply the methods of surveying in finding the measurements on Earth surface.

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 not same level as PO2 verb. Therefore, the correlation is medium (2)

PO6 Verb: **Thumb Rule**

CO2 correlates medium with PO6. Therefore, the correlation is medium (2)

**CO3:** Understand the importance of transportation, water resources and environmental engineering.

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO3 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze(L4)**

CO3 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO7 Verb: **Thumb Rule**

CO3 correlates medium with PO7. Therefore, the correlation is medium (2)

**CO4:** Understand the applications and role of various materials in Mechanical Engineering.

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)

PO3 Verb: **Review-L2**

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

PO7 Verb: **Thumb Rule**

CO4 correlates moderately with PO6. Therefore, the correlation is medium (2).

**CO5:** Understand the different manufacturing processes and the basics of thermal engineering with its 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)

PO3 Verb: **Review-L2**

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

PO7 Verb: **Thumb Rule**

CO5 correlates moderately with PO6. Therefore, the correlation is medium (2).

**CO6:** Understand the working of different mechanical power transmission systems, power plants and applications of robotics.

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)

PO3 Verb: **Review-L2**

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

PO7 Verb: **Thumb Rule**

CO5 correlates moderately with PO6. Therefore, the correlation is medium (2).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Introduction to Programming (Common to All branches of Engineering)	L	T / CLC	P	C
23AES0501	I-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

- CO 1: **Understand** the computer Programming concepts and Algorithms.
- CO 2: **Analyze** the control structures to implement basic programs.
- CO 3: **Understand** the concept of Arrays and string to manipulate the stored data.
- CO 4: **Create** the dynamic memory allocation using pointers and structures.
- CO 5: **Create** the user defined functions and files for modifying stored data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the computer Programming concepts and Algorithms.			L2
CO2	Analyze	the control structures		to implement basic programs.	L4
CO3	Understand	the concept of Arrays and string		to manipulate the stored data	L2
CO4	Create	the dynamic memory allocation	using pointers and structures.		L6
CO5	Create	user defined functions and files		for modifying stored data.	L6

<b>UNIT - I</b>	<b>Introduction to Programming and Problem Solving</b>	<b>10 Hrs</b>
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**History of Computers, Basic organization of a computer:** ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

**Problem solving techniques:** Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

<b>UNIT - II</b>	<b>Control Structures</b>	<b>9 Hrs</b>
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Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

<b>UNIT - III</b>	<b>Arrays and Strings</b>	<b>9 Hrs</b>
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Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

<b>UNIT - IV</b>	<b>Pointers &amp; User Defined Data types</b>	<b>9 Hrs</b>
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Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

<b>UNIT - V</b>	<b>Functions &amp; File Handling</b>	<b>9 Hrs</b>
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Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

**Textbooks:**

- "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice - Hall, 1988
- Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996.

**Reference Books:**

- Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
- Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
- C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition
- Amaravathi | 978-93-93199-58-4 | Introduction to Programming (JNTU) - Dr. S. V. Raju

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2									3	
CO2	3	3	3								2	2	
CO3	2	3									2	2	

CO4	3	3	3								2	2	
CO5	3	3	3									2	2

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

### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	19	25%	3	CO1: Understand	L2	PO1 PO2 PO3	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3)	2 3 2
2	10	14%	2	CO2: Analyze	L4	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
3	19	25%	3	CO3: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review (L2) PO1: Thumb rule	2 3 2
4	15	20%	2	CO4: Create	L6	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
5	12	16%	2	CO5: Create	L6	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 3
	75	100%						

### Justification Statements :

**CO1: Understand** the computer Programming concepts and Algorithms.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Review (L2)**

CO1 Action verb is same as than as PO2 verb by two level. Therefore, the correlation is High (3)

**PO3 Verb: Develop (L3)**

CO1 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)

**CO2: Analyze** the control structures to implement basic programs.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is equal to 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)

**PO11: Thumb rule**

**Some of the flow of control statements knowledge are used to solve various problems.**

**Therefore, the correlation is moderate (2)**

**CO3: Understand** the concept of Arrays and string to manipulate the stored data.

**Action Verb: Understand (L2)**

**PO1: Apply (L3)**

CO3 Action verb is less than PO1 verb 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)

**PO11: Thumb rule**

For some matrix operations array and string concepts were used Therefore, the correlation is

moderate (2)

**CO4: Create** the dynamic memory allocation using pointers and structures.

**Action Verb: Create (L6)**

**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 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)

**PO11: Thumb rule**

For some mathematical operations Pointers and structures are used to manipulate the memory references. Therefore, the correlation is moderate (2)

**CO5: Create** the user defined functions and files for modifying stored data.

**Action Verb: Create (L6)**

**PO1: Apply (L3)**

CO5 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)

**PO2: Review (L2)**

CO5 Action verb is greater than as 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)

**PO11: Thumb rule**

In today's world file handling techniques were used in most of the areas. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI**  
**(Autonomous)**

(Effective for the batches admitted from 2023-24)

**Year: I B.Tech**

**(Common to all branches)**

Semester: I & I

<b>Subject Code</b> <b>23AHM9902</b>	Subject Name <b>Communicative English Lab</b>	L 0	T 0	P 2	Credit: 1
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**Course Outcomes (CO):** Student will be able to

CO1: **Understand**-the different aspects of the English language proficiency with emphasis On LSRW skills.

CO2: **Apply** communication skills through various language learning activities.

CO3: **Analyze** the English speech sounds, for better listening and speaking.

CO4: **Evaluate** and exhibit professionalism in participating in debates and group discussions.

CO5: **Analyze** the mselves to face interviews in future.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
<b>1</b>	<b>Understand</b>	the different aspects of the English language proficiency with emphasis on LSRW skills			L2
<b>2</b>	<b>Apply</b>	communication skills through various language learning activities			L3
<b>3</b>	<b>Analyze</b>	the English speech sounds, for better listening and speaking.			L4
<b>4</b>	<b>Evaluate</b>	and exhibit professionalism in participating in debates and group discussions			L5
<b>5</b>	<b>Analyze</b>	themselves to face interviews in future			L4

**List of Topics:**

1. Vowels & Consonants (CO3)
2. Non Verbal Communication (CO2)
3. Communication Skills(CO2)
4. Role Player Conversational Practice (CO1,CO2)
5. E-mail Writing (CO1)
6. Just A Minute (CO1,CO2)
7. Group Discussions-methods&practice (CO4)
8. Debates-Methods &Practice (CO4)
9. PPT Presentations/Poster Presentation (CO2)
10. Interviews Skills (CO5)

**Suggested Software:**

- Walden Infotech
- Young India Films

**Reference Books:**

1. RamanMeenakshi,Sangeeta-Sharma.*TechnicalCommunication*.OxfordPress.2018.
2. TaylorGrant:*EnglishConversationPractice*,TataMcGraw-HillEducationIndia,2016
3. Hewing's, Martin. Cambridge *AcademicEnglish(B2)*.CUP,2012.
4. J.Sethi & P.V.Dhamija. *ACourse in Phonetics and Spoken English*,(2<sup>nd</sup>Ed),Kindle,2013.
5. SUP | 978-93-92184-99-4 | Communication English (JNTU) - Dr. V. B. Chithra

**Web Resources:**

**Spoken English:**

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishmedialab.com](http://www.englishmedialab.com)
3. [www.englishinteractive.net](http://www.englishinteractive.net)
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. [https://www.youtube.com/c/mmmEnglish\\_Emma/featured](https://www.youtube.com/c/mmmEnglish_Emma/featured)
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. [https://www.youtube.com/channel/UCV1h\\_cBE0Drdx19qkTM0WNw](https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw)

**Voice & Accent:**

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. [https://www.youtube.com/channel/UC\\_OskgZBoS4dAnVUgJVexc](https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc)
4. [https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp\\_IA](https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA)

**Mapping of COs to POs and PSOs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1										2	
2									2	2	
3										3	
4									3	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)	%	corr	Verb	BTL			
1				Understand	L2	10	Thumb Rule	2
2				Apply	L3	9,10	Thumb Rule	2,2
3				Analyze	L4	10	Thumb Rule	3
4				Evaluate	L5	9,10	Thumb Rule	3,3
5				Analyze	L4	10	Thumb Rule	3

**CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills**

**Action Verb: Understand (L2)**

CO1 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**CO2:**Apply communication skills through various language learning activities.

**Action Verb: Apply (L3)**

CO2 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate(2).

**CO3:**Analyze the English speech sounds, for better listening and speaking.

**Action Verb: Analyze (L4)**

CO3 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

**CO4:** Evaluate and exhibit professionalism in participating in debates and group discussions.

**Action Verb: Evaluate (L5)**

CO4 Action Verb is Evaluate of BTL 5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

**CO5: Analyze themselves to face interviews in future.**

**Action Verb: Develop (L4)**

CO5 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).



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**Year: I B.Tech (Common to EEE, ECE, CSE & allied branches) Semester: I &I**

<b>Subject Code:</b> 23ABS9906	<b>Subject Name:</b> Chemistry Lab	L 0	T 0	P 2	Credits:1
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**Course Objectives:** Students are expected to  
Verify the fundamental concepts with experiments.

**Course Outcomes:** At the end of the course, the students will be able to  
CO1: Determine the cell constant and conductance of solutions.  
CO2: Prepare advanced polymer Bakelite materials.  
CO3: Measure the strength of an acid present in secondary batteries.  
CO4: Analyze the UV-Visible spectra of some organic compounds.  
CO5: Estimate the unknown solution by volumetric analysis

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Determine</b>	Cell constant and conductance of solutions.			<b>L4</b>
2	<b>Prepare</b>	advanced polymer Bakelite materials			<b>L4</b>
3	<b>Measure</b>	Strength of an acid present in secondary batteries.			<b>L4</b>
4	<b>Analyze</b>	UV-Visible spectra of some organic compounds.			<b>L4</b>
5	<b>Estimate</b>	Unknown solution by volumetric analysis.			<b>L5</b>

**List of Experiments:**

1. Measurement of 10Dq by spectrophotometric method( CO1)
2. Conductometric titration of strong acid vs. strong base (CO1)
3. Conductometric titration of weak acid vs. strong base (CO1)
4. Determination of cell constant and conductance of solutions (CO1)
5. Potentiometry - determination of redox potentials and emfs (CO5)
6. Determination of Strength of an acid in Pb-Acid battery (CO3)
7. Preparation of a Bakelite (CO2)
8. Verify Lambert-Beer's law (CO4)
9. Estimation of copper by Iodometry ( CO5)
10. Wavelength measurement of sample through UV-Visible Spectroscopy (CO1)
11. Preparation of nanomaterials by precipitation method ( CO1)
12. Estimation of Ferrous Iron by Dichrometry (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 Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar
- Seven Hills | 978-93-94122-28-4 | Chemistry (JNTU) - Dr. N. Devenna

**Mapping of COs to POs and PSOs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1				3							
2				3							
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				<b>Determine</b>	<b>L4</b>	PO4	PO4: Analyze (L4)	3
2				<b>Prepare</b>	<b>L4</b>	PO4	PO4: Analyze (L4)	3
3				<b>Measure</b>	<b>L4</b>	PO4	PO4: Analyze (L4)	3
4				<b>Analyze</b>	<b>L4</b>	PO4	PO4: Analyze (L4)	3
5				<b>Estimate</b>	<b>L5</b>	PO4	PO4: Analyze (L5)	3

**Justification Statements**

**CO1:** Determine the cell constant and conductance of solutions.

**Action Verb:** Determine (**L4**)

PO4 Verb: Analyze (L4)

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

**CO2:** Prepare advanced polymer Bakelite materials.

**Action Verb:** Prepare (**L4**)

PO4 Verb: Analyze (L4)

CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO3:** Measure the strength of an acid present in secondary batteries.

**Action Verb:** Measure (**L4**)

PO4 Verb: Analyze (L4)

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

**CO4:** Analyze the UV-Visible spectra of some organic compounds.

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

PO4 Verb: Analyze (L4)

CO4 Action Verb is equal to PO4 verb; Therefore, correlation is high (3)

**CO5:** Estimate the unknown solution by volumetric analysis.

**Action Verb:** Estimate (**L5**)

PO4 Verb: Analyze (L4)

CO5 Action Verb is greater than PO4; Therefore correlation is high (3).



CO1	3	3	3					3			3	3
CO2	3	3	3					3			3	3
CO3	3	3	3					3			3	3
CO4	3	3	3					3			3	3
CO5	2	2	2					2			3	3

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

**CO-PO mapping justification:**

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	-	-	3	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
2	-	-	3	Analyze	L4	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
3	-	-	1	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
4	-	-	2	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
5	-	-	2	Understand	L2	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	2 2 2 2

**Justification Statements:**

**CO1:** Apply the wood working skills to prepare different joints

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: **Review** (L2)

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)

PO9 Verb: **Thumb Rule**

CO1 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

**CO2:** Analyze the sheet metal and fitting operations to prepare various components

Action Verb: **Analyse** (L4)

PO1 Verb: **Apply** (L3)

CO2 Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Review** (L2)

CO2 Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Develop** (L3)

CO2 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **Thumb Rule**

CO2 Action verb is same level (greater) as PO9 verb. Therefore, the correlation is high (3)

**CO3:** Apply the basic electrical engineering knowledge for house wiring practice

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: **Review** (L2)

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

PO3 Verb: **Develop** (L3)

CO3 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **Thumb Rule**

CO3 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

**CO4:** Apply the Welding process for Lap and Butt Joints

Action Verb: **Apply** (L3)

PO1 Verb: **Apply** (L3)

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

PO2 Verb: **Review** (L2)

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

PO3 Verb: **Develop** (L3)

CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **Thumb Rule**

CO4 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

**CO5:** Understand the various plumbing pipe joints.

Action Verb: **Understand** (L2)

PO1 Verb: **Apply** (L2)

CO5 Action verb is less than as PO1 verb. Therefore, the correlation is high (2)

PO2 Verb: **Review** (L2)

CO5 Action verb is less than as PO2 verb. Therefore, the correlation is high (2)

PO3 Verb: **Develop** (L3)

CO5 Action verb is less than as PO3 verb. Therefore, the correlation is high (2)

PO9 Verb: **Thumb Rule**

CO5 Action verb is less than as PO9 verb. Therefore, the correlation is high (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Computer Programming Lab (Common to All Branches of Engineering)	L	T	P	C
23AES0502	I-I		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the basic syntax of C program to build applications.

**CO2: Create** the control structure for solving complex problems.

**CO3: Apply** the concepts of arrays, functions, basic concepts of pointers to organize the data.

**CO4: Apply** the concepts of structures, unions and linked list to manage heterogeneous data.

**CO5: Create** the file applications for storing and accessing data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic syntax of C program		to build applications	L2
CO2	Create	the control structure		for solving complex problems	L6
CO3	Apply	the concepts of arrays, functions, basic concepts of pointers		to organize the data	L3
CO4	Apply	the concepts of structures, unions and linked list		to manage heterogeneous data	L3
CO5	Create	the file applications		for storing and accessing data	L6

**List of Experiments:**

**Exercise 1: Problem-solving using Computers[CO1]**

- i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- ii) Exposure to Turbo C, gcc
- iii) Writing simple programs using printf(), scanf()

**Exercise 2: Problem-solving using Algorithms and Flow charts.[CO1]**

- i) Sum and average of 3 numbers
- ii) Conversion of Fahrenheit to Celsius and vice versa
- iii) Simple interest calculation

**Exercise 3: Variable types and type conversions[CO2]**

- i) Finding the square root of a given number
- ii) Finding compound interest
- iii) Area of a triangle using heron's formulae
- iv) Distance travelled by an object

**Exercise 4: Operators and the precedence and as associativity[CO2]**

- i) Evaluate the following expressions.
  - a.  $A+B*C+(D*E) + F*G$
  - b.  $A/B*C-B+A*D/3$
  - c.  $A+++B---A$
  - d.  $J= (i++) + (++i)$
- ii) Find the maximum of three numbers using conditional operator
- iii) Take marks of 5 subjects in integers, and find the total, average in float list and perform insertion, deletion, and traversal.

**Exercise 5: Branching and logical expressions[CO2]**

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Write a C program to simulate a calculator using switch case.
- v) Write a C program to find the given year is a leap year or not.

**Exercise 6: Loops, while and for loops[CO2]**

- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not.
- iii) Compute sine and cos series
- iv) Checking a number palindrome
- iv) Construct a pyramid of numbers.

**Exercise 7: 1 D Arrays: searching[CO3]**

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array.
- iii) The reverse of a 1D integer array
- iv) Find 2's complement of the given binary number.
- v) Eliminate duplicate elements in an array.

**Exercise 8: 2 D arrays, sorting and Strings[CO3]**

- i) Addition of two matrices
- ii) Multiplication two matrices
- iii) Sort array elements using bubble sort
- iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

**Exercise 9: Pointers, structures and dynamic memory allocation[CO3]**

- i. Write a C program to find the sum of a 1D array using malloc()
- ii. Write a C program to find the total, average of n students using structures
- iii. Enter n students data using calloc() and display failed students list
- iv. Read student name and marks from the command line and display the student details along with the total.
- v. Write a C program to implement realloc()

**Exercise 10: Bitfields, Self-Referential Structures, Linked lists[CO4]**

- i) Create and display a singly linked list using self-referential structure.
- ii) Demonstrate the differences between structures and unions using a C program.
- iii) Write a C program to shift/rotate using bitfields.
- iv) Write a C program to copy one structure variable to another structure of the same type.

**Exercise 11: Functions, call by value, scope and extent[CO2]**

- i) Write a C function to calculate NCR value.
- ii) Write a C function to find the length of a string.
- iii) Write a C function to transpose of a matrix.
- iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

**Exercise 12: Recursion, the structure of recursive calls[CO4]**

- i) Write a recursive function to generate Fibonacci series.
- ii) Write a recursive function to find the lcm of two numbers.
- iii) Write a recursive function to find the factorial of a number.
- iv) Write a C Program to implement Ackermann function using recursion.
- v) Write a recursive function to find the sum of series.

**Exercise 13: Call by reference, dangling pointers[CO4]**

- i) Write a C program to swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem using a C program.
- iii) Write a C program to copy one string into another using pointer.
- v) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**Exercise 14: File handling[CO5]**

- i) Write a C program to write and read text into a file.
- ii) Write a C program to write and read text into a binary file using fread() and fwrite()
- iii) Copy the contents of one file to another file.
- iv) Write a C program to merge two files into the third file using command-line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Write a C program to print last n characters of a given file.

**Textbooks:**

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

**Reference Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE
3. Amaravathi | 978-93-93199-58-4 | Introduction to Programming (JNTU) - Dr. S. V. Raju

### Mapping of course outcomes with program outcomes

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

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

### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Review(L2)	3
			PO3	PO3: Develop(L3)	2
			PO4	PO4: Analyze(L4)	2
2	CO2: Create	L6	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L3)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply(L3)	3
3	CO3: Apply	L3	PO11	PO11: Thumb rule	2
			PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L3)	3
			PO4	PO4: Analyze (L4)	2
4	CO4: Apply	L3	PO5	PO5: Apply(L3)	3
			PO11	PO11: Thumb rule	3
			PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L2)	3
5	CO5: Create	L6	PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	3
			PO11	PO11: Thumb rule	3
			PO1	PO1: Apply(L3)	3

### Justification Statements :

**CO1: Understand** the basic syntax of C program to build applications.

#### Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2 Verb: Review(L2)

CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

PO3: Develop(L3)

CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

PO4: Analyze(L4)

CO1 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate is (2)

**CO2: Create** the control structure for solving complex problems.

#### Action Verb: Create (L6)

PO1: Apply (L3)

CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

PO2: Review (L3)

CO2 Action verb is same level PO2 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 same as PO5 verb. Therefore, the correlation is high (3)

PO11: 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 (2)

**CO3: Apply** the concepts of arrays, functions, basic concepts of pointers to organize the data..

**Action Verb: Apply (L3)**

PO1: Apply (L3)

CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

PO2: Review (L3)

CO3 Action verb is same level 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 moderate (2)

PO5: Apply(L3)

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO11: 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)

**CO4: Apply** the concepts of structures, unions and linked list to manage heterogeneous data.

**Action Verb: Apply (L3)**

PO1: Apply (L3)

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

PO2: Review (L3)

CO4 Action verb is same level 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 moderate (2)

PO5: Apply(L3)

CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO11: 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 (2)

**CO5: Create** the file applications for storing and accessing data.

**Action Verb: Create (L6)**

PO1: Apply (L3)

CO5 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

PO2: Review (L3)

CO5 Action verb is same level PO2 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 same as PO5 verb. Therefore, the correlation is high (3)

PO11: 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)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI**  
(Autonomous)

(Effective for the batches admitted from 2023-24)

**Common to I SEM CSE/CIC/SCD/EEE & II SEM ECE/AI&DS/AI&ML/CE/ME**

<b>Course Code:</b> 23AHM9903	<b>Health And Wellness, Yoga and Sports</b>	<b>L</b> <b>0</b>	<b>T</b> <b>0</b>	<b>P</b> <b>1</b>	<b>C</b> <b>0.5</b>
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**Course Objectives:**

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

**Course Outcomes:** After completion of the course the student will be able to

- CO1. **Understand** the health & fitness by diet
- CO2. **Understand** the importance of yoga.
- CO3. **Apply** The yoga practices including Surya Namaskar
- CO4. **Understand** the importance of sports.
- CO5. **Analyze** various activities that help enhance their health & Positive Personality

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	Health & fitness by diet			<b>L2</b>
2	<b>Understand</b>	Importance of yoga.			<b>L2</b>
3	<b>Apply</b>	yoga practices including Surya Namaskar			<b>L3</b>
4	<b>Understand</b>	Importance of sports			<b>L2</b>
5	<b>Analyze</b>	Various activities that help enhance their health & Positive Personality			<b>L4</b>

**UNIT I**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

**Activities:**

- i) Organizing health awareness programmes in community
- ii) Preparation of health profile
- iii) Preparation of chart for balance diet for all age groups

**UNIT II**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

**Activities:**

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

**UNIT III**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

**Activities:**

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.  
Practicing general and specific warm up, aerobics
- ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

**Reference Books:**

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

**General Guidelines:**

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva in the subject

**Mapping of COs to POs and PSOs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1						2	2						
2						2	2						
3						2	2						
4						2	2						
5						3	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)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL		
1					<b>Understand</b>	<b>L2</b>	P06,P07	2
2					<b>Understand</b>	<b>L2</b>	P06,P07	2
3					<b>Apply</b>	<b>L3</b>	P06,P07	2
4					<b>Understand</b>	<b>L2</b>	P06,P07	2
5					<b>Analyze</b>	<b>L4</b>	P06,P07	3

**CO-PO mapping justification:**

**CO1:** Understand the health & fitness by diet

**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 Importance of yoga

**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**

yoga practices including Surya Namaskar

**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:** Understand Importance of sports

**Action Verb: Understand (L2)**

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

**Action Verb: APPLY (L3)**

**CO5:** Analyze the Various activities that help enhance their health & Positive Personality

**Action Verb: Analyze (L4)**

CO5 Action Verb is **Analyze** of BTL 2.Using Thumb rule; L4 correlates PO6 and PO7 as a moderate (2)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)  
(Effective for the batches admitted in 2023-24)**

**Semester II (First year)**

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	BS	23ABS9905	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
3	ES	23AES0201	Basic Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
6	PC	23APC0501	Data Structures	2	1	0	3	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical and Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0502	Data Structures Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts and Guides/Community Service	0	0	1	0.5	50	-	50
<b>Total</b>				<b>09</b>	<b>04</b>	<b>15</b>	<b>20.5</b>	<b>320</b>	<b>630</b>	<b>950</b>



Course Code	<b>Engineering Physics</b>	L	T/CLC	P	C
<b>23ABS9903</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>
Regulation: <b>AK23</b>	<b>Common to I B.Tech ECE, AI&amp;DS, AI&amp;ML, ME, CE (Sem-1) &amp; CSE, CIC, EEE, &amp;CSD (Sem-2)</b>				

**Course Outcomes (CO):** At the end of the course students will be able to  
 CO1:**Understand** the intensity variation of light due to interference, diffraction, and polarization.  
 CO2:**Analyze** the fundamentals of crystallography and X-ray diffraction.  
 CO3:**Apply** the basic concepts of dielectric and magnetic materials for engineering applications.  
 CO4:**Analyze** the fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.  
 CO5:**Analyze** the charge carrier dynamics in semiconductors by implementing the equations of state.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	The intensity variation of light due to interference, diffraction, and polarization.			L2
2	<b>Analyze</b>	The fundamentals of crystallography and X-ray diffraction.			L4
3	<b>Apply</b>	The basic concepts of dielectric and magnetic materials		for engineering applications.	L3
4	<b>Analyze</b>	The fundamentals of Quantum mechanics and interpret the nanomaterials		for engineering problems.	L4
5	<b>Analyze</b>	The charge carrier dynamics in semiconductors.	By implementing the equations of state.		L4

**UNIT I Wave Optics**

**10 Hrs**

Interference: Introduction - Principle of superposition -Interference of light - Interference in thin films (Reflection Geometry) & applications - Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit (Qualitative) - Diffraction Grating.

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

**UNIT II Crystallography and X-ray diffraction**

**8 Hrs**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters - Bravais Lattices - crystal systems (3D) - coordination number - packing fraction of SC, BCC & FCC - Miller indices - separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer - crystal structure determination by Laue's and powder methods.

**UNIT III Dielectric and Magnetic Materials**

**8 Hrs**

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector - Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - Frequency dependence of polarization-Applications of Dielectric materials.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials - Applications of magnetic materials.

**UNIT IV Quantum Mechanics and Nanomaterials**

**12 Hrs**

Quantum Mechanics: Dual nature of matter - Heisenberg's Uncertainty Principle - Significance and properties of wave function - Schrodinger's time independent and dependent wave equations- Particle in a one-dimensional infinite potential well.

Nanomaterials: Introduction to Nanomaterials-Significance of nanoscale - Physical, Mechanical, Magnetic, and optical properties of nanomaterials -Synthesis of nanomaterials: Ball Milling,

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein’s equation – Hall effect and its applications – Applications of semiconductors.

**Textbooks:**

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. K.Thyagarajan “Engineering Physics”,-Mc Graw Hill Publishing Company Ltd, 2016.
3. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

**Reference Books:**

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics” - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).
5. Sun | 978-93-92933-95-0 | Engineering Physics (JNTU) - Dr. K. Ramya

**Web Resources:** <https://www.loc.gov/rr/scitech/selected-internet/physics.html>

**Mapping of COs to POs and PSOs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3												
2	3												
3	3			3									
4	3												
5	3			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	22.3	3	Understand	L2	PO1	PO1: Apply (L3)	2
2	11	16.4	2	Analyze	L4	PO1	PO1: Apply (L3)	3
3	12	17.9	2	Apply	L3	PO1, PO4	PO1, PO4: Apply (L3)	3
4	13	19.4	2	Analyze	L4	PO1	PO1: Apply (L3)	3
5	16	23.8	3	Analyze	L4	PO1, PO4	PO1, PO4: Apply (L3)	3
	67							

**CO1: The intensity variation of light due to interference, diffraction, and polarization.**

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

CO1 Action Verb is lesser than PO1 verb by one level; Therefore, correlation is moderate (2).

**CO2: The fundamentals of crystallography.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)

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

**CO3: Apply the basic concepts of dielectric and magnetic materials for engineering applications.**

**Action Verb: Apply (L3)**

PO1 and PO4 Verbs: Apply (L3)

CO3 Action Verb level is equal to PO1 and PO4 verb; Therefore correlation is high (3).

**CO4: The fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.**

**Action Verb: Analyze (L4)**

PO1 Verb: Apply (L3)

CO4 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).

**CO5: The charge carrier dynamics in semiconductors by implementing the equations of state.**

**Action Verb: Analyze (L4)**

PO1 and PO4 Verb: Apply (L3)

CO5 Action verb is greater than PO1 verb; therefore, the correlation is high (3).



<b>Subject Code:</b> <b>23ABS9905</b>	<b>Subject Name: Differential Equations and Vector Calculus</b>	<b>L</b> <b>2</b>	<b>T/CLC</b> <b>1</b>	<b>P</b> <b>0</b>	<b>Credits</b> <b>3</b>
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**Course Outcomes (CO):** Student will be able to

- CO1. **Apply** the concepts of ordinary differential equations of first order and first degree.  
 CO2. **Apply** the methods of linear differential equations related to various engineering problems.  
 CO3. **Analyze** the solutions of partial differential equations using Lagrange's method.  
 CO4. **Understand** the different operators and identities in the vector calculus.  
 CO5. **Evaluate** the surface integral and volume integral in the vector calculus using various theorems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	The concepts of ordinary differential equations.		of first order and first degree	L3
2	Apply	The methods of linear differential equations related to various engineering problems.			L3
3	Analyze	The solutions of partial differential equations.	Using Lagrange's method		L4
4	Understand	different operators and identities in the vector calculus.			L2
5	Evaluate	the surface integral and volume integral in the vector calculus.	Using various theorems		L5

**UNIT I: Linear Differential Equations of first Order and first Degree**

**9hrs**

Linear differential equations-Bernoulli's equations-Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling-Law of natural growth and decay-Electrical circuits.

**UNIT II: Equations Reducible to Linear Differential Equations and Applications**

**9 hrs**

Definitions, homogeneous and non-homogeneous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and simple Harmonic motion.

**UNIT III: Partial Differential Equations**

**9 hrs**

Introduction and formation of partial differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

**UNIT IV: Vector differentiation**

**9 hrs**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

**UNIT V: Vector integration**

**9 hrs**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

**Text Books :**

1. B. S. Grewal, Higher Engineering Mathematics, 44<sup>th</sup> Edition, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & Sons, 2011.

**References:**

1. Dr.T.K.V.Iyengar, Engineering Mathematics-I,S.Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science

International Ltd., 2002

3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publication, 2008

4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.

5. Sri Krishna | 978-93-94246-77-5 | Differential Equations & Vector Calculus (JNTU) - Dr. M. S. Reddy

**Mapping of COs to POs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	3										
2	3										
3		3									
4	2										
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	14	20.8	3	Apply	L4	PO1	Apply	3
2	15	22.3	3	Apply	L3	PO1	Apply	3
3	14	20.8	3	Analyze	L4	PO2	Analyze	3
4	9	13.4	2	Understand	L2	PO1	Apply	2
5	15	22.3	3	Evaluate	L5	PO2	Analyze	3

**CO1:** Apply the concepts of ordinary differential equations of first order and first degree.

Action Verb: Apply(L3)

PO1 Verbs: Apply(L3)

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

**CO2:** Apply the methods of linear differential equations related to various engineering problems.

**Action Verb: Apply (L3)**

PO1 Verbs: Apply (L3)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

**CO3:** Analyze the solutions of partial differential equations.

**Action Verb: Analyze(L4)**

PO2 Verb: Analyze (L4)

CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

**CO4:** Understand the different operators and identities in the vector calculus.

**Action Verb: Understand(L2)**

PO1 Verb: Apply(L3)

CO4 Action Verb is low level to PO1 to one level; Therefore correlation is moderate (2).

**CO5:** Evaluate the surface integral and volume integral in the vector calculus.

**Action Verb: Evaluate(L5)**

PO2 Verb: Analyze (L4)

CO5 Action verb is high level to PO2 verb; therefore the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Basic Electrical and Electronics Engineering	L	T/CLC	P	C
23AES0201	I-II			2	1	0

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the fundamental laws of A. C circuits and D. C circuits.

CO2: **Understand** operating principles of motors, generators and measuring instruments.

CO3: **Understand** the fundamentals of power generation, costing and safety measures.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
1	Understand	The fundamentals laws of A. C circuits and D. C circuits.		A. C circuits and D. C circuits	L2
2	Understand	Operating principles of motors, generators and measuring instruments.			L2
3	Understand	The fundamentals of Power generation, costing and safety measures.			L2

**PART-A**

**BASIC ELECTRICAL ENGINEERING**

**UNIT I: DC & AC Circuits**

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

**UNIT II: Machines and Measuring Instruments**

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone Bridge.

**UNIT III: Energy Resources, Electricity Bill & Safety Measures**

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

**TEXTBOOKS:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013.
2. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

**REFERENCE BOOKS:**

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition.
2. Principles of Power Systems, V.K. Mehtha, S. Chand Technical Publishers, 2020.
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017.
4. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Person Publications, 2018, Second Edition.
5. Amaravathi | 978-93-93199-46-1 | Basic Electrical & EE (JNTU) - Dr. K. Gopi

**WEB RESOURCES:**

1. <https://nptel.ac.in/courses/108105053>
2. <https://nptel.ac.in/courses/108108076>

**PART-B****COURSE OUTCOMES:**

After completion of the course, students will be able to:

CO4: **Understand** the fundamental concepts of diodes, transistors and its applications.

CO5: **Analyze** the concepts of rectifiers, power supplies and amplifiers in electronics.

CO6: **Analyze** the concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
4	Understand	fundamental concepts of diodes, transistors and its applications			L2
5	Analyze	concepts of rectifiers, power supplies and amplifiers in electronics			L4
6	Analyze	concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits			L4

**UNIT I: SEMICONDUCTOR DEVICES**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

**UNIT II : BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION**

Rectifiers and power supplies: Block diagram description of a DC power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

**UNIT III: DIGITAL ELECTRONICS**

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

**Textbooks:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

**Reference Books:**

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

**Mapping of course outcomes with program outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	2				1						2	
CO2	2	1				1						1	
CO3	2	1				2						1	2
CO4	2	3											
CO5	3	3											
CO6	3	3											

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



**Justification Table:**

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	08	30	3	Understand	L2	PO1, PO2, PO6	PO1: Apply (L3) PO2: Identify (L3) PO6: Thumb Rule	2 2 1
2	08	30	3	Understand	L2	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze (L4) PO6: Thumb Rule	2 1 1
3	10	38	3	Understand	L2	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze (L4) PO6: Thumb Rule	2 1 2
4	08	30	3	Understand	L2	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	2 3
5	08	30	3	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
6	10	38	3	Analyze	L4	PO1, PO2	PO1:Apply(L3) PO2:Review (L2)	3 3

**CO1: Understand the fundamental laws of AC and DC circuits.**

Action Verb: Understand (L2)

PO1: Apply (L3)

CO1 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Identify (L3)

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: Understand operating principles of motors, generators, MC and MI instruments.**

Action Verb: Understand (L2)

PO1: Apply (L3)

CO2 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).

PO6: Using thumb rule, CO2 correlates PO6 as low (1).

**CO3: Understand the fundamentals of power generation, costing and safety measures.**

Action Verb: Understand (L2)

PO1: Apply (L3)

CO3 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).

PO6: Using thumb rule, CO3 correlates PO6 as medium (2).

**CO4: Understand the fundamental concepts of diodes, transistors and its applications**

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).

**CO5: Analyze the concepts of rectifiers, power supplies and amplifiers in electronics.**

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

**CO6: Analyze the concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits.**

Action Verb: Analyze (L4)

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



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

Course Code	Year & Sem	Engineering Graphics	L	T	P	C
23AES0301	I-II			1	0	4

**Course Outcomes:**

After studying the course, student will be able to

- CO: 1 **Apply** the concepts of engineering curves and scales for technical drawing.
- CO: 2 **Understand** the quadrant system to locate the position of points, lines and planes.
- CO: 3 **Analyze** the projection of solids located in quadrant system.
- CO: 4 **Analyze** the sectional views and development of surfaces of regular solids.
- CO: 5 **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 and scales	for technical drawing		L3
CO2	Understand	the quadrant system to locate the position of points, lines and planes			L2
CO3	Analyze	the projection of 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:** Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

**Curves:** construction of ellipse, parabola and hyperbola by general, Cycloids, Involute, Normal and tangent to Curves.

**Scales:** Plain scales, diagonal scales and vernier scales.

**Unit II**

**Orthographic Projections:** Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

**Projections of Straight Lines:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

**Projections of Planes:** regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

**Unit III**

**Projections of Solids:** Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

**Unit IV**

**Sections of Solids:** Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

**Development of Surfaces:** Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

**Unit V**

**Conversion of Views:** Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. **Computer graphics:** Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

**Text Books:**

1. K. L. Narayana & P. Kannaiyah, Engineering Drawing, 3/e, Scitech Publishers
2. N. D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers
3. SPHPL | 978-93-94155-83-1 | Engineering Graphics (JNTU) - Dr. C. N. Reddy

**Reference Books:**

1. Engineering Drawing, K.L. Narayana and P. Kanniah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B. Shah and B.C. Rana, Pearson Education Inc, 2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

**Mapping of course outcomes with program outcomes**

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	
Engineering Graphics	CO 1	3		3							3		2	2	
	CO 2	2		2							3		2	2	
	CO 3	2		2							3		2	2	
	CO 4	3		3							3		2	2	
	CO 5	3		3							3		2	2	

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

**Correlation 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 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
2	15	20	2	Understand	L2	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	2 2 3
3	15	20	2	Analyze	L4	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
4	15	20	2	Analyze	L4	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
5	12	16	2	Apply	L3	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3

**Justification Statements:**

**CO1: Apply** the concepts of engineering curves and scales 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, lines and planes.

**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 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)



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Course Code	Year & Sem	IT workshop (Common to CSE, CIC, CSE(DS) & EEE)	L	T	P	C
23AES0503	I-II		0	0	2	1

**Course Outcomes:**

After studying the course, student will be able to

- CO1: Understand** The Process of Software Installation & Hardware troubleshooting.
- CO2: Analyze** the network configurations for customizing web pages and search engines.
- CO3: Apply** the basic editing function, formatting text & objects on a required content.
- CO4: Apply** the formulas, functions and visualizations to manage the data.
- CO5: Understand** the libraries and models of chatGPT to generate information.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The Process of Software Installation & Hardware troubleshooting.			L2
CO2	Analyze	the network configurations		for customizing web pages and search engines	L4
CO3	Apply	The basic editing function, formatting text & objects		on a required content	L3
CO4	Apply	the formulas, functions and visualizations		to manage the data	L3
CO5	Understand	The libraries and models of chatGPT		to generate information	L2

**List of Experiments**

**PC Hardware & Software Installation**

**Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.[CO1]

**Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.[CO1]

**Task 3:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.[CO1]

**Task 4:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.[CO1]

**Task 5:** Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.[CO1]

**Internet & World Wide Web**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.[CO2]

**Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.[CO2]

**Task 3:** Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student. [CO2]

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms. [CO2]

**LaTeX and WORD**

**Task 1 – Word Orientation:** The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word. [CO3]

**Task 2:** Using La TeX and Word to create a project certificate. Features to be covered:- Formatting

Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word. [CO3]

**Task 3:** Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes. [CO3]

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word. [CO3]

#### **EXCEL**

**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources. [CO4]

**Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text[CO4]

**Task 2:** Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, [CO4]

#### **LOOKUP/VLOOKUP**

**Task 3:** Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting[CO4]

#### **POWER POINT**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint. [CO4]

**Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts. [CO4]

**Task 3:** Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides. [CO4]

#### **AI TOOLS – ChatGPT**

**Task 1:** Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them. [CO5]

• Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

**Task 2:** Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas[CO5]

• Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

**Task 3:** Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are. [CO5]

• Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

#### **Reference Books:**

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and re pair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

#### **Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	2	3										1	
<b>CO2</b>	3	3	3	3	3								
<b>CO3</b>	3	3	3	2	3						3	2	
<b>CO4</b>	3	3	3	2	3						3		2
<b>CO5</b>	2	2											1

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

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2 3 3
5	CO5: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify (L3)	2 2

**Justification Statements :**

**CO1: Understand** The Process of Software Installation & Hardware troubleshooting

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Review(L2)**

CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)

**CO2: Analyze** the network configurations for customizing web pages and search engines

**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 editing function, formatting text & objects on a required content.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO3 Action verb is greater than 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 high(3)

**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 moderate (2)

**PO5: Apply (L3)**

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

Documentation and presentation is learning process to find the solution better manner the correlation is high (3)

**CO 4: Apply** the formulas, functions and visualizations to manage the data.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

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

**PO2: identify(L3)**

CO4 Action verb is greater than 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 as PO4 verb by one level. Therefore, the correlation is moderate (2)

**PO5: Apply (L3)**

CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

Spread sheets in Excel is the trending approach in the current days Therefore, the correlation is high (3)

**CO 5: Understand** the libraries and models of chatGPT to generate information.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Identify(L3)**

CO1 Action verb is same as PO2 verb. Therefore, the correlation is moderate (2)



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

Course Code	Year & Sem	Data Structures (Common to CSE, CIC, CSE(DS), AIML & AIDS)	L	T/CLC	P	C
23APC0501	I-II		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the concepts of Linear Data Structures to sort the data

**CO 2: Apply** the Linked list concepts to perform operations on data.

**CO 3: Apply** the stacks features to manage the memory

**CO 4: Analyse** various operations of queues, dequeues and their applications.

**CO 5: Understand** binary search trees and hash tables to facilitate indexed search

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts of Linear Data Structures		to sort the data	L2
CO2	Apply	The Linked list concepts		to perform operations on data.	L3
CO3	Apply	The stacks features		to manage the memory	L3
CO4	Analyse	various operations of queues, dequeues and their applications.			L4
CO5	Understand	The Binary Search Trees and hash tables		to facilitate indexed search	L2

<b>UNIT - I</b>	9 Hrs
<b>Introduction to Linear Data Structures:</b> Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort	
<b>UNIT - II</b>	9 Hrs
<b>Linked Lists:</b> Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists	
<b>UNIT - III</b>	9 Hrs
<b>Stacks:</b> Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.	
<b>UNIT - IV</b>	9 Hrs
<b>Queues:</b> Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc. Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.	
<b>UNIT - V</b>	9 Hrs
<b>Trees:</b> Introduction to Trees, Binary Search Tree - Insertion, Deletion & Traversal <b>Hashing:</b> Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc	
<b>Textbooks:</b>	
1.Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition. 2.Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson - Freed, Silicon Press, 2008	
<b>Reference Books:</b>	
1.Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders 2.C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft 3.Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum 4.Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein 5.Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick 6. STP   978-93-93162-18-2   Data Structures (JNTU) - Dr. S. Vasundra	
<b>Online Learning Resources:</b>	
www.nptel.ac.in	

### Mapping of course outcomes with program outcomes

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

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

### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	18	24%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	14	19%	2	CO2: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Analysis (L4) PO11: Thumb rule	3 3 2 1
3	15	20%	2	CO3: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Analysis (L4) PO11: Thumb rule	3 3 2 2
4	13	18%	2	CO4: Analyse	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3 2
5	14	19%	2	CO5: Understand	L2	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: review(L2) PO3: develop(L3) PO4: Interpret(L2) PO11: Thumb rule	2 3 2 3 2
	74	100 %						

### Justification Statements :

**CO1: Understand the** concepts of Linear Data Structures to sort the data

**Action Verb: Understand (L2)**

PO1 Verb: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2 Verb: Review (L2)

CO1 Action verb is same level as PO2. Therefore, the correlation is high (3)

**CO2: Apply** the Linked list concepts to perform operations on data.

**Action Verb: Apply (L3)**

PO1: Apply (L3)

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Develop (L3)

CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)

PO4: Analysis (L4)

CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

PO11: Thumb rule

For some of Linear Data Structure applications, array and structure concepts are used to write programs store the data. Therefore, the correlation is low (1)

**CO3: Apply the** stacks features to manage the memory

**Action Verb: Apply (L3)**

PO1: Apply (L3)

CO3 Action verb is same level 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)

PO4: Analysis (L4)

CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

PO11: Thumb rule

For some of Data Structure applications, stacks concepts are used to write programs to manage programs. Therefore, the correlation is low (1)

**CO4: Analyse** various operations of queues, dequeues and their applications.

**Action Verb: Analyse (L4)**

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 PO1 verb by two levels. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)

PO4: Analysis (L4)

CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)

PO11: 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 moderate (2)

**CO5: Understand** binary search trees and hash tables to facilitate indexed search

**Action Verb: Create (L6)**

PO1: Apply(L3)

CO5 Action verb is greater than PO1 verb by three levels. Therefore, the correlation is high (3)

PO2: Review (L6)

CO5 Action verb is same level as 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: Interpret (L2)

CO5 Action verb is greater than PO4 verb by two levels. Therefore, the correlation is high (3)

PO11S: Thumb rule

For some of data manipulations Sorting and File Organization methods are used to solve storage problems. Therefore, the correlation is low (3)



(Autonomous)

Common to I Sem ECE/ AI&amp;DS/AI&amp;ML/CE/ME &amp; II Sem CSE/CIC/EEE/CSD

Subject Code: 23ABS9908	Subject Name: <b>Engineering Physics Lab</b>	L 0	T 0	P 2	Credits: 1
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**Course Outcomes**

- CO1: **Analyze** the properties of light for engineering problems.  
 CO2: **Evaluate** the crystallite size using X-ray diffraction.  
 CO3: **Analyze** the basic properties of dielectric and magnetic behavior of the given material.  
 CO4: **Determine** the mechanical behavior of a 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 engineering problems.	L4
2	Evaluate	The crystallite size using X-ray diffraction.			L5
3	Analyze	The basic properties of dielectric and magnetic behavior of the given material.			L4
4	Determine	The mechanical behavior of a given material.			L5
5	Evaluate	The basic parameters of a given semiconductor material.			L5

**List of Experiments:**

- Determination of radius of curvature of a given Plano-convex lens by Newton's rings – CO1.
- Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration – CO1.
- Study the variation of B versus H by magnetizing the magnetic material (B-H curve) – CO3.
- Determination of wave length of Laser light using diffraction grating – CO1.
- Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method – CO3.
- Determination of energy gap of a semiconductor using p-n junction diode – CO5.
- Determination of the resistivity of semiconductors by four probe methods – CO5.
- Determination of the crystallite size using X-Ray Diffraction spectra – CO2.
- Determination of the numerical aperture of a given optical fiber and angle of acceptance – CO1.
- Verification of Brewster's law – CO1.
- Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum – CO4.
- Determination of rigidity modulus of the material of the given wire using Torsional pendulum – CO4.
- Determination of temperature coefficients of a thermistor – CO5.
- Determination of dielectric constant using charging and discharging method – CO3.
- Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect – CO5.
- Sonometer: Verification of laws of stretched string – CO4.
- Determination of magnetic susceptibility by Kundt's tube method – CO3.
- Determination of Frequency of electrically maintained tuning fork by Melde's experiment – CO4.

**Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO**

**Experiments may be conducted in virtual mode.**

**References:**

- A Textbook of Practical Physics - S. Balasubramanian, M. N. Srinivasan, S. Chand Publishers, 2017.
- Sun | 978-93-92933-95-0 | Engineering Physics (JNTU) - Dr. K. Ramya

**URL:** [www.vlab.co.in](http://www.vlab.co.in)

### Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3			3									
2	3			3									
3	3			3									
4	3			3									
5	3			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	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
2	6	16	2	Evaluate	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
3	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
4	6	16	2	Determine	L5	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							

#### 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: Evaluate the crystallite size using X-ray diffraction.

##### Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

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

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

#### CO3: 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)

CO3 Action Verb level is greater than PO1 action verb by one level; Therefore correlation is high (3).

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

#### CO4: Determine the mechanical behavior of a given material using dynamic methods.

##### Action Verb: Determine (L5)

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

CO4 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).

CO4 Action Verb is greater than PO4 verb by one level; 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).



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

Course Code	Year & Sem	Electrical and Electronics Engineering Workshop	L	T	P	C
23AES0202	I-II		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the Electrical circuit design, measurement of resistance, power, and power factor.

CO2: **Apply** suitable methods to measure Resistance, power, energy and power factor.

CO3: **Design** suitable methods for magnetization characteristics of D. C shunt generator.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Electrical circuit design; measurement of resistance, power, power factor			L2
CO2	Apply	Suitable methods to measure Resistance, power, energy and power factor.			L3
CO3	Design	Suitable methods for magnetization characteristics of D. C shunt generator.			L6

**SYLLABUS:**

**PART A  
ELECTRICAL ENGINEERING LAB**

**List of experiments:**

1. Verification of Kirchoff's current law and Voltage law-(CO1).
2. Verification of Superposition theorem-(CO1).
3. Measurement of Resistance using Wheat stone bridge-(CO1).
4. Measurement of Power and Power factor using Single-phase watt-meter-(CO2).
5. Measurement of Earth Resistance using Megger-(CO2).
6. Calculation of Electrical Energy for Domestic Premises-(CO2).
7. Magnetization Characteristics of DC shunt Generator-(CO3).

**Reference Books:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition
4. Amaravathi | 978-93-93199-46-1 | Basic Electrical & EE (JNTU) - Dr. K. Gopi

**Note:** Minimum Six Experiments to be performed.

**PART B  
ELECTRONICS ENGINEERING LAB**

**COURSE OUTCOMES:**

After completion of the course, students will be able to:

CO4: **Understand** the V-I Characteristics of diodes and its applications.

CO5: **Analyze** the input and output characteristics of BJT and its applications.

CO6: **Analyze** the truth tables of all logic gates and f/f's using IC's.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO4	Understand	V-I Characteristics of diodes and its applications.			L2
CO5	Analyze	input and output characteristics of BJT and its applications			L4
CO6	Analyze	Truth tables of all logic gates and f/f's using IC's.			L4

**List of Experiments:**

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias. (CO4)
2. Plot VI characteristics of Zener Diode and its application as voltage Regulator. (CO4)
3. Implementation of half wave and full wave rectifiers (CO4)

4. Plot Input & Output characteristics of BJT in CE and CB configurations (CO5)
5. Frequency response of CE amplifier. (CO5)
6. Simulation of RC coupled amplifier with the design supplied. (CO5)
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs. (CO6)
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. (CO6)

**Tools Equipment Required:** DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROS, and all the required active devices.

**References:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits - Conventional Flow Version, Pearson Education, 2009.
4. Amaravathi | 978-93-93199-46-1 | Basic Electrical & EE (JNTU) - Dr. K. Gopi

**Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.**

**Mapping of course outcomes with program outcomes**

Mapping of Course outcomes with Program outcomes													
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1		1					1			2	
CO2	3	2		2					1			2	
CO3		3		3					1			2	1
CO4	2	3											
CO5	3	3											
CO6	3	3											

**Levels of correlation, viz., 1.Low, 2.Moderate, 3.High**

**Justification Table:**

CO	COs		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Understand	L2	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4: Analyze (L4) PO9: Thumb Rule	2 1 1 1
2	Apply	L3	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4: Analyze (L4) PO9: Thumb Rule	3 2 2 1
3	Design	L6	PO2, PO4, PO9	PO2: Analyze (L4) PO4: Design (L6) PO9: Thumb Rule	3 3 1
4	Understand	L2	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	2 3
5	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
6	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3

**CO1: Understand the Electrical circuit design, measurement of resistance, power, and power factor.**

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).

PO4: Analyze (L4)

CO1 Action Verb is Less than PO4 verb by two level; Therefore, correlation is low (1).

PO9: Using Thumb Rule, CO1 correlates to PO9 as low (1).

**CO2: Apply suitable methods to measure Resistance, power, energy and power factor.**

Action Verb: Apply (L3)

PO1: Apply (L3)

CO2 Action Verb is same as 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).

PO4: Analyze (L4)

CO2 Action Verb is Less than PO4 verb by one level; Therefore, correlation is moderate (2).

PO9: Using Thumb Rule, CO2 correlates to PO9 as low (1).

**CO3: Design suitable methods for magnetization characteristics of D. C shunt generator.**

Action Verb: Design (L6)

PO2: Analyze (L4)

CO3 Action Verb is greater than PO2 verb by two level; Therefore, correlation is high (3).

PO4: Design (L6)

CO3 Action Verb is same as PO4 verb; Therefore, correlation is high (3).

PO9: Using Thumb Rule, CO3 correlates to PO9 as low (1).

**CO4: Understand the V-I Characteristics of diodes and its applications.**

**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).

**CO5: Analyze the input and output characteristics of BJT and its applications.**

**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 equal to PO2 verb; Therefore correlation is high (3).

**CO6: Analyze the truth tables of all logic gates and f/f's using IC's.**

**Action Verb: Analyze (L4)**

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



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

Course Code	Year & Sem	Data Structures Lab (Common to CSE, CIC, CSE(DS), AIML & AIDS)	L	T	P	C
23APC0502	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 techniques using Arrays

**CO 2: Develop** linked list operations for efficient access to data.

**CO 3: Develop** stacks and queues to solve real time applications.

**CO 4: Develop** binary search tree operations using linked list

**CO 5: Apply** the hashing techniques to organise the data in hash table.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	sorting and searching algorithm	using arrays		L3
CO2	Develop	linked list operations		for efficient access to data.	L6
CO3	Develop	stacks and queues		to solve real time applications.	L6
CO4	Develop	binary search tree operations	using linked list		L6
CO5	Apply	the hashing techniques		to organise the data in hash table.	L3

**List of Experiments:**

**Exercise 1: Array Manipulation[CO1]**

- i) Write a program to reverse an array.
- ii) C Programs to implement the Searching Techniques – Linear & Binary Search
- iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

**Exercise 2: Linked List Implementation[CO2]**

- i) Implement a singly linked list and perform insertion and deletion operations.
- ii) Develop a program to reverse a linked list iteratively and recursively.
- iii) Solve problems involving linked list traversal and manipulation.

**Exercise 3: Linked List Applications[CO2]**

- i) Create a program to detect and remove duplicates from a linked list.
- ii) Implement a linked list to represent polynomials and perform addition.
- iii) Implement a double-ended queue (deque) with essential operations.

**Exercise 4: Double Linked List Implementation[CO2]**

- i) Implement a doubly linked list and perform various operations to understand its properties and applications.
- ii) Implement a circular linked list and perform insertion, deletion, and traversal.

**Exercise 5: Stack Operations[CO3]**

- i) Implement a stack using arrays and linked lists.
- ii) Write a program to evaluate a postfix expression using a stack.
- iii) Implement a program to check for balanced parentheses using a stack.

**Exercise 6: Queue Operations[CO3]**

- i) Implement a queue using arrays and linked lists.
- ii) Develop a program to simulate a simple printer queue system.
- iii) Solve problems involving circular queues.

**Exercise 7: Stack and Queue Applications[CO3]**

- i) Use a stack to evaluate an infix expression and convert it to postfix.
- ii) Create a program to determine whether a given string is a palindrome or not.
- iii) Implement a stack or queue to perform comparison and check for symmetry.

**Exercise 8: Binary Search Tree CO4]**

- i) Implementing a BST using Linked List.
- ii) Traversing of BST.

**Exercise 9: Hashing [CO5]**

- i) Implement a hash table with collision resolution techniques.
- ii) Write a program to implement a simple cache using hashing.

**Textbooks:**

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.

2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson - Freed, Silicon Press, 2008

**Reference Books:**

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Apply	L3	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	3 3
2	CO2: Develop	L6	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Design (L6) PO11: Thumb rule	3 3 3 3
3	CO3: Develop	L6	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Design (L6) PO11: Thumb rule	3 3 3 3
4	CO4: Develop	L6	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Design (L6) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO4: Analysis(L4) PO11: Thumb rule	3 3 2 3

**Justification Statements :**

**CO1: Apply** the sorting and searching techniques using Arrays

**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)

**CO2: Develop** linked list operations for efficient access to data.

**Action Verb: Develop (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)

PO4: Design (L6)

CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO11: 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: Develop** stacks and queues to solve real time applications

**Action Verb: Develop (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)

PO4: Design (L6)

CO3 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO11: 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: Develop** binary search tree operations using linked list

**Action Verb: Develop (L6)**

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 same as PO3 verb. Therefore, the correlation is high (3)

PO4: Analysis (L4)

CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)

PO11: 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:Apply** the hashing techniques to organise the data in hash table.

**Action Verb: Apply (L3)**

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)

PO4: Analysis (L4)

CO5 Action verb less than PO4 verb by one level. Therefore, the correlation is moderate (2)

PO11: Thumb rule

For some of data manipulations tree and graphs concepts are used to solve data storage problems. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	NSS/NCC/Scouts and Guides/Community Service	L	T	P	C
23AHM9904	I-II		0	0	1	0.5

**Course Outcomes:** After studying the course, students will be able to

**CO1: Understand** the importance of discipline, character and service motto of community.

**CO2: Analyze** the activities need to be done for nature protection

**CO3: Analyze** the social issues in a community and address it through the base camps.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the importance of discipline, character and service motto		of community	L1
CO2	Analyze	the activities need to be done for nature protection			L4
CO3	Analyze	the social issues in a community and address it through the base camps			L4

**UNIT-I**

**Orientation**

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.

**Activities:**

- i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
- iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
- iv) Conducting talent show in singing patriotic songs-paintings- any other contribution

**UNIT-II**

**Nature & Care**

**Activities:**

- i) Best out of waste competition.
- ii) Poster and signs making competition to spread environmental awareness.
- iii) Recycling and environmental pollution article writing competition.
- iv) Organizing Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

**UNIT-III**

**Community Service**

**Activities:**

- i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.
- ii) Mental health, Spiritual Health, HIV/AIDS,
- iii) Conducting consumer Awareness. Explaining various legal provisions etc.
- iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.
- vi) Conducting awareness programs on Health-related issues such as General Health,

**CORRELATION OF COS WITH THE POS & PSOS:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2								2			2
CO2	3	3								3			2
CO3	3	3								3			2

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

**CO-POMAPPING JUSTIFICATION:**

Unit No	Course Outcomes		Program Outcome (PO)	PO(s):Action Verb and BTL(forPO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Understand	L2	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 2 2
2	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3
3	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3

**Justification Statements:**

**CO1: Understand the importance of discipline, character and service motto of community.**

**Action Verb: Understand (L2)**

CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).  
CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).  
CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO10 as moderate (2).

**CO2: Analyze the activities need to be done for nature protection**

**Action Verb: Analyze (L4)**

CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2).  
CO2 Action Verb is same as PO2 verb, Therefore correlation is High (3)  
CO2 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4).

**CO3: Analyze the social issues in a community and address it through the base camps**

**Action Verb: Analyze (L4)**

CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2).  
CO3 Action Verb is same as PO2 verb, Therefore correlation is High (3)  
CO3 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4).

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)  
(Effective for the batches admitted in 2023-24)**

**Semester III (Second year)**

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	BS	23ABS9913	Discrete Mathematics and Graph Theory	2	1	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	2	1	0	3	30	70	100
3	PC	23APC0503	Digital Logic and Computer Organization	2	1	0	3	30	70	100
4	PC	23APC0504	Advanced Data Structures and Algorithms Analysis	2	1	0	3	30	70	100
5	PC	23APC0506	Object-Oriented Programming Through JAVA	2	1	0	3	30	70	100
6	PC	23APC0505	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0507	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	0	2	2	30	70	100
9	MC	23AMC9901	Environmental Science	2	0	0	-	30	-	30
<b>Total</b>				<b>12</b>	<b>06</b>	<b>08</b>	<b>20</b>	<b>270</b>	<b>560</b>	<b>830</b>



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Course Code	Year & Sem	Discrete Mathematics and Graph Theory (Common to CSE,CIC,CSD,AI&DS, AI&ML)	L	T/ CLC	P	C
23ABS9913	II-I		2	1	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 inhomogeneous 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
CO1	Apply	the concepts of mathematical logic	in various engineering fields		L3
CO2	Understand	the concepts related to set theory and algebraic structures.			L2
CO3	Analyze	the theory of elementary combinatorics	by using binomial and multinomial theorems		L4
CO4	Evaluate	The solutions of homogeneous and inhomogeneous recurrence relations.			L5
CO5	Apply	The graph theory solving computer science problems.		and finite difference approximation.	L3

<b>UNIT – I: Mathematical Logic</b>	9Hrs
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	
<b>UNIT – II: Set theory</b>	9Hrs
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 , Monoids, groups, sub groups, homomorphism, Isomorphism.	
<b>UNIT – III: Elementary Combinatorics</b>	9Hrs
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.	
<b>UNIT – IV: Recurrence Relations</b>	9Hrs
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.	
<b>UNIT – V: Graphs</b>	9Hrs
Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler’s Formula, Multi graphs and Euler Circuits, Hamiltonian Graphs.	
<b>Textbooks</b>	
1.J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002. 2.Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited	

<b>Reference Books</b>
1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.
3. Dr. J. Rajendra Prasad, T. Rama Rao and A. Madana Mohan Rao, Mathematical Foundation of Computer Science
<b>Online Learning Resources:</b>
<a href="http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf">http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf</a>

**Mapping of COs to POs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2	2										
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)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				Apply	L3	PO1	Apply (L3)	3
2				Understand	L2	PO1	Apply (L3)	2
3				Analyze	L4	PO2	Analyze (L4)	3
4				Evaluate	L5	PO2	Analyze (L4)	3
5				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 inhomogeneous recurrence relations.**

**Action Verb: Evaluate (L5)**

PO2 Verb: Analyze (L4)

CO4 Action Verb 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).



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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
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Course Code	Year & Sem	Universal Human Values	L	T/ CLC	P	C
23AHM9905	II-I		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
1	Understand	the essentials of human values, self-exploration, happiness and prosperity for value added education.			L2
2	Analyze	the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.			L4
3	Apply	the nine universal human values in relationships for harmony in the family and orderliness in the society.			L3
4	Evaluate	the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.			L5
5	Apply	the holistic understanding of harmony on professional ethics through augmenting universal human order.			L3

<b>UNIT - I:</b>	6 lectures and 3 tutorials for practice session
Introduction to Value Education (6 lectures and 3 tutorials for practice session)	
Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)	
Lecture 2: Understanding Value Education	
Tutorial 1: Practice Session PS1 Sharing about Oneself	
Lecture 3: self-exploration as the Process for Value Education	
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations	
Tutorial 2: Practice Session PS2 Exploring Human Consciousness	
Lecture 5: Happiness and Prosperity – Current Scenario	
Lecture 6: Method to Fulfill the Basic Human Aspirations	
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance	
<b>UNIT - II:</b>	6 lectures and 3 tutorials for practice session
Harmony in the Human Being (6 lectures and 3 tutorials for practice session)	
Lecture 7: Understanding Human being as the Co-existence of the self and the body.	
Lecture 8: Distinguishing between the Needs of the self and the body	
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.	
Lecture 9: The body as an Instrument of the self	
Lecture 10: Understanding Harmony in the self	
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self	
Lecture 11: Harmony of the self with the body	
Lecture 12: Programme to ensure self-regulation and Health	
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body	
<b>UNIT - III:</b>	6 lectures and 3 tutorials for practice session
Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)	
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction	
Lecture 14: 'Trust' – the Foundational Value in Relationship	

<p>Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society Lecture 18: Vision for the Universal Human Order Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal</p>	
<b>UNIT – IV:</b>	4 lectures and 2 tutorials for practice session
<p>Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session) Lecture 19: Understanding Harmony in the Nature Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels Lecture 22: The Holistic Perception of Harmony in Existence Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.</p>	
<b>UNIT – V:</b>	6 lectures and 3 tutorials for practice session
<p>Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session) Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Lecture 26: Competence in Professional Ethics Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order</p>	
<b>Textbooks</b>	
<p>a. The Textbook 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 b. The Teacher's Manual 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</p>	
<b>Reference Books</b>	
<ol style="list-style-type: none"> <li>Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.</li> <li>Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.</li> <li>The Story of Stuff (Book).</li> <li>The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi</li> <li>Small is Beautiful - E. F Schumacher.</li> <li>Slow is Beautiful - Cecile Andrews</li> <li>Economy of Permanence - J C Kumarappa</li> <li>Bharat Mein Angreji Raj – Pandit Sunderlal</li> <li>Rediscovering India - by Dharampal</li> <li>Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi</li> <li>India Wins Freedom - Maulana Abdul Kalam Azad</li> <li>Vivekananda - Romain Rolland (English)</li> <li>Gandhi - Romain Rolland (English)</li> </ol>	
<b>Online Learning Resources:</b>	
<ol style="list-style-type: none"> <li><a href="https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf">https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf</a></li> <li><a href="https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf">https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf</a></li> <li><a href="https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf">https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf</a></li> <li><a href="https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf">https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf</a></li> <li><a href="https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf">https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&amp;%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf</a></li> <li><a href="https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-">https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-</a></li> </ol>	

SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. [https://onlinecourses.swayam2.ac.in/aic22\\_ge23/preview](https://onlinecourses.swayam2.ac.in/aic22_ge23/preview)

#### Mapping of course outcomes with program outcomes

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

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

#### Correlation 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	7	19.4	2	Understand	2	PO8,PO11	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,PO11	Thumb Rule	3,3,3,3
5	7	19.4	2	Apply	3	PO6,PO7,PO8,PO11	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 PO11 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 PO11 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 PO11 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 PO11 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 PO11 as moderate (2).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	Digital Logic and Computer Organization (Common to CSE & CIC)	L	T/ CLC	P	C
23APC0503	II-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the number system concepts, number conversions, logic gates using binary numbers

**CO2: Understand** the sequential circuits, flip-flops, registers and computer fundamentals to store data.

**CO3: Evaluate** the Arithmetic operations for understanding execution process

**CO4: Analyze** the hardware requirements of primary and secondary memories to store the data.

**CO5: Apply** Input/Output devices and Interfaces to connect multiple devices.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the number system concepts, number conversions, logic gates		using binary numbers	L2
CO2	Understand	the sequential circuits, flip-flops, registers and computer fundamentals			L2
CO3	Evaluate	the Arithmetic operations		for understanding execution process	L5
CO4	Analyze	the hardware requirements of primary and secondary memories		to store the data	L4
CO5	Apply	Input/Output devices and Interfaces			L3

<b>UNIT - I</b>	9Hrs
<b>Data Representation:</b> Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Character representation.	
<b>Digital Logic Circuits-I:</b> Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers, dumping.	
<b>UNIT - II</b>	9Hrs
<b>Digital Logic Circuits-II:</b> Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters	
<b>Basic Structure of Computers:</b> Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Addressing modes, subroutines.	
<b>UNIT - III</b>	12Hrs
<b>Computer Arithmetic :</b> Addition and Subtraction of Signed Numbers, Ripple carry adder, Ripple carry multiplier, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations	
<b>Processor Organization:</b> Fundamental Concepts, Execution of a Complete Instruction, Multiple -Bus Organization, Hardwired Control and Multi programmed Control	
<b>Pipelining:</b> Basic Concepts, Data Hazards, Instruction Hazards, Forms of Parallel Processing	
<b>UNIT - IV</b>	9Hrs
<b>The Memory Organization:</b> Memory hierarchy, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Cache mappings, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage	
<b>UNIT - V</b>	9Hrs
<b>Input /Output Organization:</b> Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Synchronous and Asynchronous bus, Interface Circuits, Standard I/O Interfaces	
<b>Textbooks</b>	
1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6 <sup>th</sup> edition, McGraw Hill, 2023.	
2. Digital Design, 6 <sup>th</sup> Edition, M. Morris Mano, Pearson Education, 2018.	
3. Computer Organization and Architecture, William Stallings, 11 <sup>th</sup> Edition, Pearson, 2022.	
<b>Reference Books</b>	
1. Computer Systems Architecture, M.Moris Mano, 3 <sup>rd</sup> Edition, Pearson, 2017.	

2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5<sup>th</sup> Edition, Thomson, 2003.
4. Computer Organization & Architecture, William Stallings, 11<sup>th</sup> Edition, Pearson, 2022

**Online Learning Resources:**

<https://nptel.ac.in/courses/106/103/106103068/>

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2:Analyze(L4) PO3: Develop(L3) PO11: Thumb rule	2 1 2 1
2	9	20	2	CO2 : Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2:Review(L2) PO3: Develop (L3) PO11: Thumb rule	2 3 2 1
3	9	20	2	CO3 : Evaluate	L5	PO1 PO2 PO3 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 3 2 1 1
4	9	20	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Develop (L3)	3 3 3 3
5	9	20	2	CO5 : Apply	L3	PO1 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO4: Analyze (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 2 3 2 2
	45	100						

**Justification Statements:**

**CO1: Understand** the number system concepts, number conversions, logic gates using binary numbers

Action Verb: Understand(L2)

PO1 Verb: Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2 Verb: Analyze(L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)

PO3: Develop (L3)

CO1 Action verb is less than PO3 verb . Therefore, the correlation is moderate (2)

PO11: Thumb rule

updating the logical circuits and combinational circuits. Therefore, the correlation is low (1)

**CO2: Understand** the sequential circuits, flip-flops, registers and computer fundamentals to store data.

Action Verb: Understand(L2)

PO1: Apply(L3)

CO2 Action verb is greater than level PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2: Review(L2)

CO2 Action verb is less than PO2 verb by two level. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO2 Action verb is less than PO3 verb . Therefore, the correlation is moderate (2)

PO11: Thumb rule

Update sequential circuits and registers. Therefore, the correlation is low (1)

**CO3: Evaluate** the Arithmetic operations for understanding execution process

Action Verb: Evaluate(L5)

PO1: Apply(L3)

CO3 Action verb is higher level than PO1 verb level by two level. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is less than PO2 verb by one level. Therefore, the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

PO8: Thumb rule

Team work is required. Hence the correlation is low (1)

PO11: Thumb rule

Updating the Numbers and execution process. Therefore the correlation is low (1)

**CO4: Analyze** the hardware requirements of primary and secondary memories to store the data.

Action Verb: Analyze(L4)

PO1: Apply(L3)

CO4 Action verb is less 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 less than PO3 verb by two levels. Therefore, the correlation is High (3)

PO4: Develop (L3)

CO4 Action verb is less than PO4 verb by two levels. Therefore, the correlation is High (3)

**CO5: Apply** Input/Output devices and Interfaces to connect multiple devices

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO4: Analyze (L4)

CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

PO5: Apply(L3)

CO5 Action verb is less than PO5 verb . Therefore, the correlation is high (3)

PO8: Thumb rule

Team work is required to provide the solutions on different numbers. Hence the correlation is moderate (2)

PO11: Thumb rule

Updating the Numbers and execution process. Therefore, the correlation is moderate (2)



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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
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Course Code	Year & Sem	Advanced Data Structures and Algorithms Analysis (Common to CSE,CIC,CSE(DS),AIDS & AIML)	L	T/ CLC	P	C
23APC0504	II-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the asymptotic notations and operations on AVL, B-Trees.

CO2: **Apply** the Trees, Graphs, Divide and conquer method to solve various problems.

CO3: **Apply** the greedy and dynamic programming methods to solve real time problems.

CO4: **Evaluate** the backtracking, 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	Understand	The asymptotic notations	operations on AVL,B-Trees		L2
CO2	Apply	The Trees, Graphs, Divide and conquer method		to solve various problems	L3
CO3	Apply	The greedy and dynamic programming methods		to solve real time problems.	L3
CO4	Evaluate	The backtracking, branch and bound methods		to solve minimization problems	L5
CO5	Analyze	The P, NP, NP hard, NP complete problems		for solving reduction problems	L4

<b>UNIT – I</b>	9Hrs
Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. Review of Binary Search Trees: Binary Search Tree – Insertion, Deletion & Traversal AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications	
<b>UNIT – II</b>	9 Hrs
Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications Divide and Conquer: The General Method, Quick Sort, Merge Sort, Finding Minimum and Maximum, Strassen’s matrix multiplication.	
<b>UNIT – III</b>	9 Hrs
Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths Dynamic Programming: General Method, Multi Stage graphs, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, Travelling Salesperson problem	
<b>UNIT – IV</b>	8 Hrs
Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem.	
<b>UNIT – V</b>	10Hrs
NP Hard and NP Complete Problems: Basic Concepts, Cook’s theorem NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP) NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling	
<b>Textbooks:</b>	
1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press. 2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran 2nd Edition University Press	
<b>Reference Books:</b>	
1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia 2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill 3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.	

4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs: N. Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz, Sahni & Mehta, Galgotia Pub.
7. Data structures in Java: Thomas Standish, Pearson Education Asia.

**Online Learning Resources:**

1. [https://www.tutorialspoint.com/advanced\\_data\\_structures/index.asp](https://www.tutorialspoint.com/advanced_data_structures/index.asp)
2. <http://peterindia.net/Algorithms.html>
3. Abdul Bari, [1. Introduction to Algorithms \(youtube.com\)](https://www.youtube.com/watch?v=...)

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11: Thumb rule	2 1 2
2	9	20	2	CO2: Apply	L3	PO1 PO2 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO4: Analyze(L4) PO6: Thumb rule PO11: Thumb rule	3 2 2 2 2
3	9	20	2	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO6: Thumb rule PO11: Thumb rule	3 2 3 2 2 2
4	9	20	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 2 2
5	9	20	2	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	2 3 3 3 3 2
	45	100						

**Justification Statements:**

**CO1: Understand** the asymptotic notations and operations on AVL, B-Trees.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Analyze (L4)**

CO1 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)

**PO11: Thumb rule**

The asymptotic performance of algorithms, To Analyze the behavior of algorithms as their input increases. Therefore the correlation is moderate (2)

**CO2: Apply** the Trees, Graphs, Divide and conquer method to solve various 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 level. Therefore, the correlation is moderate (2)

**PO4: Analyze (L4)**

CO2 Action verb is lesser than PO4 verb by one level. Therefore, the correlation is moderate (2)

**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 moderate (2)

**PO11: Thumb rule**

Finding optimal solution to a real-world problem is a continuous activity. Therefore, the correlation is

moderate (2)

**CO3: Apply** the greedy and dynamic programming methods to solve real time problems.

**Action Verb: Apply (L3)**

**PO1: Apply(L3)**

CO3 Action verb is same level of PO1 verb. Therefore, the correlation is High (3)

**PO2: Analyze (L4)**

CO3 Action verb is less than of PO2 verb by one level. Therefore, the correlation is moderate (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 PO4 verb by one level. Therefore, the correlation is moderate (2))

**PO6 : Thumb rule**

backtracking and searching techniques were applied for GPS. Therefore, the correlation is moderate (2)

**PO11: Thumb rule**

backtracking and searching techniques will give optimal solutions to various problems.

Therefore, the

correlation is moderate (2)

**CO4: Evaluate the** backtracking, branch and bound methods to solve minimization problems.

**Action Verb: Evaluate (L5)**

**PO1: Apply(L3)**

CO3 Action verb is greater than of PO1 verb . Therefore, the correlation is High (3)

**PO2: Analyze (L4)**

CO3 Action verb is greater than of PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop (L3)**

CO3 Action verb is greater than of PO3 verb. Therefore the correlation is high(3)

**PO4: Analyze (L4)**

CO3 Action verb is greater than of PO4 verb. Therefore the correlation is high(3)

**PO6 : Thumb rule**

Backtracking and searching techniques were applied for GPS. Therefore, the correlation is moderate (2)

**PO11: Thumb rule**

Backtracking and searching techniques will give optimal solutions to various problems.

Therefore, the

correlation is moderate (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 less than of PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2: Analyze (L4)**

CO5 Action verb is same level of 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)

**PO11: Thumb rule**

In research-oriented purpose P, NP concepts can be applied. Therefore, the correlation is moderate (2)



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

Course Code	Year & Sem	Object-Oriented Programming Through JAVA (common to CSE, CIC, CSE(DS), AIDS & AIML)	L	T/ CLC	P	C
23APC0506	II-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the Java language components and how to apply in applications

**CO2: Apply** the concepts of OOP's fundamentals like classes, Methods and class libraries to develop applications

**CO3: Analyze** the concepts of arrays, inheritance and interfaces to develop efficient java applications.

**CO4: Evaluate** the concepts of packages, file I/O, by using access control, and exception handling mechanisms to solve real world scenarios

**CO5: Create** the GUI applications by using concepts like multi-threading, Java FX, JDBC

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the Java language components		How to apply in applications	L2
CO2	Apply	the concepts of OOP's fundamentals	like classes, methods and class libraries	to develop applications	L3
CO3	Analyze	the concepts of arrays, inheritance and interfaces		to develop efficient java applications	L4
CO4	Evaluate	the concepts of packages, file I/O	by using access control, and exception handling mechanisms	to solve real world scenarios	L5
CO5	Create	The GUI applications, JDBC applications	by using concepts like multi-threading, Java FX, JDBC		L6

UNIT – I	7 Hrs
<p><b>Object Oriented Programming:</b> Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.</p> <p><b>Data Types, Variables, and Operators:</b> Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator ( = ), Basic Arithmetic Operators, Increment (++) and Decrement ( - - ) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.</p> <p><b>Control Statements:</b> Introduction, if Expression, Nested if Expressions, if-else Expressions, Ternary Operator?, Switch Statement, Iteration Statements, while Expression, do-while Loop, for Loop, Nested for Loop, For-Each for Loop, Break Statement, Continue Statement.</p>	
UNIT – II	12 Hrs
<p><b>Classes and Objects:</b> Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.</p> <p><b>Methods:</b> Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.</p>	
UNIT – III	19 Hrs
<p><b>Arrays:</b> Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.</p> <p><b>Inheritance:</b> Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.</p> <p><b>Interfaces:</b> Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.</p>	

<b>UNIT – IV</b>	<b>19 Hrs</b>
<p><b>Packages and Java Library:</b> Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.</p> <p><b>Exception Handling:</b> Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.</p> <p><b>Java I/O and File:</b> Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)</p>	
<b>UNIT – V</b>	<b>19 Hrs</b>
<p><b>String Handling in Java:</b> Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.</p> <p><b>Multithreaded Programming:</b> Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.</p> <p><b>Java Database Connectivity:</b> Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface</p> <p><b>Java FX GUI:</b> Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)</p>	
<b>Textbooks:</b>	
<ol style="list-style-type: none"> <li>1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.</li> <li>2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.</li> <li>3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. The complete Reference Java, 11th edition, Herbert Schildt, TMH</li> <li>2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson</li> </ol>	
<b>Online Resources:</b>	
<ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/106/105/106105191/">https://nptel.ac.in/courses/106/105/106105191/</a></li> <li>2. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview</a></li> </ol>	

#### Mapping of course outcomes with program outcomes

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	12	13.63%	2	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	13	14.77%	2	CO2: Apply	L3	PO2 PO3 PO4 PO5 PO10 PO11	PO2: Review (L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3) PO10: Thumb Rule PO11: Thumb Rule	3 3 2 3 2 2
3	23	26.13%	3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design(L6) PO4: Interpret(L5) PO5: SSelect(L5)	3 3 1 2 2
4	20	22.72%	3	CO4: Evaluate	L5	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze(L4) PO5: Select(L3)	3 3 3 3
5	20	22.72%	3	CO5: Create	L6	PO2 PO3 PO5 PO10 PO11	PO2: Formulate (L6) PO3: Design (L6) PO5: Create(L6) PO10: Thumb Rule PO11: Thumb rule	3 3 3 3 3
	88	100 %						

**Justification Statements:**

**CO1: Understand the Java language components and how to apply in applications.**

**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 concepts of OOP's fundamentals like classes, Methods and class libraries to develop applications**

**Action Verb: Apply (L3)**

PO2: Review (L2)

CO2 Action verb is same level as 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 moderate (2)

PO5: Apply(L3)

CO2 Action verb is less than PO5 verb by three level. Therefore, the correlation is High (3)

PO10: Thumb Rule

Create some Java programs to solve real world problems. Therefore, the correlation is moderate (2)

PO11: Thumb Rule

Learn java programs to solve. Therefore, the correlation is moderate (2)

**CO3: Analyze the concepts of arrays, inheritance and interfaces to develop efficient java applications.**

**Action Verb: Analyze(L4)**

PO1: Apply (L3)

CO3 Action verb is Greater than PO1. Therefore, the correlation is high (3)

PO2: Analyze (L4)

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

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by two level. Therefore, the correlation is low (1)

PO4: Interpret (L5)

CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)

PO5: Select (L5)

CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)

**CO4: Evaluate the concepts of packages, access control, file I/O, and exception handling**

**mechanisms to solve real world scenarios**

**Action Verb: Evaluate(L5)**

PO1: Apply(L3)

CO4 Action verb is Greater than PO1. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is Greater than PO2. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO4 Action verb is Greater than PO4. Therefore, the correlation is high (3)

PO5: Select (L3)

CO4 Action verb is Greater than PO5. Therefore, the correlation is high (3)

**CO5: Create GUI applications by using concepts like multi-threading, Java FX, JDBC**

**Action Verb: Create (L6)**

PO2: Formulate (L6)

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

PO3: Design (L6)

CO5 Action verb is same level as PO3. Therefore, the correlation is high (3)

PO5: Create (L6)

CO5 Action verb is same level as PO5. Therefore, the correlation is high (3)

PO10: Thumb Rule

Java is used to design simple and enterprise applications so need for project management.

Therefore, the correlation is high (3)

PO11: Thumb Rule

It is a programming language so new version available so we need to learn. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Advanced Data Structures and Algorithms Analysis Lab (Common to CSE,CIC,AIDS & AIML)	L	T	P	C
23APC0505	II-I		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the operations on AVL Trees, B-Trees and graph traversals.

**CO2: Create** the Min, Max Heap using arrays and find BFT, DFT for the graphs.

**CO3: Create** the sorting techniques for finding the time complexities and use greedy method to find single source shortest path.

**CO4: Apply** backtracking strategy for finding the N-Queens ,0/1 knapsack problem.

**CO5: Apply** greedy strategy for job sequencing and using dynamic programming to find 0/1 knapsack problem.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the operations	on AVL Trees, B-Trees and graph traversals		L2
CO2	Create	the Min, Max Heap using arrays and find BFT, DFT		for the graphs	L6
CO3	Create	the sorting techniques		for finding the time complexities	L6
CO4	Apply	backtracking strategy		for finding the N-Queens ,0/1 knapsack problem	L3
CO5	Apply	greedy strategy		for job sequencing	L3

**List of Experiments:**

- Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order. **(CO1)**
- Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations. **(CO1)**
- Construct Min and Max Heap using arrays, delete any element and display the content of the Heap. **(CO2)**
- Implement BFT and DFT for given graph, when graph is represented by  
a) Adjacency Matrix b) Adjacency Lists. **(CO2)**
- Write a program for finding the bi-connected components in a given graph. **(CO2)**
- Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases). **(CO2)**
- Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists. **(CO3)**
- Implement Job sequencing with deadlines using Greedy strategy. **(CO5)**
- Write a program to solve 0/1 Knapsack problem Using Dynamic Programming. **(CO4)**
- Implement N-Queens Problem Using Backtracking. **(CO4)**
- Use Backtracking strategy to solve 0/1 Knapsack problem. **(CO4)**
- Implement Travelling Sales Person problem using Branch and Bound approach. **(CO5)**

**Reference Books:**

- Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2ndEdition, Universities Press
- Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2ndEdition, University Press
- Data Structures and program design in C, Robert Kruse, Pearson Education Asia
- An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill

**Online Learning Resources:**

- <http://cse01-iiith.vlabs.ac.in/>
- <http://peterindia.net/Algorithms.html>

### Mapping of course outcomes with program outcomes

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

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

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 : Understand	L2	PO1 PO2 PO8 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO8: Thumb rule PO11: Thumb rule	2 1 1 2
2	CO2 : Create	L6	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO5: Develop (L6) PO11: Thumb rule	3 3 3 2
3	CO3 : Create	L6	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L6) PO4: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 1 1
4	CO4 : Apply	L3	PO1 PO2 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO8: Thumb rule PO11: Thumb rule	3 2 2 2
5	CO5 : Apply	L3	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Develop (L3) PO8: Thumb rule PO11: Thumb rule	3 2 3 3 1 2

#### Justification Statements :

**CO1: Understand** the operations on AVL Trees, B-Trees and graph traversals.

#### Action Verb : Understand (L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

PO2 Verb : Analyze(L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

PO8: Thumb rule

Perform operations on AVL trees and B-trees are individual. Therefore the correlation is low(1)

PO11 : Thumb rule

Apply different values of operations on AVL Trees, B-Trees and graph traversals is life long.

Therefore

the correlation is moderate (2)

**CO2: Create** the Min, Max Heap using arrays and find BFT, DFT for the graphs

#### Action Verb : Create (L6)

PO1 Verb : Apply(L3)

CO2 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Analyze(L4)

CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO5: Develop(L6)

CO2 Action verb is less than PO5 verb by one level. Therefore the correlation is high (3)

PO11: Thumb rule

To Apply the min and max heap on arrays and finding traversals on graphs is lifelong learning.

Therefore the

correlation is moderate (2)

**CO3: Create** the sorting techniques for finding the time complexities and use greedy method to find single source shortest path.

Action Verb : Create (L6)

PO1: Apply(L3)

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is greater than PO1 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 moderate (2)

PO4: Develop (L6)

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)

PO8: Thumb rule

Team work or individual work is required to analyze sorting techniques time complexities. Hence the

correlation is low (1)

PO11: Thumb rule

To Develop sorting techniques and single source shortest path as life long learning. Therefore the correlation

is low (1)

**CO4: Apply** backtracking strategy for finding the N-Queens ,0/1 knapsack problem

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

Team work/ individual work is required find the N-Queens and 0/1 Knapsack through

backtracking. Hence

the correlation is medium (2)

PO11: Thumb rule

To Develop back tracking in N-Queens problem is life long learning. Therefore the correlation is medium (2)

**CO5 : Apply** greedy strategy for job sequencing and using dynamic programming to find 0/1 knapsack

problem.

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 medium (2)

PO3: Design (L3)

CO5 Action verb is less than PO3 verb. Therefore the correlation is high (3)

PO4: Design (L3)

CO5 Action verb is less than PO4 verb. Therefore the correlation is high (3)

PO8: Thumb rule

Team work / individual work is required applying greedy strategy on job sequencing. Hence the correlation

is low (1)

PO11: Thumb rule

To apply dynamic programming for 0/1 knapsack is life long learning. Therefore the correlation is medium (2)



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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
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Course Code	Year & Sem	Object-Oriented Programming Through Java Lab (common to CSE,CIC, CSE(DS), AIDS & AIML)	L	T	P	C
23APC0507	II-I		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the Java syntax, data types, control structures and OOPs principles.

**CO2: Apply** the problem-solving skills and algorithmic thinking by using OOP concepts

**CO3: Apply** the fundamental OOP principles to solve programming problems effectively.

**CO4: Analyze** the Java libraries to implement thread Applications.

**CO5: Create** graphical user interface (GUI) applications using JavaFX

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The Java syntax, data types, control structures and OOPs principles			L2
CO2	Apply	The problem-solving skills and algorithmic thinking	by using OOP concepts		L3
CO3	Apply	The fundamental OOP principles		to solve programming problems effectively	L3
CO4	Analyze	The Java libraries		to implement thread Applications.	L4
CO5	Create	graphical user interface (GUI) applications	using JavaFX		L6

**List of Experiments:**

**Exercise - 1**

- Write a JAVA program to display default value of all primitive data type of JAVA **(CO1)**
- Write a java program that display the roots of a quadratic equation  $ax^2+bx=0$ . Calculate the discriminate D and basing on value of D, describe the nature of root. **(CO2)**

**Exercise - 2**

- Write a JAVA program to search for an element in a given list of elements using binary search mechanism. b) Write a JAVA program to sort for an element in a given list of elements using bubble sort. **(CO2)**
- Write a JAVA program using StringBuffer to delete, remove character. **(CO2)**

**Exercise - 3**

- Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method. **(CO2)**
- Write a JAVA program implement method overloading. **(CO3)**
- Write a JAVA program to implement constructor. **(CO3)**
- Write a JAVA program to implement constructor overloading. **(CO3)**

**Exercise - 4**

- Write a JAVA program to implement Single Inheritance **(CO3)**
- Write a JAVA program to implement multi level Inheritance **(CO3)**
- Write a JAVA program for abstract class to find areas of different shapes **(CO3)**

**Exercise - 5**

- Write a JAVA program give example for "super" keyword. **(CO3)**
- Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? **(CO3)**
- Write a JAVA program that implements Runtime polymorphism **(CO3)**

**Exercise - 6**

- Write a JAVA program that describes exception handling mechanism **(CO4)**
- Write a JAVA program Illustrating Multiple catch clauses **(CO4)**
- Write a JAVA program for creation of Java Built-in Exceptions **(CO4)**
- Write a JAVA program for creation of User Defined Exception **(CO4)**

**Exercise - 7**

- Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning" every 1 sec, the second thread displays "Hello" every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable) **(CO4)**
- Write a program illustrating is Alive and join () **(CO4)**
- Write a Program illustrating Daemon Threads. **(CO4)**
- Write a JAVA program Producer Consumer Problem **(CO4)**

**Exercise – 8**

- a) Write a JAVA program that import and use the user defined packages **(CO4)**  
 b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX) **(CO5)**  
 c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI **(CO5)**

**Exercise – 9**

- a) Write a java program that connects to a database using JDBC **(CO5)**  
 b) Write a java program to connect to a database using JDBC and insert values into it. **(CO5)**  
 c) Write a java program to connect to a database using JDBC and delete values from it. **(CO5)**

**Textbooks:**

- JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
- Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
- JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

**Reference Books:**

- The complete Reference Java, 11th edition, Herbert Schildt, TMH
- Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

**Online Resources:**

- <https://nptel.ac.in/courses/106/105/106105191/>
- [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_012880464547618816347\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO2 PO5	PO2: Review(L2) PO5: Apply(L3)	3 2
2	CO2 :Apply	L3	PO2 PO3 PO4 PO5	PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 2 3
3	CO3: Apply	L3	PO3 PO4 PO5	PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3)	3 2 3
4	CO4: Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO10 PO11	PO2: Analyze (L4) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
5	CO5 :Create	L6	PO3 PO5 PO8 PO10 PO11	PO3: Design (L6) PO5: Create(L6) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3

**Justification Statements :**

**CO1: Understand Java syntax thoroughly, encompassing data types and control structures.**

**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 moderate (2)

**CO2: Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.**

**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 moderate (2)

PO5: Apply (L3)

CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**CO3: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.**

**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 moderate(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 solving complex 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)

PO8: Thumb Rule

It is a programming language we need to collaborate with team. Therefore the correlation is high (3)

PO10: Thumb Rule

By using java to manage enterprise projects in multi-disciplinary environments . Therefore the correlation is

high (3)

PO11: Thumb Rule

It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation

is high (3)

**CO5: Create GUI based applications using Java FX.**

**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)

PO8: Thumb Rule

It is a programming language we need to collaborate with team. Therefore the correlation is high (3)

PO10: Thumb Rule

By using java to manage enterprise and web based projects in multi-disciplinary environments. Therefore the correlation is high (3)

PO11: Thumb Rule

It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation is high (3)



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Course Code	Year & Sem	Python Programming (SKILL ENHANCEMENT COURSE) (Common to CSE,CIC,CSE(DS),AIDS & AIML)	L	T	P	C
			0	1	2	2

**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 Dictionaries, Tuples and sets to perform operations on data.

**CO4: Analyze** the file concepts and oops paradigms to manage data.

**CO5: Apply** the concepts of JSON and XML for data processing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	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 Dictionaries, Tuples and sets		to perform operations on data.	L3
CO4	Analyze	the file concepts and oops paradigms.		to manage data	L4
CO5	Apply	the concepts of JSON and XML		for data processing	L3

UNIT - I	9Hrs
<p>History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.</p> <p><b>Parts of Python Programming Language:</b> Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.</p> <p><b>Control Flow Statements:</b> if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.</p> <p><b>Sample Experiments:</b></p> <ol style="list-style-type: none"> <li>Write a program to find the largest element among three Numbers.</li> <li>Write a Program to display all prime numbers within an interval</li> <li>Write a program to swap two numbers without using a temporary variable.</li> <li>Demonstrate the following Operators in Python with suitable examples.               <ol style="list-style-type: none"> <li>Arithmetic Operators</li> <li>Relational Operators</li> <li>Assignment Operators</li> <li>Logical Operators</li> <li>Bit wise Operators</li> <li>Ternary Operator</li> <li>Membership Operators</li> <li>Identity Operators</li> </ol> </li> <li>Write a program to add and multiply complex numbers</li> <li>Write a program to print multiplication table of a given number.</li> </ol>	
UNIT - II	9 Hrs
<p><b>Functions:</b> Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.</p> <p><b>Strings:</b> Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.</p> <p><b>Lists:</b> Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.</p> <p><b>Sample Experiments:</b></p> <ol style="list-style-type: none"> <li>Write a program to define a function with multiple return values.</li> <li>Write a program to define a function using default arguments.</li> <li>Write a program to find the length of the string without using any library functions.</li> <li>Write a program to check if the substring is present in a given string or not.</li> <li>Write a program to perform the given operations on a list:               <ol style="list-style-type: none"> <li>Addition</li> <li>Insertion</li> <li>slicing</li> </ol> </li> </ol>	

12. Write a program to perform any 5 built-in functions by taking any list.	
<b>UNIT – III</b>	9 Hrs
<p><b>Dictionaries:</b> Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.</p> <p><b>Tuples and Sets:</b> Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.</p> <p><b>Sample Experiments:</b></p> <ol style="list-style-type: none"> <li>13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.</li> <li>14. Write a program to count the number of vowels in a string (No control flow allowed).</li> <li>15. Write a program to check if a given key exists in a dictionary or not.</li> <li>16. Write a program to add a new key-value pair to an existing dictionary.</li> <li>17. Write a program to sum all the items in a given dictionary.</li> </ol>	
<b>UNIT – IV</b>	9 Hrs
<p><b>Files:</b> Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.</p> <p><b>Object-Oriented Programming:</b> Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.</p> <p><b>Sample Experiments:</b></p> <ol style="list-style-type: none"> <li>18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.</li> <li>19. Python program to print each line of a file in reverse order.</li> <li>20. Python program to compute the number of characters, words and lines in a file.</li> <li>21. Write a program to create, display, append, insert and reverse the order of the items in the array.</li> <li>22. Write a program to add, transpose and multiply two matrices.</li> <li>23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.</li> </ol>	
<b>UNIT – V</b>	9Hrs
<p><b>Introduction to Data Science:</b> Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.</p> <p><b>Sample Experiments:</b></p> <ol style="list-style-type: none"> <li>24. Python program to check whether a JSON string contains complex object or not.</li> <li>25. Python Program to demonstrate NumPy arrays creation using array () function.</li> <li>26. Python program to demonstrate use of ndim, shape, size, dtype.</li> <li>27. Python program to demonstrate basic slicing, integer and Boolean indexing.</li> <li>28. Python program to find min, max, sum, cumulative sum of array</li> <li>29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows: <ol style="list-style-type: none"> <li>a) Apply head () function to the pandas data frame</li> <li>b) Perform various data selection operations on Data Frame</li> </ol> </li> <li>30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.</li> <li>2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2<sup>nd</sup> Edition, Pearson, 2024</li> <li>3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.</li> </ol>	
<b>Online Learning Resources/Virtual Labs</b>	
<ol style="list-style-type: none"> <li>1. <a href="https://www.coursera.org/learn/python-for-applied-data-science-ai">https://www.coursera.org/learn/python-for-applied-data-science-ai</a></li> <li>2. <a href="https://www.coursera.org/learn/python?specialization=python#syllabus">https://www.coursera.org/learn/python?specialization=python#syllabus</a></li> </ol>	

### Mapping of course outcomes with program outcomes

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

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

### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO5: Apply (L3)	2 3 2 2
2	9	20	2	CO2 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
3	9	20	2	CO3 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
4	9	20	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3) PO11:Thumb Rule	3 3 3 3 3 2
5	9	20	2	CO5 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
	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 moderate (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**PO3 Verb : Develop(L3)**

CO1 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)

**PO5 Verb : Apply(L3)**

CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (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 Verb : Review(L2)**

CO2 Action verb is greater than PO2 verb. Therefore the correlation high (3)

**PO3 Verb : Develop (L3)**

CO2 Action verb same as PO3 verb. Therefore the correlation high (3)

**PO4 Verb : Analyze(L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)

**PO5 Verb : Apply(L3)**

CO2 Action verb is same as PO5 verb. Therefore the correlation is high (3)

**CO3: Apply** the concept of Dictionaries, Tuples and sets to perform operations on data.

**Action Verb : Apply(L3)**

**PO1: Apply(L3)**

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

**PO2 Verb : Review(L2)**

CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)

**PO3 Verb : Develop (L3)**

CO3 Action verb same as PO3 verb. Therefore the correlation high (3)

**PO4 Verb : Analyze(L4)**

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)

**PO5 Verb : Apply(L3)**

CO3 Action verb is same as PO5 verb. Therefore the correlation is high (3)

**CO4: Analyze** the file concepts and oops paradigms to manage data.

**Action Verb: Analyze(L4)**

**PO1: Apply(L3)**

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

**PO2 Verb : Review(L2)**

CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)

**PO3 Verb : Develop (L3)**

CO3 Action verb is greater than PO3 verb. Therefore the correlation high (3)

**PO4 Verb : Analyze(L4)**

CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)

**PO5 Verb : Apply(L3)**

CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

**PO11: Thumb rule**

To solve the real time problems oops and file concepts are necessary for data security. Therefore the correlation is medium(2)

**CO5: Apply** the concepts of JSON and XML for data processing.

**Action Verb : Apply(L3)**

**PO1: Apply(L3)**

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

**PO2 Verb : Review(L2)**

CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)

**PO3 Verb : Develop (L3)**

CO3 Action verb same as PO3 verb. Therefore the correlation high (3)

**PO4 Verb : Analyze(L4)**

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)

**PO5 Verb : Apply(L3)**

CO3 Action verb is same as PO5 verb. Therefore the correlation is high (3)



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Course Code	Year & Sem	Environmental Science (common to CSE, CIC, CSD & EEE)	L	T	P	C
23AMC9901	II-I		2	0	0	0

**Course Outcomes:**

After studying the course, student will be able to

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

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

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

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

**CO5: Analyze** the population explosion and impact of environmental health issues on human being.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the multidisciplinary nature of environmental studies, various renewable and nonrenewable resources.			L2
2	Understand	the ecosystem and biodiversity	to solve complex environmental problems		L2
3	Apply	the various types of pollution, solid waste management, and related preventive measures			L3
4	Apply	the rainwater harvesting, watershed management, ozone layer depletion, and wasteland reclamation			L3
5	Analyze	the population explosion and impact of environmental health issues on human being.			L4

<b>UNIT – I</b>	
<p><b>Multidisciplinary Nature of Environmental Studies:</b> Introduction □ Multidisciplinary Nature of Environmental Studies □ Definition, Scope and Importance – Need for Public Awareness.</p> <p><b>Natural Resources:</b> Renewable and non-renewable energy resources –Natural resources and associated problems.</p> <p><b>Forest resources:</b> Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.</p> <p><b>Water resources:</b> Use and overutilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems.</p> <p><b>Mineral resources:</b> Use and exploitation, environmental effects of extracting and using mineral resources, case studies.</p> <p><b>Food resources:</b> World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.</p> <p><b>Energy resources:</b> Renewable and non-renewable energy resources.</p>	
<b>UNIT – II</b>	
<p><b>Ecosystems:</b> 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).</p> <p><b>Biodiversity And Its Conservation :</b> 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-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man - wildlife conflicts □ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.</p>	
<b>UNIT – III</b>	
<p><b>Environmental Pollution:</b> Definition, Causes, effects and its controlmeasures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, and Thermal pollution and Nuclear hazards.</p> <p><b>Solid Waste Management:</b> Causes, effects and control measures of urban and industrial wastes – Role</p>	

of an individual in prevention of pollution – Pollution case studies – Disaster management: earthquakes, cyclones, tsunamis, and landslides.

**UNIT – IV**

**Social Issues and the Environment:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, Rainwater 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**

**Human Population and the Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programs. – 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 ErachBharucha 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.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1						2	2						
CO 2							2						
CO 3						2	2						
CO 4						2	2						
CO 5							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	12	23	3	Understand	L2	PO6, PO7	Thumb Rule Thumb Rule	2, 2
2	15	15	28	3	Understand	L2	PO7	Thumb Rule	2
3	8	8	15	2	Apply	L3	PO6 PO7	Thumb Rule Thumb Rule	2, 2
4	9	10	19	2	Apply	L3	PO6, PO7	Thumb Rule Thumb Rule	2, 2
5	8	8	15	2	Analyze	L4	PO7	Thumb Rule	2
	50	53	100						

**Justification Statements**

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

**Action Verb: Understand (L2)**

Using Thumb rule, CO1 correlates PO6 and PO7 as a moderate (2)

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

**Action Verb: Understand (L2)**

Using Thumb rule, CO2 correlates PO7 as a moderate (2)

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

**Action Verb: APPLY (L3)**

Using Thumb rule, CO3 correlates PO6 and PO7 as a moderate (2)

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

**Action Verb: APPLY (L3)**

Using Thumb rule, CO4 correlates PO6 and PO7 as a moderate (2)

**CO5: Analyze** the population explosion and impact of environmental health issues on human being

**Action Verb: Analyze (L4)**

Using Thumb rule, CO5 correlates PO7 as a moderate (2)

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INCLUDING BLOCKCHAIN TECHNOLOGY)  
(Effective for the batches admitted in 2023-24)**

**Semester IV (Second year)**

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	HM	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	BS	23ABS9917	Number Theory and Applications	2	1	0	3	30	70	100
3	PC	23APC0510	Operating Systems	2	1	0	3	30	70	100
4	PC	23APC0508	Database Management Systems	2	1	0	3	30	70	100
5	PC	23APC3601	Computer Networks	2	1	0	3	30	70	100
6	PC	23APC3602	Computer Networks and OS Lab	0	0	3	1.5	30	70	100
7	PC	23APC0509	Database Management Systems Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0503	Full Stack Development-1	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking and Innovation	0	1	2	2	30	70	100
<b>Total</b>				<b>10</b>	<b>06</b>	<b>10</b>	<b>21</b>	<b>270</b>	<b>630</b>	<b>900</b>
<b>Mandatory Community Service Project Internship of 08 weeks duration during summer vacation</b>										



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Course Code	Year & Sem	Managerial Economics and Financial Analysis	L	T	P	C
23AHMMB01	II-II		2	0	0	2

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the fundamentals of managerial economics and **Apply** the forecasting techniques for

estimation of demand.

**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	BL
CO1	Understand Apply	The fundamentals of Managerial economics and the demand of a product	by using statistical and survey methods.		L3
CO2	Understand	Production and cost concepts		To optimize the output	L2
CO3	Analyze	Price output relationship		In perfect and imperfect competition 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

<b>UNIT - I</b>	<b>Managerial economics</b>	
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.		
<b>UNIT - II</b>	<b>Production and Cost Analysis</b>	
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Iso quants and Iso costs, 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.		
<b>UNIT - III</b>	<b>Business Organizations and Markets</b>	
Introduction-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.		
<b>UNIT - IV</b>	<b>Capital Budgeting</b>	
Introduction- Nature, meaning, significance, types of working capital, Components, Sources of Short-term and Long-term Capital, 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, Profitability Index(PI) Method (simple problems).		
<b>UNIT - V</b>	<b>Financial Accounting and Analysis</b>	
Introduction - Concepts and Conventions- Double- Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). <b>Financial Analysis</b> - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.		
<b>Textbooks:</b>		
1.Varshney & Maheswari: Managerial Economics, Sultan Chand, 2013. 2.Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019		
<b>Reference Books:</b>		
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**

1. <https://www.slideshare.net/123ps/managerial-economics-ppt>
2. <https://www.slideshare.net/rossanz/production-and-cost-45827016>
3. <https://www.slideshare.net/darkyla/business-organizations-19917607>
4. <https://www.slideshare.net/balarajbl/market-and-classification-of-market>
5. <https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>
6. <https://www.slideshare.net/ashu1983/financial-accounting>.

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
Managerial Economics and Finance	CO1	3													
	CO2	1								1					
	CO3	3								3					
	CO4									3					
	CO5									3					

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	10	16.1%	2	CO1: Apply	L3	PO1	Apply	<b>3</b>
2	14	22.5%	3	CO2: Understand	L2	PO1, PO10	Apply Apply	<b>1</b> <b>1</b>
3	14	22.5%	3	CO3: Analyze	L4	PO1, PO10	Apply Apply	<b>3</b> <b>3</b>
4	10	16.1%	2	CO4: Evaluate	L5	PO10	Apply	<b>3</b>
5	14	22.5%	3	CO5: Analyze	L4	PO10	Apply	<b>3</b>
Total	<b>62</b>	<b>100</b>						

**Justification Statements:**

**CO1: Understand the fundamentals of managerial economics and Apply the forecasting techniques for estimation of demand.**

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO1 Action verb is same as PO1verb. Therefore the correlation is high (3)

**CO2: Understand the production and cost concepts to optimize the output.**

**Action Verb: Understand (L2)**

PO1: Apply (L3)

CO2 Action verb is less than PO1 verb by two levels. Therefore the correlation is low (1)

PO10: Apply (L3)

CO2 Action verb is less than PO1 verb by two levels. Therefore the correlation is low (1)

**CO3: Analyze the price output relationship in different 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)

PO10: 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 to invest in various projects.**

**Action Verb: Evaluate (L5)**

PO10: Apply (L3)

CO4 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

**CO5: Analyze the accounting statements to evaluate the financial performance of business entity.**

Action Verb: Analyze (L4)

PO10: Apply (L3)

CO5 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)



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Course Code	Year & Sem	Number Theory and Its Applications	L	T / CLC	P	C
23ABS9917	II-II			2	1	0

**Course Outcomes:**

After studying the course, student will be able to

- CO1. **Understand**. the concepts related to primality, divisibility and greatest common divisors
- CO2. **Apply** the divisibility proofs of different means including induction and congruences .
- CO3. **Apply** the divisibility tests for congruences through various theorems.
- CO4. **Analyze** the notations of finite fields, primality and factoring in related applications.
- CO5. **Analyze** the encryption methods and its applications to computer science.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the concepts related to primality, divisibility and greatest common divisors			L2
2	Apply	the divisibility proofs of different means including induction and congruences .			L3
3	Apply	the divisibility tests	for congruences through various theorems		L3
4	Analyze	the notations of finite fields, primality and factoring	in related applications.		L4
5	Analyze	the encryption methods and its applications	to computer science		L4

<b>UNIT - I</b>	Integers, Greatest common divisors and prime Factorization	9 Hrs
The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations.		
<b>UNIT - II</b>	Congruences	9 Hrs
Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruence		
<b>UNIT - III</b>	Applications of Congruences	9 Hrs
Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem- Pseudoprimes- Euler's theorem- Euler's phi-function- The sum and number of divisors- Perfect numbers and Mersenne primes.		
<b>UNIT - IV</b>	Finite fields & Primality, factoring	10 Hrs
Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-Fermat factorization and factor bases		
<b>UNIT - V</b>	Cryptology	10 Hrs
Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers-Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.		
<b>Textbooks:</b>		
1. Kenneth H Rosen, Elementary number theory and its applications, AT&T Information systems & Bell laboratories.		
2. Neal Koblitz, A course in Number theory & Cryptography, Springer		
<b>Reference Books:</b>		
1. Herbert S.Zuckerman, Hugh L. Montgomery, Ivan Niven, An Introduction To The Theory Of Numbers, Wiley publishers		
2. Tom M Apostol, Introduction to Analytic number theory-springer		
3. VK Krishnan, Elementary number theory, Universities press		
<b>Online Learning Resources:</b>		
1. <a href="https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications">https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications</a>		

### Mapping of COs to POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				Understand	L2	PO1	Apply(L3)	2
2				Apply	L3	PO1	Apply(L3)	3
3				Apply	L3	PO1	Apply(L3)	3
4				Analyze	L4	PO2	Analyze(L4)	3
5				Analyze	L4	PO2	Analyze(L4)	3

**CO1:** Understand the concepts related to primality, divisibility, and greatest common divisors.

**CO1 Action Verb: Understand (L2)**

PO1 Verb: Apply (L3)

CO1 Action Verb is less than to PO1 verb by one level, therefore correlation is moderate (2).

**CO2:** Apply the divisibility proofs of different means including induction and congruences.

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

PO1 Verb: Apply (L3)

CO2 Action Verb is equal to PO1 verb, therefore correlation is high (3).

**CO3:** Apply the divisibility tests for congruences through various theorems.

**CO 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 notations of finite fields, primality and factoring in related applications.

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

PO2 Verb: Analyze (L4)

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

**CO5:** Analyze the encryption methods and its applications to computer science.

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

PO2 Verb: Analyze (L4)

CO5 Action verb is equal to PO2 verb, therefore the correlation is high (3).



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

Course Code	Year & Sem	Operating Systems (common to CSE & CIC)	L	T/CLC	P	C
23APC0510	II-II		2	1	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

CO5: **Understand** the issues and goals of File System protection

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			L5
CO5	Understand	the issues and goals of File System protection			L2

<b>UNIT - I</b>	9 Hrs
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**Operating Systems Overview:** Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems **System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

<b>UNIT - II</b>	10Hrs
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**Processes:** Process Concept, Process scheduling, Operations on processes, Inter-process communication. **Threads and Concurrency:** Multithreading models, Thread libraries, Threading issues. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling

<b>UNIT - III</b>	8Hrs
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**Synchronization Tools:** The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

<b>UNIT - IV</b>	9Hrs
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**Memory-Management Strategies:** Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. **Virtual Memory Management:** Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing. **Storage Management:** Overview of Mass Storage Structure, HDD Scheduling

<b>UNIT - V</b>	8Hrs
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**File System:** File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: FileSystem Mounting, Partitions and Mounting, File Sharing. **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

**Textbooks:**

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson, 2016

**Reference Books:**

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

**Online Learning Resources:**1. <https://nptel.ac.in/courses/106/106/106106144/>2. <http://peterindia.net/OperatingSystems.html>**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	2 3 2
2	9	20	2	CO2 :Apply	L3	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO11: Thumb rule	3 3 2 3
3	9	20	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	9	20	2	CO4 : Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO7: Thumb rule PO11: Thumb rule	3 3 3 3 3 2 3 2
5	9	20	2	CO5 : Understand	L2	PO1 PO2 PO7 PO11	PO1: Apply(L3) PO2: Review(L2) PO7: Thumb rule PO11: Thumb rule	2 3 3 2
	<b>45</b>	<b>100</b>						

**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 moderate(2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same as PO2 verb. Therefore the correlation is high(3)

**PO11: Thumb rule**

In today's world operating system services are updating, those services needs to understand. Therefore the correlation is moderate (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)

**PO11: 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  
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 moderate (2)

**PO7: Thumb rule**

Since ethical principles shall be followed in file manipulations and data storage. Therefore the correlation is high(3)

**PO11: Thumb rule**

File manipulation of data and storage of data is playing major role in current scenario. Therefore, the correlation is moderate (2)

**CO5: Understand the issues and goals of File System protection**

**Action Verb : Understand (L2)**

**PO1: Apply(L3)**

CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

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

**PO7: Thumb rule**

Ethical principles should be followed for various security issues. Therefore the correlation is high(3)

**PO11: Thumb rule**

Security services and principles are keep on updating in the today's world. Therefore, the correlation is moderate (2)



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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND  
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Course Code	Year & Sem	Database Management Systems	L	T/CLC	P	C
23APC0508	II-II	Common to CSE,AI ML,CSE(DS) & CIC	2	1	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 E-R model for database design of real world applications.

**CO3: Apply** the SQL and PL/SQL concepts to formulate queries.

**CO4: Analyze** normalization methods to enhance database structures

**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 E-R model		for database design of real world applications	L3
CO3	Apply	the SQL and PL/SQL concepts		To formulate queries.	L3
CO4	Analyze	normalization methods		to enhance database structures	L4
CO5	Analyze	the concurrent transactions and recover systems		to prevent data loss in system crash.	L4

<b>UNIT - I</b>	9 Hrs
<p><b>Introduction:</b> Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.</p> <p><b>Entity Relationship Model:</b> Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.</p>	
<b>UNIT - II</b>	9Hrs
<p><b>Relational Model:</b> Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL:Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).</p>	
<b>UNIT - III</b>	9 Hrs
<p><b>SQL:</b> Basic SQL querying (select and project) using where clause, arithmetic &amp; logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.</p> <p><b>NoSQL:</b>Introduction and Properties of NoSQL, Different NoSQL Systems, Columnar families, Schema-Less Databases, Materialized Views, Distribution Models, Sharding</p>	
<b>UNIT - IV</b>	9 Hrs
<p><b>Schema Refinement (Normalization):</b> Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).</p>	
<b>UNIT - V</b>	9 Hrs
<p><b>Transaction Concept:</b> Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.</p> <p><b>Introduction to Indexing Techniques:</b> B+ Trees, operations on B+Trees, Hash Based Indexing:</p>	

<b>Textbooks:</b>
1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)
<b>Reference Books:</b>
1. Introduction to Database Systems, 8th edition, C J Date, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
<b>Online Learning Resources:</b>
1. <a href="https://nptel.ac.in/courses/106/105/106105175/">https://nptel.ac.in/courses/106/105/106105175/</a>
2. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview</a>

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	9	20	2	CO2 :Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	9	20	2	CO3 :Apply	L3	PO1 PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 2 3 2 2 2
4	9	20	2	CO4 :Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO7	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule	3 3 3 3 3
5	9	20	2	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO7 PO8	PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:	3 3 3 3 2 2

						PO11	Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	2
	45	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 moderate (2)

PO2 Verb: Review(L2)

CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the E-R model for database design of real world applications.**

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)

PO11: Thumb rule

For some of DB applications, PL/SQL concepts are used to formulate queries. Therefore the correlation is moderate (2)

**CO3: Apply the SQL and PL/SQL concepts to formulate queries.**

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 moderate (2)

PO5: Apply(L3)

CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO7: Thumb rule

Since ethical principles should be followed to create a database. Therefore the correlation is moderate(2)

PO8 : Thumb rule

Team work is required between DBA and Database designer to create a database. Hence the correlation is moderate (2)

PO11: Thumb rule

For some of DB applications, ER model concepts are used to create designs. Therefore the correlation is moderate(2)

**CO4: Analyze normalization methods to enhance database structures**

Action Verb: Analyze(L4) PO1: Apply(L3)

CO4 Action verb is greater than 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)

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)

PO7: 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)

PO7 : Thumb rule

Since ethical principles should be followed for transaction management. Therefore the correlation is moderate(2)

PO8: Thumb rule

Team work is required for transaction management and recovery of failure transactions. Hence the correlation is moderate (2)

PO11: Thumb rule

In real time transaction management is continuously updating. Therefore the correlation is moderate (2)



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(AUTONOMOUS)  
CSE(IOT AND CYBER SECURITY INCLUDING BLOCKCHAIN  
TECHNOLOGY)**

Course Code	Year & Sem	Computer Networks (CIC)	L	T / CLC	P	C
23APC3601	II-II		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

- CO1: **Understand** the software and hardware components of a Computer network.
- CO2: **Apply** the Data link Layer functionalities to solve real world problems.
- CO3: **Analyze** new routing, and congestion control algorithms.
- 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 software and hardware components of a Computer network.			L2
CO2	Apply	the Data link Layer functionalities		to solve real world problems.	L3
CO3	Analyze	new routing, and congestion control algorithms.			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

<b>UNIT - I</b>	9 Hrs
<b>Introduction:</b> Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Network Hardware, Network Software, Reference Models.	
<b>UNIT - II</b>	9Hrs
<b>The Data Link Layer:</b> Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Error Detection And Correction, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Multiple Access Protocols, Ethernet.	
<b>UNIT - III</b>	9 Hrs
<b>The Network Layer:</b> Network Layer Design Issues, Routing Algorithms In A Single Network, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet.	
<b>UNIT - IV</b>	9 Hrs
<b>The Transport Layer:</b> The Transport Service, Elements Of Transport Protocols, Congestion Control, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.	
<b>UNIT - V</b>	9 Hrs
<b>The Application Layer:</b> Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.	
<b>Textbooks:</b>	
1. Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition.	
<b>Reference Books:</b>	
1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.	

2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

3. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO			Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation					
1				CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 2
2				CO2: Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze (L4) PO6: Thumb rule	3 2 1
3				CO3: Analyze	L4	PO1 PO2 PO4 PO5 PO6	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule	3 3 3 3 1
4				CO4: Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3
5				CO5: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 2
				CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 2

**Justification Statements :**

**CO1: Understand** the software and hardware components of a Computer network.

**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. Therefore, the correlation is medium(2)

**CO2: Apply the 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 level. Therefore, the correlation is medium(2).

**PO6: Thumb rule**

Data link Layer functionalities are useful for real-time applications. Therefore the correlation is (1)

**CO3: Analyze** new routing, and congestion control algorithms.

**Action Verb : Analyze(L4)**

**PO1: Apply(L3)**

CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

**PO2: Analyze (L4)**

CO3 Action verb is greater level as PO2 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**

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 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)

**PO4: Analyze (L4)**

CO4 Action verb is greater than 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: Understand** the 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. Therefore, the correlation is medium(2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES,  
TIRUPATI (AUTONOMOUS)  
CSE(IOT AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Computer Networks and OS Lab (CIC)	L	T	P	C
23APC3602	II-II		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Analyze** the data traffic using network tools.

**CO2: Understand** network commands.

**CO3: Understand** the basic commands in UNIX operating systems.

**CO4: Apply** the concepts of CPU scheduling algorithms to solve real time problems.

**CO5: Analyze** the solutions for virtual memory and Deadlocks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the data traffic using network tools.			L4
CO2	Understand	network commands.			L2
CO3	Understand	the basic commands in UNIX operating system			L2
CO4	Apply	the concepts of CPU scheduling algorithms		to solve real time problems.	L3
CO5	Analyze	the solutions for virtual memory and Deadlocks.			L4

**List of Experiments:**

**List of Experiments (Computer Networks):**

1. Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect Two or more systems. Use crimping tool to connect jacks. Use LAN tester to connect the cables.

- Install and configure Network Devices: HUB, Switch and Routers. Consider both manageable and non-manageable switches. Do the logical configuration of the system. Set the bandwidth of different ports.

- Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both adhoc and infrastructure mode of operation. **(CO1)**

2. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslookup **(CO2)**

3. Use Packet tracer software to build network topology and configure using Distance vector routing protocol. **(CO1)**

4. Use Packet tracer software to build network topology and configure using Link State routing protocol. **(CO1)**

5. Using JAVA RMI Write a program to implement Basic Calculator. **(CO1)**

6. Implement a Chatting application using JAVA TCP and UDP sockets. **(CO1)**

7. Hello command is used to know whether the machine at the other end is working or not. Echo command is used to measure the round-trip time to the neighbor. Implement Hello and Echo commands using JAVA. **(CO2)**

8. Using Wireshark perform the following operations:

- Inspect HTTP Traffic
- Inspect HTTP Traffic from a Given IP Address,
- Inspect HTTP Traffic to a Given IP Address,
- Reject Packets to Given IP Address,
- Monitor Apache and MySQL Network Traffic. **(CO2)**

**List of Experiments (Operating Systems):**

1. Practicing of Basic UNIX Commands. **(CO3)**

2. Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir **(CO3)**

3. Simulate the following CPU scheduling algorithms

- a) FCFS b) SJF c) Priority d) Round Robin **(CO4)**

4. Write a program to solve producer-consumer problem using Semaphores. **(CO4)**
5. Implement the following memory allocation methods for fixed partition
  - a) First fit b) Worst fit c) Best fit **(CO5)**
6. Simulate the following page replacement algorithms
  - a) FIFO b) LRU c) LFU **(CO5)**
7. Simulate Paging Technique of memory management. **(CO5)**  
Implement Bankers Algorithm for Dead Lock avoidance **(CO5)**

**Textbooks:**

1. Shivendra S. Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, "TCP/IP Essentials: A Lab-Based Approach", Cambridge University Press, 2004.
2. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.

**Reference Books**

1. Cisco Networking Academy, "CCNA1 and CCNA2 Companion Guide", Cisco Networking Academy Program, 3rd edition, 2003.
2. Elloitte Rusty Harold, "Java Network Programming", 3rd edition, O'REILLY, 2011.
3. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson, 2016

**Online Learning Resources:**

- <https://www.netacad.com/courses/packet-tracer> - Cisco Packet Tracer.  
 Ns Manual, Available at: <https://www.isi.edu/nsnam/ns/ns-documentation.html>, 2011.  
[https://www.wireshark.org/docs/wsug\\_html\\_chunked/](https://www.wireshark.org/docs/wsug_html_chunked/) -Wireshark.  
<https://nptel.ac.in/courses/106105183/25>  
<http://www.nptelvideos.in/2012/11/computer-networks.html>  
<https://nptel.ac.in/courses/106105183/3>  
[http://vlabs.iitb.ac.in/vlabs-dev/labs\\_local/computer-networks/labs/explist.php](http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php)  
<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	PSO1	PSO2
CO1	3	3	3	3	2						2	1	
CO2	3	3									2		2
CO3	3				3							1	
CO4	3	3	3		3						2		2
CO5	2	2		3	3							1	

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

**Correlation matrix**

Unit No.	CO's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Identify(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 2 3 2 2
2	CO2 :Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb rule	3 3 2
3	CO3 :Understand	L2	PO1 PO5	PO1: Apply(L3) PO5: Create (L6)	3 3
4	CO4 : Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L6) PO5: Create (L6) PO11:Thumb Rule	3 3 3 3 2
5	CO5 : Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze (L4) PO5: Create (L6)	2 2 3 3

**Justification Statements :**

**CO1: Analyze** the data traffic using network tools.

**Action Verb : Analyze (L4)**

PO1 Verb : Identify(L3)

CO1 Action verb is greater than PO1 verb by one level. 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)

PO3: Develop(L3)

CO1 Action verb is less than PO3 verb by one level. Therefore the correlation is medium (2)

PO4: Analyze (L4)

CO1 Action verb is same level as PO4 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)

PO11: Thumb rule

Using network tools analyze the data traffic in a network. Therefore, the correlation is medium(2)

**CO2: Understand** network commands.

**Action Verb : Understand(L2)**

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level. Therefore the correlation is high(3)

PO11: Thumb rule

Networking commands can be used to check the connectivity of the networking devices. Therefore the correlation is medium(2)

**CO3: Understand** the basic commands in UNIX operating systems.

**Action Verb: Understand (L2)**

PO1 Verb: Apply (L3)

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

PO5 Verb: Create (L3)

CO3 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO4: Apply** the concepts of CPU scheduling algorithms to solve real time problems.

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

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

PO2 Verb: Analyze (L4)

CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: Develop (L6)

CO4 Action verb is greater than as PO3 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)

PO11 Verb: Thumb rule Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

**CO5: 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: Identify(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)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	Database Management Systems Lab (Common to CSE,CIC,CSE(DS),AIML)	L	T	P	C
23APC0509	II-II		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

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

**CO2: Create** queries to manipulate and retrieve data from databases.

**CO3: Analyze** application programs using PL/SQL

**CO4: Analyze** Procedures, Functions, Cursors, and Triggers to automate tasks and optimize database functionality

**CO5: Analyze** JDBC concepts for Database connectivity.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the DDL, DML&DCL Commands		for manipulating the data.	L3
CO2	Create	queries		to manipulate and retrieve data from databases.	L6
CO3	Analyze	application programs	using PL/SQL		L4
CO4	Analyze	Procedures, Functions, Cursors, and Triggers		to automate tasks and optimize database functionality	L4
CO5	Analyze	JDBC concepts		for Database connectivity	L4

**List of Experiments:**

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command. **(CO1)**
2. Queries (along with subQueries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT, Constraints. Example: Select the roll number and name of the student who secured fourth rank in the class. **(CO1)**
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views. **(CO1)**
4. Queries using Conversion functions (to\_char, to\_number and to\_date), string functions Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next\_day, add\_months, last\_day, months\_between, least, greatest, trunc, round, to\_char, to\_date) **(CO2)**
5.
  - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found) **(CO2)**
  - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block **(CO2)**
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions. **(CO2)**
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE APPLICATION ERROR. **(CO3)**
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES. **(CO3)**
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions. **(CO3)**
10. Develop programs using features parameters in a CURSOR, FOR UPDATECURSOR, WHERE CURRENT of clause and CURSOR variables. **(CO4)**
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers **(CO4)**
12. Create a table and perform the search operation on table using indexing and non

indexing techniques. **(CO4)**

13. Write a Java program that connects to a database using JDBC **(CO5)**

14. Write a Java program to connect to a database using JDBC and insert values into it **(CO5)**

15. Write a Java program to connect to a database using JDBC and delete values from it **(CO5)**

**References:**

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	Apply	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3)	3 2 3 3
2	Create	L6	PO2 PO5	PO3:Formulate(L6) PO5:Create(L6)	3 3
3	Analyze	L4	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2:Review(L2) PO4:Design(L6) PO5:Create(L6)	2 1 3 3
4	Analyze	L4	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2:Review(L2) PO4:Design(L6) PO5:Create(L6)	2 1 3 3
5	Analyze	L4	PO3 PO5 PO11	PO3:Design(L6) PO5:Create(L6) PO11:Thumb rule	3 3 2

**Justification Statements:**

**CO1: Apply the DDL, DML&DCL 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 moderate (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: Create** queries to manipulate and retrieve data from databases.

**Action Verb: Create (L6)**

**PO2 Verb : Formulate(L6)**

CO2 Action verb is same as PO2 verb. Therefore, the correlation is high (3)

**PO5 Verb: Create(L6)**

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**CO3: Analyze** application programs using PL/SQL

**Action Verb: Analyze(L4)**

**PO1 Verb: Apply (L3)**

CO3 Action verb is less than PO1 verb. Therefore, the correlation is moderate(2)

**PO2 Verb: Review(L2)**

CO3 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low(1)

**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: Analyze Procedures,Functions, Cursors, and Triggers to automate tasks and optimize database functionality**

**Action Verb: Analyze(L3) PO1 Verb: Apply (L3)**

CO4 Action verb is less than PO1 verb. Therefore, the correlation is moderate(2)

**PO2 Verb: Review(L2)**

CO4 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low(1)

**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: Analyze** JDBC concepts for Database connectivity.

**Action Verb: Analyze (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)

**PO11: Verb:Thumb rule**

Database connection is a continuous learning activity for the user, the correlation is moderate(2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**CSE(IOT AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Full Stack Development - 1 (Skill Enhancement Course) (Common to CSE,CIC,AIDS & AIML)	L	T	P	C
			0	1	2	2

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the web page and identify basic tags and properties in HTML.

**CO 2: Apply** the concept of CSS properties to design web pages.

**CO 3: Analyze** the web pages in real time applications of JavaScript for dynamic web pages.

**CO 4: Apply** the concepts of objects and methods in JavaScript for solving complex problem

**CO 5: Evaluate** the web pages for developing applications by using events and forms

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the web page and identify basic tags and properties in HTML.			L2
CO2	Apply	the concept of CSS properties		to design web pages.	L3
CO3	Analyze	the web pages in real time applications of JavaScript		for dynamic web pages.	L4
CO4	Apply	the concepts of objects and methods in JavaScript		for solving complex problems	L3
CO5	Evaluate	the web pages for developing applications by		using events and forms	L5

**List of Experiments:**

**1. Lists, Links and Images[CO-1]**

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100\*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

**2. HTML Tables, Forms and Frames[CO-1]**

- Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan) **[CO-1]**

- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.). **[CO-1]**

- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view). **[CO-1]**

- Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed). **[CO-1]**

**3. HTML 5 and Cascading Style Sheets, Types of CSS[CO-2]**

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

**4. Selector forms[CO-2]**

- a. Write a program to apply different types of selector forms
  - Simple selector (element, id, class, group, universal)
  - Combinator selector (descendant, child, adjacent sibling, general sibling)
  - Pseudo-class selector
  - Pseudo-element selector
  - Attribute selector

#### **5. CSS with Color, Background, Font, Text and CSS Box Model[CO-2]**

- a. Write a program to demonstrate the various ways you can reference a color in CSS.
- b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
- c. Write a program using the following terms related to CSS font and text:
  - i. font-size
  - ii. font-weight
  - iii. font-style
  - iv. text-decoration
  - v. text-transformation
  - vi. text-alignment
- d. Write a program, to explain the importance of CSS Box model using
  - i. Content
  - ii. Border
  - iii. Margin
  - iv. padding

#### **6. Applying JavaScript - internal and external, I/O, Type Conversion[CO-2]**

- a. Write a program to embed internal and external JavaScript in a web page.
- b. Write a program to explain the different ways for displaying output.
- c. Write a program to explain the different ways for taking input.
- d. Create a webpage which uses prompt dialog box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

#### **7. JavaScript Pre-defined and User-defined Objects[CO-3]**

- a. Write a program using document object properties and methods.
- b. Write a program using window object properties and methods.
- c. Write a program using array object properties and methods.
- d. Write a program using math object properties and methods.
- e. Write a program using string object properties and methods.
- f. Write a program using regex object properties and methods.
- g. Write a program using date object properties and methods.
- h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

#### **8. JavaScript Conditional Statements and Loops[CO-4]**

- a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
- b. Write a program to display week days using switch case.
- c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
- d. Write a program to print data in object using for-in, for-each and for-of loops
- e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,  $13^3 + 5^3 + 3^3 = 153$ ]
- f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1-10's, 1-2's & 1-1's)

#### **9. Javascript Functions and Events[CO-5]**

- a. Design an appropriate function should be called to display
  - Factorial of that number
  - Fibonacci series up to that number
  - Prime numbers up to that number
  - Is it palindrome or not
- b. Design an HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
  11. Factorial of that number
  12. Fibonacci series up to that number
  13. Prime numbers up to that number
  14. Is it palindrome or not
- c. Write a program to validate the following fields in a registration page
  - i. Name (start with alphabet and followed by alphanumeric and the length should not be

- less than 6 characters)
- ii. Mobile (only numbers and length 10 digits)
- iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

**Textbooks:**

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasanth Subramanian, 2nd edition, APress, O'Reilly.

**Web Links:**

1. <https://www.w3schools.com/html>
2. <https://www.w3schools.com/css>
3. <https://www.w3schools.com/js/>
4. <https://www.w3schools.com/nodejs>
5. <https://www.w3schools.com/typescript>

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO11: Thumb rule	2 3 2 2
2	CO2: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO9	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO9: Thumb rule	3 3 3 3 3 2
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 2 3 2
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3

**Justification Statements:**

**CO1: Understand** the web page and identify basic tags and properties in HTML.

**Action Verb : Understand (L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is moderate (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO5 Verb : Apply(L2)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is moderate (2)

**PO11: Thumb rule**

To make use of HTML elements and tags in application, need to upgrade for long period.

Therefore, the correlation is moderate (2)

**CO2: Apply** the concept of CSS properties to design web pages.

**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 by one, Therefore the correlation is high (3)

**PO11: Thumb rule**

The application can be designed specifically all kind of users and web browsers.

Therefore the correlation is moderate (2)

**CO 3: Analyze** the web pages in real time applications of JavaScript for dynamic web pages.

**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 than level as PO2 verb by one. 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 PO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

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

**PO9: Thumb rule**

To make web site and web pages should be interactive understand by user, so need to provide proper forms. Therefore, the correlation is moderate (2)

**CO4: Apply** the concepts of objects and methods in JavaScript for solving complex problem

**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)

**PO3: Develop(L2)**

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze(L2)**

CO4 Action verb is less than of PO4 verb. Therefore the correlation is moderate (2)

**PO5: Apply(L3)**

CO4 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

The design application needs to upgrade for future specific requirement. Therefore the correlation is moderate (2)

**CO 5: Evaluate** the web pages for developing applications by using events and forms

**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 two 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)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**CSE(IOT AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Design Thinking and Innovation	L	T	P	C
23AES0304	II-II			0	1	2

**Course Outcomes:**

After studying the course, student will be able to

- CO: 1 **Understand** the concepts and principles of design thinking process.
- CO: 2 **Apply** the design thinking techniques for solving problems in various sectors.
- CO: 3 **Analyze** the art of innovation & creativity in product development.
- CO: 4 **Apply** the design guidelines for produced development.
- CO: 5 **Analyze** the design thinking strategies for solving real time business issues.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts and principles of design thinking process.			L1
CO2	Apply	the design thinking techniques for solving problems in various sectors.			L3
CO3	Analyze	the art of innovation & creativity in product development.			L4
CO4	Apply	the design guidelines for produced development.			L3
CO5	Analyze	the design thinking strategies for solving real time business issues.			L4

**Unit I:**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

**Unit II**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

**Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

**Unit III**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

**Unit IV**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

**Activity:** Importance of modelling, how to set specifications, Explaining their own product design.

**Unit V**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes

**Activity:** How to market our own product, About maintenance, Reliability and plan for startup.

**Text Books:**

1. Tim Brown, Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

**Reference Books:**

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritina holden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/110/106/110106124/>
2. <https://nptel.ac.in/courses/109/104/109104109/>
3. [https://swayam.gov.in/nd1\\_noc19\\_mg60/preview](https://swayam.gov.in/nd1_noc19_mg60/preview)

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	
Design Thinking & Innovation	CO 1	2		2									2	2	
	CO 2	2	2	2									2	2	
	CO 3	2	2	2			1						2	2	
	CO 4	2	2	2			1						2	2	
	CO 5	2	2	2			2						2	2	

(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	11	20.3	L3	Understand	L2	PO1 PO3	Apply (L3) Develop (L3)	2 2
2	10	18.5	L2	Apply	L3	PO1 PO2 PO3	Apply (L3) Identify (L3) Develop (L3)	3 3 3
3	11	20.3	L3	Analyze	L4	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 1
4	12	22.2	L3	Apply	L3	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 1
5	10	18.5	L2	Analyze	L4	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 2
Total	54	100						

**Justification Statements:**

**CO1: Understand** the concepts and principles of design thinking process.

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO1 Action verb is lower than PO1 verb. Therefore, the correlation is medium (2)

PO3 Verb: **Develop (L3)**

CO1 Action verb is lower than PO3 verb. Therefore, the correlation is medium (2)

**CO2: Apply** the design thinking techniques for solving problems in various sectors.

PO1 Verb: **Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Identify (L3)**

CO2 Action verb is same level as PO2 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)

**CO3: Analyze** the art of innovation & creativity in product development.

Action Verb: **Analyze** (L4)

PO1 Verb: **Apply** (L3)

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

PO2 Verb: **Identify** (L3)

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

PO3 Verb: **Develop** (L3)

CO3 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is high (3)

PO6 Verb: Thumb Rule

As per thumb rule CO3 co-relates slightly with PO6 verb. Therefore, the correlation is high (3)

**CO4: Apply** the design guidelines for produced development.

**Action Verb: Apply** (L3)

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)

PO3 Verb: **Develop** (L3)

CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO6 Verb: Thumb Rule

As per thumb rule CO4 co-relates slightly with PO6 verb. Therefore, the correlation is high (3)

**CO5: Analyze** the design thinking strategies for solving real time business issues.

**Action Verb: Analyze** (L4)

PO1 Verb: **Apply** (L3)

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

PO2 Verb: **Identify** (L3)

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

PO3 Verb: **Develop** (L3)

CO5 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is low (1)

PO6 Verb: Thumb Rule

As per thumb rule CO5 co-relates moderately with PO6 verb. Therefore, the correlation is high (3)

## **COMMUNITY SERVICE PROJECT**

### **.....Experiential learning through community engagement**

#### **Introduction**

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

#### **Objective**

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

#### **Implementation of Community Service Project**

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

**Procedure**

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - o First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - o Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

**EXPECTED OUTCOMES  
BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**

**Learning Outcomes**

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

**Personal Outcomes**

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

**Social Outcomes**

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

**Career Development**

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

### **Relationship with the Institution**

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS**

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES**

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY**

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

### **SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT**

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

### **For Engineering Students**

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration

34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

**Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs**

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days Programs

for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
  - i. Agriculture
  - ii. Health
  - iii. Marketing and Cooperation
  - iv. Animal Husbandry
  - v. Horticulture
  - vi. Fisheries
  - vii. Sericulture
  - viii. Revenue and Survey
  - ix. Natural Disaster Management
  - x. Irrigation
  - xi. Law & Order
  - xii. Excise and Prohibition
  - xiii. Mines and Geology
  - xiv. Energy

**Role of Students:**

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like
- Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

**Timeline for the Community Service Project Activity****Duration: 8 weeks****1. Preliminary Survey (One Week)**

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

**2. Community Awareness Campaigns (One Week)**

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

**3. Community Immersion Programme (Three Weeks)**

**Along with the Community Awareness Programmes**, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

**4. Community Exit Report (One Week)**

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)  
(Effective for the batches admitted in 2023-24)**

**Semester V (Third Year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	PC	23APC3603	Internet of Things	2	1	0	3	30	70	100
2	PC	23APC3604	Introduction to Cyber Security	2	1	0	3	30	70	100
3	PC	23APC3605	Cyber Crimes and Digital Forensics	2	1	0	3	30	70	100
4	PE-I	23APE3601 23APE3602 23APE3603 23APE3604	1. Software Engineering 2. Wireless Sensor Networks 3. Artificial Intelligence 4. Cryptography and Network Security	2	1	0	3	30	70	100
5	OE-I		OPEN ELECTIVE-I	2	1	0	3	30	70	100
6	PC	23APC3606	Internet of Things Lab	0	0	3	1.5	30	70	100
7	PC	23APC3607	Cyber Security Lab	0	0	3	1.5	30	70	100
8	SC	23ASC9901	Soft skills	0	1	2	2	30	70	100
9	ES	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	ES	23AES0504	Introduction to Quantum Technologies and Applications	2	1	0	3	30	70	100
11	INTRN	23APR3601	Community Service Project	-	-	-	2	100	00	100
<b>Total</b>				<b>12</b>	<b>07</b>	<b>10</b>	<b>26</b>	<b>395</b>	<b>705</b>	<b>1100</b>

**Mandatory Community Service Project Internship of 08 weeks duration during summer vacation**

**Open Elective - I**

<b>S. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1.	23AOE0101	Green Buildings	CIVIL
2.	23AOE0102	Construction Technology and Management	
3.	23AOE0201	Electrical Safety Practices and Standards	EEE
4.	23AOE0301	Sustainable Energy Technologies	ME
5.	23AOE0401	Electronic Circuits	ECE
6.	23AOE9901	Mathematics for Machine Learning and AI	Mathematics
7.	23AOE9906	Materials Characterization Techniques	Physics
8.	23AOE9911	Chemistry of Energy Systems	Chemistry
9.	23AOE9915	English for Competitive Examinations	Humanities
10.	23AOEMB01	Entrepreneurship and New Venture Creation	MBA



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Internet of Things CIC	L	T	P	C
23APC3603	III-I		2	1	0	3

Pre-Requisites	Semester
<b>Course Outcomes (CO):</b> Student will be able to	
<b>CO1</b>	<b>Understand</b> the application and characteristics of IoT
<b>CO2</b>	<b>Apply</b> design concept to build IoT solutions
<b>CO3</b>	<b>Analyze</b> various M2M and IoT architectures to optimize device communication
<b>CO4</b>	<b>Analyze</b> design issues to address the challenges in IoT applications
<b>CO5</b>	<b>Design</b> IoT solutions using sensors, actuators and Devices

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the application and characteristics of IoT			L2
CO2	Apply	design concept to build IoT solutions			L3
CO3	Analyze	various M2M and IoT architectures		to optimize device communication	L4
CO4	Analyze	design issues to address the challenges in IoT applications			L4
CO5	Design	IoT solutions	using sensors, actuators and Devices		L6

<b>UNIT - I</b>	<b>Introduction to IoT</b>	8 Hrs
Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates.		
<b>UNIT - II</b>	<b>Prototyping IoT Objects using Microprocessor/Microcontroller</b>	9 Hrs
Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.		
<b>UNIT - III</b>	<b>IoT Architecture and Protocol</b>	8 Hrs
Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak		
<b>UNIT - IV</b>	<b>Device Discovery and Cloud Services for IoT</b>	8 Hrs
Introduction, Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis. IEEE 802.15.4: The IEEE 802 committee family of protocols, The physical layer, The Media Access control layer, Uses of 802.15.4, The Future of 802.15.4: 802.15.4e and 802.15.4g.		
<b>UNIT - V</b>	<b>UAV IoT</b>	10 Hrs
Introduction to Unmanned Aerial Vehicles/Drones, Drone Types. Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.		
<b>Textbooks:</b>		
1. Vijay Madiseti and ArshdeepBahga, –Internet of Things (A Hands-on-Approach)l, 1st Edition, VPT, 2014. 2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.		
<b>Reference Books:</b>		

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, – From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2. Arshdeep Bahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, –Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013
5. CunoPfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 9781-4493-9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

**Online Learning Resources:**

1. <https://www.arduino.cc/>
2. <https://www.raspberrypi.org/>
3. <https://nptel.ac.in/courses/106105166/5>
4. <https://nptel.ac.in/courses/108108098/4>

**Mapping of course outcomes with program outcomes**

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

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

**Correlation Matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	8	19%	2	CO1:Understand	L2	PO1 PO2	PO1: Apply(L3) PO2:Interpret(L2)	2 3
2	9	21%	3	CO2 :Apply	L3	PO1 PO3 PO4 PO5 PO6	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule	3 3 2 3 2
3	8	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO6 PO7	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO6: Thumb rule PO7: Thumb rule	3 3 3 3 3 3
4	8	19%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO6	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO6: Thumb rule	3 3 3 3 3
5	10	23%	3	CO5 : Design	L6	PO2 PO3 PO4 PO5 PO6 PO11	PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 3 3
	43	100%						

**Justification Statements :**

**CO1: Understand** the application and characteristics 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 : Interpret(L2)**

CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply** design concept to build IoT solutions

**Action Verb : Apply (L3)****PO1: Apply(L3)**

CO2 Action verb is same level as 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 moderate (2)

**PO5: Apply(L3)**

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO6: Thumb rule**

Some of IoT applications are used in society for health, safety, legal and cultural issues, . Therefore the correlation is moderate (2)

**CO3: Analyze** various M2M and IoT architectures to optimize device communication

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

**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)

**PO6 : Thumb rule**

It is used to illustrating the IoT design in Home automation, Cities, Environment, agriculture, productivity applications Therefore the correlation is high(3)

**PO7: Thumb rule**

Since ethical principles should be followed by IoT Technologies. Hence the correlation is high(3)

**CO4: Analyze** design issues to address the challenges in IoT applications

**Action Verb : Analyze(L4)****PO1: Apply(L3)**

CO4 Action verb is greater than as 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)

**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)**

CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

**PO6: Thumb rule**

Since ethical principles shall be followed in IEEE protocols. Therefore the correlation is high(3)

**CO5: Design** IoT solutions using sensors, actuators and Devices

**Action Verb : Design(L6)****PO2: Review (L2)**

CO3 Action verb is greater than PO2 verb . Therefore the correlation is high(3)

**PO3: Develop(L3)**

CO2 Action verb is greater than PO2 verb. Therefore the correlation is high(3)

**PO4: Analyze(L4)**

CO2 Action verb is greater than PO4 verb. Therefore the correlation is high(3)

**PO5: Apply(L3)**

CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO6 : Thumb rule**

Since ethical principles should be followed to Zigbee devices. Therefore the correlation is high(3)

**PO11: Thumb rule**

To create robust and scalable networks by Zigbee. Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Introduction to Cyber Security (Common to CSE(CIC))	L	T	P	C
23APC3604	III-I		2	1	0	3

Pre-Requisites	Semester
<b>Course Outcomes (CO):</b> Student will be able to	
<b>CO1</b>	<b>Understand</b> key cybersecurity concepts, including common threats, vulnerabilities, the CIA triad, cybersecurity cube, and their impact on digital assets.
<b>CO2</b>	<b>Apply</b> cloud security principles to mitigate threats, manage risks, ensure compliance, and protect sensitive data using governance practices and CSA tools.
<b>CO3</b>	<b>Analyze</b> data integrity controls and cryptographic methods to ensure system authenticity and integrity.
<b>CO4</b>	<b>Evaluate</b> and recommend effective data availability and recovery methods to ensure continuous system operations.
<b>CO5</b>	<b>Evaluate</b> strategies for defending systems and devices, including server and network hardening, physical security, and ethical practices, to protect cybersecurity domains.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
<b>CO1</b>	Understand	Key cybersecurity concepts, common threats, vulnerabilities, CIA triad, cybersecurity cube		Explain how these concepts impact digital assets	L2
<b>CO2</b>	Apply	Cloud security principles, threat mitigation, risk management, compliance, CSA tools	In cloud environments	Effectively use governance practices and CSA tools to protect sensitive data	L3
<b>CO3</b>	Analyze	Data integrity controls, cryptographic methods (digital signatures, certificates)		Ensure system authenticity and integrity through analysis of control effectiveness	L4
<b>CO4</b>	Evaluate	Data availability and recovery methods, incident response, disaster recovery strategies		Recommend methods to ensure continuous operations during disruptions	L5
<b>CO5</b>	Evaluate	Strategies for defending systems, devices, network/server hardening, physical security, ethical practices	In cybersecurity domains	Effectiveness of defense strategies in protecting systems and devices	L5

<b>UNIT - I</b>	<b>Cyber security Essentials and Cube</b>	<b>9 Hrs</b>
The Cyber security World, Cyber Criminals versus Cyber security Specialists, Common Threats, Spreading Cyber security Threats, The Three Dimensions of the Cyber security Cube, CIA Triad, States of Data, Cyber security Countermeasures, IT Security Management Framework.		
<b>UNIT - II</b>	<b>Cyber security Threats, Vulnerabilities, Attacks and Protecting Secrets</b>	<b>9 Hrs</b>
Introduction, Governance, Managing Cloud Security Risk, Compliance, Legal Issues in Cloud, Audit, CSA Tools.		
<b>UNIT - III</b>	<b>Data Integrity</b>	<b>9 Hrs</b>
Types of Data Integrity Controls, Digital Signatures, Certificates, Database Integrity Enforcement.		
<b>UNIT - IV</b>	<b>Data Availability and Recovery</b>	<b>9 Hrs</b>

High Availability, Measures to Improve Availability, Incident Response, Disaster Recovery.	
<b>UNIT - V</b>	<b>Protecting a Cyber security Domain</b> <span style="float: right;"><b>9 Hrs</b></span>
Defending Systems and Devices, Server Hardening, Network Hardening, Physical and Environmental Security, Cyber security Domains, Ethics of Working in Cyber security.	
<b>Textbooks:</b>	
1. CISSP (ISC)2 Certified Information Systems Security Professional Official Study Guide, Mike Chappell, James Michael Stewart and Darrel Gibson, 9 th Edition	
2. Cyber security: The Beginner's Guide, Dr. Erdal Ozkaya, Packt Publishing Limited, 2019.	
<b>Reference Books:</b>	
1. Cyber security Essentials, Charles J. Brooks, Christopher Grow, Philip Craig and Donald Short, 1st edition, Say box.	
2. Network Security Essentials, William Stallings, 6th edition, Pearson Education, 2018.	

### Mapping of course outcomes with program outcomes

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

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

### CO-PO mapping justification:

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1: Understand	L2	PO1 PO2 PO6 PO7	PO1: Apply (L3) PO2: Analyze (L4) PO6: Thumb Rule PO7:Thumb Rule	2 1 2 2
2	9	20%	2	CO2: Apply	L3	PO1 PO3 PO5 PO6 PO7	PO1: Apply (L3) PO3: Develop (L3) PO5: Select (L5) PO6: Thumb Rule PO7: Thumb Rule	3 3 1 2 2
3	9	20%	2	CO3: Analyze	L4	PO1 PO2 PO4 PO5 PO7	PO1: Apply (L3) PO2: Analyze (L4) PO4: Analyze (L4) PO5: Select (L5) PO7: Thumb Rule	3 3 3 2 3
4	9	20%	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO5	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L6) PO5: Apply (L3)	3 3 2 3
5	9	20%	2	CO5: Evaluate	L5	PO1 PO2 PO3 PO6 PO7	PO1: Apply (L3) PO2: Analyze (L4) PO3: Design (L6) PO6: Thumb Rule PO7: Thumb Rule	3 3 2 3 3
	45	100						

### Justification Statements:

**CO1: Understand** key cybersecurity concepts, including common threats, vulnerabilities, the CIA triad, cybersecurity cube, and their impact on digital assets.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Analyze (L4)**

CO1 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)

**PO6: Thumb rule**

Cybersecurity involves understanding legal and societal impacts of threats and protection mechanisms. Therefore, the correlation is moderate (2)

**PO7: Thumb rule**

Ensuring secure digital systems supports long-term sustainability in the digital environment. Therefore, the correlation is moderate (2)

**CO2: Apply** cloud security principles to mitigate threats, manage risks, ensure compliance, and protect sensitive data using governance practices and CSA tools.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same level as 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)

**PO5: Select (L5)**

CO2 Action verb is less than PO5 verb by two levels. Therefore, the correlation is low (1)

**PO6: Thumb Rule**

Cloud security includes compliance with legal and organizational policies, impacting societal trust. Therefore, the correlation is moderate (2).

**PO7: Thumb Rule**

Applying cloud security principles promotes secure and sustainable digital environments. Therefore, the correlation is moderate (2).

**CO3: Analyze** data integrity controls and cryptographic methods to ensure system authenticity and integrity.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO3 Action verb is greater than of 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: Select (L5)**

CO3 Action verb is less than PO5 verb by one level. Therefore, the correlation is high (2)

**PO7: Thumb Rule**

Analyzing cryptographic methods supports the development of secure and sustainable digital systems. Therefore, the correlation is moderate (3).

**CO4: Evaluate** and recommend effective data availability and recovery methods to ensure continuous system operations.

**Action Verb: Evaluate (L5)**

**PO1: Apply (L3)**

CO4 Action verb is greater than of PO1 verb. Therefore, the correlation is High (3)

**PO2: Identify(L3)**

CO4 Action verb is greater than of PO2 verb. Therefore, the correlation is High (3)

**PO3: Develop (L6)**

CO4 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

**PO5: Apply (L3)**

CO4 Action verb is greater than of PO5 verb. Therefore, the correlation is High (3)

**CO5: Evaluate** strategies for defending systems and devices, including server and network hardening, physical security, and ethical practices, to protect cybersecurity domains.

**Action Verb: Analyze (L5)**

**PO1: Apply (L3)**

CO4 Action verb is greater than of PO1 verb. Therefore, the correlation is High (3)

**PO2: Analyze (L4)**

CO5 Action verb is greater than of 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 moderate (2)

**PO6: Thumb Rule**

Analyzing defense strategies involves consideration of societal safety and ethical responsibilities. Therefore, the correlation is moderate (3).

**PO7: Thumb Rule**

Implementing secure system practices supports environmental and digital sustainability. Therefore, the correlation is moderate (3).





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Course Code	Year & Sem	Cyber Crimes and Digital Forensics Common to CSE (CIC)	L	T	P	C
23APC3605	III-I		2	1	0	3

<b>Pre-Requisites</b>	<b>Basic knowledge of computer systems, networking fundamentals, and programming.</b>	<b>Semester</b>	
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> the basic terminology of cybercrimes.		
<b>CO2</b>	<b>Understand</b> the nature of cybercrimes such as unauthorized access, computer intrusions, and virus attacks.		
<b>CO3</b>	<b>Analyze</b> the different investigation tools for cybercrime.		
<b>CO4</b>	<b>Apply</b> the hardware and software tools used in forensic investigations.		
<b>CO5</b>	<b>Analyze</b> the different laws, ethics and evidence handling procedures.		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	basic terminology of cybercrimes.			L2
2	Understand	nature of cybercrimes		Unauthorized access, computer intrusions, virus attacks.	L2
3	Analyze	different investigation tools for cybercrime.			L4
4	Apply	hardware and software tools used in forensic investigations.			L3
5	Analyze	different laws, ethics and evidence handling procedures.			L4

<b>UNIT - I</b>	<b>Introduction</b>	<b>9 Hrs</b>
Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.		
<b>UNIT - II</b>	<b>Cyber Crime Issues</b>	<b>9 Hrs</b>
Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.		
<b>UNIT - III</b>	<b>Investigation</b>	<b>9 Hrs</b>
Introduction to Cyber Crime Investigation, Investigation Tools, rediscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E- Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.		
<b>UNIT - IV</b>	<b>Digital Forensics</b>	<b>9 Hrs</b>
Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.		
<b>UNIT - V</b>	<b>Laws and Acts</b>	<b>9 Hrs</b>
Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and Corps, Electronic Communication Privacy ACT, Legal Policies		
<b>Textbooks:</b>		
1. Nelson Phillips and Engineer Stuart, –Computer Forensics and Investigations I, CEng age Learning, New Delhi, 2009.		

2. Kevin Media, Chris Promise, Matt Pipe, –Incident Response and Computer Forensics –, Tata McGraw-Hill, New Delhi, 2006.

**Reference Books:**

1. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005.
2. Bernadette H Schell, Clemens Martin, –Cybercrime, ABC – CLIO Inc, California, 2004
3. –Understanding Forensics in IT –, NIIT Ltd, 2005.

**Mapping of course outcomes with program outcomes**

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

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

**Correlation matrix**

Unit No.	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 PO2 PO5	PO1: Apply(L3) PO2:Review(L2) PO5: Apply(L3)	2 3 2
2	9	20%	2	CO2: Understand	L2	PO1 PO2 PO4	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4)	2 3 3
3	9	20%	2	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 2 3 3
4	9	20%	2	CO4: Apply	L3	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO5: Apply(L3)	3 3 2 3
5	9	20%	2	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
	45	100%						

**Justification Statements:**

**CO1: Understand** the basic terminology of cybercrimes.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Review(L2)**

CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

**PO5: ApplyL3)**

CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

**CO2: Understand** the nature of cybercrimes such as unauthorized access, computer intrusions, and virus attacks.

**Action Verb: Understand (L2)**

**PO1: Apply (L3)**

CO 2:Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2: Review (L3)**

CO2 Action verb is same level PO2 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** the different investigation tools for cybercrime.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

**PO2: Review (L3)**

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

**PO3: Develop (L3)**

CO3: CO3 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

**PO4: Analyze (L4)**

CO3 Action verb is same as 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)

**CO4: Apply** the hardware and software tools used in forensic investigations.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

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

**PO2: Review (L3)**

CO4 Action verb is same level 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 moderate (2)

**PO5: Apply(L3)**

CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**CO5 Analyze** the different laws, ethics and evidence handling procedures.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO5 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

**PO2: Review (L3)**

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

**PO3: Develop (L3)**

CO5: CO5 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

**PO4: Analyze (L4)**

CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

**PO5: Apply(L3)**

CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)



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INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Software Engineering (Professional Elective-1)	L	T/CLC	P	C
23APE3601	III-I		2	1	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

<b>UNIT - I</b>	9 Hrs
<p><b>Introduction:</b> Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.</p> <p><b>Software Life Cycle Models:</b> Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.</p>	
<b>UNIT - II</b>	9Hrs
<p><b>Software Project Management:</b> Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.</p> <p><b>Requirements Analysis And Specification:</b> Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.</p>	
<b>UNIT - III</b>	9 Hrs
<p><b>Software Design:</b> Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.</p> <p><b>Agility:</b> Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)</p> <p><b>Function-Oriented Software Design:</b> Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.</p> <p><b>User Interface Design:</b> Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.</p>	
<b>UNIT - IV</b>	9 Hrs
<p><b>Coding And Testing:</b> Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Regression Testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.</p> <p><b>Software Reliability And Quality Management:</b> Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.</p>	
<b>UNIT - V</b>	9 Hrs

**Computer-Aided Software Engineering (Case):** CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

**Software Maintenance:** Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

**Software Reuse:** reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

**Textbooks:**

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9th Edition, McGraw Hill International Edition.

**Reference Books:**

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

**Online Learning Resources:**

- 1) <https://nptel.ac.in/courses/106/105/106105182/>
- 2) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01260589506387148827\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview)
- 3) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_013382690411003904735\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview)

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
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: Develo(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 PO9 PO10	PO1:Apply(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6:Thumb rule PO9: Thumb rule PO10: Thumb rule	3 3 3 3 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 moderate (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 moderate(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 moderate(2)

**PO9: Thumb rule**

Team work is required for software project, therefore the correlation is moderate(2)

**PO10: Thumb rule**

Demonstrate knowledge and understanding of the engineering and management principles And apply these to one's own work, therefore the correlation is moderate(2)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

CourseCode	Year & Sem	WIRELESS SENSOR NETWORKS (Professional Elective-1)	L	T	P	C
23APE3602	III-I		2	1	0	3
Pre-requisite		Semester				

**CourseOutcomes:**

Student will be able to	
CO1	<b>Understand</b> the fundamental concepts and architecture of wireless sensor networks.
CO2	<b>Analyze</b> various network architectures, optimization strategies, and design principles for wireless sensor networks.
CO3	<b>Understand</b> MAC protocols, routing techniques and addressing mechanisms for efficient communication in sensor networks.
CO4	<b>Analyze</b> methods for establishing sensor network infrastructure, including topology control and synchronization techniques.
CO5	<b>Apply</b> knowledge of sensor network platforms, identify programming challenges and use simulation tools for network modeling.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	<b>Understand</b>	the fundamental concepts and architecture of	wireless sensor networks		L2
CO2	<b>Analyze</b>	various network architectures, optimization strategies, and design principles for wireless sensor networks			L4
CO3	<b>Understand</b>	MAC protocols, routing techniques and addressing mechanisms	for efficient communication in sensor networks		L2
CO4	<b>Analyze</b>	methods for establishing sensor network infrastructure, including topology control and synchronization techniques			L4
CO5	<b>Apply</b>	Knowledge of sensor network platforms, identify programming challenges and	use simulation tools for network modeling		L3

<b>UNIT-I</b>		<b>13Hrs</b>
<b>Overview of Wireless Sensor Networks:</b> Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.		
<b>UNIT-II</b>		<b>12Hrs</b>
<b>Architectures:</b> Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts		
<b>UNIT-III</b>		<b>11Hrs</b>
<b>Networking Sensors:</b> MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.		
<b>UNIT-IV</b>		<b>12Hrs</b>
<b>Infrastructure Establishment:</b> Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control		
<b>UNIT-V</b>		<b>12Hrs</b>
<b>Sensor Network Platforms and Tools:</b> Sensor Node Hardware - BerkeleyMotes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.		

**Textbooks:**

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks, John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, –Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

**Reference Books:**

1. Waltenege Dargie, Christian Poellabauer,— Fundamentals of Wireless Sensor Networks Theory And Practicel, By John Wiley & Sons Publications, 2011
2. Kazem Sohraby, Daniel Minoli & Taieb Znati,— Wireless Sensor Networks-Technology, Protocols, and Applications, John Wiley, 2007.
3. AnnaHac,— Wireless Sensor Network Designs, John Wiley, 2003

**Mapping of Course Outcomes with POs and PSOs**

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

**Correlation Matrix:**

**CO1: Understand** the fundamental concepts and architecture of wireless sensor networks.

**Action Verb: Understand(L2)**

PO1Verbs: Apply(L3)

CO	LessonPlan (Hrs)	%	correlation	Verb	BTL	Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 toPO11)	Level of Correlation (0-3)
1	13	22	2	Understand	L2	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Identify(L3) PO6: Thumb Rule PO11: Thumb Rule	3 2 2 2
2	12	20	3	Analyze	L4	PO2 PO6 PO11	PO2: Identify(L3) PO6: Thumb Rule PO11: Thumb Rule	3 3 3
3	11	18	2	Understand	L2	PO1 PO6 PO11	PO1: Apply(L3) PO6: Thumb Rule PO11: Thumb Rule	3 2 2
4	12	20	2	Analyze	L4	PO2 PO6 PO11	PO2: Identify(L3) PO6: Thumb Rule PO11: Thumb Rule	2 3 3
5	12	20	2	Apply	L3	PO1 PO6 PO11	PO1: Apply(L3) PO6: Thumb Rule PO11: Thumb Rule	3 2 2
	60	100						

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)

PO11 fromthumbruleL2 correlation is moderate (2)

**CO2: Analyze** various network architectures, optimization strategies, and design principles for wireless sensor networks.

**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)

PO11 from thumb rule L4 the correlation is high (3)

**CO3: Understand** MAC protocols, routing techniques and addressing mechanisms for efficient communication in sensor networks.

**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)

PO11 from thumb rule L2 correlation is moderate (2)

**CO4: Analyze** methods for establishing sensor network infrastructure, including topology control and synchronization techniques.

**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)

PO11 from thumb rule L4 the correlation is high (3)

**CO5: Apply** knowledge of sensor network platforms, identify programming challenges and use simulation tools for network modeling

**Action Verb: Apply (L3)**

PO1 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)

PO11 from thumb rule L2 correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Artificial Intelligence (Professional Elective-1)	L	T / CLC	P	C
23APE3603	III-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

Student will be able to	
<b>CO1</b>	<b>Understand</b> the basic concepts of artificial intelligence and intelligent agents
<b>CO2</b>	<b>Apply</b> the searching techniques for solving searching problems.
<b>CO3</b>	<b>Analyze</b> the concepts of Reinforcement Learning and NLP Models.
<b>CO4</b>	<b>Evaluate</b> Natural Language Interfaces and perception mechanisms for Machines
<b>CO5</b>	<b>Analyze</b> the robotic designing modules and philosophy constraints for artificial intelligence.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basics concepts of artificial intelligence and intelligent agents			L2
CO2	Apply	the searching techniques		For Solving searching problems	L3
CO3	Analyze	The concepts of Reinforcement Learning and NLP Models			L4
CO4	Evaluate	Natural Language Interfaces and perception mechanisms		For Machines understanding	L5
CO5	Analyze	the robotic designing modules and philosophy constraints		for artificial intelligence.	L4

<b>UNIT - I</b>		<b>9 Hrs</b>
<b>Introduction:</b> What is AI, Foundations of AI, History of AI, The State of Art. <b>Intelligent Agents:</b> Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.		
<b>UNIT - II</b>		<b>9Hrs</b>
<b>Solving Problems by searching:</b> Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.		
<b>UNIT - III</b>		<b>9 Hrs</b>
<b>Reinforcement Learning:</b> Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL <b>Natural Language Processing:</b> Language Models, Text Classification, Information Retrieval, Information Extraction.		
<b>UNIT - IV</b>		<b>9 Hrs</b>
<b>Natural Language for Communication:</b> Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition <b>Perception:</b> Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.		
<b>UNIT - V</b>		<b>9 Hrs</b>
<b>Robotics:</b> Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains <b>Philosophical foundations:</b> Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.		
<b>Textbooks:</b>		
Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3 <sup>rd</sup> Edition, Pearson Education, 2019.		
<b>Reference Books:</b>		
1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan aufmann, 1998.		

2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." *Journal of Accounting Education* 27.1 (2009): 30-39.

**Online Learning Resources:**

<http://peterindia.net/Allinks.html>

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	10	19%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	13	25%	3	CO2 :Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3)	3 2 3 2 3
3	10	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO7	PO1: Apply (L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6: Thumb Rule PO7: Thumb Rule	3 3 3 3 3 3 3
4	9	17%	2	CO4 :Evaluate	L5	PO2 PO3 PO5 PO6 PO7	PO2: Review(L2) PO3: Develop (L3) PO5: Apply(L3) PO6: Thumb Rule PO7: Thumb Rule	3 3 3 3 3
5	11	20%	3	CO5 :Analyze	L4	PO1 PO2 PO3 PO6 PO7 PO8 PO11	PO1:Apply(L3) PO2:Analyze(L4) PO3: Develop(L3) PO6:Thumb Rule PO7: Thumb Rule PO8:Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
	53	100 %						

**Justification Statements :**

**CO1: Understand the basic concepts of artificial intelligence and intelligent agents**

**Action Verb : Understand(L2)**

**PO1 : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 : Review(L2)**

CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the searching techniques for solving searching 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 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)

**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)

**CO3:Analyze the concepts of Reinforcement Learning and NLP Models.**

**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 same 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 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**

Apply contextual knowledge is used for society to address the security issues so correlation is high(3)

**PO7: Thumb rule**

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

**CO4: Evaluate Natural Language Interfaces and perception mechanisms for Machines understanding.**

**Action Verb : Evaluvate(L5)**

**PO2: Review(L2)**

CO4 Action verb is same level as 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)

**PO5: Apply(L3)**

CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**PO6 : Thumb rule**

To address the security issues we apply contextual knowledge . so correlation is high(3)

**PO7: Thumb rule**

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

**CO5: Analyze the robotic designing modules and philosophy constraints for artificial intelligence.**

**Action Verb : Analyze(L4)**

**PO1:Apply(L3)**

CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

**PO2:Analyze(L4)**

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)

**PO6:Thumb Rule**

Apply contextual knowledge is used for society to address the security issues so correlation is medium (2)

**PO7: Thumb Rule**

Since ethical principles should be followed to create a robot. Therefore the correlation is medium (2)

**PO8: Thumb rule**

Team work is required to create robots. Hence the correlation is medium (2)

**PO11: Thumb rule**

For some of AI applications, AI concepts are used to create robots designs. Therefore the correlation is medium (2)



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

Course Code	Year & Sem	Cryptography and Network Security (Professional Elective-1)	L	T / CLC	P	C
23APE3604	III-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

Student will be able to	
CO1	<b>Understand</b> the basic Security and Cryptography concepts and techniques
CO2	<b>Analyze</b> the various cryptography algorithms for data encryption
CO3	<b>Analyze</b> the different MAC and HASH algorithms to authenticate a message
CO4	<b>Apply</b> the various security mechanisms for E-mail and IP security
CO5	<b>Analyze</b> 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 algorithms		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

<b>UNIT - I</b>	<b>14 Hrs</b>
<p><b>Computer and Network Security Concepts:</b> Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security</p> <p><b>Classical Encryption Techniques:</b> Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography</p> <p><b>Block Ciphers:</b> Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard: AES Structure, AES Transformation Functions</p>	

<b>UNIT - II</b>	<b>10 Hrs</b>
<p><b>Number Theory:</b> The Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms,</p> <p><b>Finite Fields:</b> Finite Fields of the Form GF(p), Finite Fields of the Form GF(2<sup>n</sup>)</p> <p><b>Public Key Cryptography:</b> Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.</p>	

<b>UNIT - III</b>	<b>9 Hrs</b>
<p><b>Cryptographic Hash Functions:</b> Application of Cryptographic Hash Functions, Requirements &amp; Security, Secure Hash Algorithm, Message Authentication Functions, Requirements &amp; Security, HMAC &amp; CMAC.</p> <p><b>Digital Signatures:</b> NIST Digital Signature Algorithm, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure</p>	

<b>UNIT - IV</b>	<b>9 Hrs</b>
<p><b>User Authentication:</b> Remote User Authentication Principles, Kerberos. Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME.</p> <p><b>IP Security:</b> IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.</p>	

<b>UNIT - V</b>	<b>9 Hrs</b>
<p><b>Transport Level Security:</b> Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH)</p> <p><b>Fire walls:</b> Fire wall Characteristics and Access Policy, Types of Fire walls, Fire wall Location and Configurations.</p>	

**Textbooks:**

1. Cryptography and Network Security – William Stallings, Pearson Education, 8th Edition.
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition.

**Reference Books:**

1. Cryptography and Network Security-BehrouzA Forouzan, De bdeep Mukhopadhyaya, Mc- Graw Hill, 3rd Edition, 2015.
2. Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

#### Online Learning Resources:

1. <https://nptel.ac.in/courses/106/105/106105031/lecture>
2. [https://nptel.ac.in/courses/106/105/106105162/lecturebyDr.SouravMukhopadhyayIITKharagpur\[VideoLecture\]](https://nptel.ac.in/courses/106/105/106105162/lecturebyDr.SouravMukhopadhyayIITKharagpur[VideoLecture])
3. <https://www.mitel.com/articles/web-communication-cryptography-and-network-security-web-articles-by-Mitel-Power-Connections>

#### Mapping of course outcomes with program outcomes

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

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

#### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1:Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	9	20%	2	CO2 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
3	9	20%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3 3
4	9	20%	2	CO4 : Apply	L3	PO1 PO2 PO7	PO1: Apply(L3) PO2: Review(L2) PO7: Thumb rule	3 3 2
5	9	20%	2	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
	45	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)

**PO11: 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**

Since ethical principles should be followed to while authenticating a message. Therefore the correlation is high(3)

**PO8 : Thumb rule**

Team work is required between client and server to perform authentication. Hence the correlation is high(3)

**PO11 : 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)

**PO7: 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)

**PO7 : Thumb rule**

Since ethical principles should be followed to analyze the security breaches. Therefore the correlation is high(3)

**PO8 : Thumb rule**

Team work is required between client and server to secure the data. Hence the correlation is high(3)

**PO11 : Thumb rule**

For some of Security applications, Various Cryptographic algorithms were analysed. Therefore the correlation is high(3)

**OPEN ELECTIVE-I**



ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)

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

Course Code	Year & Sem	Green Buildings (Open Elective I)	L	T	P	C
23AOE0101	III-I		2	1	0	3

**Course Outcomes (CO)**

Student will be able to	
CO1	Understand the fundamental concepts and significance of green buildings, including their necessity, benefits and sustainable features.
CO2	Apply knowledge of typical energy-saving approaches and sustainable practices to enhance the design and performance of green buildings.
CO3	Analyze strategies for maximizing system efficiency in energy usage by integrating renewable energy sources in buildings and industrial process
CO4	Apply principles of energy modeling to assess building performance in terms of energy consumption and savings.
CO5	Analyze indoor environmental quality parameters such as air conditioning systems, indoor air quality, and control of tobacco smoke for healthy building environments.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the fundamental concepts and significance, including their necessity, benefits and sustainable features.	of green buildings		L2
2	Apply	Knowledge of typical energy saving approaches and sustainable practices	Of green buildings	To enhance and design performance	L3
3	Analyze	Strategies for maximizing system efficiency in energy usage by integrating renewable energy sources	In building and industrial process		L4
4	Apply	principles of energy modeling to assess building performance		in terms of energy consumption and savings.	L3
5	Analyze	indoor environmental quality parameters such as air conditioning systems, indoor air quality, and control of tobacco smoke		for healthy building environments.	L4

<b>UNIT - I</b>	<b>INTRODUCTION TO GREEN BUILDING</b>	<b>9 Hrs</b>
Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing A Green Building, Important Sustainable Features for Green Buildings.		
<b>UNIT - II</b>	<b>GREEN BUILDING CONCEPTS AND PRACTICES</b>	<b>9 Hrs</b>
Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.		
<b>UNIT - III</b>	<b>GREEN BUILDING DESIGN</b>	<b>9 Hrs</b>
Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.		
<b>UNIT - IV</b>	<b>AIR CONDITIONING</b>	<b>9 Hrs</b>
Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.		
<b>UNIT - V</b>	<b>MATERIAL CONSERVATION</b>	<b>9 Hrs</b>
Handling of Non-Process Waste, Waste Reduction During Construction, Materials with Recycle d Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.		
<b>Textbooks:</b>		
1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009. 2. Green Building Hand Book by tom woolley and Sam kimings, 2009		
<b>Reference Books:</b>		
1. Complete Guide to Green Buildings by Trish riley 2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009 3. Energy Conservation Building Code –ECBC-2020, published by BEE		
<a href="https://archive.nptel.ac.in/courses/105/102/105102195/">https://archive.nptel.ac.in/courses/105/102/105102195/</a>		

#### Mapping of course outcomes with program outcomes

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

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

#### Correlation matrix

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	12	20	2	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	12	20	2	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3

4	12	20	2	Apply	L3	PO1	Apply (L3)	3
						PO2	Analyze (L4)	2
						PO6	Thumb Rule	2
5	12	20	2	Analyze	L4	PO1	Apply (L3)	2
						PO2	Analyze (L4)	3
						PO4	Analyze (L4)	3
						PO6	Thumb Rule	3

**CO-PO MAPPING JUSTIFICATION:**

**JUSTIFICATION STATEMENTS:**

**CO 1: Understand the fundamental concepts and significance of green buildings, including their necessity, benefits and sustainable features.**

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO 1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO 1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO 2: Apply knowledge of typical energy-saving approaches and sustainable practices to enhance the design and performance of green buildings.**

Action Verb: Apply (L3)

PO1: Apply(L3)

CO Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO 2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO 2 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

**CO 3: Analyze strategies for maximizing system efficiency in energy usage by integrating renewable energy sources in buildings and industrial process**

Action Verb: Analyze (L4)

PO1: Apply(L3)

CO 3 Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2)

PO2: Analyze (L4)

CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

CO 3 Action Verb is equal to PO4; Therefore, correlation is high (3)

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

**CO4: Apply principles of energy modeling to assess building performance in terms of energy consumption and savings.**

Action Verb: Apply (L3)

PO1: Apply(L3)

CO Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO 4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO 4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

**CO 5: Analyze indoor environmental quality parameters such as air conditioning systems, indoor air quality, and control of tobacco smoke for healthy building environments.**

Action Verb: Analyze (L4)

PO1: Apply(L3)

CO Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

CO 5 Action Verb is equal to PO4; Therefore, correlation is high (3)

CO 5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as high (3).

This course syllabus has been approved by the Board of Studies-Civil



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	Construction Technology and Management (Open Elective I)	L	T / CLC	P	C
23AOE0102	III-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

Student will be able to	
<b>CO1</b>	Understand the project management fundamentals, organizational structures, and leadership principles in construction.
<b>CO2</b>	Understand the manpower planning, equipment management, and cost estimation in civil engineering projects.
<b>CO3</b>	Apply the planning, scheduling, and project management techniques such as CPM and PERT.
<b>CO4</b>	Understand the various contract types, contract formation, and legal aspects in construction management
<b>CO5</b>	Understand the safety management practices, accident prevention strategies, and quality management systems in construction.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
<b>CO1</b>	Understand	the project management fundamentals, organizational structures, and leadership principle		in construction	L2
<b>CO2</b>	Understand	the manpower planning, equipment management, and cost estimation		in civil engineering projects.	L2
<b>CO3</b>	Apply	the planning, scheduling, and project management techniques such as CPM and PERT.		in construction projects	L3
<b>CO4</b>	Understand	the various contract types, contract formation, and legal aspects		in construction management	L2
<b>CO5</b>	Understand	the safety management practices, accident prevention strategies, and quality management systems		in construction	L2

<b>UNIT - I</b>		<b>9 Hrs</b>
<b>INTRODUCTION:</b> Project forms, Management Objectives and Functions; Organizational Chart of A Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability.		
<b>UNIT - II</b>		<b>9Hrs</b>
<b>MAN AND MACHINE:</b> Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.		
<b>UNIT - III</b>		<b>9 Hrs</b>
<b>PLANNING, SCHEDULING AND PROJECT MANAGEMENT:</b> Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network-formulation and Time Computation.		
<b>UNIT - IV</b>		<b>9 Hrs</b>
<b>CONTRACTS:</b> Types of Contracts, formation of Contract – Contract Conditions – Contract for Labour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements		

Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.		
<b>UNIT - V</b>		<b>9 Hrs</b>
<b>SAFETY MANAGEMENT:</b> Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.		
<b>Textbooks:</b>		
1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016. 2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019 Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.		
<b>Reference Books:</b>		
1. Brien, J.O. and Plotnick, F.L., CPM in Construction Management, Mcgraw Hill, 2010. 2. Punmia, B.C., and Khandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002. 3. Construction Methods and Management: Pearson New International Edition 8 th Edition Stephens Nunnally. 4. Rhoden, M and Cato B, Construction Management and Organisational Behaviour, Wiley-Blackwell, 2016.		
<b>Online Learning Resources:</b>		
<a href="https://archive.nptel.ac.in/courses/105/104/105104161/">https://archive.nptel.ac.in/courses/105/104/105104161/</a> <a href="https://archive.nptel.ac.in/courses/105/103/105103093/">https://archive.nptel.ac.in/courses/105/103/105103093/</a>		

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	10	18.18	3	Understand	L1	PO1 PO6 PO7 PO10	Apply (L3) Thumb Rule Thumb Rule Thumb Rule	2 2 2 2
2	10	18.18	3	Understand	L1	PO1 PO6 PO10	Apply (L3) Thumb Rule Thumb Rule	2 2 2
3	15	27.27	3	Apply	L3	PO1 PO2 PO6 PO10	Apply (L3) Analyze (L4) Thumb Rule Thumb Rule	3 2 2 2
4	10	18.18	3	Understand	L1	PO1 PO6 PO10	Apply (L3) Thumb Rule Thumb Rule	2 2 2
5	10	18.18	3	Understand	L1	PO1 PO6 PO10	Apply (L3) Thumb Rule Thumb Rule	2 2 2

## JUSTIFICATION STATEMENTS:

### **CO 1: Understand the fundamental concepts and significance of green buildings, including their necessity, benefits and sustainable features.**

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO 1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO 1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

### **CO 2: Apply knowledge of typical energy-saving approaches and sustainable practices to enhance the design and performance of green buildings.**

Action Verb: Apply (L3)

PO1: Apply(L3)

CO Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO 2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO 2 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

### **CO 3: Analyze strategies for maximizing system efficiency in energy usage by integrating renewable energy sources in buildings and industrial process**

Action Verb: Analyze (L4)

PO1: Apply(L3)

CO 3 Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2)

PO2: Analyze (L4)

CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

CO 3 Action Verb is equal to PO4; Therefore, correlation is high (3)

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

### **CO4: Apply principles of energy modeling to assess building performance in terms of energy consumption and savings.**

Action Verb: Apply (L3)

PO1: Apply(L3)

CO Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO 4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO 4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

### **CO 5: Analyze indoor environmental quality parameters such as air conditioning systems, indoor air quality, and control of tobacco smoke for healthy building environments.**

Action Verb: Analyze (L4)

PO1: Apply(L3)

CO Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

CO 5 Action Verb is equal to PO4; Therefore, correlation is high (3)

CO 5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as high (3).

<b>This course syllabus has been approved by the Board of Studies-Civil</b>
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**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Electrical Safety Practices and Standards (Open Elective-1)	L	T / CLC	P	C
23AOE0201	III-I		2	1	0	3

After completion of the course, students will be able to:	
CO1	Understanding the Fundamentals of Electrical Safety -L2
CO2	Identifying and Applying Safety Components -L3
CO3	Analyzing Grounding Practices and Electrical Bonding-L4
CO4	Applying Safety Practices in Electrical Installations and Environments- L4
CO5	Evaluating Electrical Safety Standards and Regulatory Compliance -L5

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Fundamentals of Electrical Safety			L2
CO2	Identify	Applying Safety Components			L3
CO3	Analyze	Grounding Practices and Electrical Bonding			L4
CO4	Apply	Safety Practices in Electrical Installations and Environments			L4
CO5	Evaluate	Electrical Safety Standards and Regulatory Compliance			L5

<b>UNIT - I</b>	<b>Introduction To Electrical Safety</b>	<b>9 Hrs</b>
Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements - Hazards of electricity- Arc - Blast- Causes for electrical failure.		
<b>UNIT - II</b>	<b>Safety Components</b>	<b>9Hrs</b>
Introduction to conductors and insulators- voltage classification -safety against over voltages- safety against static electricity-Electrical safety equipment's - Fire extinguishers for electrical safety.		
<b>UNIT - III</b>	<b>Grounding</b>	<b>9 Hrs</b>
General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.		
<b>UNIT - IV</b>	<b>Safety Practices</b>	<b>9 Hrs</b>
General first aid- Safety in handling hand held electrical appliances tools- Electrical safety in train stations- swimming pools, external lighting installations, medical locations-Case studies.		
<b>UNIT - V</b>	<b>Standards For Electrical Safety</b>	<b>9 Hrs</b>
Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate		
<b>Textbooks:</b>		
1. Massimo A.G.Mitolo, –Electrical Safety of Low-Voltage Systems  , McGraw Hill, USA, 2009. 2. Mohamed El-Sharkawi, –Electric Safety - Practice and Standards  , CRC Press, USA, 2014		
<b>Reference Books:</b>		
1. Kenneth G.Mastrullo, Ray A. Jones, –The Electrical Safety Program Book  , Jones and Bartlett Publishers, London, 2nd Edition, 2011 2. Palmer Hickman, –Electrical Safety-Related Work Practices  , Jones & Bartlett Publishers, London, 2009. 3. Fordham Cooper, W., –Electrical Safety Engineering  , Butterworth and Company, London, 1986. 4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, –Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012.		

Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)													
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	–	–	–	1	–	–	–	–	1	1	2
CO2	3	3	–	–	–	2	–	–	–	–	2	2	3
CO3	3	–	1	–	3	3	–	–	–	–	3	3	3
CO4	3	2	–	–	3	2	–	–	–	–	2	2	3
CO5	3	3	2	–	3	3	1	–	–	–	2	3	3

Mapping of Course outcomes with Program outcomes Justification Table								
CO No.	CO					Program Outcomes (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1	9	20	2	Understand	L2	PO1 PO2 PO6	Apply-L3 Analyse-L4 Analyse-L4	Medium-2 Low-1 Low-1
2	9	20	2	Identify	L3	PO1 PO2 PO6	Apply-L3 Analyse-L4 Analyse-L4	High-3 Medium-2 Medium-2
3	9	20	2	Analyze	L4	PO1 PO3 PO5 PO6	Apply-L3 Design-L6 Apply-L3 Analyse-L4	High-3 Low-1 High-3 High-3
4	9	20	2	Apply	L4	PO1 PO2 PO5 PO6	Apply-L3 Analyse-L4 Apply-L3 Analyse-L4	High-3 High-3 High-3 High-3
5	9	20	2	Evaluate	L5	PO1 PO2 PO3 PO5 PO6 PO7	Apply-L3 Analyse-L4 Design-L6 Apply-L3 Analyse-L4 Apply-L3	High-3 High-3 Medium-1 High-3 High-3 High-3

Justification:

**CO1:** Understanding the Fundamentals of Electrical Safety

**Action Verb:** L2

**CO1** Action Verb is Less than PO1 Action By1 Therefore The Correlation Is Medium -2

**CO1** Action Verb is Less than PO2 Action By2 Therefore The Correlation Is Low-1

**CO1** Action Verb is Less Than PO6 Action By2 Therefore The Correlation Is Low-1

**CO2:** Identifying and Applying Safety Components

**Action Verb:** L3

**CO2** Action Verb Is Equal To PO1 Therefore The Correlation Is High-3

**CO2** Action Verb Is Less than PO2 Action by one Therefore The Correlation Is Medium-2

**CO2** Action Verb Is Less than PO6 action by one Therefore The Correlation Is Medium-2

**CO3:** Analyzing Grounding Practices and Electrical Bonding

**Action Verb:** L4

**CO3** Action Verb Is greater than PO1 action by one Therefore The Correlation Is High-3

**C03** Action Verb Is Less than PO3 Action by 2 Therefore The Correlation Is Low-1  
**C03** Action Verb Is greater than PO5 Action by 1 Therefore The Correlation Is High-3  
**C03** Action Verb Is Equal To PO6 Therefore The Correlation Is High-3

**C04:** Applying Safety Practices in Electrical Installations and Environments

**Action Verb:** L4

**C04** Action Verb Is Greater Than PO1 Action By 1 Therefore The Correlation Is High-3  
**C04** Action Verb Is Equal To PO2 Therefore The Correlation Is High-3  
**C04** Action Verb Is Greater Than PO5 Action By 1 Therefore The Correlation Is High-3  
**C04** Action Verb Is Equal To PO6 Therefore The Correlation Is High-3

**C05:** Evaluating Electrical Safety Standards and Regulatory Compliance

**Action Verb:** L5

**C05** Action Verb Is Greater Than PO1 Action By 2 Therefore The Correlation Is High-3  
**C05** Action Verb Is Greater Than PO2 Action By 1 Therefore The Correlation Is High-3  
**C05** Action Verb Is less Than PO3 Action By One Therefore The Correlation Is Medium-1  
**C05** Action Verb Is Greater Than PO5 Action By 2 therefore The Correlation Is High-3  
**C05** Action Verb Is Greater Than PO6 Action By 1 therefore The Correlation Is High-3  
**C05** Action Verb Is Greater Than PO7 Action By 2 Therefore The Correlation Is High-3

**This course syllabus has been approved by the Board of Studies-EEE**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	Sustainable Energy Technologies	L	T / CLC	P	C
23AOE0301	III-I	(Open Elective-1)	2	1	0	3

**After completion of the course, students will be able to:**

C01	Analyze solar radiation data, PV module characteristics, and the environmental impact of solar power systems.
C02	Evaluate the performance of various solar thermal collectors and select appropriate battery storage systems for PV applications.
C03	Apply the principles of wind and biomass energy conversion to analyze the performance of renewable energy systems.
C04	Analyze the operational principles and applications of geothermal, ocean energy, and fuel cell systems.
C05	Design an off-grid solar PV power plant considering component selection, system integration, and economic aspects

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Solar radiation data, PV module characteristics, and the environmental impact of solar power systems.			L4
CO2	Evaluate	The performance of various solar thermal collectors and select appropriate battery storage systems.	for PV applications.		L5
CO3	Apply	The principles of wind and biomass energy conversion.	to analyze the performance of renewable energy systems.		L3
CO4	Analyze	The operational principles and applications of geothermal, ocean energy, and fuel cell systems.			L4
CO5	Design	An off-grid solar PV power plant.	considering component selection, system integration, and economic aspects.		L6

<b>UNIT - I</b>		<b>9 Hrs</b>
<b>SOLAR RADIATION:</b> Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems		
<b>UNIT - II</b>		<b>9Hrs</b>
<b>SOLAR PV MODULES AND PV SYSTEMS:</b> PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems- Design of Off Grid Solar Power Plant. Installation and Maintenance		
<b>UNIT - III</b>		<b>9 Hrs</b>
<b>STORAGE IN PV SYSTEMS:</b> Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.		
<b>SOLAR ENERGY COLLECTION:</b> Flat plate and concentrating collectors, classification of concentrating collectors, orientation.		
<b>SOLAR ENERGY STORAGE AND APPLICATIONS:</b> Different methods, sensible, latent heat and stratified		

storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

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

**GWIND ENERGY:** Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

**BIO-MASS:** Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

**UNIT - V** **Standards For Electrical Safety** **9 Hrs**

**GEOTHERMAL ENERGY:** Origin, Applications, Types of Geothermal Resources, Relative Merits

**OCEAN ENERGY:** Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges

**FUEL CELLS:** Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

**Textbooks:**

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

**Reference Books:**

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor & Francis
2. Non-Conventional Energy - Ashok V Desai / New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar / Narosa
4. Non-conventional Energy Source- G.D Roy/Standard Publishers.

**Online Learning Resources:**

- <https://nptel.ac.in/courses/112106318>
- <https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13>
- [https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb\\_N3](https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3)
- [https://youtu.be/zx04Kl8y4dE?si=VmOvp\\_OgqisILTAF](https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF)

**Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	3		3								3	2
C02	3	3	3									3	3
C03	3	3										3	2
C04	3	3		2								3	2
C05		3	3		3	3						3	3

**Mapping of Course outcomes with Program outcomes Justification Table**

CO No.	CO					Program Outcomes (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1	9	20	2	Analyze	L4	PO1, PO2, PO4	Apply(L3) Analyze(L4) Analyze(L4)	3
2	9	20	2	Evaluate	L5	PO1, PO2, PO3	Apply(L3) Analyze(L4) Design(L6)	3
3	9	20	2	Apply	L3	PO1, PO2	Apply(L3) Analyze(L4)	3

4	9	20	2	Analyze	L4	PO1, PO2, PO4	Apply(L3) Analyze(L4) Analyze(L4)	3
5	9	20	2	Design	L6	PO2, PO3, PO5, PO6	Analyze(L4) Design(L6) Usage(L3) Design(L6)	3

### Justification Statements:

**C01:** Analyze solar radiation data, PV module characteristics, and the environmental impact of solar power systems.

**Action Verb:** Analyze (L4)

**PO1, PO2 & PO4 Verbs:** Apply (L3), Analyze (L4), Sustainability (L3)

The C01 Action Verb 'Analyze' (L4) is at a higher cognitive level than PO1 and PO7 verbs and is equal to PO2's 'Analyze' (L4). This outcome requires analyzing complex data in the context of sustainable engineering. Therefore, the correlation is high (3).

**C02:** Evaluate the performance of various solar thermal collectors and select appropriate battery storage systems for PV applications.

**Action Verb:** Evaluate (L5)

**PO2 & PO3 Verbs:** Analyze (L4), Design (L6)

The C02 Action Verb 'Evaluate' (L5) is a higher-order skill that requires analysis (PO2) and is a critical component of designing solutions (PO3). The ability to make judgments based on criteria is fundamental to these POs. Therefore, the correlation is high (3).

**C03:** Apply the principles of wind and biomass energy conversion to analyze the performance of renewable energy systems.

**Action Verb:** Apply (L3)

**PO1 & PO2 Verbs:** Apply (L3), Analyze (L4)

The C03 Action Verb 'Apply' (L3) is at the same cognitive level as PO1's verb and is a prerequisite for PO2's 'Analyze' (L4). It involves applying fundamental engineering knowledge to solve problems. Therefore, the correlation is high (3).

**C04:** Analyze the operational principles and applications of geothermal, ocean energy, and fuel cell systems.

**Action Verb:** Analyze (L4)

**PO1, PO2 & PO4 Verbs:** Apply (L3), Analyze (L4)

The C04 Action Verb 'Analyze' (L4) is at a higher level than PO1's 'Apply' (L3) and is equal to the verbs for PO2 and PO4. It requires a detailed investigation of complex energy systems. Therefore, the correlation is high (3).

**C05:** Design an off-grid solar PV power plant considering component selection, system integration, and economic aspects.

**Action Verb:** Design (L6)

**PO2, PO3 & PO5 Verbs:** Analyze (L4), Design (L6), Usage (L3)

The C05 Action Verb 'Design' (L6) is at the same cognitive level as PO3's verb. This complex design task requires in-depth analysis of the problem (PO2) and the use of modern engineering tools (PO5). Therefore, the correlation is high (3).

<b>This course syllabus has been approved by the Board of Studies-ME</b>
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**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Electronic Circuits (Open Elective-1)	L	T / CLC	P	C
23AOE0401	III-I		2	1	0	3

After completion of the course, students will be able to:

CO1	<b>Understand</b> the operation of various semiconductor diodes and their applications.
CO2	<b>Analyze</b> the BJT characteristics, biasing methods and stabilization techniques.
CO3	<b>Understand</b> the single and multi-stage amplifiers using simplified hybrid model.
CO4	<b>Evaluate</b> the parameters of feedback amplifiers and frequency of various oscillators.
CO5	<b>Analyze</b> the characteristics, operation of Operational amplifier and it's applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Operation of various semiconductor diodes and their applications.		Rectifiers, Clampers, Clippers, voltage regulators.	L2
CO2	Analyze	BJT characteristics, biasing methods and stabilization techniques.			L4
CO3	Understand	Single and multi-stage amplifiers using simplified hybrid model.		BJT, Coupled amplifiers	L2
CO4	Evaluate	Parameters of feedback amplifiers and frequency of various oscillators.			L5
CO5	Analyze	characteristics, operation of Operational amplifier and it's applications			L4

<b>UNIT - I</b>	9Hrs
<b>Semiconductor Diode and Applications:</b> Introduction, PN junction diode - structure, operation and VI characteristics, Half- wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only). Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .	
<b>UNIT - II</b>	9Hrs
<b>Bipolar Junction Transistor (BJT):</b> Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.	
<b>UNIT - III</b>	9 Hrs
<b>Single stage amplifiers:</b> Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model. <b>Multistage amplifiers:</b> Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).	
<b>UNIT - IV</b>	9 Hrs
<b>Feedback amplifiers:</b> Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).	

<b>Oscillators:</b> Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.	
<b>UNIT - V</b>	9 Hrs
<b>Op-amp:</b> Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.	
<b>Applications of op-amp :</b> Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.	
<b>Textbooks:</b>	
1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.	
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.	
<b>Reference Books:</b>	
1. Electronics Devices and Circuits Theory, R.L.Boylestad, LouisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.	
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012	
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.	
<b>Online Learning Resources:</b>	
nptel videos	

### Mapping of course outcomes with program outcomes

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

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	BT L			
1	9	20	2	Understand	L2	PO 1, PO 2	PO1: Apply (L3) PO2: Review(L2)	2 3
2	9	20	2	Analyze	L4	PO 1, PO 2, PO 3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
3	9	20	2	Understand	L2	PO 1, PO 2, PO 4, PO5	PO1: Apply (L3) PO2:Review (L2) PO3:Analyze(L4) PO5: Select(L1)	2 3 1 3
4	9	20	2	Evaluate	L5	PO 1, PO 2, PO 4, PO5	PO1: Apply (L3) PO2:Identify(L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 3
5	9	20	2	Analyze	L4	PO1, PO 2, PO 4	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze( L4)	3 3 3

	45	100 %					
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**Correlation matrix Justification Statements:**

**CO1: Understand** the operation of various semiconductor diodes and their applications.

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore, the correlation is moderate (2). PO2 Verbs: Review (L2) CO1 Action Verb is equal to PO2 verb; Therefore, the correlation is high (3).

**CO2: Analyze** the BJT characteristics, biasing methods and stabilization techniques.

**Action Verb: Analyze(L4)**

PO1 Verbs: Apply (L3) CO2 Action Verb is greater than PO1 verb; Therefore, the correlation is high (3). PO2 Verbs: Identify (L3) CO2 Action Verb is greater than PO2 verb; Therefore, the correlation is high (3). PO3 Verbs: Develop (L3) CO2 Action Verb is greater than PO3 verb; Therefore, the correlation is high (3). PO4 Verbs: Analyze (L4) CO2 Action Verb is equal to PO4 verb; Therefore, the correlation is high (3).

**CO3: Understand** the single and multi-stage amplifiers using simplified hybrid model.

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3),CO3 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2). PO2 Verbs: Review (L2),CO3 Action Verb is equal to PO2 verb by same levels; therefore, correlation is High (3). PO4 Verbs: Analyze-L4,CO3 Action Verb is less than PO4 verb by two levels; therefore, correlation is low (1).

PO5 Verbs: Select-L1,CO3 Action Verb is more than PO5 verb by one level; therefore, correlation is high (3).

**CO4: Evaluate** the parameters of feedback amplifiers and frequency of various oscillators.

**Action Verb: Evaluate(L5)**

PO1 Verbs: Apply (L3)CO4 Action Verb is high than PO1 verb by two levels ; Therefore, correlation is high (3). PO2 Verb: Identify (L3)CO4 Action Verb is high than PO2 verb by two levels ; Therefore, correlation is high (3). PO4 Verbs: Analyze( L4)CO4 Action Verb is higher than PO4 verb by one levels; therefore, correlation is high (3). PO5 Verbs: Apply (L3),CO4 Action Verb is higher than PO5 verb by two levels; Therefore, correlation is high (3).

**CO5: Analyze** the characteristics, operation of Operational amplifiers and it's applications

**Action Verb: Analyze(L4)**

PO1 Verbs: Apply (L3)CO5 Action Verb is PO1 verb by two levels ; Therefore, correlation is high (3).

PO2 Verb: Identify (L3)CO5 Action Verb is high than PO2 verb by two levels ; Therefore, correlation is high (3). PO4 Verbs: Analyze( L4)CO5

Action Verb is higher than PO4 verb by one levels; therefore, correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	<b>Mathematics for Machine Learning and AI (Open Elective I)</b>	L	T	P	C
23AOE9901	III-I		2	1	0	3

**Course Outcomes (CO)**

Student will be able to	
CO1	<b>Apply</b> linear algebra concepts to ML techniques like PCA and regression
CO2	<b>Analyze</b> probabilistic models and statistical methods for AI applications..
CO3	<b>Apply</b> optimization techniques for machine learning algorithms.
CO4	<b>Apply</b> vector calculus and transformations in AI-based models
CO5	<b>Evaluate</b> graph-based AI models using mathematical representations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	linear algebra concepts	to ML techniques like PCA and regression.		<b>L3</b>
2	Analyze	probabilistic models and statistical methods	for AI applications.		<b>L4</b>
3	Apply	optimization techniques	for machine learning algorithms.		<b>L3</b>
4	Apply	vector calculus and transformations	in AI-based models.		<b>L3</b>
5	Evaluate	graph-based AI models	using mathematical representations.		<b>L5</b>

<b>UNIT I:</b>	<b>Linear Algebra for Machine Learning</b>	<b>9 Hrs</b>
Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigen values, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).		
<b>UNIT - II</b>	<b>Probability and Statistics for AI</b>	<b>9 Hrs</b>
Probability distributions: Gaussian, Binomial, Poisson. Bayes' Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP). Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.		
<b>UNIT - III</b>	<b>Optimization Techniques for ML</b>	<b>9 Hrs</b>
Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions. Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS method.		
<b>UNIT - IV</b>	<b>Vector Calculus &amp; Transformations</b>	<b>9 Hrs</b>
Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.		
<b>UNIT - V</b>	<b>Graph Theory for AI</b>	<b>9 Hrs</b>
Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).		
<b>Textbooks:</b>		
1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.		
2. Pattern Recognition and Machine Learning by Christopher Bishop, Springer.		

**Reference Books:**

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

**Online Learning Resources:**

- MIT– Mathematics for Machine Learning <https://ocw.mit.edu>
- Stanford CS229 – Machine Learning Course <https://cs229.stanford.edu/>
- DeepAI – Mathematical Foundations for AI <https://deepai.org>

**Mapping of course outcomes with program outcomes**

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

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

**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	<b>Apply</b>	<b>L3</b>	PO1	<b>Apply</b>	3
2	<b>Analyze</b>	<b>L4</b>	PO2	<b>Analyze</b>	3
3	<b>Apply</b>	<b>L3</b>	PO1	<b>Apply</b>	3
4	<b>Apply</b>	<b>L3</b>	PO1	<b>Apply</b>	3
5	<b>Evaluate</b>	<b>L5</b>	PO3	<b>Evaluate</b>	3

**Justification Statements:**

**CO1:** Apply linear algebra concepts to ML techniques like PCA and regression.

**Action Verb: Apply(L3)**

PO1 Verbs: Apply (L3)

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

**CO2:** Analyze probabilistic models and statistical methods for AI applications.

**Action Verb: Analyze (L4)**

PO2 Verbs: Analyze (L4)

CO2 Action Verbis equal to PO2 verb; Therefore correlation is high (3).

**CO3:** Apply optimization techniques for machine learning algorithms.

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO3 Action Verblevel is equal to PO1 verb; Therefore correlation is high (3).

**CO4:** Apply vector calculus and transformations in AI-based models.

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO4 Action Verblevel is equal to PO1 verb; Therefore correlation is high (3).

**CO5:** Evaluate graph-based AI models using mathematical representations.

**Action Verb: Evaluate(L5)**

PO3 Verb: Evaluate (L6)

CO5 Action verb is equal to PO3 verb; therefore the correlation is high (3).

**This course syllabus has been approved by the Board of Studies-Mathematics**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Materials Characterization Techniques (Open Elective-1)	L	T / CLC	P	C
23AOE9906	III-I		2	1	0	3

After completion of the course, students will be able to:

CO1	Understand the crystal structure and crystal size by using X-ray Diffraction (XRD) technique.
CO2	Analyze the basic principles of Scanning Electron Microscopy (SEM).
CO3	Analyze the fundamentals of Transmission Electron Microscope (TEM).
CO4	Apply the various spectroscopic techniques for engineering applications.
CO5	Analyze the electric and magnetic properties of a specimen using various characterization techniques.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The crystal structure and crystal size by using X-ray Diffraction (XRD) technique.			L2
CO2	Analyze	The various spectroscopic techniques for engineering applications.			L4
CO3	Analyze	The fundamentals of Transmission Electron Microscope (TEM).			L4
CO4	Apply	The various spectroscopic techniques for engineering applications.			L3
CO5	Analyze	The electric and magnetic properties of a specimen using various characterization techniques.			L4

<b>UNIT - I</b>	<b>Structure analysis by Powder X-Ray Diffraction</b>	<b>9 Hrs</b>
Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).		
<b>UNIT - II</b>	<b>Microscopy technique -1 -Scanning Electron Microscopy (SEM)</b>	<b>9Hrs</b>
Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.		
<b>UNIT - III</b>	<b>Microscopy Technique -2 - Transmission Electron Microscopy (TEM)</b>	<b>9 Hrs</b>
Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.		
<b>UNIT - IV</b>	<b>Spectroscopy techniques</b>	<b>9 Hrs</b>
Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).		
<b>UNIT - V</b>	<b>Electrical &amp; Magnetic Characterization techniques</b>	<b>9 Hrs</b>
Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of		

Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

**Textbooks:**

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008.

**Reference Books:**

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall, 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. Materials Characterization Techniques - Sam Zhang, Lin Li, Ashok Kumar - CRC Press - 2008

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/115/103/115103030/>
2. [https://nptel.ac.in/content/syllabus\\_pdf/113106034.pdf](https://nptel.ac.in/content/syllabus_pdf/113106034.pdf)
3. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/>

**Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	2												
CO2	3												
CO3	3				3								
CO4	3												
CO5	3	3											

**Mapping of Course outcomes with Program outcomes Justification Table**

CO No.	CO					Program Outcomes (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1	9	20	2	Understand	L2	PO1	PO1: Apply (L3)	2
2	9	20	2	Analyze	L4	PO1	PO1: Apply (L3)	3
3	9	20	2	Analyze	L4	PO1, PO5	PO1, PO5: Apply (L3)	3
4	9	20	2	Apply	L3	PO1	PO1: Apply (L3)	3
5	9	20	2	Analyze	L4	PO1, PO2	PO1, PO2: Apply (L3)	3

**Justification:**

**CO1: Understand the crystal structure and crystal size by using X-ray Diffraction (XRD) technique.**

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

CO1 Action Verb level is less than PO1 verb by one level; Therefore, correlation is moderate (2).

**CO2: Analyze the basic principles of Scanning Electron Microscopy (SEM).**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)

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

**CO3: Analyze the fundamentals of Transmission Electron Microscope (TEM).**

**Action Verb: Analyze (L4)**

PO1 and PO5 Verbs: Apply (L3)

CO3 Action Verb level is greater than PO1 and PO5 verbs by one level; Therefore correlation is high (3).

**CO4: Apply the various spectroscopic techniques for engineering applications.**

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO4 Action Verb is equal to PO1 verb; Therefore, correlation is high (3).

**CO5: Analyze the electric and magnetic properties of a specimen using various characterization techniques.**

**Action Verb: Analyze (L4)**

PO1 and PO2 Verb: Apply (L3)

CO5 Action verb is greater than PO1 and PO2 verbs by one level; therefore, the correlation is high (3).

**This course syllabus has been approved by the Board of Studies-Physics**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

<b>Course Code</b>	<b>Year &amp; Sem</b>	<b>Chemistry of Energy Systems (Open Elective-1)</b>	<b>L</b>	<b>T / CLC</b>	<b>P</b>	<b>C</b>
23A0E9911	III-I		2	1	0	3

After completion of the course, students will be able to:

CO1	Understand the problems based on electrode potential and concept of batteries.
CO2	Apply fuel technology in various energy and engineering contexts.
CO3	Analyze the advantages of photoelectric catalytic process such as high efficiency, low environmental impact and renewable energy applications.
CO4	Apply the electrochemical principles to photo voltaic cell, solar power and solar cells.
CO5	Analyze various methods for storage of hydrogen fuel.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	the problems based on electrode potential and concept of batteries.			L2
CO2	Apply	fuel technology in various energy and engineering contexts.			L3
CO3	Analyze	the advantages of photoelectric catalytic process such as high efficiency, low environmental impact and renewable energy applications.			L4
CO4	Apply	the electrochemical principles to photo voltaic cell, solar power and solar cells.			L3
CO5	Analyze	various methods for storage of hydrogen fuel.			L4

<b>UNIT - I</b>	<b>Electrochemical Systems</b>	<b>9 Hrs</b>
Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction, Lead-acid, Nickel-cadmium, Lithium ion batteries and their applications.		
<b>UNIT - II</b>	<b>Fuel Cells</b>	<b>9Hrs</b>
Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications		
<b>UNIT - III</b>	<b>Photo and Photo electrochemical Conversions)</b>	<b>9 Hrs</b>
Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.		
<b>UNIT - IV</b>	<b>Solar Energy</b>	<b>9 Hrs</b>
Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications		
<b>UNIT - V</b>	<b>Hydrogen Storage</b>	<b>9 Hrs</b>
Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel, and Organic hydrogen carriers.		
<b>Textbooks:</b>		
1. Physical chemistry by Ira N. Levine 2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli. 3. Inorganic Chemistry, Silver and Atkins		

**Reference Books:**

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by Arvind Tiwari and Shyam
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/115/103/115103030/>
2. [https://nptel.ac.in/content/syllabus\\_pdf/113106034.pdf](https://nptel.ac.in/content/syllabus_pdf/113106034.pdf)
3. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/>

**Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)**

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

**Mapping of Course outcomes with Program outcomes Justification Table**

CO No.	CO					Program Outcomes (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1	9	20	2	Understand	L2	PO1	PO1: Apply (L3)	2
2	9	20	2	Apply	L3	PO1	PO1: Apply (L3)	3
3	9	20	2	Analyze	L3	PO1	PO1: Apply (L3)	3
4	9	20	2	Apply	L4	PO1	PO1: Apply (L3)	3
5	9	20	2	Analyze	L4	PO1	PO1: Apply (L3)	3

**Justification:**

**CO1: Understand the problems based on electrode potential and concept of batteries**

**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 fuel technology in various energy and engineering contexts**

**Action Verb: Apply (L3)**

PO1 Verbs: Apply (L3)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

**CO3: Analyze the advantages of photoelectric catalytic process such as high efficiency, low environmental impact and renewable energy applications**

**Action Verb: Analyze (L4)**

PO1 Verb: Apply (L3)

CO3 Action Verb is less than PO1 verb; Therefore correlation is high (2).

**CO4: Apply the electrochemical principles to photo voltaic cell, solar power and solar cells**

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO5 Analyze various methods for storage of hydrogen fuel**

**Action Verb: Analyze (L4)**

PO1 Verb: Analyze (L4)

CO5 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**This course syllabus has been approved by the Board of Studies-Chemistry**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	English For Competitive Examinations (Open Elective-I)	L	T	P	C
23AOE9915	III-I		2	1	0	3

**Course Outcomes (CO)**

Student will be able to	
CO1	Understand the basics of English grammar to develop proficiency in language skills.
CO2	Apply the grammatical structures in sentences for an effective communication
CO3	Apply the use of various concepts in grammar and vocabulary in everyday use and competitive exams
CO4	Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills
CO5	Create effective writing forms like essays and precise writing by using grammar and structure rules

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	the basics of English grammar to develop proficiency in language skills.			L2
2	<b>Apply</b>	the grammatical structures in sentences for an effective communication			L3
3	<b>Analyze</b>	the use of various concepts in grammar and vocabulary in everyday use and competitive exams		in everyday use and competitive exams	L3
4	<b>Understand</b>	Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills			L4
5	<b>Evaluate</b>	effective writing forms like essays and precise writing by using grammar and structure rules.	by using grammar and structure rules.		L6

UNIT - I	GRAMMAR-1	9 Hrs
Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees of Comparison-Adverbs-types- errors-Conjunctions-usage-repositions-usage-Tag Questions, types-identifying errors- Practice		
UNIT - II	GRAMMAR-2	9 Hrs
Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices		
UNIT - III	VERBAL ABILITY	9 Hrs
Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.		

<b>UNIT - IV</b>	<b>READING COMPREHENSION AND VOCUBULARY</b>	<b>9 Hrs</b>
Competitive Vocabulary :Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix &Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones-Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods		
<b>UNIT - V</b>	<b>WRITING FOR COMPETITIVE EXAMINATIONS</b>	<b>9 Hrs</b>
Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features- types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs-Essay writing-types		
<b>Textbooks:</b>		
1.Wren & Martin, English for Competitive Examinations, S.Chand & Co, 2021 2.Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.		
<b>Reference Books:</b>		
1.Hari Mohan Prasad, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014. 2.Philip Sunil Solomon, English for Success in Competitive Exams, Oxford 2016 3.Shalini Verma , Word Power Made Handy, S Chand Publications 4.Neira, Anjana Dev & Co. Creative Writing: A Beginner's Manual. Pearson Education India, 2008. 5.Abhishek Jain,Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013. 6.Michel Swan, Practical English Usage,Oxford,2006.		
<b>Online Learning Resources:</b>		
1. <a href="https://www.grammar.cl/english/parts-of-speech.html">https://www.grammar.cl/english/parts-of-speech.html</a> 2. <a href="https://academicguides.waldenu.edu/writingcenter/grammar/partssofspeech">https://academicguides.waldenu.edu/writingcenter/grammar/partssofspeech</a> 3. <a href="https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice">https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice</a> 4. <a href="https://language-tool.org/insights/post/verb-tenses/">https://language-tool.org/insights/post/verb-tenses/</a> 5. <a href="https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council">https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council</a> <a href="https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx">https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx</a>		

#### Mapping of course outcomes with program outcomes

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

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

#### 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			Thumb Rule	
2	CO2: Apply			Thumb Rule	
3	CO3: Analyze			Thumb Rule	
4	CO4: Apply			Thumb Rule	
5	CO5: Evaluate			Thumb Rule	

#### Justification Statements:

**CO1:** Understand the basics of English grammar to develop proficiency in language skills.

#### Action Verb: Understand (L2)

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**CO2:** Apply the grammatical structures in sentences for an effective communication.

CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

**CO3:** Apply the use of various concepts in grammar and vocabulary in everyday use and competitive exams

CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

**CO4:** Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills

**Action Verb: Analyze (L4)**

CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

**CO5:** Create effective writing forms like essays and precise writing by using grammar and structure rules.

**Action Verb: Create(L6)**

CO5 Action Verb Create is of BTL 6. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

**This course syllabus has been approved by the Board of Studies-Humanities**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Entrepreneurship and New Venture Creation (Open Elective-I)	L	T	P	C
23AOEMB01	III-I		2	1	0	3

**Course Outcomes (CO)**

Student will be able to	
CO1	Understand the entrepreneurial mind – set for venture creation and Intrapreneurial Leadership.
CO2	Analyze the process of problem-opportunity identification through design thinking, and validating with the potential customer.
CO3	Understand Prototype Development and validate MVP of their venture idea.
CO4	Evaluate the financial and market viability of a venture by conducting financial and marketing feasibility.
CO5	Understand an investible pitch deck of their practice venture to attract stakeholders.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	an entrepreneurial mind – set		for venture creation and Entrepreneurial Leadership	L2
CO2	Analyze	the process of problem-opportunity identification	Through design thinking, and validating with the potential customer.		L4
CO3	Understand	Proto type Development and validate MVP of their venture idea			L2
CO4	Evaluate	the financial and market viability of a venture	by conducting financial and marketing feasibility.		L5
CO5	Understand	an investible pitch deck of their practice venture		to attract stakeholders	L2

<b>UNIT-I</b>	<b>Entrepreneurship Fundamentals and context</b>	
Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.		
<b>Unit II</b>	<b>Problem &amp; Customer Identification</b>	
Understanding and analyzing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analyzing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.		
<b>Unit III</b>	<b>Solution design, Prototyping &amp; Opportunity Assessment and Sizing</b>	
Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.		
<b>UNIT-IV</b>	<b>Business &amp; Financial Model, Go-to-Market Plan</b>	
Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure - Lean approach. Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance.		

Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity Map the Start-up Life-cycle to Funding Options.

**UNIT-V Scale Outlook and Venture Pitch readiness**

Understand and identify potential and aspiration for scale vis-à-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Textbooks:

1. Robert D.Hisrich, Michael P.Peters, Dean A. Shepherd, Sabyasachi Sinha. Entrepreneurship, McGrawHill, 11th Edition (2020)
2. Ries E, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, (2011).
3. Osterwalder, A., & Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons. (2010).

**References:**

1. Simon Sinek, *Start with Why*, Penguin Books limited. (2011)
2. Brown Tim, *Change by Design Revised & Updated: How Design Thinking*
3. *Transforms Organizations and Inspires Innovation*, Harper Business. (2019)
4. Namita Thapar (2022) *The Dolphin and the Shark: Stories on Entrepreneurship*, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) *Effectuation: Elements of Entrepreneurial Expertise*, Elgar Publishing Ltd.

**Mapping of course outcomes with program outcomes**

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

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s): Action Verb and BTL	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	Understand	L2	PO1	Apply (L3)	2
2	9	20%	2	Analyze	L4	PO3	Apply (L3)	3
3	9	20%	2	Create	L6	PO4	Apply (L3)	3
4	9	20%	2	Evaluate	L5	PO1	Apply (L3)	3
5	9	20%	2	Understand	L2	PO9	Thumb Rule	2
Total	45	100						

**Justification Statements:**

**CO1:** Understand an entrepreneurial mind – set for venture creation and Intrapreneurial Leadership.

**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 process of problem-opportunity identification through design thinking, and validating with the potential customer.

**Action Verb: Analyze (L4)**

PO3: Apply (L3)

CO2 Action verb is more than PO3 verb. Therefore the correlation is High (3)

**CO3:** Understand Prototype Development and validate MVP of their venture idea.

**Action Verb: Understand (L2)**

PO4: Apply (L3)

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

**CO4:** Evaluate the financial and market viability of a venture by conducting financial and marketing feasibility.

**Action Verb: Evaluate (L5)**

PO1: Apply (L3)

CO4 Action verb is more than PO1 verb by two levels. Therefore the correlation is High (3)

**CO5:** Understand an investible pitch deck of their practice venture to attract stakeholders.

**Action Verb: Understand (L2)**

PO9: Thumb Rule

As using thumb rule, correlates with PO9. Therefore the correlation is medium (2)

<b>This course syllabus has been approved by the Board of Studies-MBA</b>
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**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Internet of Things Lab	L	T	P	C
23APC3606	III-I		0	0	3	1.5

**Course Outcomes (CO)**

Student will be able to	
CO1	<b>Understand</b> the ability to interface actuators and sensors.
CO2	<b>Apply</b> the object distance measurement systems using ultrasonic sensors to display data.
CO3	<b>Analyze</b> the HTTP-based web interfaces on ESP32 to control and monitor sensor/actuator devices.
CO4	<b>Apply</b> the MQTT protocol to control devices such as LEDs, motors, and AC appliances using Android or web applications.
CO5	<b>Evaluate</b> the UAV/Drone systems including flight controller programming and GPS data reading using Python.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	ability to interface actuators and sensors.			L2
2	<b>Apply</b>	object distance measurement systems	using ultrasonic sensors	to display data.	L3
3	<b>Analyze</b>	HTTP-based web interfaces on ESP32		to control and monitor sensor /actuator devices.	L4
4	<b>Understand</b>	MQTT protocol	using Android or web applications	to control devices such as LEDs, motors, and AC appliances	L3
5	<b>Evaluate</b>	the UAV/Drone systems including flight controller programming and GPS data reading	using Python.		L5

**List of Experiments:**

- 1. Serial Monitor, LED, Servo Motor - Controlling**  
**Experiment1:** Controlling actuators through Serial Monitor. Creating different led patterns and controlling them using push button switches. Controlling servo motor with the help of joystick. **(CO-1)**
- 2. Distance Measurement of an object Experiment(**  
2: Calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD. **(CO-1)**
- 3. LDR Sensor, Alarm and temperature, humidity measurement**  
**Experiment3:** Controlling relay state based on ambient light levels using LDR sensor. Basic Burglar alarm security system with the help of PIR sensor and buzzer. Displaying humidity and temperature values on LCD **(CO-1)**
- 4. Experiments using Raspberry Pi**  
**Experiment 4:** λ Controlling relay state based on input from IR sensors λ Interfacing stepper motor with R-Pi λ Advanced burglar alarm security system with the help of PIR sensor, buzzer and keypad. (Alarm gets disabled if correct keypad password is entered) λ Automated LED light control based on input from PIR (to detect if people are present) and LDR(ambient light level) **(CO-2)**
- 5. IOT Framework Experiment 5:** Upload humidity & temperature data to Thing Speak, periodically logging ambient light level to Thing Speak Experiment 6: Controlling LEDs, relay & buzzer using Blynk app **(CO-2)**
- 6. HTTP Based Experiment 7:** Introduction to HTTP. Hosting a basic server from the ESP32 to control various digital based actuators (led, buzzer, relay) from a simple web page. **(CO-3)**
- 7. MQTT Based**  
**Experiment 9:** Controlling LEDs/Motors from an Android/We b app, Controlling AC Appliances from an

android/web app with the help of relay. <b>(CO-4)</b> <b>Experiment 10:</b> Displaying humidity and temperature data on a web-based application <b>(CO-4)</b> <b>8. UAV/Drone</b> <b>Experiment 11</b> <ul style="list-style-type: none"> <li>Demonstration of UAV elements, Flight Controller</li> <li>Mission Planner flight planning design <b>(CO-5)</b></li> </ul> <b>Experiment 12:</b> Python program to read GPS coordinates from Flight Controller <b>(CO-5)</b>
<b>Textbooks:</b>
1. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hill Publication, 2017. 2. Zach Shelby, Carsten Bormann: "The Wireless Embedded Internet", Wiley, 1st Edition
<b>Reference Books:</b>
1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012. 2. Alexander Osterwalder, and Yves Pigneur – Business Model Generation – Wiley, 2011 3. ArshdeepBahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities Press, 2014. 4. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
<b>Online Resources:</b>
1. <a href="https://www.arduino.cc/">https://www.arduino.cc/</a> 2. <a href="https://www.raspberrypi.org/">https://www.raspberrypi.org/</a>

### Mapping of course outcomes with program outcomes

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

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

### 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 PO2 PO5	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3)	2 3 3
2	CO2: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 2 2
3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3

## **Justification Statements:**

**CO1: Understand** the ability to interface actuators and sensors.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is moderate (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO5 Verb : Apply(L2)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is high (3)

**CO 2: Apply** the object distance measurement systems using ultrasonic sensors to display data.

**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 by one, Therefore the correlation is moderate (2)

**PO11: Thumb rule**

The Object distance measurement systems using upgrade sensors and actuators. Therefore the correlation is moderate (2)

**CO 3: Analyze** the HTTP-based web interfaces on ESP32 to control and monitor sensor/actuator devices.

**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 than level as PO2 verb by one. 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 PO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

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

**PO10: Thumb rule**

To make web site and web pages should be interactive understand by user, so need to provide proper forms. Therefore, the correlation is high (3)

**CO4: Apply** the MQTT protocol to control devices such as LEDs, motors, and AC appliances using Android or web applications

**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)

**PO3: Develop(L2)**

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze(L2)**

CO4 Action verb is same level of PO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

CO4 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

**CO 5: Evaluate** the UAV/Drone systems including flight controller programming and GPS data reading using Python.

**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 two 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)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Cyber Security Lab	L	T	P	C
23APC3607	III-I		0	0	3	1.5

Pre-Requisites	Basic computer knowledge, operating systems, networking fundamentals	Semester	
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<b>Course Outcomes (CO):</b> Student will be able to
<b>CO1: Understand</b> the cyber-attacks and data privacy issues and preventive measures
<b>CO2: Apply</b> the cryptographic algorithms and digital signatures using Hash and Digital PKI to secure communications.
<b>CO3: Understand</b> the network security protocols such as IDS, firewalls, SSL.
<b>CO4: Analyze</b> the various file types using the Autopsy to digital forensics platform.
<b>CO5: Evaluate</b> the network forensics principles using Miner to identify malicious activity.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	cyber-attacks and data privacy issues and preventive measures			L2
2	<b>Apply</b>	cryptographic algorithms and digital signatures	using Hash and Digital PKI	to secure communications.	L3
3	<b>Understand</b>	the network security protocols such as IDS, firewalls, SSL.			L2
4	<b>Analyze</b>	various file types	using the Autopsy	to digital forensics platform.	L4
5	<b>Evaluate</b>	network forensics principles	Using Miner.	to identify malicious activity.	L5

<b>List of Experiments:</b>
<ol style="list-style-type: none"> <li>1. Perform an Experiment for port scanning with neap</li> <li>2. Set Up a honey pot and monitor the honey pot on the network</li> <li>3. Install Jscript/Cryptal tool (or any other equivalent) and demonstrate Asymmetric, symmetric crypto algorithm, Hash and Digital/PKI signatures.</li> <li>4. Generate minimum 10 passwords of length 12 characters using open SSL command</li> <li>5. Perform practical approach to implement Foot printing-Gathering target information using Dmitry-D magic, U Attester</li> <li>6. Working with sniffers for monitoring network communication (Wire shark).</li> <li>7. Using Snort, perform real time traffic analysis and packet logging.</li> <li>8. Perform email analysis using the Autopsy tool.</li> <li>9. Perform Registry analysis and get boot time logging using process monitor tool</li> <li>10. Perform File type detection using Autopsy tool</li> <li>11. Perform Memory capture and analysis using FTK imager tool</li> <li>12. Perform Network analysis using the Network Miner tool</li> </ol>
<b>Textbooks:</b>
<ol style="list-style-type: none"> <li>1. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auer back Publications, 2013.</li> <li>2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Singles Publishing, 2012.</li> </ol>
<b>Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.</li> <li>2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H.Malian, E. Casey and J. M. Aquiline, Signers, 2012.</li> <li>3. The Best Damn Cybercrime and Digital Forensics Book.</li> </ol>
<b>Online Resources:</b>
<a href="https://github.com/Cyber-Labs/Cyber-Labs-Get-Started">https://github.com/Cyber-Labs/Cyber-Labs-Get-Started</a>

### Mapping of course outcomes with program outcomes

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

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

### 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	CO:1 Understand	L2	PO1 PO2 PO5	PO1: Apply(L3) PO2: Review(L2) PO5 : Apply(L3)	2 3 3
2	CO 2: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO11: Thumb rule	3 3 2 2
3	CO 3:Understand	L2	PO1 PO2 PO3 PO5 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO5: Apply(L3) PO10: Thumb rule	2 3 2 2 3
4	CO 4:Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
5	CO 5:Evaluate	L5	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3

### Justification Statements:

**CO1: Understand** the cyber-attacks and data privacy issues and preventive measures

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is moderate (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO5 Verb : Apply(L2)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is high (3)

**CO2: Apply** the cryptographic algorithms and digital signatures using Hash and Digital PKI to secure communications.

**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 by one, Therefore the correlation is high(3)

**PO4: Analyze (L4)**

CO2 Action verb is less than by one level PO4verb. Therefore the correlation is moderate(2)

**PO11: Thumb rule**

The cryptographic algorithms and digital signatures systems upgrade to secure communications. Therefore the correlation is moderate (2)

**CO 3: Understand** the network security protocols such as IDS, firewalls, SSL.

**Action Verb : Understand (L2)**

**PO1: Apply(L3)**

CO3 Action verb is less than by one level of PO1 verb. Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

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

**PO3: Develop (L3)**

CO3 Action verb is less than than PO3 verb. Therefore the correlation is moderate (2)

**PO5: Apply(L3)**

CO3 Action verb is less than by one level as PO1 verb. Therefore, the correlation is moderate (2)

**PO10: Thumb rule**

To make web site and networks to secure communications, so need to provide protocols. Therefore, the correlation is high (3)

**CO4: Analyze** the various file types using the Autopsy to digital forensics platform.

**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 than level as PO2 verb by one. 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 PO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

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

**CO 5: Evaluate** the network forensics principles using Miner to identify malicious activity.

**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 two 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)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI  
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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Soft Skills Skill Enhancement Course	L	T	P	C
			23ASC9901	III-I	0	1

**Course Outcomes:**

**CO1:** Understand the various techniques of soft skills and communication skills.  
**CO2:** Analyze the listening and thinking skills to enhance professional development.  
**CO3:** Apply the critical thinking skills in problem solving and decision making through Discussions.  
**CO4:** Evaluate the emotional intelligence and stress management for individuals and groups.  
**CO5:** Apply the corporate etiquette atmosphere to enhance professional behavior in workplace environment.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the various techniques of soft skills and communication skills.			L2
2	Analyze	the listening and thinking skills to enhance professional development.			L4
3	Apply	the critical thinking skills in problem solving and decision making through Discussions .			L3
4	Evaluate	the emotional intelligence and stress management to control in themselves and others.			L5
5	Apply	the corporate etiquette atmosphere to enhance professional behavior in workplace environment.			L3

**UNIT I Soft Skills & Communication Skills**

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques.

**Activities:**

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

**UNIT II Critical Thinking**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection

**Activities:**

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

**UNIT III Problem Solving & Decision Making**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

**Activities:**

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

**UNIT IV Emotional Intelligence & Stress Management**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

**Activities:**

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

**UNIT V Corporate Etiquette**

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges

**Activities**

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

**Prescribed Books:**

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

**Reference Books:**

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

**Online Learning Resources:**

1. [https://youtu.be/DUlsNJtg2L8?list=PLLy\\_2iUCG87CQhELCytvXh0E\\_y-bOO1\\_q](https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q)
2. [https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZe1\\_j2PUy0pwjVUgj7KLJ](https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZe1_j2PUy0pwjVUgj7KLJ)
3. <https://youtu.be/-Y-R9hD17IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>
7. <https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/>
8. [https://onlinecourses.nptel.ac.in/noc24\\_hs15/preview](https://onlinecourses.nptel.ac.in/noc24_hs15/preview)
9. [https://onlinecourses.nptel.ac.in/noc21\\_hs76/preview](https://onlinecourses.nptel.ac.in/noc21_hs76/preview)

**Correlation of COs with the POs & PSOs for B.Tech  
AK-23 Regulations**

**\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated**

Course Title	Course Outcomes COs	Programme Outcomes(POs)											
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12
Soft Skills Lab	CO1										2		
	CO2									3	3		
	CO3									2			
	CO4									3			
	CO5									2	2		

**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	9		CO1	<b>UNDERSTAND</b>	L2	PO10	Thumb rule	2
2	9		CO2	<b>ANALYZE</b>	L4	PO9, PO10	Thumb rule	3,3
3	9		CO3	<b>APPLY</b>	L3	PO9	Thumb rule	2
4	9		CO4	<b>EVALUATE</b>	L5	PO9	Thumb rule	3
5	9		CO5	<b>Apply</b>	L3	PO9, PO10	Thumb rule	2,2

**CO1:** Understand the various techniques of soft skills and communication 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:** Analyze the listening and thinking skills to enhance professional development.

**Action Verb: Analyze (L4)**

CO2 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3)

**CO3:** Apply the critical thinking skills in problem solving and decision making through Discussions .

**Action Verb: Apply (L3)**

CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

**CO4:** Evaluate the emotional intelligence and stress management to control themselves and others.

**Action Verb: Evaluate (L5)**

CO4 Action Verb Evaluate is of BTL 5. Using Thumb rule, L2 correlates PO6 to PO12 as high(3).

**CO5:** :: Apply the corporate etiquette atmosphere to enhance professional behavior in workplace environment.

**Action Verb: Create e (L3)**

CO5 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

**This course syllabus has been approved by the Board of Studies-ENGLISH**

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	TINKERING LAB (Engineering Science)	L	T	P	C
23AES0404	III-I		0	0	2	1

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

**Course Outcomes:**

After Studying the Course Student will able to	
CO1	<b>Develop</b> arduino/ESP32 programming for basic circuits using breadboard/Tinkercad
CO2	<b>Analyze</b> the LDR interfacing circuits with arduino / ESP32 controllers.
CO3	<b>Analyze</b> the control of traffic light circuit, sensor-based servomotor and mobile app-based LED.
CO4	<b>Design</b> a walking robot and rocket using 3-Dimensional (3D) printing Technology.
CO5	<b>Create</b> a prototype for soil moisture monitor and redesign a motor bike using Design Thinking steps.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	<b>Develop</b>	Arduino/ESP32 programming for basic circuits	breadboard/Tinkercad		L3
CO2	<b>Analyze</b>	The LDR interfacing circuits	Arduino / ESP32		L4
CO3	<b>Analyze</b>	The control of traffic light circuit, sensor-based servomotor and mobile app-based LED			L4
CO4	<b>Design</b>	A walking robot and rocket	3D Printing Technology		L6
CO5	<b>Create</b>	A prototype for soil moisture monitor and redesign a motor bike	Design Thinking steps		L6

**List of experiments:**

- 1) Make your own parallel and series circuits using breadboard for any application of your choice. **(CO1)**
- 2) Demonstrate a traffic light circuit using breadboard. **(CO3)**
- 3) Build and demonstrate automatic Street Light using LDR. **(CO2)**
- 4) Simulate the Arduino LED blinking activity in Tinkercad. **(CO1)**
- 5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE. **(CO1)**
- 6) Interfacing IR Sensor and Servo Motor with Arduino. **(CO3)**
- 7) Blink LED using ESP32. **(CO1)**
- 8) LDR Interfacing with ESP32. **(CO2)**
- 9) Control an LED using Mobile App. **(CO3)**
- 10) Design and 3D print a Walking Robot **(CO4)**
- 11) Design and 3D Print a Rocket. **(CO4)**
- 12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard. **(CO5)**
- 13) Demonstrate all the steps in design thinking to redesign a motor bike. **(CO5)**

Students need to refer to the following links:

**Course Outcomes:** The students will be able to experiment, innovate, and solve real-world challenges.

- 1) <https://aim.gov.in/pdf/equipment-manual-pdf.pdf>
- 2) <https://atl.aim.gov.in/ATL-Equipment-Manual/>
- 3) <https://aim.gov.in/pdf/Level-1.pdf>

- 4) <https://aim.gov.in/pdf/Level-2.pdf>  
 5) <https://aim.gov.in/pdf/Level-3.pdf>

### Mapping of course outcomes with program outcomes

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

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

### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation BTL (0-3)
1	CO1: Develop	L3	PO1 PO5	PO1: Apply(L3) PO5: Select(L1)	3 3
2	CO2: Analyze	L4	PO2 PO3 PO5	PO2: Review (L3) PO3: Develop(L3) PO5: Create (L6)	3 3 1
3	CO3: Analyze	L4	PO3 PO5 PO9 PO10	PO3: Design (L6) PO5: Create (L6) PO9: Thumb rule PO10: Thumb rule	1 1 3 3
4	CO4: Design	L6	PO3 PO4 PO5	PO3: Analyze (L4) PO4: Design(L6) PO5: Create (L6)	3 3 3
5	CO5: Create	L6	PO2 PO3 PO5 PO6 PO9 PO10 PO11	PO2: Review(L2) PO3: Analyze (L4) PO5:Create (L6) PO6:Thumb rule PO9:Thumb rule PO10:Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3

### Justification Statements:

**CO1: Develop** Arduino/ESP32 programming for basic circuits using breadboard/Tinkercad

**Action Verb: Develop (L3)**

PO1 Verb: Apply (L3)

CO1 Action verb is equal as PO1 verb. Therefore, the correlation is high (3)

PO5 Verb: Select (L1)

CO1 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**CO2: Analyze** the LDR interfacing circuits with Arduino / ESP32 controllers.

**Action Verb: Analyze (L4)**

PO2 Verb: Review (L3)

CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: Develop (L3)

CO2 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)

PO5 Verb: Create (L6)

CO2 Action verb is lesser than as PO5 verb by two levels Therefore, the correlation is low (1)

**CO3: Analyze** the control of traffic light circuit, sensor-based servomotor and mobile app-based LED.

**Action Verb: Analyze (L4)**

PO3 Verb: Design (L6)

CO3 Action verb is lesser than PO3 verb by two levels. Therefore, the correlation is low (1)

PO5 Verb: Create (L6)

CO3 Action verb is lesser than PO5 verb by two levels Therefore, the correlation is low (1)

PO9: Thumb rule

CO3 using Thumb rule, correlates with PO9 as high (3)

PO10: Thumb rule

CO3 using Thumb rule, correlates with PO10 as high (3)

**CO4: Design** a walking robot and rocket using 3-Dimensional (3D) printing Technology.

**Action Verb: Design (L6)**

PO3 Verb: Analyze (L4)

CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)

PO4 Verb: Design (L6)

CO4 Action verb is equal to PO4 verb. Therefore, the correlation is high (3)

PO5 Verb: Create (L6)

CO4 Action verb is equal to as PO5 verb. Therefore, the correlation is high (3)

**CO5: Create** a prototype for soil moisture monitor and redesign a motor bike using Design Thinking steps

**Action Verb: Create (L6)**

**PO2 Verb: Review (L2)**

CO5 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

**PO3 Verb: Analyze (L4)**

CO5 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)

**PO5 Verb: Create (L6)**

CO5 Action verb is equal to PO5 verb. Therefore, the correlation is high (3)

**PO6 Verb: Thumb rule**

CO5 using Thumb rule, correlates with PO6 as high (3)

**PO9: Thumb rule**

CO5 using Thumb rule, correlates with PO9 as high (3)

**PO10: Thumb rule**

CO5 using Thumb rule, correlates with PO10 as high (3)

**PO11: Thumb rule**

CO5 using Thumb rule, correlates with PO11 as high (3)

**This course syllabus has been approved by the Board of Studies-ECE**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	Introduction to Quantum Technologies and Applications (Qualitative Treatment)	L	T / CLC	P	C
23AES0504	III-I		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the transition from classical to quantum physics and quantum states.

**CO2: Understand** qubits, quantum systems, and their philosophical significance.

**CO3: Analyze** quantum computer requirements, system fragility, hardware platforms, and software roles.

**CO4: Analyze** quantum information, communication, computing, and their future potential.

**CO5: Apply** quantum applications, industry cases, challenges, and opportunities.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the transition from classical		to quantum physics and quantum states.	L2
CO2	Understand	qubits, quantum systems, and their philosophical significance			L2
CO3	Analyze	quantum computer requirements, system fragility, hardware platforms, and software roles.			L4
CO4	Analyze	quantum information, communication, computing, and their future potential.			L4
CO5	Apply	quantum applications, industry cases, challenges, and opportunities.			L3

<b>UNIT – I</b>	<b>Introduction to Quantum Theory and Technologies</b>	<b>9 Hrs</b>
The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, Why quantum? Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: India’s Quantum Mission, EU, USA, China		
<b>UNIT – II</b>	<b>Theoretical Structure of Quantum Information Systems</b>	<b>9 Hrs</b>
What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view), Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role		
<b>UNIT – III</b>	<b>Building a Quantum Computer – Theoretical Challenges and Requirements</b>	<b>9 Hrs</b>
What is required to build a quantum computer (conceptual overview)? Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison), Superconducting circuits, trapped ions, Photonics, Vision vs reality: what’s working and what remains elusive, The role of quantum software in managing theoretical complexities		
<b>UNIT – IV</b>	<b>Quantum Communication and Computing – Theoretical Perspective</b>	<b>9 Hrs</b>
Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD), Role of Entanglement in Communication, The Idea of the Quantum Internet – Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once), Classical vs Quantum Gates, Challenges: Decoherence and Error Correction, Real-World Importance and Future Potential		
<b>UNIT – V</b>	<b>Applications, Use Cases, and the Quantum Future</b>	<b>9 Hrs</b>
Real-world application domains: Healthcare (drug discovery), Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways,		

Educational and research landscape – India's opportunity in the global quantum race

**Textbooks:**

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

**Reference Books:**

1. David McMahon, *Quantum Computing Explained*, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.
3. Scott Aaronson, *Quantum Computing Since Democritus*, Cambridge University Press, 2013.
4. **Alastair I.M. Rae**, *Quantum Physics: A Beginner's Guide*, Oneworld Publications, Revised Edition, 2005.
5. **Eleanor G. Rieffel, Wolfgang H. Polak**, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
6. **Leonard Susskind, Art Friedman**, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, 2014.
7. **Bruce Rosenblum, Fred Kuttner**, *Quantum Enigma: Physics Encounters Consciousness*, Oxford University Press, 2nd Edition, 2011.
8. **Giuliano Benenti, Giulio Casati, Giuliano Strini**, *Principles of Quantum Computation and Information, Volume I: Basic Concepts*, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, *Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document*, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, *National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers*, MeitY/DST Publications, 2020 onward.

Online Learning Resources:

- [IBM Quantum Experience and Qiskit Tutorials](#)
- [Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley](#)
- [edX – The Quantum Internet and Quantum Computers](#)
- [YouTube – Quantum Computing for the Determined by Michael Nielsen](#)
- Qiskit Textbook – IBM Quantum

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb Rule	2 1 3
2	9	20	2	CO2: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb Rule	2 1 3
3	9	20	2	CO3: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb Rule	3 3 3
4	9	20	2	CO4: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4)	3 3 3

							PO11: Thumb Rule	
5	9	20	2	CO5: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Apply(L3) PO11: Thumb Rule	3 3 3
	45	100						

**Justification Statements:**

**CO1: Understand** the transition from classical to quantum physics and quantum states.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than one level PO1 verb. Therefore, the correlation is moderate (2)

**PO2 Verb: Analyze (L4)**

CO1 Action verb is less than two level PO2 verb. Therefore, the correlation is low (1)

**PO11: Thumb Rule**

Quantum physics demands that we accept probability and discreteness at nature's core. Therefore, the correlation is high (3)

**CO2: Understand** qubits, quantum systems, and their philosophical significance.

**Action Verb: Understand (L2)**

**PO1: Apply (L3)**

CO2 Action verb is less than one level PO1 verb. Therefore, the correlation is moderate (2)

**PO2: Analyze (L4)**

CO2 Action verb is less than two level PO2 verb. Therefore, the correlation is low (1)

**PO11: Thumb Rule**

A qubit is a superposed quantum state that enables powerful new ways to store and process information. Therefore, the correlation is high (3)

**CO3: Analyze** quantum computer requirements, system fragility, hardware platforms, and software roles.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

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

**PO2: Analyze (L4)**

CO3 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

**PO11: Thumb Rule**

Building a quantum computer requires stable qubits, precise control, error correction, and scalability. Therefore, the correlation is high (3)

**CO4: Analyze** quantum information, communication, computing, and their future potential.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO4 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

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

**PO11: Thumb Rule**

Quantum communication and computing leverage superposition, entanglement, and no-cloning to enable secure communication and powerful computation. Therefore, the correlation is high (3)

**CO5: Analyze** quantum applications, industry cases, challenges, and opportunities.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO5 Action verb is same as PO . Therefore, the correlation is high(3)

**PO2: Apply(L3)**

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

**PO11: Thumb Rule**

Quantum technologies enable breakthroughs in healthcare, materials, optimization, and security. Therefore, the correlation is high (3)



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(Effective for the batches admitted in 2023-24)**

**Semester VI (Third year)**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P				
1	PC	23APC3608	Big data Analytics for IoT	2	1	0	3	30	70	100
2	PC	23APC3609	Cloud Computing	2	1	0	3	30	70	100
3	PC	23APC3610	Blockchain Technology	2	1	0	3	30	70	100
4	PE-II	23APE3605 23APE3606 23APE3607 23APE3608	1. DevOps 2. Applied Cryptography 3. Automata Theory and Compiler Design 4. Machine Learning	2	1	0	3	30	70	100
5	PE-III	23APE3609 23APE3610 23APE3611 23APE3612	1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Security Assessment and Risk Analysis	2	1	0	3	30	70	100
6	OE-II		OPEN ELECTIVE-II	2	1	0	3	25	75	100
7	PC	23APC3611	Cloud Computing Lab	0	0	3	1.5	30	70	100
8	PC	23APC3612	Blockchain Technology Lab	0	0	3	1.5	30	70	100
9	SC	23ASC3601	Full Stack Development-2	0	1	2	2	30	70	100
10	SC	23ASC3602	Technical Workshop	-	-	-	-	-	-	-
11	Audit	23AMC9902	Technical Paper Writing and IPR	2	0	0	-	30	00	30
<b>Total</b>				<b>14</b>	<b>07</b>	<b>08</b>	<b>23</b>	<b>295</b>	<b>635</b>	<b>930</b>

**NOTE: Workshop can be conducted either in III-I or III-II and participation certificate with 90% or above of attendance should be submitted to Examination Section before III-II regular exam notification released.**

**Open Elective – II**

<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1.	23AOE0103	Disaster Management	CIVIL
2.	23AOE0104	Sustainability in Engineering Practices	
3.	23AOE0202	Renewable Energy Sources	EEE
4.	23AOE0302	Automation and Robotics	ME
5.	23AOE0402	Digital Electronics	ECE
6.	23AOE9902	Advanced Operations Research	Mathematics
7.	23AOE9903	Mathematical Foundation of Quantum Technologies	
8.	23AOE9907	Physics Of Electronic Materials And Devices	Physics
9.	23AOE9912	Chemistry Of Polymers and Applications	Chemistry
10.	23AOE9916	Academic Writing and Public Speaking	Humanities





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<b>Course Code</b>	<b>Year &amp; Sem</b>	<b>Big data Analytics for IoT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
23APC3608	III-II		2	1	0	3

<b>Pre-Requisites</b>		<b>Semester</b>	
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> the architecture and data management models of IoT including sensors,actuators and computing layers such as fog,edge and cloud		
<b>CO2</b>	<b>Apply</b> communication technologies and protocols to design optimized and compliant IoT connectivity solutions		
<b>CO3</b>	<b>Apply</b> IoT system development methodologies to design and program devices like Rasberry Pi and Arduino		
<b>CO4</b>	<b>Analyze</b> data analytics tools and security challenges in IoT applications and operational environments		
<b>CO5</b>	<b>Understand</b> the architectures, protocols and use cases of IoT applications in industries such as manufacturing,utilities,smart cities and transportation.		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the architecture and data management models		of IoT including sensors,actuators and computing layers such as fog,edge and cloud	L2
CO2	Apply	communication technologies and protocols	to design optimized and compliant IoT connectivity solutions		L3
CO3	Apply	IoT system development methodologies	to design and program devices like Rasberry Pi and Arduino		L3
CO4	Analyze	data analytics tools and security challenges	in IoT applications and operational environments		L4
CO5	Understand	the architectures, protocols and use cases of IoT applications	in industries such as manufacturing,utilities,smart cities and transportation.		L2

<b>UNIT - I</b>	<b>ARCHITECTURES AND MODELS</b>	<b>9 Hrs</b>
Introduction to IoT- IoT Architectures- Core IoT Functional Stack, Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer - IoT Data Management and Compute Stack, Fog Computing, Edge Computing, Cloud Computing - Sensors, Actuators, Smart Objects, Sensor networks.		
<b>UNIT - II</b>	<b>CONNECTIVITY</b>	<b>9 Hrs</b>
Communications Criteria-AccessTechnologies-IPas IoT Network Layer -Business case-Optimization - Profiles and compliances - Application Protocols - Transport Layer - Application Transport Methods		
<b>UNIT - III</b>	<b>SYSTEM DEVELOPMENT</b>	<b>9 Hrs</b>
Design Methodology-Case study-Basic blocks of IoT device-Raspberry Pi -Board, Interfaces, Linux, Setting up, Programming - Arduino - Other IoT Devices		
<b>UNIT - IV</b>	<b>DATAANALYTICS AND IoT SECURITY</b>	<b>9 Hrs</b>
Data Analytics for IoT - Big Data Analytics Tools and Technology - Edge Streaming Analytics - Network Analytics. Applications. Security history, challenges, variations -Risk Analysis Structures - Application in Operational Environment.		
<b>UNIT - V</b>	<b>IoT IN INDUSTRY</b>	<b>9 Hrs</b>
Manufacturing, Architecture, Protocols - Utilities, Grid Blocks-Smart Cities, Architecture, Use cases - Transportation, Architecture, Use cases.		
<b>Textbooks:</b>		
1. David Hanes, Gonzalo Salgueiro, Patrick Grosse tete, Rob Barton and Jerome Henry,IoT		

Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things I, Cisco Press, 2017

- Olivier Hersent, David Boswarthick, Omar Elloum, The Internet of Things – Key applications and Protocols I, Wiley, 2012.
- Michael Miller, The Internet of Things I, Pearson Education, 2015.

**Reference Books:**

- Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015.
- Jan Ho" ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine - to - Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
- Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things I, Springer, 2011.

**Correlation of COs with the POs & PSOs for B.Tech**

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2							1		
CO2	3	3		2	1				2		1
CO3	3	2	1					1			
CO4	3	3	2	2	1			1	1		
CO5	3	3							1		

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

**CO-PO mapping justification:**

Unit No	CO					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1: Understand	L2	PO1 PO2 PO9	PO1: Apply (L3) PO2: Review (L2) PO9: Thumb Rule	2 3 3
2	9	20%	2	CO2: Apply	L3	PO1 PO2 PO4 PO5 PO9 PO11	PO1: Apply (L3) PO2: Review (L2) PO4: Analyze (L4) PO5: Apply (L3) PO9: Thumb Rule PO11: Thumb Rule	3 3 2 3 3 3
3	9	20%	2	CO3: Apply	L3	PO1 PO2 PO3 PO8	PO1: Apply (L3) PO2: Review (L2) PO3: Design (L3) PO8: Thumb Rule	3 2 3 3
4	9	20%	2	CO4: Analyze	L4	PO1 PO2 PO5 PO9 PO11	PO1: Apply (L3) PO2: Review (L2) PO5: Apply (L3) PO9: Thumb Rule PO11: Thumb Rule	2 1 2 3 3
5	9	20%	2	CO5: Understand	L2	PO1 PO2 PO4 PO8	PO1: Apply (L3) PO2: Review (L2) PO4: Analyze (L4) PO8: Thumb Rule	2 3 1 3
	45	100						

**Justification Statements:**

**CO1: Understand** the architecture and data management models of IoT including sensors, actuators

and computing layers such as fog, edge and cloud

**Action Verb: Understand (L2)**

PO1 verb: Apply(L3)

CO1 Action Verb Less than PO1 verb. Therefore, the correlation is moderate(2).

**PO2 Verb: Review(L2)**

CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)

PO9 Verb: Thumb Rule

Understanding architecture and data management models Communicate effectively within the engineering community and society. Then the correlation is high(3)

**CO2: Apply** communication technologies and protocols to design optimized and compliant IoT connectivity solutions

**Action Verb: Understand (L3)**

PO1 action verb Apply(L3)

CO2 action verb is same as PO1. Then the correlation is high(3)

PO2 action verb: Review(L2)

CO2 action verb is less than PO2. Then the correlation is high(3)

PO4 action verb: Analyze(L4)

CO2 action verb is less than PO4. Then the correlation is moderate(2)

PO5 action verb : Apply(L3)

CO2 action verb is same as PO2. Then the correlation is high(3)

PO9 action verb: Thumb Rule

Apply Communication technologies and protocols to design effectively within the engineering community and society. Then the correlation is high(3)

PO11 verb: Thumb Rule

Communication technologies and protocols are used to design solutions as independent and lifelong learning. Then the correlation is high(3)

**CO3: Apply** IoT system development methodologies to design and program devices like Raspberry Pi and Arduino

**Action Verb: Apply (L3)**

**PO1 verb: Apply(L3)**

CO3 Action Verb is same as PO1. Then the correlation is high(3)

PO2 verb: Review(L2)

CO3 action verb greater than PO2. Then the correlation is moderate(2)

PO3 verb: Develop(3)

CO3 action verb is same as PO3. Then the correlation is high(3)

PO8 verb: Thumb Rule

IoT system development methodologies are used to design and program devices with the help of Raspberry Pi and Arduino work effectively as an individual. Then the correlation is High(3)

**CO4: Analyze** data analytics tools and security challenges in IoT applications and operational environments

**Action Verb: Apply (L4)**

**PO1 verb: Apply(L3)**

CO4 Action Verb is greater than PO1. Then the correlation is moderate(2).

PO2 verb: Review(L2)

CO4 action verb is less than 2 levels by PO2. Then the correlation is low(1)

PO5 verb: Apply(L3)

CO4 action verb is one level less than PO5. Then the correlation is moderate(2)

PO9 verb: Thumb Rule

Analyze data analytics tools and security challenges in IoT applications are Communicate effectively within the engineering community and society. Then the correlation is high(3)

PO11 verb: Thumb Rule

Analyze data analytics tools, security challenges in IoT applications as independent and lifelong learning. Then the correlation is high(3)

**CO5: Understand** the architectures, protocols and use cases of IoT applications in industries such as manufacturing, utilities, smart cities and transportation.

**Action Verb: Analyze(L2)**

**PO1 verb: Apply(L3)**

CO5 Action Verb is greater than by one level of PO1. Then the correlation is moderate(2)

PO2 verb: Review(L2)

CO5 action verb is same as PO2. Then the correlation is high(3)

PO4 verb: Analyze(L4)

CO5 action verb is two levels greater than by PO4. Then the correlation is low(1)

PO8 verb: Thumb Rule

Architectures, protocols and use cases of IoT applications effectively work as an individual. Then the correlation is high(3)



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Course Code	Year & Sem	Cloud Computing	L	T	P	C
23APC3609	III-II		2	1	0	3

Pre-Requisites	Semester
<b>Course Outcomes (CO):</b> Student will be able to	
<b>CO1</b>	<b>Understand</b> the cloud computing basic concepts, technologies and services
<b>CO2</b>	<b>Understand</b> the Hadoop,python basics on application design
<b>CO3</b>	<b>Apply</b> python on cloud applications
<b>CO4</b>	<b>Apply</b> big data analytics,multimedia cloud on cloud applications.
<b>CO5</b>	<b>Analyze</b> cloud security on industry,healthcare and education

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
<b>CO1</b>	<b>Understand</b>	Cloud concepts, technologies and services			L2
<b>CO2</b>	<b>Understand</b>	Hadoop, python basics	On Application design		L2
<b>CO3</b>	<b>Apply</b>	Python	On cloud applications		L3
<b>CO4</b>	<b>Apply</b>	Big data analytics,multimedia cloud	On Cloud applications		L3
<b>CO5</b>	<b>Analyze</b>	Cloud security	On Industry,Healthcare and Education		L4

<b>UNIT - I</b>	<b>Basics of Cloud computing</b>	<b>9 Hrs</b>
<p><b>Introduction to cloud computing:</b> Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications</p> <p><b>Cloud concepts and Technologies:</b> Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.</p> <p><b>Cloud Services and Platforms:</b> Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software</p>		
<b>UNIT - II</b>	<b>Hadoop and Python</b>	<b>9 Hrs</b>
<p><b>Hadoop Map Reduce:</b> Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.</p> <p><b>Cloud Application Design:</b> Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.</p> <p><b>Python Basics:</b> Introduction, Installing Python, Python data Types &amp; Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes</p>		
<b>UNIT - III</b>	<b>Python for Cloud Computing</b>	<b>9 Hrs</b>
<p><b>Python for Cloud:</b> Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for Map Reduce, Python packages of Interest, Python web Application Framework, Designing a REST ful web API.</p> <p><b>Cloud Application Developing Python:</b> Design Approaches, Image Processing APP, Document Storage App, Map Reduce App, Social Media Analytics App.</p>		
<b>UNIT - IV</b>	<b>Big data, Multimedia and Tuning</b>	<b>9 Hrs</b>
<p><b>Big Data Analytics:</b> Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.</p> <p><b>Multimedia Cloud:</b> Introduction, Case Study: Live video Streaming App, Streaming Protocols, case</p> <p><b>Cloud Application Bench marking and Tuning:</b> Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing &amp; Bottleneck Detection case Study, Hadoop benchmarking case Study.</p>		
<b>UNIT - V</b>	<b>Applications and Issues in Cloud</b>	<b>9 Hrs</b>
<p><b>Cloud Security:</b> Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.</p> <p><b>Cloud for Industry, Health care &amp; Education:</b> Cloud Computing for Health care, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing</p>		

Industry, Cloud computing for Education.

**Migrating into a Cloud:** Introduction, Broad Approaches to migrating into the cloud, the seven- step model of migration into a cloud.

**Organizational readiness and Change Management in The Cloud Age:** Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self – assessment.

**Legal Issues in Cloud Computing:** Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issue raised by virtualization and data location, commercial and business considerations, Special Topics.

**Textbooks:**

1. Cloud Computing A hands on Approach by Arshdeep Bahga, Vijay Madiseti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms by Raj Kumar Buyya, James Broberg, Andrzej, Goscinski, Wiley,2016

**Reference Books:**

1. Mastering Cloud Computing by Raj kumar Buyya, Christian Vecchiola, SThamarai Selvi, TMH
2. Cloud computing A Hands On Approach by Arshdeep Bahga and Vijay Madiseti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O\_Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K.Chandrasekaran. CRC Press.

**Online Learning Resources:**

1. Cloud computing – Course (nptel.ac.in)

**Correlation of COs with the POs & PSOs for B.Tech**

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2						2		2
CO2	3	3	2		2			1	1		
CO3	3	2	2	1				1			
CO4	3	2	2		2				2		2
CO5	2	2		1				2			

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

**CO-PO mapping justification:**

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1:Understand	L2	PO1 PO2 PO3 PO9 PO11	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO9:Thumb Rule PO11:Thumb Rule	2 3 2 3 3
2	9	20%	2	CO2:Understand	L2	PO1 PO2 PO3 PO5 PO8 PO9	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO5:Apply(L3) PO8:Thumb Rule PO9:Thumb Rule	2 3 2 2 3 3
3	9	20%	2	CO3:Apply	L3	PO1 PO2 PO3 PO4 PO8	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO4:Analyze (L4) PO8:Thumb Rule	3 3 3 2 3
4	9	20%	2	CO4:Apply	L3	PO1 PO2 PO3 PO5	PO1:Apply(L3) PO2:Review(L2) PO3Develop(L3) PO5:Apply(L3)	3 3 3 3

						PO9 PO11	PO9:Thumb Rule PO11:Thumb Rule	3 3
5	9	20%	2	<b>CO5:Analyze</b>	<b>L4</b>	PO1 PO2 PO4 PO8	PO1:Apply(L3) PO2:Review(L2) PO4:Analyze(L4) PO8:Thumb Rule	2 1 3 3
	45	100						

### Justification Statements:

**CO1: Understanding** the cloud computing concepts, technologies and services

**Action Verb: Understand (L2)**

**PO1 verb:Apply(L3)**

CO1 Action Verb Less then PO1 verb.Therefore,the correlation is moderate(2).

**PO2 Verb: Review(L2)**

CO1 Action verb is grater 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 moderate(2)

**PO9 Verb:Thumb Rule**

Cloud computing concepts are Communicate effectively within the engineering community and society as large.Then the correlation is high(3)

**PO11verb:Thumb Rule**

Recognize the need of basic concepts ,technologies and services as independent and lifelong learning.Then the correlation is high(3)

**CO2: Understand** Hadoop,python basics on application design

**Action Verb: Understand (L2)**

**PO1 verb Apply(L3)**

CO2 action verb is one level greater then PO1.Then the correlation is moderate(2)

**PO2 verb:Review(L2)**

CO2 action verb is grater then PO2. Then the correlation is high(3)

**PO3 verb:Develop(L3)**

CO2 action verb is less then PO2.Then the correlation is moderate(2)

**PO5 verb: Apply(L3)**

CO2 action verb is less than PO2.Then the correlation is moderate(2)

**PO8 verb:Themb Rule**

Hadoop, python basics are effectively work as individual and collaboratively .Then the correlation is High(3)

**PO9 verb:Thumb Rule**

The concepts of Haddop and basic concepts for a design the application for effectively communicate with the engineering community and society.Then the correlation is high(3)

**CO3: Apply** python on cloud applications.

**Action Verb: Apply (L3)**

**PO1 verb:Apply(L3)**

CO3 Action Verb is same as PO1.Then the correlation is high(3)

**PO2 verb:Review(L2)**

CO3 action verb greater then PO2.Then the correlation is high(3)

**PO3 verb:Develop(3)**

CO3 action verb is same as PO3.Then the correlation is high(3)

**PO4 verb: Analyze(L4)**

CO3 action verb is less then PO4.then the correlation is moderate(2)

**PO8 verb:Thumb Rule**

Python concepts are applicable for cloud applications as effectively work as individual and collaboratively as a member.Then the correlation is High(3)

**CO4: Apply** big data analytics,multimedia cloud on cloud applications

**Action Verb: Apply (L3)**

**PO1 verb:Apply(L3)**

CO4 Action Verb same as PO1. Then the correlation is high(3).

**PO2 verb: Review(L2)**

CO4 action verb is less than PO2.Then the correlation is high(3)

**PO3 verb:Develop(L3)**

CO4 action verb is same as PO3.Then the correlation is high(3)

**PO5 verb:Apply(L3)**

CO4 action verb is same as PO5.Then the correlation is high(3)

**PO9 verb:Thumb Rule**

Big data analytics, multimedia cloud is applicable on cloud applications for effectively communicate within engineering community and society .Then the correlation is High(3)

**PO11 verb:Thumb Rule**

Apply big data analytics, multimedia cloud on cloud applications as lifelong learning.Then the correlation is high(3)

**CO5: Analyze** cloud security on industry,healthcare and education

**Action Verb: Analyze(L4)**

**PO1 verb:Apply(L3)**

CO5 Action Verb is greater than by one level of PO1 .Then the correlation is moderate(2)

**PO2 verb:Review(L2)**

CO5 action verb is greater than by two levels of PO2.Then the correlation is low(1)

**PO4 verb:Analyze(L4)**

CO5 action verb is same as PO4.Then the correlation is high(3)

**PO8 verb:Thumb Rule**

Analyze cloud security on industry, healthcare and education as individual work .Then the correlation is High(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Block Chain Technology	L	T	P	C
23APC3610	III-II		2	1	0	3

Pre-Requisites	Semester
<b>Course Outcomes (CO):</b> Student will be able to	
<b>CO1</b>	<b>Understand</b> the fundamentals and evolution of blockchain technology, including its characteristics, types, and ecosystem players.
<b>CO2</b>	<b>Understand</b> the concepts such as blocks, hashing, Merkle trees, consensus, tokens, smart contracts, and transaction lifecycle.
<b>CO3</b>	<b>Evaluate</b> blockchain solutions by evaluating use cases, solution architectures, and types of blockchain applications.
<b>CO4</b>	<b>Apply</b> blockchain applications using Ethereum, smart contracts, development tools, in real-life scenarios.
<b>CO5</b>	<b>Analyze</b> the Hyperledger-based solutions and explore advanced blockchain topics such as IPFS, oracles, block chain integration with emerging trends.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
<b>CO1</b>	Understand	The fundamentals, evaluation technologies and types			L2
<b>CO2</b>	Understand	The basic concepts and transaction life cycle			L2
<b>CO3</b>	Evaluate	Block chain solutions	By evaluating use cases	On types of block chain applications	L6
<b>CO4</b>	Apply	Block chain applications	Using Ethereum, smart contracts	In real life scenarios	L3
<b>CO5</b>	Analyze	The Hyperledger-based solutions and explore advanced block chain topics	Block chain integrating with emerging trends		L4

<b>UNIT - I</b>		<b>9 Hrs</b>
Introduction, Scenarios, Challenges Articulated, Block chain, Block chain Characteristics, Opportunities Using Block chain, History of Block chain. Evolution of Block chain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Block chain Evolution, Consortia, Forks, Public Block chain Environments, Type of Players in Block chain Ecosystem, Players in Market.		
<b>UNIT - II</b>		<b>9 Hrs</b>
Block chain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on block chain, data storage on block chain, wallets, coding on block chain: smart contracts, peer-to-peer network, types of block chain nodes, risk associated with block chain solutions, life cycle of block chain transaction.		
<b>UNIT - III</b>		<b>9 Hrs</b>
Architecting Block chain solutions: Introduction, Obstacles for Use of Block chain, Block chain Relevance Evaluation Framework, Block chain Solutions Reference Architecture, Types of Block chain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Block chain Solutions, Architecture Considerations, Architecture with Block chain Platforms, Approach for Designing Block chain Applications.		
<b>UNIT - IV</b>		<b>9 Hrs</b>
Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, Open Zeppelin Contracts		
<b>UNIT - V</b>		<b>9 Hrs</b>

Introduction, Use Case–Car Ownership Tracking, Hyper ledger Fabric, Hyper ledger Fabric Transaction Flow, Fab Car Use Case Implementation, nvoking Chain code Functions Using Client Application.

Advanced Concepts in Block chain: Introduction, Inter Planetary File System (IPFS), Zero-Knowledgeroots, Oracles, Self-Sovereign Identity, Block chain with IoT and AI/ML Quantum Computing and Block chain, Initial Coin Offering, Block chain Cloud Offerings, Block chain and its Future Potential.

**Textbooks:**

1. Ambadas, Arshad Sarfarzariff, Sham –Block chain for Enterprise Application Developers, Wiley
2. Andreas M. Antonopoulos, –Mastering Bitcoin: Programming the Open Block chain, O’Reilly.

**Reference Books:**

1. Block chain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Block chain: Blueprint for a New Economy, Melanie Swan, O’Reilly

**Online Learning Resources:**

1. <https://github.com/blockchainindia/resource>
2. Hyperledger Fabric - <https://www.hyperledger.org/projects/fabric>
3. Zero to Block chain - An IBM Redbooks course, by Bob Dill, David Smits
4. <https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>
5. <https://nptel.ac.in/courses/106105184>
6. [https://onlinecourses.nptel.ac.in/noc22\\_cs44/preview](https://onlinecourses.nptel.ac.in/noc22_cs44/preview)

**Correlation of COs with the POs & PSOs for B.Tech**

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2		1				1		
CO2	3		2								1
CO3	3	2	2					1			
CO4	3	2			2				2		1
CO5	3	3		2				1			

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

**CO-PO mapping justification:**

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 toPO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co’s Action verb	BTL			
1	9	20%	2	CO1:Understand	L2	PO1 PO2 PO3 PO5 PO9	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO5:Apply(L3) PO11:Thumb Rule	2 3 2 2 3
2	9	20%	2	CO2:Understand	L2	PO1 PO3 PO11	PO1:Apply(L3) PO3:Develop(L3) PO11:Thumb Rule	2 2 3
3	9	20%	2	CO3:Evaluate	L5	PO1 PO2 PO3 PO8	PO1:Apply(L3) PO2:Review(L2) PO3:Design(L3) PO8:Thumb Rule	2 3 1 3
4	9	20%	2	CO4:Apply	L3	PO1 PO2 PO5 PO9 PO11	PO1:Apply(L3) PO2:Review(L2) PO5:Apply(L3) PO9:Thumb Rule PO11:Thumb Rule	3 2 3 3 3
5	9	20%	2	CO5:Analyze	L4	PO1 PO2 PO4 PO8	PO1:Apply(L3) PO2:Review(L2) PO4:Analyze(L4) PO8:Thumb Rule	2 1 3 3

	45	100					
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### Justification Statements:

**CO1: Understand** the fundamentals and evolution of blockchain technology, including its characteristics, types, and ecosystem players.

**Action Verb: Understand (L2)**

PO1 verb:Apply(L3)

CO1 Action Verb Less then PO1 verb.Therefore,the correlation is moderate(2).

**PO2 Verb: Review(L2)**

CO1 Action verb is grater 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 moderate(2)

PO5 verb: Apply(L3)

PO9 Verb:Thumb Rule

Understanding fundamentals and evaluation of block chain technology Communicate effectively within the engineering community and society .Then the correlation is high(3)

**CO2: Understand** the concepts such as blocks, hashing, Merkle trees, consensus, tokens, smart contracts, and transaction lifecycle

**Action Verb: Understand (L2)**

PO1 action verb Apply(L3)

CO2 action verb is one level greater then PO1.Then the correlation is moderate(2)

PO3 action verb:Develop(L3)

CO2 action verb is less then PO2.Then the correlation is moderate(2)

PO11 action verb:Thumb Rule

The concepts of blocks,hashing,Merkle trees,tokens are need to recognize as independent and lifelong learning.Then the correlation is high(3)

**CO3: Evaluate** blockchain solutions by evaluating use cases, solution architectures, and types of blockchain applications.

**Action Verb: Evaluate (L5)**

**PO1 verb:Apply(L3)**

CO3 Action Verb is same as PO1.Then the correlation is high(3)

**PO2 verb:Review(L2)**

CO3 action verb greater then PO2.Then the correlation is high(3)

**PO3 verb:Develop(3)**

CO3 action verb is same as PO3.Then the correlation is high(3)

**PO8 verb:Thumb Rule**

Evaluation of block chain solutions effectively works as an individual /collaboratively.Then the correlation is High(3)

**CO4: Apply** blockchain applications using Ethereum, smart contracts, development tools, in real-life scenarios.

**Action Verb: Apply (L3)**

**PO1 verb:Apply(L3)**

CO4 Action Verb same as PO1. Then the correlation is high(3).

**PO2 verb: Review(L2)**

CO4 action verb is less than PO2.Then the correlation is high(3)

**PO5 verb:Apply(L3)**

CO4 action verb is same as PO5.Then the correlation is high(3)

**PO9 verb:Thumb Rule**

blockchain applications using Ethereum, smart contracts, development tools, in real-life scenarios effectively works as collaboratively .Then the correlation is High(3)

**PO11 verb:Thumb Rule**

**Apply** blockchain applications using Ethereum, smart contracts, development tools, in real-life scenarios as lifelong learning.Then the correlation is high(3)

**CO5: Analyze** the Hyperledger-based solutions and explore advanced blockchain topics such as IPFS, oracles, block chain integration with emerging trends.

**Action Verb: Analyze(L4)**

**PO1 verb:Apply(L3)**

CO5 Action Verb is greater than by one level of PO1 .Then the correlation is moderate(2)

**PO2 verb:Review(L2)**

CO5 action verb is greater than by two levels of PO2.Then the correlation is low(1)

**PO4 verb:Analyze(L4)**

CO5 action verb is same as PO4.Then the correlation is high(3)

**PO8 verb:Thumb Rule**

Hyperledger-based solutions and explore advanced blockchain topics effectively works as an individual .Then the correlation is high(3)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (CSE)**

Course Code	Year & Sem	Devops (Professional Elective-II)	L	T / CLC	P	C
23APE3605	III-II		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

<b>CO1</b>	<b>Understand</b> the principles, cultural foundations, and adoption strategies of DevOps for enabling organizational transformation.
<b>CO2</b>	<b>Apply</b> business model canvas components and DevOps plays to optimize the software delivery pipeline and align with organizational goals.
<b>CO3</b>	<b>Analyze</b> DevOps strategies for innovation through platform development, microservices, APIs, and organizational restructuring.
<b>CO4</b>	<b>Evaluate</b> enterprise-level DevOps practices including scaling innovation, standardization, team models, and security integration.
<b>CO5</b>	<b>Create</b> a roadmap for DevOps adoption in large organizations by designing pilot projects, fostering collaboration, and managing change initiatives.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the principles, cultural foundations, and adoption strategies of DevOps		for enabling organizational transformation.	L2
CO2	Apply	business model canvas components and DevOps plays		to optimize the software delivery pipeline and align with organizational goals.	L3
CO3	Analyze	DevOps strategies for innovation through platform development, microservices, APIs, and organizational restructuring.			L4
CO4	Evaluate	enterprise-level DevOps practices including scaling innovation, standardization, team models, and security integration.			L5
CO5	Create	roadmap for DevOps adoption in large organizations	by designing pilot projects, fostering collaboration, and managing change initiatives.		L6

<b>UNIT - I</b>		<b>9 Hrs</b>
<b>DevOps:</b> An Overview, DevOps: Origins, DevOps: Roots, DevOps: Practices DevOps: Culture. <b>Adopting DevOps:</b> Developing the Playbook. Developing a Business Case for a DevOps: Developing the Business Case		
<b>UNIT - II</b>		<b>9Hrs</b>
Completing the Business Model Canvas, Customer Segments, Value Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structures. <b>DevOps Plays for Optimizing the delivery Pipeline:</b> DevOps as an optimization Exercise, Core Themes, The DevOps Plays, Specializing Core Plays		
<b>UNIT - III</b>		<b>9 Hrs</b>
<b>DevOps Plays for Driving Innovation:</b> Optimize to Innovate, The Uber Syndrome, Innovation and the Role of Technology, Core Themes, play: Build a DevOps Platform, play: Deliver Micro services Architectures, play: DevOps an API Economy, play: Organizing for Innovation.		
<b>UNIT - IV</b>		<b>9 Hrs</b>
<b>Scaling DevOps for the Enterprise:</b> Core Themes, play: DevOps Center of Competency, play: Developing Culture of Innovation at Scale, play: Developing a Culture of continuous Improvement,		



						PO11	Rule PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3
5	9	20%	2	Create	L6	PO3 PO5	PO3: Design (L6) PO5: Create(L6)	3 3
	45	100%						

**Justification Statements :**

**CO1: Understand the principles, cultural foundations, and adoption strategies of DevOps for enabling organizational transformation.**

**Action Verb: Understand (L2)**

PO1: CO1 Action verb is one level lower than PO1 verb (Apply - L3). Therefore, the correlation is medium (2)

**PO2: Analyze (L4)**

CO1 Action verb is two levels lower than PO2 verb (Analyze - L4). Therefore, the correlation is low (2)

**PO11: Thumb Rule**

CO1 supports life-long learning of modeling practices. Therefore, the correlation is medium (2)

**CO2: Apply business model canvas components and DevOps plays to optimize the software delivery pipeline and align with organizational goals.**

Action Verb: Apply (L3)

**PO1: Apply(L3)**

CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is one level lower than PO2 verb. Therefore, the correlation is medium (3)

**PO3: Design (L6)**

CO2 Action verb is same as PO3 verb (Design - L3). Therefore, the correlation is high (3)

**PO5: Apply (L3)**

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO8: Thumb Rule**

Team collaboration helps implement class diagrams. Correlation is medium (2)

**PO11: Thumb Rule**

CO2 supports modeling as a learning process. Correlation is medium (2)

**CO3: Analyze DevOps strategies for innovation through platform development, microservices, APIs, and organizational restructuring.**

Action Verb: Analyze (L4)

**PO1: Apply(L3)**

CO3 Action verb is one level higher 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: Design (L6)**

CO3 Action verb is one level higher than PO3 verb. Therefore, the correlation is medium (2)

**PO4: Design (L6)**

CO3 Action verb is same as PO4 verb. Therefore, the correlation is medium (2)

**PO5: Apply (L3)**

CO3 Action verb is one level higher than PO5 verb. Therefore, the correlation is high (3)

**PO8: Thumb Rule**

Behavioral modeling requires collaboration. Correlation is high (3)

**PO11: Thumb Rule**

Diagram-based analysis supports learning. Correlation is high (3)

**CO4: Evaluate enterprise-level DevOps practices including scaling innovation, standardization, team models, and security integration.**

Action Verb: Evaluate (L5)

**PO1: Apply(L3)**

CO5 Action verb is two levels higher than PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO5 Action verb is one level higher than PO2 verb. Therefore, the correlation is high (3)

**PO3: Design (L6)**

CO5 Action verb is two levels higher than PO3 verb. Therefore, the correlation is high (3)

**PO4: Design (L6)**

CO5 Action verb is one level higher than PO4 verb. Therefore, the correlation is high (3)

**PO5: Apply (L3)**

CO5 Action verb is two levels higher than PO5 verb. Therefore, the correlation is high (3)

**PO6: Thumb Rule**

Design patterns affect societal solutions. Correlation is high (3)

**PO7: Thumb Rule**

Ethical use of frameworks. Correlation is high (3)

**PO8: Thumb Rule**

Case study promotes collaboration. Correlation is high (3)

**PO9: Thumb Rule**

Patterns need effective communication. Correlation is high (3)

**PO10: Thumb Rule**

Projects need management frameworks. Correlation is high (3)

**PO11: Thumb Rule**

Patterns enhance learning. Correlation is high (3)

**CO5: Create** a roadmap for DevOps adoption in large organizations by designing pilot projects, fostering collaboration, and managing change initiatives.

**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)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

<b>Course Code</b>	<b>Year &amp; Sem</b>	<b>Applied Cryptography (Professional Elective-II)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
23APE3606	III-II		2	1	0	3
<b>Pre-Requisites</b>		<b>Semester</b>	II			
<b>Course Outcomes (CO):</b> Student will be able to						
<b>CO1</b>	<b>Understand</b> the basic concepts, terminology, and classical encryption techniques such as substitution, transposition, and XOR ciphers.					
<b>CO2</b>	<b>Apply</b> various cryptographic algorithms and modes of operation to encrypt and decrypt data securely.					
<b>CO3</b>	<b>Analyze</b> different public-key algorithms and digital signature schemes based on structure, security, and computational complexity.					
<b>CO4</b>	<b>Evaluate</b> advanced cryptographic protocols such as zero-knowledge proofs, secret sharing, and secure multiparty computation.					
<b>CO5</b>	<b>Demonstrate</b> the use of real-world cryptographic systems and protocols like Kerberos, PGP, and PKCS for achieving secure data transmission.					

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts, terminology, and classical encryption techniques		such as substitution, transposition, and XOR ciphers	L2
CO2	Apply	various cryptographic algorithms and modes		of operation to encrypt and decrypt data securely.	L3
CO3	Analyze	different public-key algorithms and digital signature schemes		based on structure, security, and computational complexity.	L4
CO4	Evaluate	advanced cryptographic protocols		such as zero-knowledge proofs, secret sharing, and secure multiparty computation.	L5
CO5	Demonstrate	the use of real-world cryptographic systems and protocols		like Kerberos, PGP, and PKCS for achieving secure data transmission.	L2

<b>UNIT - I</b>	<b>9 Hrs</b>
Foundations: Terminology, Steganography, Substitution Ciphers and Transposition Ciphers, Simple XOR, One-Time Pads, Computer Algorithms, Large Numbers, Cryptographic Protocols: Protocol Building Blocks: Introduction to Protocols, Communications Using Symmetric Cryptography, One-Way Functions, One-Way Hash Functions, Communications Using Public-Key Cryptography, Digital Signatures, Digital Signatures with Encryption, Random and Pseudo-Random-Sequence Generation	
<b>UNIT - II</b>	<b>9 Hrs</b>
Cryptographic Techniques: Key length: Symmetric Key length, Public key length, comparing symmetric and public key length. Algorithm types and modes: Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Cipher, Self-Synchronizing Stream Ciphers, Cipher-Feedback Mode, Synchronous Stream	

Ciphers, Output-Feedback Mod, Counter Mode, Other Block-Cipher Modes.	
<b>UNIT - III</b>	<b>9 Hrs</b>
Public-Key Algorithms: Background, Knapsack Algorithms, RSA, Poling-Hellman, Rabin, El Gamma, Mc Ellice, Elliptic Curve Cryptosystems, LUC, Finite Automaton Public-Key Cryptosystems Public-Key Digital Signature Algorithms: Digital Signature Algorithm (DSA), DSA Variants, Ghost Digital Signature Algorithm, Discrete Logarithm Signature Schemes, Gong - Schnorr-Shamir, ESIGN	
<b>UNIT - IV</b>	<b>9 Hrs</b>
Special Algorithms for Protocols: Multiple-Key Public-Key Cryptography, Secret-Sharing Algorithms, Subliminal Channel, Undeniable Digital Signatures, Designated Confirmer Signatures, Computing with Encrypted Data, Fair Coin Flips, One-Way Accumulators, All-or-Nothing Disclosure of Secrets, Fair and Failsafe Cryptosystems, Zero-Knowledge Proofs of Knowledge, Blind Signatures, Oblivious Transfer, Secure Multiparty Computation, Probabilistic Encryption, Quantum Cryptography	
<b>UNIT - V</b>	<b>9 Hrs</b>
Real World Approaches: IBM Secret key management protocol, ISDN, Kerberos, Krypto Knight, Privacy enhanced mail (PEM), Message security protocol (MSP), PGP, Public-Key Cryptography Standards (PKCS), Universal Electronic Payment System (UEPS).	
<b>Textbooks:</b>	
Bruce Schneider, Applied Cryptography, Second Edition: Protocols, Algorithms, and Source Code in C (cloth)	

### Correlation of COs with the POs & PSOs for B.Tech

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2							1	3	2
CO2	3	3	2		2				2	3	3
CO3	3	3	2	2	2				2	3	3
CO4	3	3	2	3	2				2	3	3
CO5	3	2	2	2	3			1	3	3	2

(3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

### CO-PO mapping justification:

Unit No.	CO					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1: Understand	L2	PO1 PO2 PO9	PO1: Apply(L3) PO2: Review(L2) PO9: Thumb Rule	2 3 3
2	9	20%	2	CO2: Apply	L3	PO1 PO2 PO3 PO5 PO9	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO5: Apply(L3) PO9: Thumb rule	3 2 3 3 3
3	9	20%	2	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO9	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3) PO9: Thumb Rule	2 1 2 3 2 3
4	9	20%	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO9	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L6) PO4: Analyze (L4) PO5: Create (L6) PO9: Thumb Rule	1 - 2 2 3 3
5	9	20%	2	CO5: Demonstrate	L5	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4)	2 3 2 1

						PO5 PO8 PO9	PO5:Apply(L3) PO8:Thumb Rule PO9:Thumb Rule	2 3 3
	45	100						

### Justification Statements:

**CO1: Understand** the basic concepts, terminology, and classical encryption techniques such as substitution, transposition, and XOR ciphers.

Action Verb: Understand (L2)

**PO1 : Apply (L3)**

CO1 Action verb is less than PO1 verb. Therefore, the correlation is moderate (2)

**PO2 : Review (L2)**

CO1 Action verb is same as PO2 verb. Therefore, the correlation is High (3)

**PO9 Verb: Thumb Rule**

Understand the basic concepts of encryption techniques as communicate effectively within engineering community and society. Therefore, the correlation is high(3)

**CO2: Apply** various cryptographic algorithms and modes of operation to encrypt and decrypt data securely.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is less than PO2 verb. Therefore, the correlation is moderate (2)

**PO3: Develop (L3)**

CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Apply(L3)**

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high(3)

**PO9: Thumb Rule**

Communicate with various cryptographic algorithms and modes of operations to encrypt and decrypt within the engineering community and society. Therefore, the correlation is high(3)

**CO3: Analyze** different public-key algorithms and digital signature schemes based on structure, security, and computational complexity.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO3 Action verb is less than PO1 verb . Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

CO3 Action verb is two levels less than as PO2 verb. Therefore, the correlation is low (1)

**PO3: Develop (L3)**

CO3 Action verb is less than PO3 verb. Therefore, the correlation is moderate (2)

**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 moderate(2)

**PO9 :Thumb Rule**

Analyze different public-key algorithms and digital signature schemes to communicate effectively within engineering community and society. Therefore, the correlation is high(3)

**CO4: Evaluate** advanced cryptographic protocols such as zero-knowledge proofs, secret sharing, and secure multiparty computation.

**Action Verb: Evaluate (L5)**

**PO1: Apply (L3)**

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

**PO2: Review (L2)**

CO4 Action verb is less than as PO2 verb. Therefore, the correlation is moderate (2)

**PO3: Develop (L3)**

CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO4:Analyze(L4)**

CO4 Action verb is greater than PO4 verb. Therefore, the correlation is moderate(2)

**PO5: Apply(L3)**

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high(3)

**PO9:Thumb Rule**

Evaluate advanced cryptographic protocols to communicate effectively within the engineering community and society. Therefore, the correlation is high(3)

**CO5: Demonstrate** the use of real-world cryptographic systems and protocols like Kerberos, PGP, and PKCS for achieving secure data transmission.

Action Verb: Demonstrate (L2)

**PO1: Apply (L3)**

CO5 Action verb is greater than PO1 verb. Therefore, the correlation is moderate(2)

**PO2: Review (L2)**

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

**PO3: Develop (L3)**

CO5 Action verb is less than as PO3 verb. Therefore, the correlation is moderate (2)

**PO4:Analyze(L4)**

CO5 Action verb is greater than PO4 verb. Therefore, the correlation is low(1)

**PO5: Apply(L3)**

CO5 Action verb is less than PO5. Therefore, the correlation is moderate(2)

**PO8:Thumb Rule**

The use of real-world cryptographic systems and protocols as individual or collaboratively work together. Therefore the correlation is high(3)

**PO9:Thumb Rule**

Demonstrate the use of real-world cryptographic systems and protocols is effectively within the engineering community and society. Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

<b>Course Code</b>	<b>Year &amp; Sem</b>	<b>Automata Theory and Compiler Design (Professional Elective-II)</b>	<b>L</b>	<b>T / CLC</b>	<b>P</b>	<b>C</b>
23APE3607	III-II		2	1	0	3

**Course Outcomes:**

<b>Pre-Requisites</b>		<b>Semester</b>	II
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> the different Formal Language and Regular Expressions for Conversion of regular expression to NFA, NFA to DFA.		
<b>CO2</b>	<b>Apply</b> the Bottom-up parsing for checking string acceptance.		
<b>CO3</b>	<b>Analyze</b> the different types of grammars by using Chomsky hierarchy.		
<b>CO4</b>	<b>Apply</b> the dynamic memory allocation for memory management.		
<b>CO5</b>	<b>Evaluate</b> 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

<b>UNIT - I</b>	9 Hrs
<b>Formal Language and Regular Expressions :</b> 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.	
<b>UNIT - II</b>	9Hrs
<b>Context Free grammars and parsing :</b> Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.	
<b>UNIT - III</b>	9 Hrs
<b>Semantics :</b> Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.	
<b>UNIT - IV</b>	9 Hrs
<b>Run time storage:</b> Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. <b>Code optimization:</b> Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.	
<b>UNIT - V</b>	9 Hrs
<b>Code generation:</b> Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.	
<b>Textbooks:</b>	
1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008. 2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.	
<b>Reference Books:</b>	
1. Louden: –Compiler Construction, Principles & Practice   , 1st Edition, Thomson Press, 2006. 2. Tremblay J P, Sorenson G P: –The Theory & Practice of Compiler writing  , 1st Edition, BSP	

publication, 2010.

3. Theory of Computation, V. Kulkarni, Oxford University Press, 2013

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/106/104/106104028/>
2. <https://nptel.ac.in/courses/106/104/106104123/>

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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		

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyse(L4)	2 1
2	9	20%	2	CO2 : Apply	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyse (L4) PO11: Thumb rule	3 3 2
3	9	20%	2	CO3 : Analyze	L3	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L6) PO4: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 2 1 1 1 1
4	9	20%	2	CO4 :Apply	L4	PO1 PO2	PO1: Apply(L3) PO2: Analyse (L4)	3 3
5	9	20%	2	CO5 : Evaluate	L5	PO2 PO3 PO4 PO8 PO11	PO2: Analyse (L4) PO3: Design (L6) PO4: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 2 2 1 2
	45	100 %						

**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 : Analyse(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 : Analyse(L4)

CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

PO11: Thumb rule

In Automata Parsing Techniques are lifelong 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:Analyse (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)

PO8 : Thumb rule

Team work is required to implement different types of grammars Hence the correlation is low (1)

PO11: Thumb rule

Context Sensitive features can be lifelong 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)

PO8: Thumb rule

Team work is required for code generation. Hence the correlation is low (1)

PO11: Thumb rule

In real time DAG representation can be lifelong learning. Therefore the correlation is medium (2)



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

Course Code	Year & Sem	Machine Learning (Professional Elective-II)	L	T / CLC	P	C
23APE3608	III-II		2	1	0	3

**Course Outcomes:**

<b>Pre-Requisites</b>		<b>Semester</b>	II
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> the types of Machine Learning and preparing to model.		
<b>CO2</b>	<b>Evaluate</b> the hypotheses by comparing its learning algorithms		
<b>CO3</b>	<b>Evaluate</b> the decision making problems by using SVM and graphical models		
<b>CO4</b>	<b>Apply</b> the supervised learning techniques for few machine learning problems.		
<b>CO5</b>	<b>Analyze</b> the Unsupervised learning methods using clustering methods.		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the types of Machine Learning and preparing to model.			L2
CO2	Evaluate	the hypotheses	by comparing its learning algorithms		L5
CO3	Evaluate	The decision-making problems	by using SVM and graphical models		L5
CO4	Apply	The supervised learning techniques		for few machine learning problems	L3
CO5	Analyze	The Unsupervised learning methods	using clustering methods.		L4

<b>UNIT – I</b>	<b>Introduction to Machine Learning &amp; Preparing to Model</b>	<b>8 Hrs</b>
Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre -Processing		
<b>UNIT – II</b>	<b>Modelling and Evaluation &amp; Basics of Feature Engineering</b>	<b>8 Hrs</b>
Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection		
<b>UNIT – III</b>	<b>Bayesian Concept Learning &amp; Supervised Learning: Classification</b>	<b>9 Hrs</b>
Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-k-Nearest Neighbour(kNN), Decision tree, Random forest model, Support vector machines		
<b>UNIT – IV</b>	<b>Supervised Learning: Regression</b>	<b>9 Hrs</b>
Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.		
<b>UNIT – V</b>	<b>Unsupervised Learning</b>	<b>9 Hrs</b>
Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules		
<b>Textbooks:</b>		
1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.		
<b>Reference Books:</b>		
1. EthernAlpaydin, –Introduction to Machine Learning , MIT Press, 2004.		
2. Stephen Marsland, –Machine Learning -An Algorithmic Perspective , Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.		
3. Andreas C. Müller and Sarah Guido –Introduction to Machine Learning with Python: A Guide for		

**Online Resources:**

1. Andrew Ng, –Machine Learning B.Techningl

<https://www.deeplearning.ai/machine-learning- B.Techning/>

2. Shai Shalev-Shwartz , Shai Ben-David, –Understanding Machine Learning: From Theory to Algorithmsl , Cambridge University Press

<https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html>**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2		2							3	3
CO2	3	3	3	3	3			3			3	2	2
CO3	3	3	2	2	2		3				3	2	2
CO4	3	3	3	2	3	2						2	
CO5	3	3	3	3	3			3			3		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	8	19%	2	Understand	L2	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3)	2 3 2 2
2	8	19%	2	Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
3	9	21%	3	Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO7 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO7: Thumb rule PO11: Thumb rule	3 3 2 2 2 3 3
4	9	21%	3	Apply	L3	PO1 PO2 PO3 PO4 PO5 PO6	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule	3 3 3 2 3 2
5	9	21%	3	Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
	43							

**Justification Statements:****CO1: Understand** the types of Machine Learning and preparing to model.**Action Verb: Understand(L2)****PO1 Verb: Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Review(L2)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop(L3)**

CO2 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

**PO5: Apply(L3)**

CO2 Action verb is less than PO5 verb by one level. Therefore, the correlation is moderate (2)

**CO2: Evaluate** the hypotheses by comparing its learning algorithms

**Action Verb : Evaluate (L5)**

**PO1: Apply(L3)**

CO2 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

**PO2 Verb : 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 greater than PO4 verb. Therefore the correlation is High(3)

**PO5 Verb : Apply(L3)**

CO2 Action verb is greater than PO5 verb. Therefore, the correlation is High (3)

**PO8 : Thumb rule**

While creating hypothesis one need to follow the ethical principles. Therefore, the correlation is High (3)

**PO11: Thumb rule**

In current scenario all machine learning models are updating so one needs to follow the change. Therefore, the correlation is high (3)

**CO3: Evaluate** the decision making problems by using SVM and graphical models

**Action Verb : Evaluate (L5)**

**PO1: Apply(L3)**

CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

**PO2: Analyze (L4)**

CO3 Action verb is greater 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)

**PO5: Create(L6)**

CO3 Action verb is less than PO5 verb by one level. Therefore the correlation is medium(2)

**PO7: Thumb rule**

While making decisions for solving real world problems one must follow the ethical principles. Therefore, the correlation is High (3)

**PO11: Thumb rule**

For developing solutions for future problems a continuous study is need. Therefore, the correlation is high (3)

**CO4: Apply** the supervised learning techniques for few machine learning problems

**Action Verb : Apply (L3)**

**PO1 Verb : Apply(L3)**

CO4 Action verb is same level of PO1 verb. Therefore, the correlation is High (3)

**PO2 Verb : Review(L2)**

CO4 Action verb is greater than PO2 verb. Therefore the correlation is High(3)

**PO3: Develop (L3)**

CO4 Action verb is same level of 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 Verb : Apply(L3)**

CO4 Action verb is same level of PO5 verb. Therefore, the correlation is High (3)

**PO6: Thumb rule**

Some of the machine learning models will provide solutions to current societal problems. Therefore the correlation is medium (2)

**CO5: Analyze** the Unsupervised learning methods using clustering methods.

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO5 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

**PO2 Verb : 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 Verb : Apply(L3)**

CO5 Action verb is greater than PO5 verb. Therefore, the correlation is High (3)

**PO8 : Thumb rule**

some ethical principles will apply while training a model using discrimination methods. Therefore, the correlation is High (3)

**PO11: Thumb rule**

In today's world training a machine is big challenge to the developers, it is a continuous learning process.

Therefore, the correlation is high (3)



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

<b>Course Code</b>	<b>Year &amp; Sem</b>	<b>Software Project Management (Professional Elective-III)</b>	<b>L</b>	<b>T / CLC</b>	<b>P</b>	<b>C</b>
23APE3609	III-II		2	1	0	3

**Course Outcomes:**

<b>Pre-Requisites</b>		<b>Semester</b>	II
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> the purpose and importance of project management		
<b>CO2</b>	<b>Analyze</b> the phases and process of software project management life cycle		
<b>CO3</b>	<b>Analyze</b> process workflows and responsibilities		
<b>CO4</b>	<b>Analyze</b> automation tools, process metrics, and team management strategies to determine their impact on controlling and tailoring software project processes.		
<b>CO5</b>	<b>Apply</b> 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	Analyze	the phases and process of software management life cycle			L4
CO3	Analyze	process workflows and responsibilities			L4
CO4	Analyze	automation tools, process metrics, and team management strategies		to determine their impact on controlling and tailoring software project processes.	
CO5	Apply	process control and instrumentation		for CCPDS-R	L3

<b>UNIT - I</b>		<b>9 Hrs</b>
<b>Conventional Software Management:</b> The water fall model, conventional software Management performance <b>Evolution of Software Economics:</b> software Economics. Pragmatic Software Cost Estimation Improving <b>Software Economics:</b> Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality ,Peer Inspections.		
<b>UNIT - II</b>		<b>9Hrs</b>
<b>The old way and the new:</b> The principles of convention al software Engineering, principles of modern software management, transitioning to aniter ative process. <b>Lifecycle phases:</b> Engineering and production stages, inception, Elaboration, construction, transition phases. <b>Artifacts of the process:</b> The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts		
<b>UNIT - III</b>		<b>9 Hrs</b>
<b>Work Flows of the process:</b> Software process work flows, Inter Trans work flows.Check points of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. <b>Iterative Process Planning:</b> work break down structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning		
<b>UNIT - IV</b>		<b>9 Hrs</b>
<b>Process Automation:</b> Automation Building Blocks, The Project Environment. Project Control and Process instrumentation: The sevcncore Metrics, Management indicators, quality <b>indicators Tailoring the Process:</b> Process discriminants. Managing people and organizing teams.		
<b>UNIT - V</b>		<b>9 Hrs</b>
<b>Project Organizations and Responsibilities:</b> Line - of-Business Organizations, Project Organizations, evolution of Organizations. <b>Future Software Project Management:</b> modern Project Profiles, Next generation Software economics, modern process transitions. <b>Case Study:</b> The Command Center Processing and Display System-Replacement(CCPDS-R)		
<b>Textbooks:</b>		
1. Software Project Management, Walker Royce,Pearson Education,2012 2. BobHughes,MikeCotterellandRajibMall–SoftwareProjectManagement  ,6thEd ition, Mc Graw Hill Edition, 2017		
<b>Reference Books:</b>		

1. PankajJalote,—SoftwareProjectManagementinpractice||,5thEdition,PearsonEducation, 2017.
2. Murali K.Chemuturi,Thomas M.Cagley Jr.||Mastering Software Project Management: Best Practices, Tools and Techniques||, J.Ross Publishing, 2010
3. SanjayMohapatra,—SoftwareProjectManagement||,CengageLearning,2011

**Online Learning Resources:**

<http://nptel.ac.in/courses/106101061/29>

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1 :Understand	L2	PO1 PO10	PO1: Apply(L3) PO10: Thumb rule	2 2
2	9	20%	2	CO2 : Analyze	L4	PO1 PO2 PO8 PO10	PO1: Apply(L3) PO2: Identify (L3) PO8: Thumb rule PO10: Thumb rule	3 3 3 3
3	9	20%	2	CO3 : Analyze	L4	PO1 PO2 PO4 PO8 PO10	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO8: Thumb rule PO10: Thumb rule	3 3 3 3 3
4	9	20%	2	CO4 : Analyze	L4	PO1 PO2 PO4	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4)	3 3 3
5	9	20%	2	CO5 : Apply	L3	PO1 PO2 PO4 PO10	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO10: Thumb rule	3 3 2 2
	45	100 %						

**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)

**PO10: 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:** Analyze the phases and process of software project management life cycle

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO2 Action verb is more than PO1 verb. Therefore the correlation is high (3)

**PO2: Identify (L3)**

CO2 Action verb is more than PO2 verb. Therefore the correlation is high (3)

**PO8: 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)

**PO10: 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)

**CO3:** Analyze process workflows and responsibilities

**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)

**PO4: Analyze (L4)**

CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)

**PO8: Thumb rule**

To analyze process workflows and responsibilities, teamwork and individual performance is required. Therefore the correlation is high(3).

**PO10: Thumb rule**

To analyze process workflows and responsibilities, knowledge on projects and management principles are required. Therefore the correlation is high(3).

**CO4: Analyze** automation tools, process metrics, and team management strategies to determine their impact on controlling and tailoring software project processes.

**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)

**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)

**PO10: 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).



TIRUPATI

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES,

(AUTONOMOUS)

CSE(IOT AND CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)

Course Code	Year & Sem	Mobile Adhoc Networks (Professional Elective-III)	L	T / CLC	P	C
23APE3610	III-II		2	1	0	3

Course Outcomes:

<b>Pre-Requisites</b>		<b>Semester</b>	II
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> MANETs and their routing algorithms based on topology, position, and other routing approaches.		
<b>CO2</b>	<b>Analyze</b> broadcasting, multicasting, and Geocasting in MANETs, and evaluate TCP issues and solutions in Ad Hoc networks.		
<b>CO3</b>	<b>Understand</b> wireless sensor networks in terms of applications, architecture, and protocol layers.		
<b>CO4</b>	<b>Evaluate</b> data retrieval and protocol support in WSNs and security mechanisms in Ad Hoc and sensor networks.		
<b>CO5</b>	<b>Analyze</b> sensor network hardware, programming platforms, and simulation tools like TinyOS, nesC, TinyGALS, and ns-2.		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	MANETs and their routing algorithms	based on topology, position, and other routing approaches.		L2
CO2	Analyze	Broadcasting, multicasting, and Geocasting in MANETs, and evaluate TCP issues and solutions in Ad Hoc networks.			L4
CO3	Understand	wireless sensor networks in terms of applications, architecture, and protocol layers.			L2
CO4	Evaluate	Data retrieval and protocol support in WSNs and security mechanisms in Ad Hoc and sensor networks.			L5
CO5	Analyze	Sensor network hardware, programming platforms, and simulation tools like TinyOS, nesC, TinyGALS, and ns-2.			L4

<b>UNIT - I</b>	<b>Introduction to Ad Hoc Networks</b>	9 Hrs
Characteristics of MANETs, Applications of MANETs and challenges of MANETs -Routing in MANETs: Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms, Position based routing algorithms, Other routing algorithms.		
<b>UNIT - II</b>	<b>Data Transmission</b>	9 Hrs
Broadcast storm problem, Broadcasting, Multicasting and Geocasting -TC Pover Ad Hoc: TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc		
<b>UNIT - III</b>	<b>Basics of Wireless, Sensors and Applications</b>	8 Hrs
Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.		
<b>UNIT - IV</b>	<b>Data Retrieval in Sensor Networks</b>	10 Hrs
Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots-Security: Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.		
<b>UNIT - V</b>	<b>Sensor Network Platforms and Tools</b>	9 Hrs
Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms -Operating System: Tiny OS -Imperative Language: nesC, Data flow style language: Tiny GALS, Node Level Simulators, ns- 2 and its sensor network extension.		
<b>Textbooks:</b>		

1. Ad Hoc and Sensor Networks –Theory and Applications, Carlos Corderio Dharma P. Aggarwal,World Scientific Publications, March 2006,ISBN –981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN –978-1-55860-914-3 ( Morgan Kauffman)

**Reference Books:**

1. Wireless Digital Communications – Kaila Fehr, 1999, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gestapo Sasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.

**Online Learning Resources:**

<https://github.com/topics/adhoc-networks>

**Mapping of course outcomes with program outcomes**

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

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

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	18%	2	Understand	L2	PO1 PO2 PO3 PO5 PO11	PO1:Apply(L3) PO2: Analyse (L4) PO3: Design (L3) PO5: Apply (L3) PO11: Thumb rule	2 1 2 2 2
2	9	24%	3	Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 3 3 3
3	8	18%	2	Understand	L2	PO1 PO2 PO5 PO6	PO1: Apply(L3) PO2: Analyse (L4) PO5: Apply (L3) PO11: Thumb rule	2 1 2 2
4	10	22%	3	Evaluate	L5	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3)	3 3 3 3 3
5	9	18%	2	Analyse	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L3)	3 3 3 3 3

						PO9 PO10	PO4: Analyse (L4) PO5: Apply (L3) PO9: Thumb rule PO10: Thumb rule	3 3
	<b>43</b>	<b>100 %</b>						

**Justification Statements:**

**CO1: Understand** MANETs and their routing algorithms based on topology, position, and other routing approaches.

Action Verb: **Understand (L2)**

**PO1: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**PO2: Analyze (L4)**

CO1 Action verb is less than as PO2 verb by two level . Therefore, the correlation is low(1)

**PO3: Design (L3)**

CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is medium (2)

**PO5: Apply (L3)**

CO1 Action verb is less than PO5 verb by one level. Therefore, the correlation is medium (2)

**PO11: Thumb rule**

CO1 supports effective communication in documentation and presentation. Therefore, the correlation is medium (2)

**CO2: Analyze** broadcasting, multicasting, and Geocasting in MANETs, and evaluate TCP issues and solutions in Ad Hoc networks.

Action Verb: **Analyze (L4)**

**PO1: Apply (L3)**

CO2 Action verb is greater than PO1 verb by one level. 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 (L3)**

CO2 Action verb is greater than PO3 verb by one level. 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 by one level. Therefore, the correlation is high (3)

**PO11: Thumb rule**

CO2 Encourages continuous learning due to evolving wireless communication protocols.. Therefore, the correlation is high (3)

**CO3: Understand wireless sensor networks in terms of applications, architecture, and protocol layers.**

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 level. Therefore, the correlation is high (1)

**PO5: Apply (L3)**

CO3 Action verb is greater than PO5 verb by one levels. Therefore, the correlation is medium(2).

**PO11: Thumb rule**

CO3 Encourages continuous learning due to rapid evolution in IoT and sensor technologies. Therefore, the correlation is medium(2)

**CO4: Evaluate data retrieval and protocol support in WSNs and security mechanisms in Ad Hoc and sensor networks.**

Action Verb: **Evaluate (L5)**

**PO1: Apply (L3)**

CO4 Action verb is greater than PO1 verb by two level. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO4 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)

**PO3: Design (L3)**

CO4 Action verb is greater than PO3 verb by two level. 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 by one level. Therefore, the correlation is high (3)

**CO5: Analyze** sensor network hardware, programming platforms, and simulation tools like TinyOS, nesC, TinyGALS, and ns-2.

Action Verb: **Analyze (L4)**

**PO1: Apply (L3)**

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

**PO2: Analyze (L4)**

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

**PO3: Design (L3)**

CO5 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)

**PO4: Analyze (L4)**

CO5 Action verb is same level as PO4 verb. Therefore, the correlation is the correlation is high (3)

**PO5: Apply (L3)**

CO5 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)

**PO9: Thumb rule**

CO5 involves sensor network hardware, programming platforms. Therefore, the correlation is high (3)

**PO10: Thumb rule**

CO5 involves simulation tools like TinyOS, nesC, TinyGALS, and ns-2. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

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

Course Code	Year & Sem	Natural Language Processing (Professional Elective-III)	L	T / CLC	P	C
23APE3611	III-II		2	1	0	3

**Course Outcomes:**

After studying the course, student will be able to

<b>Pre-Requisites</b>		<b>Semester</b>	II
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> the basic concepts of NLP to build language models		
<b>CO2</b>	<b>Apply</b> parsing techniques to study syntactic structure of sentences in natural language		
<b>CO3</b>	<b>Analyze</b> grammars and mechanisms of augmented transition network for NLP		
<b>CO4</b>	<b>Apply</b> language models and semantic interpretation to NLP		
<b>CO5</b>	<b>Analyze</b> machine translation and multi lingual information retrieval approaches to improve system performance		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of NLP		to build language models	L2
CO2	Apply	parsing techniques		to study syntactic structure of sentences in natural language	L3
CO3	Analyze	grammars and mechanisms of		augmented transition network for NLP	L4
CO4	Apply	language models and semantic interpretation		to generate compelling 2D transitions between images	L3
CO5	Analyze	machine translation and multi lingual information retrieval approaches		To improve system performance	L4

<b>UNIT - I</b>	<b>Introduction to Natural language</b>	<b>8 Hrs</b>
<b>Introduction to Natural language:</b> The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax		
<b>UNIT - II</b>	<b>Grammars and Parsing</b>	<b>9 Hrs</b>
<b>Grammars and Parsing:</b> Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.		
<b>UNIT - III</b>	<b>Grammars for Natural Language</b>	<b>8 Hrs</b>
<b>Grammars for Natural Language:</b> Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.		
<b>UNIT - IV</b>	<b>Semantic Interpretation</b>	<b>8 Hrs</b>
<b>Semantic Interpretation:</b> Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory. Language Modeling: Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modeling Problems, Multilingual and cross lingual language modeling.		
<b>UNIT - V</b>	<b>Machine Translation Survey</b>	<b>9 Hrs</b>
<b>Machine Translation Survey:</b> Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges. Multilingual Information Retrieval: Introduction, Document Preprocessing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. Multilingual Automatic Summarization: Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.		
<b>Textbooks:</b>		

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications : From Theory To Practice Daniel M. Bikel and Imed Zitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet chaitanya, Prentice – Hall of India.

#### Reference Books:

1. Charniak, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999

#### Online Learning Resources

1. <https://nptel.ac.in/courses/106/105/106105158/>
2. <http://www.nptelvideos.in/2012/11/natural-language-processing.html>

#### Mapping of course outcomes with program outcomes

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

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

#### Correlation matrix

Unit No.	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BT L	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	8	19%	2	CO1:Understand	L2	PO1 PO2 PO4	PO1: Apply(L3) PO2: Review(L2) PO4: Interpret(L2)	2 3 3
2	9	21%	3	CO2 : Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 2 3 2
3	8	19%	2	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3
4	8	19%	2	CO4 : Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO11: Thumb rule	3 3 3 2
5	9	21%	3	CO5 :Analyze	L4	PO1	PO1:	3

						PO2	Apply(L3)	3
						PO4	PO2:	3
						PO6	Identify(L3)	3
						PO11	PO4:	3
							Analyze(L4)	
							PO6:	
							Thumb rule	
							PO11:	
							Thumb rule	
	42	100%						

**Justification Statements :**

**CO1: Understand** the basic concepts of NLP concepts to build language 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 as PO2 verb. Therefore the correlation is high(3)

**PO4: Interpret(L2)**

CO1 Action verb is same as PO4 verb. Therefore the correlation is high(3)

**CO2: Apply** parsing techniques to study syntactic structure of sentences in natural language

**Action Verb : Apply(L3)**

**PO1: Apply(L3)**

CO2 Action verb is same as PO1 verb .Therefore the correlation is high (3)

**PO2: Identify(L3)**

CO2 Action verb is same 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 as PO5 verb .Therefore the correlation is high (3)

**PO11: Thumb rule**

For developing natural language applications, one needs to learn continuously. Therefore the correlation is medium(2)

**CO3: Analyze** grammars and mechanisms of augmented transistion network for NLP

**Action Verb : Analyze (L4)**

**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)

**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)

**PO11: Thumb rule**

For developing natural language applications, one needs to learn continuously. Therefore the correlation is high(3)

**CO4: Apply** language models and semantic interpretation to NLP

**Action Verb : Apply(L3)**

**PO1: Apply(L3)**

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

**PO2: Identify(L3)**

CO4 Action verb is same level 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)

**PO11: Thumb rule**

For developing natural language applications, one needs to learn continuously. Therefore the correlation is medium(2)

**CO5: Analyze** machine translation and multi lingual information retrieval approaches to improve system performance

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO2: Identify(L3)**

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)

**PO6: Thumb rule**

Information retrieval methods are used in many real time applications. Therefore the correlation is high(3)

**PO11: Thumb rule**

In language translation retrieval approaches to improve performance gets updated regularly. Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

<b>Course Code</b>	<b>Year &amp; Sem</b>	<b>Security Assessment and Risk Analysis</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
23APE3612	III-II	(Professional Elective-III)	2	1	0	3

<b>Pre-Requisites</b>		<b>Semester</b>	
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Understand</b> the basic concepts of computer security, identify threats and secure software principles.		
<b>CO2</b>	<b>Apply</b> security design techniques and use design patterns and models to detect early vulnerabilities.		
<b>CO3</b>	<b>Analyze</b> project security risks, select suitable risk management and testing strategies.		
<b>CO4</b>	<b>Apply</b> cryptographic methods, authentication schemes, and access control models in secure applications.		
<b>CO5</b>	<b>Evaluate</b> security frameworks and assess security challenges in developing and deploying e-systems.		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of computer security, identify threats and secure software principles		using cryptographic hashing	L2
CO2	Apply	security design techniques and use design patterns and models	to detect early vulnerabilities	to demonstrate block linking, validation, and token transactions	L3
CO3	Analyze	project security risks, select suitable risk management and testing strategies			L4
CO4	Apply	cryptographic methods, authentication schemes, and access control models	in secure applications	that performs mining and shares data between nodes	L3
CO5	Evaluate	security frameworks and assess security challenges	in developing and deploying e-systems		L5

<b>UNIT - I</b>	<b>Introduction</b>	<b>9 Hrs</b>
Defining computer security, the principles of secure software, trusted computing base, etc, threat modelling, advanced techniques for mapping security requirements into design specifications. Secure software implementation, deployment and ongoing management		
<b>UNIT - II</b>	<b>Security Design</b>	<b>9 Hrs</b>
Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue. Software design and an introduction to hierarchical design representations. Difference between high- level and detailed design. Handling security with high- level design. General Design Notions. Security concerns designs at multiple levels of abstraction, Design patterns, quality assurance activities and strategies that support early vulnerability detection, Trust models, security Architecture & design reviews		
<b>UNIT - III</b>	<b>Software Assurance Model</b>	<b>9Hrs</b>
Identify project security risks & selecting risk management strategies, Risk Management Framework, Security Best practices/ Known Security Flaws, Architectural risk analysis, Security Testing & Reliability (Penn testing, Risk- Based Security Testing		
<b>UNIT - IV</b>	<b>Application</b>	<b>9 Hrs</b>
Software Security in Enterprise Business: Identification and authentication, Enterprise Information Security, Symmetric and asymmetric cryptography, including public key cryptography, data encryption standard (DES), advanced encryption standard (AES), algorithms for hashes and message digests. Authentication, authentication schemes , access control models, Kerberos protocol, public key infrastructure (PKI), protocols specially designed for e-commerce and web applications, firewalls and VPNs		

<b>UNIT - V</b>	<b>Security Frameworks</b>	<b>9 Hrs</b>
Security development frameworks. Security issues associated with the development and deployment of information systems, including Internet-based e-commerce, e-business, and e - service systems.		
<b>Textbooks:</b>		
1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.		
2. Multilingual Natural Language Processing Applications : From Theory To Practice Daniel M. Bikel and Imed Zitouni, Pearson Publications.		
3. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet chaitanya, Prentice - Hall of India.		
<b>Reference Books:</b>		
1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.		
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.		
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999		
<b>Online Learning Resources</b>		
1. <a href="https://nptel.ac.in/courses/106/105/106105158/">https://nptel.ac.in/courses/106/105/106105158/</a>		
2. <a href="http://www.nptelvideos.in/2012/11/natural-language-processing.html">http://www.nptelvideos.in/2012/11/natural-language-processing.html</a>		

### Correlation of COs with the POs & PSOs for B.Tech

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	3	2		2				2		
CO3	3	3	2	2	2						
CO4	3	2	3		3						
CO5	3	3	3		2						

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

### CO-PO mapping justification:

Unit No	CO					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	9	20%	2	CO2: Apply	L3	PO1 PO2 PO3 PO5 PO9	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO5: Apply(L3) PO9: Thumb rule	3 3 3 3 3
3	9	20%	2	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3)	2 1 2 3 2
4	9	20%	2	CO4: Apply	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO5: Apply(L3)	3 2 3 3
5	9	20%	2	CO5: Evaluate	L5	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L6) PO5: Apply(L3)	1 - 2 1

	45	100					
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**Justification Statements:**

**CO1: Understand** the basic concepts of computer security, identify threats and secure software principles.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb. Therefore, the correlation is moderate (2)

**PO2 Verb: Review (L2)**

CO1 Action verb is same as PO2 verb. Therefore, the correlation is High (3)

**CO2: Apply** security design techniques and use design patterns and models to detect early vulnerabilities.

**Action Verb: Analyze (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is less than PO2 verb. Therefore, the correlation is moderate (2)

**PO3: Develop (L3)**

CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Apply(L3)**

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high(3)

**PO9: Thumb Rule**

**Apply** security design techniques and use design patterns and models Communicate effectively and inclusively with in the engineering community and society .

**CO3: Analyze** project security risks, select suitable risk management and testing strategies.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO3 Action verb is less than PO1 verb . Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

CO3 Action verb is two levels less than as PO2 verb. Therefore, the correlation is low (1)

**PO3: Develop (L3)**

CO3 Action verb is less than PO3 verb. Therefore, the correlation is moderate (2)

**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 moderate(2)

**CO4: Apply** cryptographic methods, authentication schemes, and access control models in secure applications.

**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 less than as PO2 verb. Therefore, the correlation is moderate (2)

**PO3: Develop (L3)**

CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Apply(L3)**

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high(3)

**CO5: Evaluate** security frameworks and assess security challenges in developing and deploying e-systems.

**Action Verb: Evaluate (L5)**

**PO1: Apply (L3)**

CO5 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is low (1)

**PO2: Review (L2)**

CO5 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop (L6)**

CO5 Action verb is less than as PO3 verb. Therefore, the correlation is moderate (2)

**PO5: Apply(L3)**

CO3 Action verb is greater than PO5 verb. Therefore, the correlation is moderate(2)



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Subject Code	Year & Sem	Subject Name	L	T/CLC	P	C
23AOE0103	III-II	Disaster Management (Open Elective-II)	2	1	0	3

**Course Outcomes: After studying the course, students will be able to**

<b>CO1</b>	Understand the fundamental concepts of natural disasters, their occurrence and disaster risk reduction strategies.
<b>CO2</b>	Understand the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction
<b>CO3</b>	Understand engineering principles and computational techniques in designing wind-resistant structures
<b>CO4</b>	Understand earthquake effects on buildings and develop strategies for seismic retrofitting.
<b>CO5</b>	Understand seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	fundamental concepts of natural disasters, their occurrence		disaster risk reduction strategies	L2
2	Understand	impact of cyclones on structures and explore retrofitting techniques	for adaptive reconstruction	using various strain gauge techniques.	L2
3	Understand	engineering principles and computational techniques		in designing wind-resistant structures	L2
4	Understand	earthquake effects on buildings and develop strategies		for seismic retrofitting	L2
5	Understand	seismic safety planning, design considerations, and innovative construction materials		for disaster-resistant structures	L2

**UNIT-I**

Introduction to Natural Disasters– Brief Introduction to Different Types of Natural Disasters, Occurrence of Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) of The World and India, Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socioeconomic Consequences).

**UNIT-II**

Cyclones and Their Impact– Climate Change and Its Impact On Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structures in Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.

**UNIT-III**

Wind Engineering and Structural Response– Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Lab: Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.

**UNIT-IV**

Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epi center, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic

Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening.

**UNIT-V**

Planning and Design Considerations for Seismic Safety– General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.

**TEXTBOOKS:**

1. David Alexander, *Natural Disasters*, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. DeVecchio, *Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes*, 5th Edition, Routledge, 2019.

**REFERENCES:**

1. Ben Wisner, J.C. Gaillard, and Ilan Kelman (Editors), *Handbook of Hazards and Disaster Risk Reduction and Management*, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, *Introduction to International Disaster Management*, 4th Edition, Butterworth-Heinemann, 2020.
3. Bimal Kanti Paul, *Environmental Hazards and Disasters: Contexts, Perspectives and Management*, 2nd Edition, Wiley-Blackwell, 2020.

**WEB RESOURCES:**

<https://nptel.ac.in/courses/124107010>

[https://onlinecourses.swayam2.ac.in/cec19\\_hs20/preview](https://onlinecourses.swayam2.ac.in/cec19_hs20/preview)

**CORRELATION OF COS WITH THE POS & PSOS:**

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

**CO-PO MAPPING JUSTIFICATION:**

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
3	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
4	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
5	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2

**JUSTIFICATION STATEMENTS:**

**CO1: Understand the fundamental concepts of natural disasters, their occurrence and disaster risk reduction strategies.**

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 one level; Therefore, correlation is moderate (2).

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

**CO2: Understand the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.**

Action Verb: Understand (L2)

PO1: Apply(L3)

CO2 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO3: Understand engineering principles and computational techniques in designing wind-resistant structures**

Action Verb: Understand (L2)

PO1: Apply(L3)

CO3 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO4: Understand earthquake effects on buildings and develop strategies for seismic retrofitting.**

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO5: Understand seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures**

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

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Subject Code	Year & Sem	Subject Name	L	T/CLC	P	C
23AOE0104	III-II	Sustainability in Engineering Practices (Open Elective-II)	2	1	0	3

**Course Outcomes: After studying the course, students will be able to**

<b>CO1</b>	Understand concept of sustainability in the context of construction and CO <sub>2</sub> contribution of building materials along with their environmental impact
<b>CO2</b>	Understand the relation between construction materials and indoor air quality
<b>CO3</b>	Apply concepts to calculate embodied energy for commonly used construction materials using standard methodologies
<b>CO4</b>	Apply concepts of energy codes and green building rating systems for building envelopes
<b>CO5</b>	Understand the environmental impacts and control methods of non-renewable energy sources

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	Concept of sustainability and CO <sub>2</sub> contribution of building materials along with their environmental impact		in the context of construction	L2
2	Understand	The relation between construction materials and indoor air quality			L2
3	Apply	concepts to calculate embodied energy for commonly used construction materials	using standard methodologies		L3
4	Apply	concepts of energy codes and green building rating systems		for building envelopes	L3
5	Understand	the environmental impacts and control methods		of non-renewable energy sources	L2

**UNIT-I**

**INTRODUCTION**

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO<sub>2</sub> Contribution from Cement and Other Construction Materials.

**UNIT-II**

**MATERIALS USED in SUSTAINABLE CONSTRUCTION**

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

**UNIT-III**

**ENERGY CALCULATIONS**

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

**UNIT-IV**

**GREEN BUILDINGS**

Control of Energy Use in Building - ECBC Code, Codes in Neighbouring Tropical Countries - OTTV Concepts and Calculations - Features of LEED and TERI - GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

**UNIT-V**

**ENVIRONMENTAL EFFECTS**

Non-Renewable Sources of Energy and Environmental Impact- Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

**TEXTBOOKS:**

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

**REFERENCES:**

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

**WEB RESOURCES:**

<https://archive.nptel.ac.in/courses/105/105/105105157/>

**CORRELATION OF COS WITH THE POS & PSOS:**

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

**CO-PO MAPPING JUSTIFICATION:**

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
3	9	20	2	Apply	L3	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 2 2 2
4	9	20	2	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
5	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2

**JUSTIFICATION STATEMENTS:**

**CO 1: Understand concept of sustainability in the context of construction and CO<sub>2</sub> contribution of building materials along with their environmental impact**

Action Verb: Understand (L2)

PO1: Apply(L3)

CO 1 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 one level; Therefore, correlation is moderate (2).

CO 1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO 2: Understand the relation between construction materials and indoor air quality**

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

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

CO 2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO 3: Apply concepts to calculate embodied energy for commonly used construction materials using standard methodologies**

**Action Verb: Apply (L3)**

PO1: Apply(L3)

CO 3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO 3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

PO4: Analyze (L4)

CO 3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO 3 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

**CO 4: Apply concepts of energy codes and green building rating systems for building envelopes**

**Action Verb: Apply (L3)**

PO1: Apply(L3)

CO 4 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO 4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO 4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

**CO 5: Understand the environmental impacts and control methods of non-renewable energy sources**

Action Verb: Understand (L2)

PO1: Apply(L3)

CO 5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO 5 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO 5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

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Subject Code	Year & Sem	Subject Name	L	T/CLC	P	C
23AOE0202	III-II	Renewable Energy Sources (Open Elective-II)	2	1	0	3

After completion of the course, students will be able to:

CO1	Understand solar radiation concepts, solar angles, and solar energy collection and storage methods.
CO2	Analyze the working principles, technologies, characteristics, and configurations of solar PV systems.
CO3	Analyze the components, design, and performance factors of wind energy conversion systems.
CO4	Understand Geothermal energy sources, applications, and their potential in India.
CO5	Understand the working principles, technologies, and limitations of ocean, biomass, and fuel cell energy systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Solar radiation concepts, solar angles, and solar energy collection and storage methods			L2
CO2	Analyze	Working principles, technologies, characteristics, and configurations of solar PV systems			L4
CO3	Analyze	Components, design, and performance factors of wind energy conversion systems			L4
CO4	Understand	Geothermal energy sources, applications, and potential in India			L2
CO5	Understand	Working principles, technologies, and limitations of ocean, biomass, and fuel cell energy systems			L2

### SYLLABUS

#### UNIT-I

**TITLE: Solar Energy**

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

#### UNIT-II

**TITLE: PV Energy Systems**

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

#### UNIT-III

**TITLE: Wind Energy**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

#### UNIT-IV

**TITLE : Geothermal Energy**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geopressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

### UNIT-V

#### **TITLE: Miscellaneous Energy Technologies**

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration.

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

#### **Text books:**

- |   |  |
|---|--|
| 1 | G. D. Rai, –Non-Conventional Energy Sources, 4th Edition, Khanna Publishers, 2000.   |
| 2 | Chetan Singh Solanki –Solar Photovoltaics fundamentals, technologies and applications, 2nd Edition PHI Learning Private Limited. 2012. |

#### **Reference books:**

- |   |  |
|---|--|
| 1 | Stephen Peake, –Renewable Energy Power for a Sustainable Future, Oxford International Edition, 2018.                       |
| 2 | S. P. Sukhatme, –Solar Energy, 3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.                                    |
| 3 | B H Khan, – Non-Conventional Energy Resources, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.                     |
| 4 | S. Hasan Saeed and D.K.Sharma, –Non-Conventional Energy Resources, 3rd Edition, S.K.Kataria & Sons, 2012.                  |
| 5 | G. N. Tiwari and M.K.Ghosal, –Renewable Energy Resource: Basic Principles and Applications, Narosa Publishing House, 2004. |

#### **Web Resources:**

- |   |   |
|---|---|
| 1 | <a href="https://nptel.ac.in/courses/103103206">https://nptel.ac.in/courses/103103206</a> |
| 2 | <a href="https://nptel.ac.in/courses/108108078">https://nptel.ac.in/courses/108108078</a> |

#### **Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)**

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

#### **Mapping of Course outcomes with Program outcomes Justification Table**

CO No.	CO					Program Outcomes (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1	9	20	2	Understand	L2	PO1, PO2, PO4, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO4:Analyze(L4) PO6: Analyze(L4)	2 1 1 1
2	9	20	2	Analyze	L4	PO1, PO2, PO3, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO3:Design(L6) PO6:Analyze(L4)	3 3 1 3
3	9	20	2	Analyze	L4	PO1, PO2, PO3, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO3:Design(L6) PO6:Analyze(L4)	3 3 1 3

4	9	20	2	Understand	L2	PO1, PO6	PO1:Apply(L3) PO6:Analyze(L4)	2 1
5	9	20	2	Understand	L2	PO1, PO6	PO1:Apply(L3) PO6:Analyze(L4)	2 1

<b>CO1:</b> Understand solar radiation concepts, solar angles, and solar energy collection and storage methods.
<b>Action Verb:</b> Understand (L2)
PO1Verbs: Apply (L3)
CO1 ActionVerb is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO2 Verbs: Analyze (L4)
CO1 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO4 Verbs: Analyze (L4)
CO1 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6 Verbs: Analyze (L4)
CO1 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
<b>CO2:</b> Analyze the working principles, technologies, characteristics, and configurations of solar PV systems.
<b>Action Verb:</b> Analyze (L4)
PO1Verbs: Apply (L3)
CO2 ActionVerb is Greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verbs: Analyze (L4)
CO2 ActionVerb is Same to PO2 verb ; Therefore, correlation is High (3).
PO3Verbs: Design (L6)
CO2 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6 Verbs:Analyze (L4)
CO2 ActionVerb is Same to PO6 verb ; Therefore, correlation is High (3).
<b>CO3:</b> Analyze the components, design, and performance factors of wind energy conversion systems.
<b>Action Verb:</b> Analyze (L4)
PO1Verbs: Apply (L3)
CO3 ActionVerb is Greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verbs: Analyze (L4)
CO3 ActionVerb is Same to PO2 verb ; Therefore, correlation is High (3).
PO3Verbs: Design (L6)
CO3 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6 Verbs:Analyze (L4)
CO3 ActionVerb is Same to PO6 verb ; Therefore, correlation is High (3).
<b>CO4:</b> Understand Geothermal energy sources, applications, and their potential in India.
<b>Action Verb:</b> Understand (L2)
PO1Verbs: Apply (L3)
CO4 ActionVerb is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO6 Verbs: Analyze (L4)
CO4 ActionVerb is less than PO2 verb by two level; Therefore, correlation is low (1).
<b>CO5:</b> Understand the working principles, technologies, and limitations of ocean, biomass, and fuel cell energy systems.
<b>Action Verb:</b> Understand (L2)
PO1Verbs: Apply (L3)
CO4 ActionVerb is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO6 Verbs: Analyze (L4)
CO4 ActionVerb is less than PO2 verb by two level; Therefore, correlation is low (1).

**This course syllabus has been approved by the Board of Studies-EEE**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Subject Code	Year & Sem	Subject Name	L	T	P	C
23AOE0302	III-II	<b>Automation and Robotics (Open Elective-II)</b>	2	1	0	3

**Course Outcomes:**

CO: 1	Explain the need, types, and elements of automation systems and analyze different levels of automation strategies in industry.
CO: 2	Demonstrate the operation of automated flow lines and apply methods for assembly line balancing and optimization.
CO: 3	Identify robotic components and describe their configuration, degrees of freedom, and industrial applications in various processes.
CO: 4	Apply transformation techniques and D-H notation to solve problems in robot kinematics and evaluate actuator and sensor selection.
CO: 5	Analyze robot dynamics using Jacobians and Euler formulations and develop suitable trajectories for obstacle-free motion.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
<b>CO1</b>	Understand	structure and functions of automated		manufacturing systems	L2
<b>CO2</b>	Analyze	automated flow lines with or without buffer storage		assembly line balancing	L3
<b>CO3</b>	Understand	robot configurations	production efficiency		L2
<b>CO4</b>	Apply	kinematic and dynamic modeling		real-world industrial scenario	L3
<b>CO5</b>	Create	program, and implement robotic systems		Manufacturing.	L6

**Unit I: Introduction to Automation:** Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

**Unit II**

**Automated flow lines:** Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

**Unit III**

**Introduction to Industrial Robotics:** Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers. Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

**Unit IV**

**Manipulator Kinematics:** Manipulator Kinematics, Homogenous transformations as applicable to rotation and translation - D-H notation, Forward inverse kinematics. Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

**Unit V**

**Robot Programming:** Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages. Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

**Text Books:**

1. Automation, Production systems and CIM, M.P. Groover /4thEdition, Pearson education (2016)
2. Industrial Robotics - M.P. Groover, TMH (1996)

**Reference Books:**

1. Robotics, Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal, Oxford Press, 1/e, 2006
5. Robotics and Control, Mittal R K & Nagrath I J, TMH.

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	
Automation & Robotics	CO 1	3	3				3								
	CO 2	3	3												
	CO 3	3	3			3	2								
	CO 4	3	3	3		2									
	CO 5	3	3			3	1								

**Correlation Matrix**

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	9	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Identify (L3) Develop (L3)	2 2 2
2	9	20	2	Analyze	L3	PO1 PO2	Apply (L3) Identify (L3)	3 3
3	9	20	2	Understand	L2	PO1 PO2 PO5 PO6	Apply (L3) Identify (L3) Select (L1) Apply (L3)	2 2 3 2
4	9	20	2	Apply	L3	PO1 PO2 PO3 PO5	Apply (L3) Identify (L3) Create (L6) Create (L6)	3 3 3 3
5	9	20	2	Create	L6	PO1 PO2 PO5 PO6	Apply (L3) Identify (L3) Create (L6) Apply (L3)	3 3 3 3

**Justification Statements:**

**CO1:** Understand the structure and functions of automated manufacturing systems for efficient production.

Action Verb: Understand (L2)

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 (greater) as PO2 verb. Therefore, the correlation is high (3)

PO6 Verb: **Develop (L3)**

CO1 Action verb is same level as PO6 verb. Therefore, the correlation is high (3)

**CO2:** Analyze automated flow lines with or without buffer storage, perform quantitative evaluations, assembly line balancing techniques.

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO2: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Identify (L3)**

CO2: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

**CO3:** Understand robot configurations and select suitable actuators and sensors to optimize production efficiency and flexibility.

Action Verb: **Creating (L6)**

PO1 Verb: **Apply (L3)**

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

PO2 Verb: **Identify (L3)**

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

PO5 Verb: **select (L6)**

CO3: Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO6 Verb: **Apply (L3)**

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

**CO4:** Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario.

Action Verb: **Evaluate (L5)**

PO1 Verb: **Apply (L3)**

CO2: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Identify (L3)**

CO2: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Creating (L6)**

CO3: Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO5 Verb: **Creating (L6)**

CO3: Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

**CO5:** Create program, and implement robotic systems to perform manufacturing tasks.

Action Verb: **Creating (L6)**

PO1 Verb: **Apply (L3)**

CO2: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Identify (L3)**

CO2: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

PO5 Verb: **Creating (L6)**

CO3: Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO6 Verb: **apply (L3)**

CO3: Action verb is same level as PO6 verb. Therefore, the correlation is high (3)

**This course syllabus has been approved by the Board of Studies-MECHANICAL**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Digital Electronics (Open Elective-II)	L	T/CLC	P	C
23AOE0402	III-II		2	1	0	3

**Course Outcomes:**

- CO1: Understand the logic gates and minimization of Boolean functions using K-Maps.  
 CO2: Analyze the design procedure of Arithmetic circuits and code conversions using logic gates.  
 CO3: Analyze the design concepts of combinational logic circuits using logic gates.  
 CO4: Analyze the design aspects of sequential logic circuits using flip flops.  
 CO5: Understand various programmable logic devices and digital ICs.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the logic gates and minimization of Boolean functions using K-Maps.	using K-Maps		L2
CO2	Analyze	the design procedure of Arithmetic circuits and code conversions using gates.	using logic gates.		L4
CO3	Analyze	the design concepts of combinational logic circuits	using logic gates.		L4
CO4	Analyze	the design aspects of sequential logic circuits using flip flops.	using flip flops.		L4
CO5	Understand	various programmable logic devices and digital ICs.			L2

<b>UNIT - I</b>	9Hrs
<b>Logic Simplification and Combinational Logic Design:</b> Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.	
<b>UNIT - II</b>	9Hrs
<b>Introduction to Combinational</b> Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display	
<b>UNIT - III</b>	9Hrs
<b>Combinational Logic Design</b> 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.	
<b>UNIT - IV</b>	9Hrs
<b>Sequential Logic Design:</b> Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers	
<b>UNIT - V</b>	9Hrs
<b>Programmable Logic Devices:</b> ROM, Programmable Logic Devices (PLA and PAL). <b>Digital IC's:</b> Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).	
<b>Textbooks:</b>	
1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999. 2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.	
<b>Reference Books:</b>	
1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004	
<b>Online Learning Resources:</b>	
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	1									2	
CO2	3	3	3	3									2	2
CO3	3	3	3	3									2	2
CO4	3		3	3									3	2
CO5	2	2	2										2	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	9	20%	2	Understand	L2	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	2 2 2 1
2	9	20%	2	Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
3	9	20%	2	Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
4	9	20%	2	Analyze	L4	PO1 PO3 PO4	PO1: Apply (L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3
5	9	20%	2	Understand	L2	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3)	2 2 2
	45	100%						

### Justification Statements:

**CO1: Understand the logic gates and minimization of Boolean functions using K-Maps.**

**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).

PO4 Verbs: Analyze (L4) CO1 Action verb is less than PO4 verb by two levels. Therefore, the correlation is low (1)

**CO2: Analyze the design procedure of Arithmetic circuits and code conversions using logic gates.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3) CO2 Action verb is more than PO1 verb by one level. Therefore, the correlation is

high (3)

PO2 Verbs: Identify (L3) CO2 Action verb is more than PO2 verb by one level. Therefore, the correlation is high (3)

PO3 Verbs: Develop (L3) CO2 Action verb is more than PO3 verb by one level. Therefore, the correlation is high (3)

PO4 Verbs: Analyze (L4) CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO3: Analyze the design concepts of combinational logic circuits using logic gates.**

**Action Verb: Analyze (L4)**

PO1 Verbs: CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3).

PO2 Verbs: CO3 Action verb is more than PO2 verb by one level. Therefore, the correlation is high (3).

PO3 Verb: CO3 Action verb is more than PO3 verb by one level. Therefore, the correlation is high (3).

PO4 Verbs: CO3 Action Verb is equal to PO4 verb, therefore correlation is high (3).

**CO4: Analyze the design aspects of sequential logic circuits using flip flops.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3) CO4 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3).

PO2 Verb: Identify (L3) CO4 Action verb is more than PO3 verb by one level. Therefore, the correlation is high (3).

PO4 Verb: Develop (L3) CO4 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO5: Understand various programmable logic devices and digital ICs.**

**Action Verb: Understand (L2)**

PO1 Verb: CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2 verb: CO5 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3 verb: CO5 Action Verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

**This course syllabus has been approved by the Board of Studies-ECE**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Mathematical Foundation of Quantum Technologies (Open Elective-II)	L	T/CLC	P	C
23AOE9903	III-II		2	1	0	3

**Course Outcomes (CO):** Student will be able to

1. Apply the applications to quantum systems through the study of vector spaces, inner products, and linear operators.
2. Analyze the transition from finite to infinite dimensional systems with linear algebra concepts to function spaces.
3. Analyze the quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.
4. Evaluate the statistical interpretations through quantum mechanical principles to solve problems in simple quantum systems.
5. Create the understanding of measurement processes and modern quantum theory from the advanced concepts in composite systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Apply</b>	the applications to quantum systems	through the study of vector spaces, inner products, and linear operators.		<b>L3</b>
2	<b>Analyze</b>	the transition from finite to infinite dimensional systems	with linear algebra concepts to function spaces.		<b>L4</b>
3	<b>Analyze</b>	the quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.	.		<b>L4</b>
4	<b>Evaluate</b>	statistical interpretations through quantum mechanical principles	to solve problems in simple quantum systems.		<b>L5</b>
5	<b>Create</b>	the understanding of measurement processes and modern quantum theory	from the advanced concepts in composite systems.		<b>L6</b>

**UNIT I: Linear Algebra Foundation for Quantum Mechanics**

**9 hours**

Vector spaces definition and examples ( $\mathbb{R}^2$ ,  $\mathbb{R}^3$ , function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigen values, eigen vectors), Finite-dimensional examples ( $2 \times 2$  matrices, spin-1/2 systems), Dirac notation introduction ( $|\psi\rangle$ ,  $\langle\phi|$ ,  $\langle\phi|\psi\rangle$ ), Change of basis (transformations, unitary matrices).

**UNIT II: From Finite to Infinite Dimensions**

**9 hours**

Function spaces ( $L^2$  space, square-integrable functions), Inner products for functions ( $\int \psi^* \phi dx$ ), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions ( $d/dx$ , multiplication by  $x$ ).

**UNIT III: Quantum Mechanical Formalism**

**9 hours**

Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

**UNIT IV: Applications and Statistical Interpretation**

**9 hours**

Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

**UNIT V: Advanced Topics**

**9 hours**

Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

**Textbooks:**

- David J. Griffiths, Darrell F. Schroeter, "Introduction to Quantum Mechanics", 3rd Edition, Cambridge University Press (2018).

- R. Shankar, Principles of Quantum Mechanics, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

**Reference Books:**

- George. F. Simmons, "Introduction to Topology and Modern Analysis", MedTech Science Press.
- Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Cengage Learning (2006).
- John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).

**Web Resources**

1. <https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20-%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf>
2. <https://fisica.net/mecanica-quantica/Shankar%20-%20Principles%20of%20quantum%20mechanics.pdf>

**Mapping of COs to POs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	3										
2		3									
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	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	9	20	2	Apply	L3	PO1	Apply	3
2	9	20	2	Analyze	L4	PO2	Analyze	3
3	9	20	2	Analyze	L4	PO2	Analyze	3
4	9	20	2	Evaluate	L5	PO3	Evaluate	3
5	9	20	2	Create	L6	PO3	Create	3

**CO1:** Apply the applications to quantum systems through the study of vector spaces, inner products, and linear operators.

**Action Verb: Apply(L3)**

PO1 Verbs: Apply (L3)

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

**CO2:** Analyze the transition from finite to infinite dimensional systems with linear algebra concepts to function spaces.

**Action Verb: Analyze (L4)**

PO2 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO3:** Analyze the quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.

**Action Verb: Analyze (L4)**

PO1 Verb: Apply (L3)

CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO4:** Evaluate the statistical interpretations through quantum mechanical principles to solve problems in simple quantum systems.

**Action Verb: Evaluate (L5)**

PO3 Verb: Evaluate (L5)

CO4 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).

**CO5:** Create the understanding of measurement processes and modern quantum theory from the advanced concepts in composite systems.

**Action Verb: Create (L6)**

PO3 Verb: Create (L6)

CO5 Action verb is equal to PO3 verb; therefore the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Physics Of Electronic Materials And Devices (Open Elective-II)	L	T	P	C
23AOE9907	III-II		2	1	0	3

**Course Outcomes (CO):** At the end of the course students will be able to

1. Understand the fundamentals of crystal growth and thin films.
2. Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.
3. Understand the basics of Semiconductors for Engineering Applications.
4. Analyze the concepts of excitons and luminescence in Semiconductors.
5. Apply the fundamentals of semiconductors for various display devices.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	The fundamentals of crystal growth and thin films.			L2
2	Analyze	The charge carrier dynamics in semiconductors by implementing the equations of state.			L4
3	Understand	The basics of Semiconductors for Engineering Applications.			L2
4	Analyze	The concepts of excitons and luminescence in Semiconductors.			L4
5	Apply	The fundamentals of semiconductors for various display devices.			L3

**UNIT I Fundamentals of Materials Science**

**9 Hrs**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

**UNIT II Semiconductors**

**9 Hrs**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

**UNIT III Physics of Semiconductor Devices:**

**9 Hrs**

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

**UNIT IV Excitons and Luminescence:**

**9 Hrs**

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials. Photoluminescence : General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot. Electro-luminescence : General Principles of electroluminescence, light emitting diode, diode laser.

**UNIT V Display devices :**

**9 Hrs**

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

**Textbooks:**

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4th edition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

**Reference Books:**

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012.

NPTEL course links:

1. <https://nptel.ac.in/courses/113/106/113106062/>
2. [https://onlinecourses.nptel.ac.in/noc20\\_ph24/preview](https://onlinecourses.nptel.ac.in/noc20_ph24/preview)

**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	9	20	2	Understand	L2	PO1, PO5	PO1: Apply (L3)	2
2	9	20	2	Analyze	L4	PO1, PO2	PO1: Apply (L3)	3
3	9	20	2	Understand	L2	PO1, PO5	PO1, PO5: Apply (L3)	2
4	9	20	2	Analyze	L4	PO1, PO5	PO1, PO5: Apply (L3)	3
5	9	20	2	Apply	L3	PO1	PO1: Apply (L3)	3

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2				2								
2	3	3											
3	2				2								
4	3				3								
5	3												

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

**CO1: Understand the fundamentals of crystal growth and thin films.**

**Action Verb: Understand (L2)**

PO1 & PO5 Verbs: Apply (L3)

CO1 Action Verb is lesser than PO1 and PO5 verbs by one level; Therefore, correlation is moderate (2).

**CO2: Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.**

**Action Verb: Analyze (L4)**

PO1 & PO2 Verbs: Apply (L3)

CO2 Action Verb is greater than PO1 and PO2 verbs; Therefore correlation is high (3).

**CO3: Understand the basics of Semiconductors for Engineering Applications.**

**Action Verb: Understand (L2)**

PO1 and PO5 Verbs: Apply (L3)

CO3 Action Verb is less than PO1 and PO5 verb by one level; Therefore correlation is moderate (2).

**CO4: Analyze the concepts of excitons and luminescence in Semiconductors.**

**Action Verb: Analyze (L4)**

PO1 Verb and PO5 verbs: Apply (L3)

CO4 Action Verb is greater than PO1 and PO5 verbs by one level; Therefore, correlation is high (3).

**CO5: Apply the fundamentals of semiconductors for various display devices.**

**Action Verb: Analyze (L4)**

PO1 : Apply (L3)

CO5 Action verb is equal to PO1 verb; therefore, the correlation is high (3).

**This course syllabus has been approved by the Board of Studies-PHYSICS**



ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)

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

Course Code	Year & Sem	Chemistry of Polymers and Applications	L	T/CLC	P	C
23AOE9912	III-II	(Open Elective-II)	2	1	0	3

**Course Outcomes (CO):** At the end of the course students will be able to

1. Understand polymer fundamentals and classification systems.
2. Analyze the chemical and physical properties of natural polymers and their applications.
3. Apply the knowledge of thermoplastic and thermoset polymers in practical situations.
4. Understand the fundamental principles of hydrogel in polymer networks.
5. Analyze the preparation and mechanism of conducting and degradable polymers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	polymer fundamentals and classification systems.			L2
2	<b>Analyze</b>	the chemical and physical properties of natural polymers and their applications.			L4
3	<b>Apply</b>	the knowledge of thermoplastic and thermoset polymers in practical situations			L3
4	<b>Understand</b>	the fundamental principles of hydrogel in polymer networks.			L2
5	<b>Analyze</b>	the fundamental principles of hydrogel in polymer networks			L4

Unit – I: Polymers-Basics and Characterization:-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit – II: Natural Polymers & Modified cellulose

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulose: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit – III: Synthetic Polymers

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit-IV: Hydrogels of Polymer networks

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Unit – V: Conducting and Degradable Polymers:

**Conducting polymers:** Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

**Degradable polymers:** Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

References Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3												
2	3												
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)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1		9	20	2	<b>Understand</b>	<b>L2</b>	PO1	PO1: Apply (L3)	2
2		9	20	2	<b>Analyze</b>	<b>L4</b>	PO1	PO1: Apply (L3)	3
3		9	20	2	<b>Apply</b>	<b>L3</b>	PO1	PO1: Apply (L3)	3
4		9	20	2	<b>Understand</b>	<b>L2</b>	PO1	PO1: Apply (L3)	3
5		9	20	2	<b>Analyze</b>	<b>L4</b>	PO1	PO1: Apply (L3)	3

**CO1:** Understand polymer fundamentals and classification 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).

**CO2:** Analyze the chemical and physical properties of natural polymers and their applications

**Action Verb: Analyze(L4)**

PO1 Verbs: Apply (L3)

CO2 Action Verb is less than PO1 verb; Therefore correlation is moderate (2).

**CO3:** Apply the knowledge of thermoplastic and thermoset polymers in practical situations.

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO4:** Understand the fundamental principles of hydrogel in polymer networks.

**Action Verb: Understand (L2)**

PO1 Verb: Apply (L3)

CO3 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

**CO5** Analyze the preparation and mechanism of conducting and degradable polymers

**Action Verb: Analyze (L4)**

PO1 Verb: Apply (L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

**This course syllabus has been approved by the Board of Studies-CHEMISTRY**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Academic Writing and Public Speaking	L	T/CLC	P	C
23AOE9916	III-II	(Open Elective-II)	2	1	0	3

Pre-Requisites		Semester	<b>II</b>
<b>Course Outcomes (CO):</b> Student will be able to			
CO1: Apply the essential features of Academic Writing in scholarly works.		L3	
CO2: Apply the strategies of writing skills in research paper writing without plagiarism.		L3	
CO3: Create a coherent and well-organized paragraphs in essays, reports, reviews and SOP.		6	
CO4: Analyze the characteristics and strategies of public speaking skills for impactful speeches.		L4	
CO5: Apply non-verbal communication skills for effective public speaking..		L3	

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the essential features of Academic Writing in scholarly works			L3
2	Apply	the strategies of writing skills in research paper writing without plagiarism.	without plagiarism.		L3
3	Create	a coherent and well-organized paragraphs in essays, reports, reviews and SOP			L6
4	Analyze	the characteristics and strategies of public speaking skills for impactful speeches.		for impactful speeches.	L4
5	Apply	non-verbal communication skills for effective public speaking..		for effective public speaking..	L3

UNIT - I	Introduction to Academic Writing	Lecture Hrs
Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing		
UNIT - II	<b>Academic Journal Article</b>	Lecture Hrs
Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism		
UNIT - III	<b>Essay &amp; Writing Reviews</b>	Lecture Hrs
Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP		
UNIT - IV	<b>Public Speaking</b>	Lecture Hrs
Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events		
UNIT - V	<b>Public Speaking and Non-Verbal Delivery</b>	Lecture Hrs
Body Language – Facial Expressions-Kinesics – Oculistics – Proxemics – Haptics – Chronemics - Paralanguage - Signs		
<b>Textbooks:</b>		
3. <i>Critical Thinking, Academic Writing and Presentation Skills</i> : MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)		
4. Pease, Allan & Barbara. <i>The Definitive Book of Body Language</i> RHUS Publishers, 2016		
<b>ference Books:</b>		
1. <u>Alice Savage, Masoud Shafiei</u> <i>Effective Academic Writing</i> , 2Ed., 2014 .sserPytisrevinU drofxO		
2. Shalini Verma, <i>Body Language</i> , S Chand Publications 2011.		
3. Sanjay Kumar and Pushpalata, <i>Communication Skills 2E</i> 2015, Oxford.		
4. Sharon Gerson, Steven Gerson, <i>Technical Communication Process and Product</i> , Pearson, New Delhi, 2014		
5. <i>Elbow, Peter. Writing with Power. OUP USA, 1998</i>		

Online Learning Resources:

1. <https://youtu.be/NNhTIT81nH8>
2. <https://www.youtube.com/watch?v=478ccrWKY-A>
3. <https://www.youtube.com/watch?v=nzGo5ZC1gMw>
4. <https://www.youtube.com/watch?v=Qve0ZBmJMh4>
5. <https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/>
6. [https://onlinecourses.nptel.ac.in/noc21\\_hs76/preview](https://onlinecourses.nptel.ac.in/noc21_hs76/preview)
7. <https://archive.nptel.ac.in/courses/109/107/109107172/#>
8. <https://archive.nptel.ac.in/courses/109/104/109104107/>

**Correlation of COs with the POs & PSOs for B.Tech  
AK-23 Regulations**

**\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated**

Course Title	Course Outcomes COs	PO	PO	PO3	PO	PO	PO	PO	PO	PO9	PO	PO
		1	2		4	5	6	7	8		10	11
<b>ACADEMIC WRITING AND PUBLIC SPEAKING OPEN ELECTIVE - II</b>	CO1									2		
	CO2									2		
	CO3									3		
	CO4									3		3
	CO5									2		2

**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	9	20	2				Thumb Rule	
2	9	20	2				Thumb Rule	
3	9	20	2				Thumb Rule	
4	9	20	2				Thumb Rule	
5	9	20	2				Thumb Rule	

**CO1:** Apply the essential features of Academic Writing in scholarly works.

**Action Verb: Apply (L3)**

CO1 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

**CO2:** Apply the strategies of writing skills in research paper writing without plagiarism.

CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

**CO3:** Create a coherent and well-organized paragraphs in essays, reports, reviews and SOP.

CO3 Action Verb Create is of BTL 6. Using Thumb rule, L6 correlates PO6 to PO11 as high (3).

**CO4:** Analyze the characteristics and strategies of public speaking skills for impactful speeches.

**Action Verb: Analyze (L4)**

CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

**CO5:** Apply non-verbal communication skills for effective public speaking.

**Action Verb: Apply (L3)**

CO5 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).



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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
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Course Code	Year & Sem	Advanced Operations Research (Open Elective II)	L	T	P	C
23AOE9902	III-II		2	1	0	3

**Course Outcomes (CO): Student will be able to**

1. Understand the concepts of linear programming in solving practical problems in industry.
2. Analyze the transportation models to trace the solutions to the real-world problems.
3. Apply mathematical skills to solve nonlinear programming models arising from a wide range of applications.
4. Apply the concept of non-linear programming for solving non-linear constraints.
5. Apply the concept of unconstrained geometric programming for solving the non-linear constraints.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	the concepts of linear programming	in solving practical problems in industry.		L2
2	<b>Analyze</b>	the transportation models	to trace the solutions	to the real-world problems.	L4
3	<b>Apply</b>	mathematical skills	to solve nonlinear programming models	arising from a wide range of applications.	L3
4	<b>Apply</b>	the concept of non-linear programming	for solving non-linear constraints.		L3
5	<b>Apply</b>	the concept of unconstrained geometric programming	for solving the non-linear constraints.		L3

**UNIT – I: Linear programming I**

**9 hours**

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming.

**UNIT-II : Linear programming II: Duality in Linear Programming**

**9 hours**

Simplex Method, Simplex Algorithm and, Big-M method. Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method.

**UNIT – III : Linear programming III**

**9 hours**

Transportation Problem and assignment problem, Complementary slackness Theorem.

**UNIT – IV : Non-linear programming: Unconstrained optimization techniques**

**9 hours**

Introduction: Classification of Unconstrained minimization methods,

**Direct Search Methods:** Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method.

**UNIT – V : Non-linear programming: Constrained optimization techniques**

**9 hours**

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

**TEXT BOOK:**

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

**REFERENCES:**

- Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
- Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

**Web Reference:**

- [https://onlinecourses.nptel.ac.in/noc24\\_ee122/preview](https://onlinecourses.nptel.ac.in/noc24_ee122/preview)
- <https://archive.nptel.ac.in/courses/111/105/111105039/>
- [https://onlinecourses.nptel.ac.in/noc21\\_ce60/preview](https://onlinecourses.nptel.ac.in/noc21_ce60/preview)

### Mapping of COs to POs

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

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

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	9	20%	2	Understand	L2	PO2	Analyze	1
2	9	20%	2	Analyze	L4	PO2	Analyze	3
3	9	20%	2	Apply	L3	PO1	Apply	3
4	9	20%	2	Apply	L3	PO1	Apply	3
5	9	20%	2	Apply	L3	PO1	Apply	3

**CO1:** Understand the concepts of linear programming in solving practical problems in industry.

**Action Verb: Understand (L2)**

PO2 Verbs: Analyze (L4)

CO1 Action Verb is two levels low to PO2 verb ; Therefore correlation is low (1).

**CO2:** Analyze the transportation models to trace the solutions to the real-world problems.

**Action Verb: Analyze (L4)**

PO2 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO3:** Apply mathematical skills to solve nonlinear programming models arising from a wide range of applications.

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO4:** Apply the concept of non-linear programming for solving non-linear constraints.

**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 concept of unconstrained geometric programming for solving the non-linear constraints.

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb; Therefore the correlation is high (3).

**This course syllabus has been approved by the Board of Studies-HUMANITIES**



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER SECURITY  
INCLUDING BLOCKCHAIN TECHNOLOGY)**

Course Code	Year & Sem	Cloud Computing Lab	L	T	P	C
23APC3611	III-II		0	0	3	1.5

<b>Pre-Requisites</b>		<b>Semester</b>	II
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Apply</b> virtualization and development tools by installing virtual machines, operating systems, and compilers to execute basic programs and cloud SDKs.		
<b>CO2</b>	<b>Evaluate</b> cloud environments by simulating cloud scenarios using CloudSim and implementing custom scheduling algorithms.		
<b>CO3</b>	<b>Apply</b> virtual machine management techniques by transferring files between VMs and launching cloud instances using TryStack		
<b>CO4</b>	<b>Create</b> and deploy cloud-based applications using Hadoop, Google App Engine, and AWS cloud services		
<b>CO5</b>	<b>Design</b> cloud-based solutions for real-world applications such as recommendation systems, traffic management, e-learning, attendance and chatbot systems		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	virtualization and development tools	to execute basic programs and cloud SDKs	by installing virtual machines, operating systems, and compilers	L3
CO2	Evaluate	cloud environments by simulating cloud scenarios		using CloudSim and implementing custom scheduling algorithms.	L5
CO3	Apply	virtual machine management techniques	using TryStack	by transferring files between VMs and launching cloud instances	L3
CO4	Create	deploy cloud-based applications		using Hadoop, Google App Engine, and AWS cloud services	L6
CO5	Design	cloud-based solutions	recommendation systems, traffic management, e-learning, attendance and chatbot systems	solutions for real-world applications	L6

**List of Experiments:**

1. Install Virtual Box/VMware Workstation with different flavours of Linux or windows OS on top of windows operating systems.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in Cloud Sim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count
9. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
10. Develop a Guestbook Application using Google App Engine
11. Develop a Server less Web App using AWS
12. Design a Content Recommendation system using AWS
13. Design a Cloud based smart traffic management system

14. Design Cloud based attendance management system
15. Design E-learning cloud-based system
16. Using Amazon Lex build a Chatbot
<b>References</b>
1. <a href="https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html">https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html</a> .
2. <a href="http://code.google.com/appengine/downloads.html">http://code.google.com/appengine/downloads.html</a>
3. <a href="http://code.google.com/appengine/downloads.html">http://code.google.com/appengine/downloads.html</a>
<b>Online Learning Resources/Virtual Labs:</b>
Google Cloud Computing Foundations Course - Course (nptel.ac.in)

### Correlation of COs with the POs & PSOs for B.Tech

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2			1			1	1		3
CO2	2		1	1				1			2
CO3	3				1			1			3
CO4			2		1				1		
CO5			3		1			1			

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

### CO-PO mapping justification:

Unit No.	CO					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	3	CO1: Apply	L3	P01 P02 P05 P08 P09	P01: Apply (L3) P02: Review (L2) P05: Apply (L3) P08: Thumb Rule P09: Thumb Rule	3 2 3 3 3
2	9	20%	2	CO2: Evaluate	L5	P01 P03 P04 P08	P01: Apply (L3) P03: Develop (L6) P04: Design (L6) P08: Thumb Rule	1 2 2 3
3	9	20%	2	CO3: Apply	L3	P01 P05 P08	P01: Apply (L3) P05: Apply (L3) P08: Thumb Rule	3 3 3
4	9	20%	2	CO4: Create	L6	P03 P05 P09	P03: Develop (L6) P05: Create (L6) P09: Thumb Rule	3 3 3
5	9	20%	2	CO5: Design	L6	P03 P05 P08	P03: Develop (L6) P05: Create (L6) P08: Thumb Rule	3 3 3
	48	100						

### Justification Statements:

**CO1: Apply** virtualization and development tools by installing virtual machines, operating systems, and compilers to execute basic programs and cloud SDKs

#### 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 moderate (2)

**PO5 Verb: Apply(L3)**

CO1 Action verb is same as PO5 verb. Therefore the correlation is high(3)

**PO8 Verb:Thumb Rule**

Installing virtual machines,operating systems and compliers for exēcuting effectively as work individually as a member.Then the correlation is High(3)

**PO9 Verb:Thumb Rule**

Virtualization and development tools are installing for Communicate effectively within the engineering community and society .Then the correlation is high(3)

**CO2: Evaluate** cloud environments by simulating cloud scenarios using CloudSim and implementing custom scheduling algorithms.

**Action Verb: Evaluate (L5)****PO1 action verb Apply(L3)**

CO2 action verb is two level greater then PO1.Then the correlation is low(1)

**PO3 action verb:Develop(L6)**

CO2 action verb is less then PO2.Then the correlation is moderate(2)

**PO4 action verb :Design(L6)**

CO2 action verb is less than PO4.Then the correlation is moderate(2)

**PO8 action verb:Themb Rule**

Evaluate cloud environments as individual and as a member.Then the correlation is High(3)

**CO3: Apply** virtual machine management techniques by transferring files between VMs and launching cloud instances using TryStack

**Action Verb: Apply (L3)****PO1 verb:Apply(L3)**

CO3 Action Verb is same as PO1.Then the correlation is high(3)

**PO5 verb:Apply(3)**

CO3 action verb is same as PO5.Then the correlation is high(3)

**PO8 verb:Thumb Rule**

Apply virtual machine management techniques to transfer files between VMs and launching cloud instances effectively work as an individual and as a member.Then the correlation is High(3)

**CO4: Create** and deploy cloud-based applications using Hadoop,Google App Engine,and AWS cloud services

**Action Verb: Create (L6)****PO3 verb:Develop(L6)**

CO4 action verb is same as PO3.Then the correlation is high(3)

**PO5 verb:Create(L6)**

CO4 action verb is same as PO5.Then the correlation is high(3)

**PO9 verb:Thumb Rule**

Create and develop cloud based applications effectively within the engineering and society.Then the correlation is High(3)

**CO5: Design** cloud-based solutions for real-world applications such as recommendation systems,traffic management,e-learning,attendance and chatbot systems

**Action Verb: Design(L6)****PO3 verb:Develop(L6)**

CO5 Action Verb is same as PO3 .Then the correlation is high(3)

**PO5 verb:Create(L6)**

CO5 action verb is same as PO5.Then the correlation is high(3)

**PO8 verb:Thumb Rule**

Designing the cloud based solutions for real world applications as effectively work as an individual and as a member.Then the correlation is High(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS AND CYBER  
SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**

<b>Course Code</b>	<b>Year &amp; Sem</b>	<b>Blockchain Technology Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
23APC3612	III-II		0	0	3	1.5

<b>Pre-Requisites</b>		<b>Semester</b>	
<b>Course Outcomes (CO):</b> Student will be able to			
<b>CO1</b>	<b>Create</b> and implement such fundamental block chain structures as Merkle trees and basic blocks to analyze data integrity and block linking using cryptographic hashing		
<b>CO2</b>	<b>Develop</b> and deploy a simplified block chain and ERC-20 smart contract to demonstrate block linking, validation, and token transactions on a test network on a test network.		
<b>CO3</b>	<b>Implement</b> a Merkle tree in java to analyze transaction hashing and evaluate performance with large datasets		
<b>CO4</b>	<b>Create</b> a simple block chain in java that performs mining and shares data between nodes in a peer-to-peer network in a peer-to-peer network		
<b>CO5</b>	<b>Build</b> a simple cryptocurrency wallet to create keys and send signed transactions		

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Create	implement fundamental block chain structures	to analyze data integrity and block linking	using cryptographic hashing	L6
CO2	Develop	deploy a simplified block chain and ERC-20 smart contract	on a test network	to demonstrate block linking, validation, and token transactions	L6
CO3	Implement	Merkle tree in java	to analyze transaction hashing and evaluate performance with large datasets		L4
CO4	Create	simple block chain in java	in a peer-to-peer network	that performs mining and shares data between nodes	L6
CO5	Build	simple cryptocurrency wallet	to create keys and send signed transactions		L6

**List of Topics:**

**Week 1& 2: Creating a Merkle Tree**

- Objective: Understand the concept and structure of Merkle trees used in block chain.
- Tasks:
  - Write a program in Python/Java to generate a Merkle Tree.
  - Visualize the hash structure from leaf nodes to the root.
  - Demonstrate how a single change in data affects the root hash.

**Week 3 : Creation of a Basic Block**

- Objective: Learn to design and create a single block with essential components.
- Tasks:
  - Implement a basic block structure containing block ID, timestamp, data, previous hash, and current hash.
  - Show hash computation using SHA-256.
  - Link it with a previous dummy block to simulate chaining.

#### **Week 4 & 5: Block chain Implementation**

- Objective: Build a simplified block chain by linking multiple blocks.
- Tasks:
  - Write code to link blocks into a simple block chain.
  - Validate block integrity (no tampering) across the chain.
  - Display the entire block chain with hashes and timestamps.

#### **Week 6 & 7: Creating an ERC-20 Token (Ethereum)**

- Objective: Understand how crypto tokens are created on Ethereum.
- Tasks:
  - Write a smart contract in Solidity for an ERC-20 token.
  - Deploy it on a test net (e.g., Ropsten using Remix IDE).
  - Perform basic operations like transfer, approve, and balance check.

#### **Week 8 & 9: Merkle Tree with Java**

- Objective: Implement Merkle Tree in Java and explore its integration in block chains.
- Tasks:
  - Write a Java program to simulate transaction hashing and Merkle root generation.
  - Emphasize tree construction performance with a large dataset.

#### **Week 10 & 11: Implementing Mining in Block chain (Java)**

- Objective: Learn about Proof-of-Work and mining difficulty.
- Tasks:
  - Simulate mining by finding a hash with a specific number of leading zeros.
  - Implement nonce handling and performance measurement.

#### **Week 12 & 13: Peer-to-Peer (P2P) Block chain Simulation**

- Objective: Simulate how P2P block chain nodes communicate and share blocks.
- Tasks:
  - Use Java to implement a simple P2P block chain network with multiple simulated nodes.
  - Ensure data synchronization across nodes when new blocks are added.

#### **Week 14 & 15: Creating a Basic Cryptocurrency Wallet**

- Objective: Understand key generation, address creation, and transactions.
- Tasks:
  - Generate public/private key pairs.
  - Create a simple wallet UI (CLI or GUI) that stores keys and performs basic transaction signing.
  - Use Python libraries like bitcoinlib or JavaScript libraries like ethers.js.

#### **Textbook:**

1. Arshdeep Bahga and Vijay Madiseti, Blockchain Applications: A Hands-On Approach, VPT, 2017.

#### **Reference Books:**

1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media, 2017 (2nd Edition).
2. Imran Bashir, Mastering Block chain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, Packt Publishing, 2020 (3rd Edition).
3. Narayanan, Bonneau, Felten, Miller, and Goldfeder, Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2016.

**Correlation of COs with the POs & PSOs for B.Tech**

Course Outcomes COs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2		2						
CO2	3	2	3		3						
CO3	3	3	2	2	3						
CO4	3	2	3		3						
CO5	3	2	3		3						

(\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

**CO-PO mapping justification:**

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	12	26%	3	CO1:Create	L6	PO1 PO2 PO3 PO5	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L6) PO5:Create(L6)	- - 3 3
2	9	20%	2	CO2:Develop	L5	PO1 PO2 PO3 PO5	PO1:Apply(L3) PO2:Review(L2) PO3:Design(L6) PO5:Create(L6)	1 - 3 3
3	9	20%	2	CO3: Implement	L6	PO1 PO2 PO3 PO4 PO5	PO1:Apply(L3) PO2:Review(L2) PO3:Design(L6) PO4:Analyze(L4) PO5:Develop(L6)	- - 3 1 3
4	6	14%	2	CO4: Create	L6	PO1 PO2 PO3 PO5	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L6) PO5:Create(L6)	- - 3 3
5	9	20%	2	CO5: Build	L6	PO1 PO2 PO3 PO5	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L6) PO5:Create(L6)	- - 3 3
	48	100						

**Justification Statements:**

**CO1: Create** and implement such fundamental block chain structures as merkle trees and basic blocks to analyze data integrity and block linking using cryptographic hashing

**Action Verb: Create (L6)**

**PO1: Apply (L3)**

CO1 Action verb is greater than PO1 verb . Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

CO1 Action verb is two levels less than as PO2 verb. Therefore, the correlation is low (1)

**PO3: Design (L6)**

CO1 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Create(L6)**

CO1 Action verb is same as PO5 verb. Therefore, the correlation is high(3)

**CO2: Develop** and deploy a simplified block chain and ERC-20 smart contract to demonstrate block linking, validation, and token transactions on a test network on a test network.

**Action Verb: Develop(L5)**

**PO1: Apply (L3)**

CO2 Action verb is greater than PO1 verb . Therefore, the correlation is low (1)

**PO2: Review (L2)**

CO2 Action verb is two levels less than as PO2 verb. Therefore, the correlation is low (1)

**PO3: Develop (L5)**

CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Create(L6)**

CO2 Action verb is less than PO5 verb. Therefore, the correlation is high(L6)

**CO3:Implement** a Merkle tree in java to analyze transaction hashing and evaluate performance with large datasets

**Action Verb: Implement (L6)**

**PO1: Apply (L3)**

CO3 Action verb is greater than PO1 verb . Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

CO3 Action verb is two levels less than as PO2 verb. Therefore, the correlation is low (1)

**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 PO4 verb. Therefore, the correlation is low(1)

**PO5: Develop(L6)**

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high(3)

**CO4: Create** a simple block chain in java that performs mining and shares data between nodes in a peer-to-peer network in a peer-to-peer network

**Action Verb: Create(L6)**

**PO1: Apply (L3)**

CO4 Action verb is less than PO1 verb . Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

CO4 Action verb is two levels less than as PO2 verb. Therefore, the correlation is low (1)

**PO3: Develop (L6)**

CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Create(L6)**

CO4 Action verb is same as PO5 verb. Therefore, the correlation is high(3)

**CO5:Build** a simple cryptocurrency wallet to create keys and send signed transactions

**Action Verb: Build (L6)**

**PO1: Apply (L3)**

CO5 Action verb is less than PO1 verb . Therefore, the correlation is moderate (2)

**PO2: Review (L2)**

CO5 Action verb is two levels less than as PO2 verb. Therefore, the correlation is low (1)

**PO3: Develop (L6)**

CO5 Action verb is less than PO3 verb. Therefore, the correlation is moderate (2)

**PO5: Create(L6)**

CO5 Action verb is same as PO5 verb. Therefore, the correlation is high(3)



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

Course Code	Year & Sem	Full Stack Development -2 Skill Enhancement Course	L	T	P	C
23ASC3601	III-II		0	1	2	2

**Course Outcomes:**

After Studying the Course Student will able to

Pre-Requisites	Semester
<b>Course Outcomes (CO):</b> Student will be able to	
<b>CO1</b>	<b>Understand the</b> Structure and working of DOM, basic ES6 concepts.
<b>CO2</b>	<b>Analyze</b> the differences between Real DOM and Virtual DOM in terms of performance.
<b>CO3</b>	<b>Apply</b> key React.js concepts and the Fetch API to develop interactive web applications.
<b>CO4</b>	<b>Apply</b> database connectivity using MySQL in web applications.
<b>CO5</b>	<b>Design</b> dynamic backend systems by integrating MySQL databases with Express.js servers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Structure and working of DOM, basic ES6 concepts.			L2
CO2	Analyze	the differences between Real DOM and Virtual DOM		in terms of performance.	L4
CO3	Apply	key React.js concepts and the Fetch API		to develop interactive web applications.	L3
CO4	Apply	database connectivity	using MySQL in web applications.		L3
CO5	Design	dynamic backend systems by integrating MySQL databases		with Express.js servers.	L6

**Sample Experiments:**

**1. Introduction to Modern JavaScript and DOM[CO1]**

- Write a JavaScript program to link JavaScript file with the HTML page
- Write a JavaScript program to select the elements in HTML page using selectors
- Write a JavaScript program to implement the event listeners
- Write a JavaScript program to handle the click events for the HTML button elements
- Write a JavaScript program to With three types of functions
  - Function declaration
  - Function definition
  - Arrow functions

**2. Basics of React.js[CO1]**

- Write a React program to implement a counter button using react class components
- Write a React program to implement a counter button using react functional components
- Write a React program to handle the button click events in functional component
- Write a React program to conditionally render a component in the browser
- Write a React program to display text using String literals

**3. Important concepts of React.js[CO3]**

- Write a React program to implement a counter button using React use State hook
- Write a React program to fetch the data from an API using React use Effect hook
- Write a React program with two react components sharing data using Props.
- Write a React program to implement the forms in react
- Write a React program to implement the iterative rendering using map() function.

**4. Introduction to Node.js and Express.js[CO4]**

- Write a program to implement the ‘hello world’ message in the route through the browser using Express

- Write a program to develop a small website with multiple routes using Express.js
- Write a program to print the 'hello world' in the browser console using Express.js
- Write a program to implement the CRUD operations using Express.js
- Write a program to establish the connection between API and Database using Express - MySQL driver

### 5. Introduction to MySQL[CO5]

- Write a program to create a Database and table inside that database using MySQL Command line client
- Write a MySQL queries to create table, and insert the data, update the data in the table
- Write a MySQL queries to implement the subqueries in the MySQL command line client
- Write a MySQL program to create the script files in the MySQL workbench
- Write a MySQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API.

### Mapping of course outcomes with program outcomes

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

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

### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1:Understand	L2	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO11: Thumb rule	2 3 2 2
2	CO2:Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO9	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO9: Thumb rule	3 3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO4:Analyze (L4) PO5:Apply(L3) PO11: Thumb rule	3 3 3 2 3 2
4	CO4:Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO4:Analyze (L4) PO5:Apply(L3) PO11: Thumb rule	3 3 3 2 3 2
5	CO5:Design	L6	PO1 PO2 PO3 PO5 PO9 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3:Create(L6) PO5: Apply (L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3 3

### Justification Statements:

**CO1: Understand the** Structure and working of DOM, basic ES6 concepts.

**Action Verb : Understand (L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one, Therefore the correlation is moderate (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**PO5 Verb : Apply(L2)**

CO1 Action verb is less than PO5 verb by one, Therefore the correlation is moderate (2)

**PO11: Thumb rule**

Recognize the structures and working of DOM as life-long learning . Therefore the correlation is moderate (2)

**CO2: Analyze** the differences between Real DOM and Virtual DOM in terms of performance.

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO2 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

**PO2: Review (L2)**

CO2 Action verb is greater than level as PO2 verb by one. 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 PO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

CO2 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

**PO9: Thumb rule**

Communicate effectively and inclusively with real and virtual DOM learning differences . Therefore, the correlation is high (3)

**CO3: Apply** key React.js concepts and the Fetch API to develop interactive web applications.

**Action Verb: Apply (L3)**

**PO1: Apply(L3)**

CO3 Action verb is same level of 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(L2)**

CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze(L2)**

CO3 Action verb is less than of PO4 verb. Therefore the correlation is moderate (2)

**PO5: Apply(L3)**

CO3 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

Recognize the key concepts to develop interactive web applications as life-long learning . Therefore the correlation is moderate (2)

**CO4: Apply** database connectivity using MySQL in web applications.

**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)

**PO3: Develop(L2)**

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze(L2)**

CO4 Action verb is less than of PO4 verb. Therefore the correlation is moderate (2)

**PO5: Apply(L3)**

CO4 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

Learning database connectivity often requires consulting external resources, documentation, updates independently ,Therefore the correlation is moderate (2)

**CO5: Create** dynamic backend systems by integrating MySQL databases with Express.js servers.

**Action Verb: Create(L6)**

**PO1: Apply(L3)**

CO5 Action verb is same level of PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze(L4)**

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO3:Create(L6)**

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO5: Apply (L3)**

CO5 Action verb is same level of PO5 verb. Therefore the correlation is high (3)

**PO9: Thumb rule**

Backend projects are often team-based, requiring coordination and shared version control. Therefore the correlation is high (3)

**PO11: Thumb rule**

Requires continuous learning of evolving Node.js, Express, and MySQL technologies. Therefore the correlation is high (3)



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

Course Code	Year & Sem	Technical Paper Writing and IPR (Audit Course)	L	T	P	C
23AMC9902	III-II		2	0	0	0

**Course Outcomes:**

Pre-Requisites	Semester
<b>Course Outcomes (CO):</b> Student will be able to	
<b>CO1</b>	Understand various principles and styles of technical writing by avoiding confusion, repetition, unclear language and plagiarism.
<b>CO2</b>	Apply the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.
<b>CO3</b>	Apply the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.
<b>CO4</b>	Evaluate the rights and responsibilities of the holder of Intellectual Property.
<b>CO5</b>	Apply various forms of copy rights and patents at national and international levels.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	various principles and styles of technical writing by avoiding confusion, repetition, unclear language and plagiarism.	by avoiding confusion, repetition, unclear language and plagiarism.		L2
2	Apply	the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.	by organizing abstract, objectives, limitations, literature review to frame effective research questions.		L3
3	Apply	the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.		for paper writing.	L3
4	Evaluate	rights and responsibilities of holder of Patent, Copyright, trademark, International Trademark etc.			L5
5	Apply	various forms of copy rights and patents at national and international levels		At national and international levels	L3

**UNIT :1**

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings- discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

**UNIT - II:**

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature - Problems and Framing Research Questions- Synopsis

**UNIT – III:**

Process of research: publication mechanism: types of journals- indexing-seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules

**UNIT – IV:**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights  
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting technical evaluating trade mark, trade mark registration processes.

**UNIT – V:**

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law  
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer, Patent law, intellectual property audits.

**Textbooks:**

1. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. *Technical Communication: Principles and practices*. Oxford.

**Reference Books:**

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli, *Intellectual Property Rights* Tata Mcgraw Hill, 2001
3. P.Naryan, *Intellectual Property Law*, 3rd Ed, Eastern Law House, 2007.
4. Adrian Wallwork. *English for Writing Research Papers* Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, *Technical Writing Style*

**Online Resources**

1. <https://theconceptwriters.com.pk/principles-of-technical-writing/>
2. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWritin g.h tml>
3. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWritin g.h tml>
4. <https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/>
5. <https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf>
6. <https://lawbhoomi.com/intellectual-property-rights-notes/>
7. <https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf>

**Mapping of course outcomes with program outcomes**

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

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

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	CO1:Create	L6	PO9	PO9:Thumb rule	3
2	9	20%	2	CO2:Develop	L5	PO2	PO2:Review(L2)	2
3	9	20%	2	CO3: Implement	L6	PO9	PO9:Thumb rule	2
4	9	20%	2	CO4: Create	L6	PO11	PO11:Thumb rule	3
5	9	20%	2	CO5: Build	L6	PO11	PO11:Thumb rule	3
	45	100						

**CO1:** Understand various principles and styles of technical writing by avoiding confusion, repetition, unclear language and plagiarism.

**Action Verb: Understand (L2)**

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**CO2:**Apply the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.

**Action Verb: Apply (L3)**

CO2 Action Verb Apply is of BTL 3. L3 is equal to PO2, then correlation is high (3)

**CO3:** Apply the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.

**Action Verb: Apply (L3)**

CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

**CO4:** Evaluate the rights and responsibilities of the holder of Intellectual Property.

**Action Verb: Evaluate (L5)**

CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

**CO5:** Apply various forms of copy rights and patents at national and international levels.

**Action Verb: Apply (L3)**

CO5 Action Verb Analyse is of BTL 4. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

**This course syllabus has been approved by the Board of Studies- H & S**