Semester V (Third year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC3613	Cryptography and Network Security	3	0	0	3	30	70	100
2	PC	20APC3615	Embedded Systems and Internet of Things	3	0	0	3	30	70	100
3	PC	20APC3617	Fundamentals of Blockchain Technology	3	0	0	3	30	70	100
4	OE-1	20AOE9926 20AOE0303 20APC0213	Mathematical Modeling and Simulation Optimization Techniques Control Systems	3	0	0	3	30	70	100
5	PE-1	20APE3601 20APE3602 20APE3603	Software Engineering Distributed Database Automata Theory and Compiler Design	3	0	0	3	30	70	100
6	PC Lab	20APC3614	Cryptography and Network Security Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC3616	Embedded Systems and Internet of Things Lab	0	0	3	1.5	30	70	100
8	SC	20ASA0502	Soft Skills	1	0	2	2	100	0	100
9	MC	20AMC9901	Biology for Engineers	2	0	0	0	30	0	30
10	CSP	20CSP3601	Evaluation of Community Service Project	0	0	0	1.5	100	0	100
Total credits							**21.5**	**440**	**490**	**930**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4	0	0	0

Course Code	Cryptography and Network Security			L	T	P	C
20APC3613				3	0	0	3
Pre-requisite	Computer Networks		Semester	III - I			

Course Outcomes (CO):

CO1: Understand basic Cryptographic algorithm, Security issues
CO2: Identify various type of vulnerabilities of a computer network
CO3: Outline various Security algorithms.
CO4: Design secure system
CO5: Investigate the threads and identify the solution for the threats

UNIT – I	Introduction	9 Hrs

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT – II	Ciphers	9 Hrs

Symmetric key Ciphers: Block Cipher principles &Algorithms (DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4,Location and placement of encryption function, Key distribution Asymmetric key Ciphers: Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman,ECC), Key Distribution.

UNIT – III	Authentication	9 Hrs

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm.

UNIT – IV	Security	9 Hrs

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, combining security associations, key management.

UNIT – V	Virus and Firewall	9 Hrs

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls. Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections.

Textbooks:

1. William Stallings, "Cryptography and Network Security", 5th Edition, Pearson Education, 2011.
2. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Mc Graw Hill, 2010.
3. Bernard Menezes "Network Security and Cryptography", 1stEdition, CENGAGE Learning, 2010.

Reference Books:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc21_cs16/preview

Mapping of course outcomes with program outcomes

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

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

Course Code	Embedded Systems and Internet of Things		L	T	P	C
20APC3615			3	0	0	3
Pre-requisite	Digital Electronics and Microcontroller	Semester	III - I			

Course Outcomes (CO):

CO1: Understand the Fundamental Concept of Embedded System

CO2: Analyze TM4C Architecture, Instruction Set, addressing modes to develop programs for various applications using Assembly and Embedded C.

CO3: Develop an embedded system by interfacing the microcontrollers and IDE tools.

CO4: Understand the basic concept of Internet of Things.

CO5: Implement the IoT basic application by Arduino Microcontroller.

UNIT – I	Introduction To Embedded Systems	9

Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

UNIT – II	Embedded Processor Architecture	9

CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, addressing modes and instruction set basics.

UNIT – III	Overview Of Microcontroller And Embedded Systems	9

Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System.

UNIT – IV	Introduction to IoT	9

Introduction to Internet of Things: Characteristics of IoT, Design principles of IoT, IoT Architecture and Protocols, Enabling Technologies for IoT, IoT levels and IoT vs M2M. IoT Design Methodology: Design methodology, Challenges in IoT Design, IoT System Management, IoT Servers – Sensors.

UNIT – V	Arduino in IoT	9

Basics of Arduino: Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins -Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino- Connecting LEDs with Arduino, Connecting LCD with Arduino – Tinkercad arduino simulation.

Textbooks:

1. Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and the Internet of Things 4th ed. 2021 Edition by Peter Marwedel.
2. Embedded System A Complete Guide - 2020 Edition by Gerardus Blokdyk
3. Ti Tiva Arm Programming for Embedded Systems: Programming Arm Cortex-M4 Tm4c123g with C (Mazidi & Naimi Arm) Paperback, 2017.
4. Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications, 2016 by Adeel Javed.

Reference Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
3. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
4. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
5. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developers Guide", Morgan Kauffman/ Elsevier, 2006.
6. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", VPT, 2014.

Online Learning Resources:

https://nptel.ac.in/courses/128108016

Mapping of course outcomes with program outcomes

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

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

Course Code	Fundamentals of Blockchain Technology		L	T	P	C
20APC3617			3	0	0	3
Pre-requisite	nil		Semester		III - I	

Course Outcomes:

CO1: Understand the fundamentals of Money used in blockchain
CO2: Describe the basics of Blockchain
CO3: State Decentralization Architecture
CO4: Relate Bitcoin usage in Blockchain Technology
CO5: Implement Blockchain for various use cases

UNIT – I		9 Hrs

Money- Physical and Digital Money, How do we define money, History, Gold Standards, Fiat Currency and Intrinsic Value, Legal Tender, Currency Pegs, Quantitative Easing, How Are Interbank Payments Made?, E-Money Wallets, Cryptocurrencies, Digital Tokens

UNIT – II		9 Hrs

Introduction to Blockchain Technology - Growth, Distributed Systems, History, Types, Consensus, CAP theorem, How Blockchain Works, What Makes a Blockchain Suitable for Business?, Propelling Business with Blockchains, Recognizing Types of Market Friction, Moving Closer to Friction-Free Business Networks, What Are Blockchains Good For?, Initial Coin Offerings, Investing

UNIT – III		9 Hrs

Decentralization using Blockchain, Methods of Decentralization, Routes to Decentralization, Blockchain and full ecosystem decentralization, Decentralized Organizations, Platforms for decentralization

UNIT – IV		9 Hrs

Introducing Bitcoin – Bitcoin, Digital keys and addresses, Transactions, Blockchain, Mining, The bitcoin network, wallets, payments, innovation, installation

UNIT – V		9 Hrs

Blockchain in Action: Use Cases, Smart Contracts, Hyperledger, Ten Steps to Your First Blockchain application, Technical and non-technical limitations of the Blockchain,

Textbooks:

1. Antony Lewis, The Basics of Bitcoins and Blockchains, Published by Mango Publishing Group, a division of Mango Media Inc., 2018
2. Mastering Blockchain, Second Edition, Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir, Packt Publishing, 2018
3. Dr. Ravindhar Vadapallin, BLOCKCHAIN FUNDAMENTALS TEXT BOOK, Research Gate
4. Daniel Drescher, Blockchain basics a non-technical introduction in 25 steps, Apress publications, 2017

Reference Books:

1. Koshik Raj, Foundations of Blockchain: The pathway to cryptocurrencies and decentralized blockchain applications Paperback – 1 January 2019, Ingram Publishers
2. Bellaj Badr , Richard Horrocks   , Xun (Brian) Wu, Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger Paperback – 30 November 2018, Packt Publishing Limited
3. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency
Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

Online Learning Resources:

https://blockchainhub.net
https://blog.todotnet.com/2019/03/solving-real-world-problems-with-distributed-ledger-technology/
https://www.velmie.com/
https://www.udemy.com/course/build-your-blockchain-az/

Mapping of course outcomes with program outcomes

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

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

Course Code	Mathematical Modeling and Simulation	L	T	P	C
20AOE9926		3	0	0	3
Pre-requisite		Semester		III - I	

Course Outcomes (CO):

CO1: Develop various mathematical techniques in modeling and modeling in dynamics through O.D.E of First order.
CO2: Analyze a modelling in Epidemics through system of O.D.E of First order.
CO3: Correlate a Mathematical modeling of Circular motion and Motion of Satellites.
CO4: Construct mathematical modeling through difference equations and also through Functional equations and Integral equations.
CO5: Valuate the Simulation for given mathematical model in real problem.

UNIT – I	**Mathematical Modeling & Mathematical modeling Through Ordinary differential equations of First Order**	9 Hrs

Mathematical modeling Need, Techniques, Classifications and Simple illustrations.
Mathematical modeling Through Ordinary differential equations of First Order :
Mathematical modeling Through differential equations; Linear growth and decay models; Non-Linear Growth and Decay models; Mathematical modeling in dynamics through ordinary differential equations of first order.

UNIT – II	**Mathematical modeling Through System of Ordinary differential equations of First Order**	9 Hrs

Mathematical modeling in population dynamics; Mathematical modeling of Epidemics through system of ordinary differential equations of first order; Compartment models through Systems of ordinary differential equations; Mathematical modeling in dynamics through systems of ordinary differential equations of first order.

UNIT – III	**Mathematical modeling Through Ordinary differential equations of Second Order**	9 Hrs

Mathematical modeling of Planetary motion ; Mathematical modeling of Circular motion and motion of satellites; Mathematical modeling through linear differential equations of second order.

UNIT – IV	**Mathematical modeling Through Ordinary differential equations of Second Order**	9 Hrs

Need for Mathematical modeling Through Difference equations and simple models; Basic theory of Linear difference equations with constant coefficients; Mathematical modeling Through Difference equations in population dynamics and genetics; Mathematical modeling Through Difference equations in Probability theory.
Mathematical modeling Through Functional equations; Mathematical modeling Through Integral equations; Mathematical modeling Through Delay- Differential and Differential-Difference Equations.

UNIT – V	**Simulation**	9 Hrs

Bartering model, Basic optimization, Basic probability, Monte-Carlo simulation, Approaches to differential equation: Heun method, Local stability theory: Bernoulli Trials, General techniques for simulating continuous random variables, simulation from Normal and Gamma distributions, simulation from discrete probability distributions**.**

Textbooks:

1. J. N. Kapoor. Mathematical Modeling , NEW AGE INTERNATIONAL PUBLISHERS.
2. A. C. Fowler. Mathematical Models in Applied Sciences, Cambridge University Press.
3. J. N. Kapoor, Mathematical Modelling, Wiley Eastern Limited
.4 . S.M. Ross, Simulation, India Elsevier Publication

Reference Books:

1. A.M.Law and W.D.Kelton.. Simulation Modeling and Analysis, T.M.H. Edition.
2. Edward A. Bender., An Introduction to Mathematical Modelling.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc22_ch47/preview

Mapping of course outcomes with program outcomes

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

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

Course Code	Optimization Techniques			L	T	P	C
20AOE0303				3	0	0	3
Pre-requisite	Problem Solving Skills	Semester		III-I			

Course Objectives:

- Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).
- The problem formulation by using linear, dynamic programming, game theory and queuing models.
- The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.
- Formulation of mathematical models for quantitative analysis of managerial problems in industry.

Course Outcomes (CO):

CO 1: Explain the need of optimization of engineering systems
CO 2: Understand optimization of electrical and electronics engineering problems
CO 3: Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
CO 4: Apply unconstrained optimization and constrained non-linear programming and dynamic programming
CO 5: Formulate optimization problems.

UNIT - I	9 Hrs

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.
Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT - II	9Hrs

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.
Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method
and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT - III	9 Hrs

Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.

UNIT - IV	9 Hrs

Constrained Nonlinear Programming: Characteristics of a constrained problem - classification – Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT - V	9 Hrs

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

Textbooks:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

Reference Books:

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

Online Learning Resources:

https://www.youtube.com/watch?v=gw_ZEUjI9KM&list=PLYihddLF-CgZGDFVwB1v699kvl4FMeAr-

Mapping of course outcomes with program outcomes

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

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

Course Code	Control Systems			L	T	P	C
20APC0213				3	0	0	3
Pre-requisite	Basic Mathematics	Semester		III-I			

Course Objectives:

1. To understand all the concepts of control system.
2. To analyze about the response time.
3. To learn about stability analysis in time domain.
4. To analyze about the frequency response.
5. To understand about the state space analysis of continuous systems.

Course Outcomes (CO):

After Completion of this course, the student will be able to:
  CO1: Formulate Mathematical model and transfer function of the physical systems.
  CO2: Determine the stability of linear systems in time domain.
  CO3: Perform frequency domain analysis using bode and polar plot.
  CO4: Formulate and design state-space analysis.

UNIT - I	Control System Concepts	9 Hrs

Basic elements of control systems – open and close loop systems – Transfer function – Modeling of Electrical Systems and Mechanical Systems – Block diagram reduction techniques – Signal flow graphs.

UNIT - II	Time Response Analysis	9 Hrs

Step Response – Impulse Response – Time Response of first order systems – characteristics Equation of Feedback control systems – Transient Response of Second Order Systems – Time domain specifications – Steady State response – Steady State errors and error constants , P, PI, PID controllers.

UNIT - III	Stability Analysis in Time Domain	9 Hrs

Stability – concept and definition, Characteristic equation – Location of Poles – Routh Hurwitz criterian – The Root Locus concept – construction of root loci effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT - IV	Frequency Response Analysis	9 Hrs

Boder plot – Correlation between frequency domain and time domain specifications – Bode Diagrams – Determination of Frequency domain specifications and transfer function from the bode diagram- Stability analysis from Bode Plots – Polar Plots – Nyquist Plots – Phase margin and Gain Margin – Stability Analysis.

UNIT – V	State Space Analysis of Continuous Systems	9 Hrs

Concepts of State, State Variables and state models- differential equations & Transfer function models – Block diagrams, Diagonalization, Transfer function from state model – State Transition Matrix and its Propoerties – System response through State space Models - The C oncepts of controllability and Observability, Duality between controllability and observability.

Text Books:

1. Katsuhiko Ogata, "Modern Control Engineering:, 5th Edition, Prentice Hall India Ltd, 2010.
2. L.J. Nagrath and M.Gopal , "Control Systems Engineering" 5th edition, New International (P) Limited Publishers, 2007.

Reference Books:

1. M.Gopal, "Control Systems Principles & Design" 4th Edition, Mc Graw Hill Education 2012.
2. B.C Kuo and Farid Golnaraghi, "Automatic Control Systems" 8th edition, John V and Sons, 2003.
3. Joseph J Distefano III, "Feedback and Control Systems" Allen R Stubberud & Iv Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Graham C. Goodwin, " Control Systems Design Stefan F.Graebe and Mario E.Salg Pearson, 2000.
5. Gene F. Franklin, "Feedback Control of Dynamic Sysems" , J.D Powell and Abu Emami- Naeini, 6th Edition, Pearson, 2010.

Online Learning Resources:

NPTEL, SWAYAM

Mapping of course outcomes with program outcomes

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

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

Course Code	Software Engineering			L	T	P	C
20APE3601				3	0	0	3
Pre-requisite	NIL		Semester		III-I		

Course Objectives:

To learn the basic concepts of software engineering and life cycle models
- To explore the issues in software requirements specification and enable to write SRS documents for software development problems
- To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems
- To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- To reveal the basic concepts in software project management

Course Outcomes:

CO1: Characterize software engineering models
CO2: Focus on analysis in software project management
CO3: Design important features of software project management
CO4: Test the software specifications
CO5: Measure the software quality

UNIT - I	9 Hrs

Introduction: Evolution, Software Development Projects, Exploratory style of Software Development, Emergence, Notable Changes in Software Development Practices, Computer Systems Engineering
Software Life Cycle Models: A few basic concepts, Waterfall Model and its extensions, RAD, Agile Development Models, Spiral Model, Comparison

UNIT - II	9Hrs

Software Project Management: SPM complexities, Responsibility of a software Development Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO, Halstead's Software Science, Staffing Level-Estimation, Scheduling, Organization and Team Structures, Risk Management, Software Configuration Management
Requirement Analysis and Specification: Requirements Gathering and Analysis, SRS, Formal System Specification, Axiomatic Specification, Algebraic Specification, Executable Specification and 4GL

UNIT - III	9 Hrs

Software Design: Overview of the Design Process, Characterize good design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design
Function-oriented Software Design: Overview, Structured Analysis, Developing the DFD model of a system, Structured Design, Detailed Design and Review
User Interface Design: Characteristics, Basic Concepts, Types, Fundamentals of Component-based GUI Development, A UI Design Methodology

UNIT - IV	9 Hrs

Object Modeling Using UML: Unified Modeling Language (UML), UML Diagrams, Use Case Model, Class Diagrams, Interaction Diagrams, Activity Diagram, State Chart Diagram, Package, Component, and Deployment Diagrams
Coding and Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-box Testing, Debugging, Program Analysis Tools, Integration Testing, Testing Object-oriented Programs, System Testing, Issues associated with Testing

UNIT - V	9 Hrs

Software Reliability and Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model, Other Important Standards, Six Sigma
Software Reuse: What can be reused, Issues, A Reuse Approach, Reuse at Organization level
Emerging Trends: Client-Server Software, Architectures, CORBA, COM, DCOM, SOA, SAAS.

Textbooks:

1. Fundamentals of Software Engineering, Rajib Mall, PHI Learning, 5th edition
2. Software Engineering: A Practitioner's Approach, R S Pressman, McGraw Hill Education, 7th edition

Reference Books:

1. Software Engineering, Ian Sommerville, Pearson Education, Tenth edition
2. Pankaj Jalote's Software Engineering: A Precise Approach, Wiley publications

Online Learning Resources:

https://nptel.ac.in/courses/106/105/106105182/
http://peterindia.net/SoftwareDevelopment.html

Mapping of course outcomes with program outcomes

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

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

Course Code	Distributed database		L	T	P	C
20APE3602			3	0	0	3
Pre-requisite	DBMS	Semester	III - I			

Course Outcomes (CO):
CO1: Understand theoretical and practical aspects of distributed database systems.
CO2: Study and identify various issues related to the development of distributed database system.
CO3: Understand the design aspects of object-oriented database system and related development.

UNIT – I	Introduction	9

Introduction; Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas.
Distributed DBMS Architecture:
Architectural Models for Distributed DBMS, DDMBS Architecture.
Distributed Database Design:
Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.

UNIT – II	Query processing and decomposition	9

Query processing and decomposition:
Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data.
Distributed query Optimization:
Query optimization, centralized query optimization, distributed query optimization algorithms.

UNIT – III	Parallel Database System	9

Parallel architectures - Parallel query processing and optimization - load balancing – Parallel Measurement of database – Parallel Query Evaluation – database clusters.

UNIT – IV	Distributed DBMS Reliability	9

Reliability concepts and measures - fault-tolerance in distributed systems - failures in Distributed DBMS - local & distributed reliability protocols - site failures and network partitioning.

UNIT – V	Distributed object Database Management Systems	9

Distributed object Database Management Systems:
Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.
Object Oriented Data Model:
Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS.

Textbooks:

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

Reference Books:

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition.

Mapping of course outcomes with program outcomes

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

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

Course Code	AUTOMATA THEORY & COMPILER DESIGN			L	T	P	C
20APE3603				3	0	0	3
Pre-requisite	-		Semester		III - I		

Course Outcomes (CO):

CO1: understanding the basics of Formal Language and Regular Expressions.
CO2: understanding about parsing, syntax and control flow statement
Co3: know the concept of expressions and overloading functions
Co4: gain knowledge in run time storage.
Co5: generate code

UNIT – I		9

Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools. Context Free grammars and parsing : Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing

UNIT – II		9

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. Semantics : Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

UNIT – III		9

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT – IV		9

Run time storage : Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. Code optimization : Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT – V		9

Code generation : Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Blocks

Textbooks:

1. Introduction to Theory of computation.Sipser, 2nd Edition, Thomson.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education

Reference Books:

1. Modern Compiler Construction in C , Andrew W.Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V. Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L. Torczon, ELSEVIER.
6. Introduction to Formal Languages and Automata Theory and Computation - Kamala Krithivasan and Rama R, Pearson.
7. Modern Compiler Design, D. Grune and others, Wiley-India.
8. A Text book on Automata Theory, S. F. B. Nasir, P. K. Srimani, Cambridge Univ. Press.
9. Automata and Language, A. Meduna, Springer.

Mapping of course outcomes with program outcomes

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

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

Course Code	Cryptography and Network Security Lab			L	T	P	C
20APC3614				0	0	3	1.5
Pre-requisite	**Computer Networks Lab**		**Semester**		**III-I**		

Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPSec

Course Outcomes (CO):

CO1: Implement the cipher techniques
CO2: Develop the various security algorithms
CO3: Use different open source tools for network security and analysis
CO4: Configure and Implement Firewall
CO5: Implement Various Security Models and Tools

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
   a. Ceaser cipher   b. Substitution cipher   c. Hill Cipher
4. Write a C/JAVA program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.
12. a. How to setup firewall
    b. How to configure firewall
    c. How to disable firewall
13. How to configure PGP (**Pretty Good Privacy**)

References:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

Online Learning Resources/Virtual Labs:

https://onlinecourses.nptel.ac.in/noc21_cs16/preview

Mapping of course outcomes with program outcomes

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

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

Course Code	Embedded Systems and Internet of Things Lab		L	T	P	C
20APC3616			0	0	3	1.5
Pre-requisite	Computer Networks Lab	Semester			III-I	

Course Objectives:

1. To learn the different types of system and process controls in Automation.
2. To identify and study different control system components.
3. To understand simulation on controllers.
4. To demonstrate working of different actuating systems and sensors.
5. To learn and demonstrate IoT.

Course Outcomes (CO):

CO1: Interface peripherals like switches, LEDs, stepper motor etc
CO2: To Know the control of all embedded Components.
CO3: To apply the knowledge in real time applications.
CO4. To work on different actuating systems & sensors.
CO5. To understand technologies like IoT, machine languages.

List of Experiments:

1. Write a Embedded CProgram for configuration of GPIO ports for Input and Output operation (blinking LED's, push button interface)
2. Write a Embedded C Program for EK-TM4C123GXL Lunchpad and associated timer TSR to toggle onboard LED using interrupt programming technique.
3. Configure hibernation module of the TM4C123GH6PM microcontroller to place the device in low power state an hen to wake up the device on RTC (Real time Clock) Interrupt.
4. Configure in –build ADC of TM4C123GH6PM microcontroller and interface the potentiometer with EK- TM4C123GXL Launchpad to observe corresponding 12-bit digital value.
5. Learn and understand the gerneration of pulse width module (PWM) signal by configuring and programming the in-build PWM module of TM4C123GH6PM microcontroller.
6. Learn and understand interfacing of accelerometer in sensor hub booster pack with EK-TM4C123GXL Lunchpad using I2C.
7. To control the LED through android app by using Arduino and Bluetooth HC05.
8. Blink an LED with Arduino in Tinkercad
9. Multiple LEDs & Breadboards With Arduino in Tinkercad
10. Potentiometer with Arduino in Tinkercad
11. Fading led with arduino analog output in Tinkercad
12. RGB LED Color Mixing With Arduino in Tinkercad
13. Digital Input With a Pushbutton With Arduino in Tinkercad
14. Arduino Serial Monitor in Tinkercad
15. PIR Motion Sensor With Arduino in Tinkercad
16. Light Sensor (Photoresistor) With Arduino in Tinkercad
17. TMP36 Temperature Sensor With Arduino in Tinkercad
18. Ultrasonic Distance Sensor in Arduino With Tinkercad.

References:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", VPT, 2014
3. Michael J. Pont, "Embedded C", Pearson Education, 2007.
4. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
5. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developers Guide", Morgan Kauffman/ Elsevier, 2006.

Online Learning Resources/Virtual Labs:

https://onlinecourses.nptel.ac.in/noc21_cs16/preview

Mapping of course outcomes with program outcomes

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

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

Course Code	SOFT SKILLS			L	T	P	C
20ASA0502				1	0	2	2
Pre-requisite	Communicative English		Semester			III-I	

Course Objectives:

This course is designed to:
- To develop awareness in students of the relevance and importance of soft skills
- To provide students with interactive practice sessions to make them internalize soft skills
- To enable them to develop employability skills
- To provide knowledge of grammatical structures and vocabulary students and encourage their appropriate use in Speech and writing.

Course Outcomes :

CO1: Recognize the importance of verbal and non verbal skills
CO2: Develop the interpersonal and intrapersonal skills
CO3: Apply grammatical structures to formulate sentences and correct word forms.
CO4: Create trust among people and develop employability skills
CO5: Identify and apply communication skills effectively for professional

UNIT - I	9 Hrs

Grammar: Articles, Prepositions, Antonyms, Synonyms.

Vocabulary: Basics of Communication (Definition, Types of communication). Importance of body language in corporate culture, Body language (Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage – Tone, pitch, pause & selection of words), Impromptu speeches.

Articles:
Web links: https://learnenglish.britishcouncil.org/grammar/a1-a2-grammar/articles-1
    https://www.youtube.com/watch?v=ueEp6U8td1I
Prepositions:
Web links: https://www.grammarbook.com/grammar/probPrep.asp
Antonyms, Synonyms.
Web links: https://www.youtube.com/watch?v=-mLRoxWM8dI
    https://www.youtube.com/watch?v=IEOrOPVMxiM
    https://www.it.iitb.ac.in/~vijaya/ssrvm/worksheetscd/getWorksheets.com/Language%20Arts/syn_ant.pdf

Basics of Communication (Definition , Types of communication).
Web links: https://wikieducator.org/INTRODUCTION_TO_COMMUNICATION
 Importance of body language in Corporate culture
Web links:
https://www.forwardfocusinc.com/consciously-communicate/the-importance-of-body-language-in-the-workplace/

Body language (Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage –Tone, pitch, pause & selection of words)
Web links: https://open.lib.umn.edu/communication/chapter/4-2-types-of-nonverbal-communication/
    https://en.wikipedia.org/wiki/Nonverbal_communication
 Impromptu speeches.
Web links: https://www.write-out-loud.com/impromptu-public-speaking-topics.html;
    https://faculty.washington.edu/mcgarrit/COM220/online%20readings/sample%20critique.pdf

UNIT - II	9Hrs

Grammar: Tenses, Idioms and Phrases, One word substitutes.
Vocabulary: Public speaking - *Oral presentations*, writing skills – *Short Essay writing and E- mail writing.*
Tenses
Web links: https://www.englisch-hilfen.de/en/grammar/english_tenses.htmj; https://onlymyenglish.com/tenses/;
    https://www.englishpage.com/verbpage/verbtenseintro.html;
    https://www.englishclub.com/grammar/verb-tenses.htm
 Idioms and Phrases:
Web links: https://www.britannica.com/list/7-everyday-english-idioms-and-where-they-come-from
    https://eslexpat.com/english-idioms-and-phrases/;
    https://onlineteachersuk.com/english-idioms/;
 One word substitutes:
Web links: https://www.careerpower.in/one-word-substitution.html;
    https://www.hitbullseye.com/Vocab/One-Word-Substitute-List.php;
    https://englishan.com/one-word-substitution-set-1/;

Public speaking - *Oral presentations*
Web links:https://egyankosh.ac.in/bitstream/123456789/26773/1/Unit-14.pdf;
    https://www.skillsyouneed.com/rhubarb/preparing-oral-presentations.html;

https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-methods-of-delivery/	

Writing skills – *Short Essay writing and E-mail writing.*
Web links: https://www.kibin.com/essay-writing-blog/important-essay-writing-skills/
　　　　　https://www.scribendi.com/academy/articles/academic_essay_writing_skills.en.html ;
　　　https://www.microsoft.com/en-us/microsoft-365/business-insights-ideas/resources/improve-email-writing-skills;

UNIT - III	9 Hrs

Grammar : Direct and Indirect speeches, Active and Passive voice, Drawing inferences (reading
　　　　　comprehensions and listening comprehensions)
Vocabulary: Leadership Skills – Negotiation skills - Team-building – *Debate.* Leadership
　　　　　Skills – Negotiation skills - Team-building
Direct and Indirect speeches:
Web links: https://onlymyenglish.com/direct-and-indirect-speech/
　　　　　https://learnenglish.britishcouncil.org/grammar/b1-b2-grammar/reported-speech-1-statements
　　　　　https://www.perfect-english-grammar.com/reported-speech.html
Active and Passive voice,
Web links: https://www.englishclub.com/grammar/passive-voice.htm
　　　　　https://www.gingersoftware.com/content/grammar-rules/verbs/passive-voice/
　　　　　https://nps.edu/web/gwc/revising-passive-voice-into-active-voice
 Drawing inferences (reading comprehensions and listening comprehensions)
Web links: https://www.readingrockets.org/strategies/inference
　　　　　https://www.thoughtco.com/making-inferences-3111201
　　　　　https://www.comprehensionconnection.net/2019/03/exploring-difference-between-making.html
Vocabulary: Leadership Skills – Negotiation skills - Team-building – *Debate.*
Leadership Skills – Negotiation skills - Team-building
Web links: https://online.hbs.edu/blog/post/negotiation-skills
　　　　　https://www.bumc.bu.edu/facdev-medicine/files/2014/08/BUSM-Leasership-training.pdf
　　　　　https://in.indeed.com/career-advice/career-development/negotiation-skills
　　　　　https://www.thebalancecareers.com/what-is-team-building-1918270
Debate:
Web links: https://noisyclassroom.com/debate-topics/
　　　　　https://www.collegeessay.org/blog/debate-topics
　　　　　https://www.edu.gov.mb.ca/k12/cur/socstud/frame_found_sr2/tns/tn-13.pdf

UNIT - IV	9 Hrs

Grammar: Common errors, Rearrangement of sentences.
Vocabulary: Resume writing, Pre-interview preparation , Group discussion.
Common errors, Rearrangement of sentences:
Web links:
 https://www.letsstudytogether.co/sentence-arrangement-questions-pdf-for-banking-exams-ibps-sbi-po-and-clerk/
 https://www.youtube.com/watch?v=e8nO3zZzkZs
Vocabulary: Resume writing, Pre-interview preparation , Group discussion.
 Web links: https://www.youtube.com/watch?v=PfJg-67smf4
　　　　　https://www.youtube.com/watch?v=-lXjbph22Fk

UNIT - V	9 Hrs

 Grammar : Verbal ability tests.
 Vocabulary: Mock interviews, Post interview Etiquette.
Verbal ability tests.
 Web links: https://prepinsta.com/infosys-english-verbal-questions/
　　　　　https://www.indiabix.com/online-test/verbal-ability-test/random
　　　　　https://www.allindiaexams.in/online-test/online-general-english-test/61
Vocabulary: Mock interviews, Post interview Etiquette.
Web links: https://www.youtube.com/watch?v=ZOLCMa2QbdE
　　　　　https://www.ziprecruiter.com/blog/the-right-way-to-follow-up-after-a-job-interview/
　　　　　https://www.youtube.com/watch?v=KIoD19uoxt8

Textbooks:

 1. Robert M Sheffield, "Developing Soft Skills", Pearson, 2010.

Reference Books:

　　1. Barun K. Mitra, "Personality Development and Soft Skills", OXFORD Higher Education 2018.
　　2. Alka Wadkar, "Life Skills for Success", Sage publications 2016.
　　3. Diana Booher, "Communicate with Confidence" Tata mcgraw hill, 1994.
　　4. B.N. Gosh, "Managing Soft skills for Personality development", Tata mcgraw hill 2012.
　　5. Michael Swan, "Practical English Usage", Oxford publications.
　　6.Raymond Murphy, "English Grammar in Use", Cambridge 5th Edition
　　7. Norman Lewis, "Word Power Made Easy",   Penguin Publishers.

	8. Advanced Grammar in Use A Self-Study Reference and Practice Book for Advanced Learners of English 3rd Edition , Cambridge

Online Learning Resources:

https://www.youtube.com/watch?v=DUlsNJtg2L8&list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q

Mapping of course outcomes with program outcomes

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

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

Course Code	BIOLOGY FOR ENGINEERS		L	T	P	C
20AMC9901			2	0	0	0
Pre-requisite		Semester		III-I		

Course Objectives:

This course is designed to:
- To provide basic understanding about life and life process animals and plant system
- To understand what bio-molecules are their structure are function application of certain bio-molecules in industry
- Brief introduction about human physiology and bio engineering
- To understand hereditary units
- Brief introduction to the production of transgenic microbes, plants and animals

Course Outcomes :

CO1: Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.

CO2: Explain about biomolecules, their structure, function and their role in the living organisms. How biomolecules are useful in Industry.

CO3: Brief about human physiology.

CO4: Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.

CO5: Know about application of biological principles in different technologies for the production of medicines and pharmaceutical molecules through transgenic microbes, plants and animals.

UNIT - I	Introduction to Basic Biology	9 Hrs

Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification.

UNIT - II	Introduction to Biomolecules	9Hrs

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

UNIT - III	Human Physiology	9 Hrs

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

UNIT - IV	Introduction to Molecular Biology and recombinant DNA Technology	9 Hrs

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

UNIT - V	Application of Biology	9 Hrs

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basics of Production of Transgenic plants and animals.

Textbooks:

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

Reference Books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.

Online Learning Resources:

https://www.youtube.com/watch?v=qmK9CF3k4sc&list=PLdaynbt2YwqHUqHJrnb860xRWKiyBO29S

Mapping of course outcomes with program outcomes

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

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