

# **B.Tech. (Computer Technology)**

## **2022 Regulations, Curriculum & Syllabi**



### **BANNARI AMMAN INSTITUTE OF TECHNOLOGY**

An Autonomous Institution Affiliated to Anna University - Chennai • Approved by AICTE • Accredited by NAAC with "A+" Grade

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## **VISION OF THE DEPARTMENT**

To be the leader in the field of computer technology, fostering innovative thinking, promoting technological excellence, and driving digital transformation for the benefit of society.

## **MISSION OF THE DEPARTMENT**

- To build an innovative and problem-solving culture, empowering students to create cutting-edge computer technology solutions.
- To equip students for thriving careers in the technology industry through practical, hands-on learning experiences and industry-relevant skill development.
- To develop socially responsible students driving impactful digital transformations for the betterment of individuals, communities, and the environment.

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

- I. Engineering professionals, innovators, or entrepreneurs engaged in technology development, technology deployment, or engineering system implementation in industry.
- II. Capable of interacting with their peers in other disciplines in industry and society and contribute to the economic growth of the country.
- III. Successful in pursuing higher studies in engineering or management and pursue career paths in teaching or research.

### **PROGRAMME OUTCOMES (POs)**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

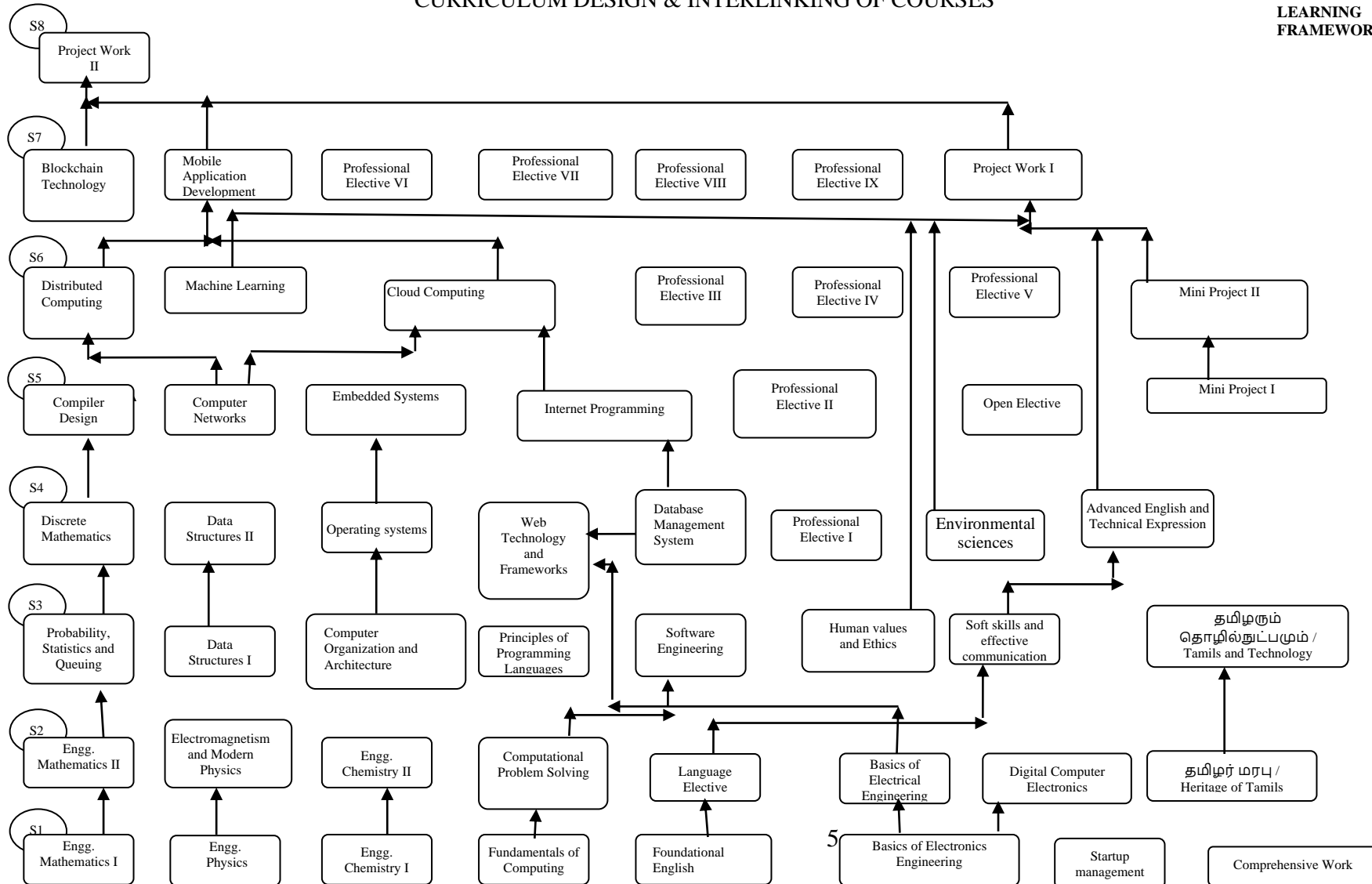
13. Demonstrate the knowledge and technical skills in software development.
14. Develop practical competencies in Software and Hardware Design

### **MAPPING OF PEOs AND Pos**

PEO(s)	Programme Outcomes(s)											
	1	2	3	4	5	6	7	8	9	10	11	12
I	X	X	X	X	X	X	X	X	X			
II	X	X	X	X	X	X		X	X	X	X	
III								X	X	X	X	X

**CONNECTIVITY CHART**  
**DEPARTMENT OF COMPUTER TECHNOLOGY**  
**CURRICULUM DESIGN & INTERLINKING OF COURSES**

**360° FLEXIBLE  
LEARNING  
FRAMEWORK**



B.Tech. Computer Technology										
Minimum Credits to be Earned: 163										
I SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22MA101	Engineering Mathematics I	3	1	0	4	4	40	60	100	BS
22PH102	Engineering Physics	2	0	2	3	4	50	50	100	BS
22CH103	Engineering Chemistry I	2	0	2	3	4	50	50	100	BS
22GE001	Fundamentals of Computing	3	0	0	3	3	40	60	100	ES
22HS001	Foundational English	1	0	2	2	3	100	0	100	HSS
22GE004	Basics of Electronics Engineering	2	0	2	3	4	50	50	100	ES
22HS002	Startup Management	1	0	2	2	3	100	0	100	HSS
22CT108	Comprehensive Work	0	0	2	1	2	100	0	100	EEC
Total		14	1	12	21	27	-	-	-	-
II SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22MA201	Engineering Mathematics II	3	1	0	4	4	40	60	100	BS
22PH202	Electromagnetism and Modern Physics	2	0	2	3	4	50	50	100	BS
22CH203	Engineering Chemistry II	2	0	2	3	4	50	50	100	BS
22GE002	Computational Problem Solving	3	0	0	3	3	40	60	100	ES
22GE003	Basics of Electrical Engineering	2	0	2	3	4	50	50	100	ES
22CT206	Digital Computer Electronics	3	0	2	4	5	50	50	100	ES
	Language Elective	1	0	2	2	3	100	0	100	HSS
*22HS003	தமிழர் மரபு / Heritage of Tamils	1	0	0	1	1	100	0	100	HSS
Total		17	1	10	23	28	-	-	-	-

\* The lateral entry students have to complete this course during IV semester.



THIRD SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22CT301	Probability, Statistics and Queuing Theory	3	1	0	4	4	40	60	100	ES
22CT302	Data Structures I	3	0	2	4	5	50	50	100	PC
22CT303	Computer Organization and Architecture	3	0	0	3	3	40	60	100	PC
22CT304	Principles of Programming Languages	3	0	2	4	5	50	50	100	PC
22CT305	Software Engineering	3	0	0	3	3	40	60	100	PC
22HS004	Human Values and Ethics	2	0	0	2	2	100	0	100	HSS
22HS005	Soft Skills and Effective Communication	0	0	2	1	2	100	0	100	HSS
22HS006	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	1	0	0	1	1	100	0	100	HSS
Total		18	1	6	22	25	-	-	-	-
FOURTH SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22CT401	Discrete Mathematics	3	1	0	4	4	40	60	100	ES
22CT402	Data Structures II	3	0	2	4	5	50	50	100	PC
22CT403	Operating Systems	3	1	0	4	4	40	60	100	PC
22CT404	Web Technology and Frameworks	2	0	2	3	4	50	50	100	PC
22CT405	Database Management System	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	-	-	-	3	-	-	-	100	PE
22HS007	Environmental Science	2	0	0	-	2	100	0	100	HSS
22HS008	Advanced English and Technical Expression	0	0	2	1	2	100	0	100	EEC
Total		-	-	-	23	-	-	-	-	-

FIFTH SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22CT501	Compiler Design	3	1	0	4	4	40	60	100	PC
22CT502	Computer Networks	3	0	2	4	5	50	50	100	PC
22CT503	Embedded Systems	3	0	0	3	3	40	60	100	PC
22CT504	Internet Programming	2	0	2	3	4	50	50	100	PC
	Professional Elective II	-	-	-	3	-	-	-	100	PE
	Open Elective	3	0	0	3	3	40	60	100	PE
22CT507	Mini Project I	0	0	2	1	2	100	0	100	EEC
Total		-	-	-	21	-	-	-	-	-
SIXTH SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22CT601	Distributed Computing	3	0	0	3	3	40	60	100	PC
22CT602	Machine Learning	3	0	2	4	5	50	50	100	PC
22CT603	Cloud Computing	3	0	2	4	5	50	50	100	PC
	Professional Elective III	-	-	-	3	-	-	-	100	PE
	Professional Elective IV	-	-	-	3	-	-	-	100	PE
	Professional Elective V	-	-	-	3	-	-	-	100	PE
22CT607	Mini Project II	0	0	2	1	2	100	0	100	EEC
Total		-	-	-	21	-	-	-	-	-

SEVENTH SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22CT701	Blockchain Technology	3	0	2	4	5	50	50	100	PC
22CT702	Mobile Application Development	3	0	2	4	5	50	50	100	PC
	Professional Elective VI	-	-	-	3	-	-	-	100	PE
	Professional Elective VII	-	-	-	3	-	-	-	100	PE
	Professional Elective VIII	-	-	-	3	-	-	-	100	PE
	Professional Elective IX	-	-	-	3	-	-	-	100	PE
22CT707	Project Work I	0	0	4	2	4	60	40	100	EEC
<b>Total</b>		-	-	-	<b>22</b>	-	-	-	-	-
EIGHTH SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22CT801	Project Work II	0	0	20	10	20	60	40	100	EEC
<b>Total</b>		<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>	<b>20</b>	-	-	-	-

ELECTIVES										
LANGUAGE ELECTIVE										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22HS201	Communicative English II	1	0	2	2	3	100	0	100	HSS
22HSH01	Hindi	1	0	2	2	3	100	0	100	HSS
22HSG01	German	1	0	2	2	3	100	0	100	HSS
22HSJ01	Japanese	1	0	2	2	3	100	0	100	HSS
22HSF01	French	1	0	2	2	3	100	0	100	HSS

ELECTIVES										
PROFESSIONAL ELECTIVES										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
VERTICAL I: DATA SCIENCE										
22CT001	Exploratory Data Analysis	2	0	2	3	4	50	50	100	PE
22CT002	Recommender Systems	3	0	0	3	3	40	60	100	PE
22CT003	Big Data Analytics	3	0	0	3	3	40	60	100	PE
22CT004	Neural Networks and Deep Learning	2	0	2	3	4	50	50	100	PE
22CT005	Natural Language Processing	3	0	0	3	3	40	60	100	PE
22CT006	Computer Vision	3	0	0	3	3	40	60	100	PE
VERTICAL II: FULL STACK DEVELOPMENT										
22CT007	Agile Software Development	3	0	0	3	3	40	60	100	PE
22CT008	UI and UX Design	3	0	0	3	3	40	60	100	PE
22CT009	Web Frameworks	3	0	0	3	3	40	60	100	PE
22CT010	Web Application Security	2	0	2	3	4	50	50	100	PE
22CT011	Software Testing and Automation	3	0	0	3	3	40	60	100	PE
22CT012	DevOps	3	0	0	3	3	40	60	100	PE
VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22CT013	Virtualization in Cloud Computing	3	0	0	3	3	40	60	100	PE
22CT014	Cloud Services and Data Management	3	0	0	3	3	40	60	100	PE
22CT015	Cloud Storage Technologies	3	0	0	3	3	40	60	100	PE
22CT016	Cloud Automation Tools and Applications	3	0	0	3	3	40	60	100	PE
22CT017	Software Defined Networks	2	0	2	3	4	50	50	100	PE
22CT018	Security and Privacy in Cloud	3	0	0	3	3	40	60	100	PE

<b>VERTICAL IV: CYBER SECURITY AND DATA PRIVACY</b>										
22CT019	Cyber Security	3	0	0	3	3	40	60	100	PE
22CT020	Modern Cryptography	3	0	0	3	3	40	60	100	PE
22CT021	Cyber Forensics	3	0	0	3	3	40	60	100	PE
22CT022	Ethical Hacking	3	0	0	3	3	40	60	100	PE
22CT023	Secure Software Systems	2	0	2	3	4	50	50	100	PE
22CT024	Malware Analysis	3	0	0	3	3	40	60	100	PE
<b>VERTICAL V: CREATIVE MEDIA</b>										
22CT025	Multimedia and Animation	2	0	2	3	4	50	50	100	PE
22CT008	UI and UX Design	3	0	0	3	3	40	60	100	PE
22CT026	Augmented Reality/Virtual Reality	2	0	2	3	4	50	50	100	PE
22CT027	Game Development	2	0	2	3	4	50	50	100	PE
22CT028	Video Creation and Editing	2	0	2	3	4	50	50	100	PE
22CT029	Digital Marketing	3	0	0	3	3	40	60	100	PE
<b>VERTICAL VI: EMBEDDED TECHNOLOGIES</b>										
22CT030	Real Time Operating System	3	0	0	3	3	40	60	100	PE
22CT031	Wireless and Mobile Communication	3	0	0	3	3	40	60	100	PE
22CT032	Design of Embedded Systems	2	0	2	3	4	50	50	100	PE
22CT033	Embedded System Networking	3	0	0	3	3	40	60	100	PE
22CT034	Embedded Security	3	0	0	3	3	40	60	100	PE
22CT035	Embedded Processor Development	3	0	0	3	3	40	60	100	PE

VERTICAL VII: DIVERSIFIED COURSES										
22CT036	XML and Web Services	3	0	0	3	3	40	60	100	PE
22CT037	Software Project Management	3	0	0	3	3	40	60	100	PE
22CT038	Human Computer Interaction	3	0	0	3	3	40	60	100	PE
22CT039	Visual Effects	3	0	0	3	3	40	60	100	PE
22CT040	Business Analytics	3	0	0	3	3	40	60	100	PE
22CT041	IoT and Use Cases	3	0	0	3	3	40	60	100	PE

HONOURS DEGREE (With Specialization)										
VERTICAL I: DATA SCIENCE										
Code No.	Course	L	T	P	C	Hour s/We ek	Maximum Marks			Categ ory
							CA	ES	Total	
22CTH01	Exploratory Data Analysis	2	0	2	3	4	50	50	100	PE
22CTH02	Recommender Systems	3	0	0	3	3	40	60	100	PE
22CTH03	Big Data Analytics	3	0	0	3	3	40	60	100	PE
22CTH04	Neural Networks and Deep Learning	2	0	2	3	4	50	50	100	PE
22CTH05	Natural Language Processing	3	0	0	3	3	40	60	100	PE
22CTH06	Computer Vision	3	0	0	3	3	40	60	100	PE

MINOR DEGREE (Other than CT Students)										
VERTICAL VIII – SOFTWARE PROGRAMMING										
Code No.	Course	L	T	P	C	Hour s/We ek	Maximum Marks			Categ ory
							CA	ES	Total	
22CTM01	Problem Solving using python	2	0	2	3	4	50	50	100	PE
22CTM02	Data Structures and Algorithms using Python	3	0	0	3	3	40	60	100	PE
22CTM03	Relational Database Systems	3	0	0	3	3	40	60	100	PE
22CTM04	Object oriented Programming using Java	2	0	2	3	4	50	50	100	PE
22CTM05	Fundamentals of Computer Networks & Operating Systems	3	0	0	3	3	40	60	100	PE
22CTM06	Software Analysis and Design	3	0	0	3	3	40	60	100	PE
22CTM07	Data Visualization with Python	2	0	2	3	4	50	50	100	PE

ONE CREDIT COURSES										
22CT0XA	MEAN Stack for Dynamic Web App Development	0	0	1	1	-	100	0	100	EEC
22CT0XB	Component based UI Development	0	0	1	1	-	100	0	100	EEC

OPEN ELECTIVES										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22OCE01	Energy Conservation and Management	3	0	0	3	3	40	60	100	OE
22OCS01	Object Oriented Programming	3	0	0	3	3	40	60	100	OE
22OCS02	JAVA Fundamentals	3	0	0	3	3	40	60	100	OE
22OCS03	Knowledge Discovery in Databases	3	0	0	3	3	40	60	100	OE
22OCS04	E-Learning Techniques	3	0	0	3	3	40	60	100	OE
22OCS05	Social Text and Media Analytics	3	0	0	3	3	40	60	100	OE
22OEC01	Basics of Analog and Digital Electronics	3	0	0	3	3	40	60	100	OE
22OEC02	Microcontroller Programming	3	0	0	3	3	40	60	100	OE
22OEC03	Principles of Communication Systems	3	0	0	3	3	40	60	100	OE
22OEC04	Principles of Computer Communication and Networks	3	0	0	3	3	40	60	100	OE
22OEI01	Programmable Logic Controller	3	0	0	3	3	40	60	100	OE
22OEI02	Sensor Technology	3	0	0	3	3	40	60	100	OE
22OEI03	Fundamentals of Virtual Instrumentation	3	0	0	3	3	40	60	100	OE
22OEI04	Optoelectronics and Laser Instrumentation	3	0	0	3	3	40	60	100	OE
22OME01	Digital Manufacturing	3	0	0	3	3	40	60	100	OE
22OME02	Industrial Process Engineering	3	0	0	3	3	40	60	100	OE
22OME03	Maintenance Engineering	3	0	0	3	3	40	60	100	OE
22OME04	Safety Engineering	3	0	0	3	3	40	60	100	OE
22OBT01	Biofuels	3	0	0	3	3	40	60	100	OE
22OFD01	Traditional Foods	3	0	0	3	3	40	60	100	OE
22OFD02	Food Laws and Regulations	3	0	0	3	3	40	60	100	OE
22OFD03	Post Harvest Technology of Fruits and Vegetables	3	0	0	3	3	40	60	100	OE
22OFD04	Cereal, Pulses and Oil Seed Technology	3	0	0	3	3	40	60	100	OE
22OFT01	Fashion Craftsmanship	3	0	0	3	3	40	60	100	OE
22OFT02	Interior Design in Fashion	3	0	0	3	3	40	60	100	OE

22OFT03	Surface Ornamentation	3	0	0	3	3	40	60	100	OE
22OPH01	Nanomaterials Science	3	0	0	3	3	40	60	100	OE
22OPH02	Semiconductor Physics and Devices	3	0	0	3	3	40	60	100	OE
22OPH03	Applied Laser Science	3	0	0	3	3	40	60	100	OE
22OPH04	Bio-photonics	3	0	0	3	3	40	60	100	OE
22OPH05	Physics of Soft Matter	3	0	0	3	3	40	60	100	OE
22OCH01	Corrosion Science and Engineering	3	0	0	3	3	40	60	100	OE
22OCH02	Polymer Science	3	0	0	3	3	40	60	100	OE
22OCH03	Energy Storing Devices	3	0	0	3	3	40	60	100	OE
22OMA01	Graph Theory and Combinatorics	3	0	0	3	3	40	60	100	OE
22OGE01	Principles of Management	3	0	0	3	3	40	60	100	OE
22OGE02	Entrepreneurship Development I	3	0	0	3	3	40	60	100	OE
22OGE03	Entrepreneurship Development II	3	0	0	3	3	40	60	100	OE
22OGE04	Nation building: Leadership and Social Responsibility	3	0	0	3	3	40	60	100	OE



**SUMMARY OF CREDIT DISTRIBUTION**

S.No	CATEGOR Y	CREDITS PER SEMESTER								TOTAL CREDIT	CREDITS in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VII I			Min	Max
1	BS	10	10							20	12.3	15%	20%
2	ES	6	10	4	4					24	14.7	15%	20%
3	HSS	2	3	3						8	04.9	5%	10%
4	PC			15	15	14	11	8		63	38.6	30%	40%
5	PE				3	6	9	12		30	18.4	10%	15%
6	EEC	3			1	1	1	2	10	18	11.1	10%	15%
Total		21	23	22	23	21	21	22	10	10	163	100	-

BS - Basic Sciences  
 ES - Engineering Sciences  
 HSS - Humanities and Social Sciences  
 PC - Professional Core  
 PE - Professional Elective  
 EEC - Employability Enhancement Course  
 CA - Continuous Assessment  
 ES - End Semester Examination

**22MA101****ENGINEERING MATHEMATICS I****3 1 0 4****Course Objectives**

- To impart mathematical modeling to describe and explore real-world phenomena and data.
- To provide basic understanding on Linear, quadratic, power and polynomial, exponential, and multi variable models
- Summarize and apply the methodologies involved in framing the real world problems related to fundamental principles of polynomial equations

**Course Outcomes (COs)**

1. Implement the concepts of mathematical modeling based on linear functions in Engineering.
2. Formulate the real-world problems as a quadratic function model
3. Demonstrate the real-world phenomena and data into Power and Polynomial functions
4. Apply the concept of mathematical modeling of exponential functions in Engineering
5. Develop the identification of multivariable functions in the physical dynamical problems

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3												
2	2	3												
3	2	3												
4	3	3												
5	1	3												

**UNIT I****9 Hours****MATHEMATICS MODELING OF LINEAR FUNCTIONS**

The geometry of linear equations - Formation of linear equations: Method of least squares and method of regression - Vector spaces: Basic concepts with examples - Linear combination - Eigen values and vectors

**UNIT II****9 Hours****MATHEMATICAL MODELING OF QUADRATIC FUNCTIONS**

General form of a quadratic function - Basic relationships between the equation and graph of a quadratic function - Sum of squares error and the quadratic function of best fit - Quadratic forms: Matrix form - Orthogonality - Canonical form and its nature

**UNIT III****9 Hours****MATHEMATICAL MODELING OF POWER AND POLYNOMIAL FUNCTIONS**

Characteristics of the graphs of power and polynomial functions - Fitting of power and polynomial functions using the method of least squares - Local maxima and local minima of power and polynomial functions - Power series of functions with real variables, Taylors series, radius and interval of convergence - Tests of convergence for series of positive terms - comparison test, ratio test

**UNIT IV**

**9 Hours**

**MATHEMATICAL MODELING OF EXPONENTIAL FUNCTIONS**

Concept of exponential growth - Graphs of exponential functions - Relationship between the growth factor and exponential growth or decline - Exponential equations have a variable as an exponent and take the form  $y = ab^x$  through least square approximation - Calculus of exponential functions - Exponential series - Characteristics

**UNIT V**

**9 Hours**

**MATHEMATICAL MODELING OF MULTIVARIABLE FUNCTIONS**

Graphing of functions of two variables - Partial derivatives - Total derivatives - Jacobians - Optimization of multivariable functions with constraints - Optimization of multivariable functions without constraints

**Total: 60 Hours**

**Reference(s)**

1. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2016
2. B. S. Grewal, Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB, Khanna, 2014
3. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons 2020
4. Thomas and Finney, Calculus and analytic Geometry, Fourteenth Edition, By Pearson Paperback, 2018

**22PH102****ENGINEERING PHYSICS****2023****Course Objectives**

- Understand the concept and principle of energy possessed by mechanical system
- Exemplify the propagation and exchange of energy
- Identify the properties of materials based on the energy possession

**Course Outcomes (COs)**

1. Illustrate the concept and principles of energy to understand mechanical systems
2. Exemplify the types of mechanical oscillations based on vibrational energy
3. Infer the concept of propagation of energy as transverse and longitudinal waves
4. Analyze the exchange of energy and work between the systems using thermodynamic principles
5. Apply the concept of energy and entropy to understand the mechanical properties of materials

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2	1							2					
3	2	1							2					
4	2	1							2					
5	2	1							2					

**UNIT I****6 Hours****CONSERVATION OF ENERGY**

Concept of energy - types of energy-conservation of energy. Mechanical energy: - translation - rotation - vibration - Kinetic and potential energies - conservation - work and energy - laws of motion - minimization of potential energy - equilibrium - dissipative systems - friction

**UNIT II****5 Hours****VIBRATIONAL ENERGY**

Periodic Motion - Simple Harmonic Motion - Energy of the SHM - Pendulum types - Damped oscillations - forced oscillations - natural frequency – resonance

**UNIT III****6 Hours****PROPAGATION OF ENERGY**

Transfer of energy - material medium - Transverse wave - Longitudinal wave - standing wave - interference - Doppler effect. Sound waves and its types - characteristics - human voice - reflection - refraction-beats

**UNIT IV****7 Hours****EXCHANGE OF ENERGY**

Energy in transit - heat - Temperature - measurement - specific heat capacity and water - thermal expansion –Heat transfer processes-Thermodynamics: Thermodynamic systems and processes - Laws of thermodynamics - Entropy - entropy on a microscopic scale -maximization of entropy

**UNIT V**

**6 Hours**

**ENERGY IN MATERIALS**

Elastic energy - Structure and bonding - Stress - strain - Tension and compression - elastic limit - Elastic Modulus - Stress - strain diagram - ductility - brittleness - rubber elasticity and entropy

**1**

**5 Hours**

**EXPERIMENT 1**

Determination of resultant of system of concurrent coplanar forces-Parallelogram law of forces

**2**

**5 Hours**

**EXPERIMENT 2**

Determination of moment of inertia-Torsional pendulum

**3**

**5 Hours**

**EXPERIMENT 3**

Determination of thickness of a thin wire using interference of light-Air wedge method

**4**

**4 Hours**

**EXPERIMENT 4**

Determination of ac frequency using Melde's apparatus

**5**

**3 Hours**

**EXPERIMENT 5**

Determination of thermal conductivity of a bad conductor using Lees disc method

**6**

**4 Hours**

**EXPERIMENT 6**

wavelength of ultrasonics in a liquid medium

(ii) velocity of ultrasonic waves in the given liquid

(iii) compressibility of the given liquid using ultrasonic interferometer

**7**

**4 Hours**

**EXPERIMENT 7**

Determination of Young's modulus of a given material- Non uniform bending method

**Total: 60 Hours**

**Reference(s)**

1. C J Fischer, The energy of Physics Part I: Classical Mechanics and Thermodynamics, Cognella Academic Publishing, 2019.
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

**22CH103****ENGINEERING CHEMISTRY I****2023****Course Objectives**

- Understand the origin of elements from the universe
- Outline the properties of elements in the periodic table
- Analyse the different types of bond formed during chemical reactions and its reaction thermodynamics
- Summarize different states of matter based on atomic arrangement

**Course Outcomes (COs)**

1. Understand nuclear transmutation reactions that lead to the formation of elements in the universe
2. Illustrate atomic structure of elements in the periodic table and interpret the periodic trends in properties of elements with its anomaly
3. Apply the conditions for the formation of different types of chemical bonds and predict the minimum energy required for a reaction to occur
4. Analyse endothermic and exothermic processes and exchange of energy during chemical reactions
5. Analyse whether the given matter is a solid, liquid, gas, or plasma and interpret the arrangement of atoms

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

**UNIT I****5 Hours****ORIGIN OF ELEMENTS**

Hydrogen - Elements and Sun - fusion - hypernova - supernova - dying stars - man-made elements

**UNIT II****7 Hours****ATOMIC STRUCTURE AND PERIODICITY**

Atomic Structure - Electronic configuration - Periodic Table - Periodic trends in properties of elements - Anomalous behaviour in periodicity

**UNIT III****6 Hours****CHEMICAL BONDING**

Octet rule &amp; its limitations - types of chemical bonds - bond energy - bond cleavage - activation energy of reactions

<b>UNIT IV</b>	<b>6 Hours</b>
<b>REACTION THERMODYNAMICS</b> Conservation of energy - Endothermic reactions & exothermic reactions - Exchange of energy involved in chemical reactions	
<b>UNIT V</b>	<b>6 Hours</b>
<b>STATES OF MATTER</b> Solid - liquid - gas - plasma - arrangement of atoms/ions/molecules in different phases	
<b>1</b>	<b>2 Hours</b>
<b>EXPERIMENT 1</b> Lab safety rules and guidelines for students - OSHA Guidelines	
<b>2</b>	<b>3 Hours</b>
<b>EXPERIMENT 2</b> Estimation of dissolved oxygen content in water sample(s) by Winkler's method	
<b>3</b>	<b>4 Hours</b>
<b>EXPERIMENT 3</b> Determination of Fe(II) in a sample using spectrophotometer	
<b>4</b>	<b>3 Hours</b>
<b>EXPERIMENT 4</b> Estimation of chromium content in water sample by volumetric analysis	
<b>5</b>	<b>3 Hours</b>
<b>EXPERIMENT 5</b> Estimation of chloride present in the given water sample by argentometric method	
<b>6</b>	<b>3 Hours</b>
<b>EXPERIMENT 6</b> Conductometric titration of mixture of acids	
<b>7</b>	<b>4 Hours</b>
<b>EXPERIMENT 7</b> Estimation of magnesium ions in given solution by EDTA method	
<b>8</b>	<b>4 Hours</b>
<b>EXPERIMENT 8</b> Preparation of salt of fatty acid by saponification process	
<b>9</b>	<b>4 Hours</b>
<b>EXPERIMENT 9</b> Recrystallization of aspirin from water/ethanol	
<b>Total: 60 Hours</b>	

**Reference(s)**

1. Peter Atkins, Physical Chemistry, Oxford university press, 2019
2. Rose Marie Gallagher and Author Paul Ingram, Complete Chemistry Cambridge IGCSE, Oxford university press, 2020
3. P L Soni, Text book of inorganic chemistry, Chand publishers, New Delhi, 2017
4. J.D. Lee, Concise inorganic chemistry, Blackman Science Ltd, France, Wiley-India, 5th edition (Reprint), 2016
5. Gareth Price, Thermodynamics of chemical processes, Oxford university press, 2019
6. D Tabor, Gases, liquids and solids and other states of matter, Oxford University press, 2018



**22GE001****FUNDAMENTALS OF COMPUTING****3 0 0 3****Course Objectives**

- Understand the fundamental digital logics behind computations of computer systems.
- Develop simple assembly language programs with respect to arithmetic operations.
- Understand the program execution process and basics of software development methodologies.

**Course Outcomes (COs)**

1. Infer the hidden languages and inner structures of computer hardware and software through codes and combinations.
2. Interpret the organizational and architectural issues of a digital computer with concepts of various data transfer techniques in digital computers and the I/O interfaces.
3. Analyze programming problems and apply assembly instructions to solve simple problems.
4. Infer the fundamentals of operating system and System programs basics.
5. Apply the software development methodologies to various real life scenarios.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1									1	2
2	3	3	3	1									1	2
3	2	2	2	1									2	
4	2	2	2	1									2	
5	2	2	2	1									3	

**UNIT I****8 Hours****CODES AND COMBINATIONS**

Communication using Mores and Braille binary codes - Digitizing letters, numbers and objects using binary codes - Performing simple operations: addition through binary codes.

**UNIT II****9 Hours****COMPUTATION USING COMPUTER**

Communication to computing devices through various input sources - Computational operation - its flow, functions and control - communication to output devices - Basic communication protocol.

**UNIT III****11 Hours****ASSEMBLY LANGUAGE PROGRAMMING**

Little Man Computing (LMC) Model - Instruction Set - Labels - Calculation -Branching - Input- Output - Loops - Simple programs.

**UNIT IV****9 Hours****OPERATING SYSTEM AND APPLICATION GENERATION**

BIOS - Device Drivers - Resources - Scheduler - Applications Generation and Creation - Stages of Compilation - Linkers, Loaders and Libraries.

**UNIT V**

**8 Hours**

**SOFTWARE DEVELOPMENT**

Phases of application life cycle management - Software Development Methodologies - Web Page development.

**Total: 45 Hours**

**Reference(s)**

1. Charles Petzold, "Code: The Hidden Language of Computer Hardware and Software", Microsoft Press books, 2009.
2. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliaz, "Little Man Computer Programming: For the Perplexed from the Ground Up", The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, "Peter Baer Galvin and Greg Gagne, Operating System Concepts", 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International edition, Seventh edition, 2010

**22HS001****FOUNDATIONAL ENGLISH****1 0 2 2****Course Objectives**

- Heighten awareness of grammar in oral and written expression
- Improve speaking potential in formal and informal contexts
- Improve reading fluency and increased vocabulary
- Prowess in interpreting complex texts
- Fluency and comprehensibility in self-expression
- Develop abilities as critical readers and writers
- Improve ability to summarize information from longer text, and distinguish between primary and supporting ideas

**Course Outcomes (COs)**

1. Express themselves in a professional manner using error-free language
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3		2		
2									2	3		2		
3									2	3		2		
4									2	3		2		
5									2	3		2		

**UNIT I****15 Hours****UNIT 1 - SELF-EXPRESSION**

Lesson Plan 1: Self-Introduction-Recreating Interview Scenarios (with a focus on verbal communication)  
 –Subject Verb Concord – Tenses – Common Errors in verbal communication-Be-verbs  
 Lesson Plan 2: Self-Introduction-Recreating interview scenarios-Haptics-Gestures-Proxemics-Facial expressions-Paralinguistics/Vocalics- Body Language- Appearance-Eye Contact-Artefacts  
 Lesson Plan 3: Self-Introduction-Powerful openings and closings at the interview-Effective stock phrases  
 - Modified for spontaneity and individuality-Question tags, framing questions including WH- questions-Prepositions-Listening to Ted talks-Listening for specific information

## UNIT II

15 Hours

### UNIT 2 - CREATIVE EXPRESSION

Lesson Plan 4: Descriptive Expression-Picture Description and Blog Writing -Vocabulary-One word substitution-Adjectives-Similes, Metaphors, Imagery & Idioms – Link words - Inclusive language

Lesson Plan 5: Narrative Expression- Travelogue and Minutes of Meeting -Verbal analogy-Sequence & Time order words - Jumbled paragraph, sentences, Sequencing-Text & Paragraph completion-Past tense - Using quotation marks

## UNIT III

15 Hours

### UNIT 3 - FORMAL EXPRESSION

Lesson Plan 6: Formal Letters and Emails-Writing: E-mails and Letters of apology, Requisition and Explanation, and Letters to newspapers-Speaking: Tendering verbal apologies, and explanations, persuading a listener/ audience-Hierarchy in Business correspondence- Subject of a mail, Header, Body (Salutation) and Footer of a mail. Conjunctional clause Punctuation-Formal Idioms-Phrases-Articles - Definite & Indefinite-Types of sentences-Modal verbs

Lesson Plan 7: Precision in comprehension, Summary writing, Selective summary-Reading: Active reading- short paragraphs, excerpts, articles and editorials-Skimming and Scanning Reading comprehension & analysis - Tenses, QP/ PQ approach. Identifying the central themes/ crux- Interpreting tone - formal/informal/semi-formal-Note-taking-Listening: Listening for data, for specific information, for opinion-Active and passive Listening-Transcription-Paraphrasing and summarizing information-Agreeing & disagreeing-Note-taking-Writing: Summary writing, selective summary, paraphrasing, note-making, opinion pieces-Finding synonyms in the context-Paraphrasing-Sentence Transformation - simple, compound, complex. Sentence substitution-Sentence completion- Interpreting paragraphs

**Total: 45 Hours**

### Reference(s)

1. Sasikumar, V, et.al. A Course in Listening & Speaking Foundation Books, 2005.
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010
4. Reynolds, John. Cambridge IGCSE, A<sup>®</sup> First Language English. 2018th ed., Hodder Education, 2018.
5. Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

**22GE004****BASICS OF ELECTRONICS ENGINEERING****2023****Course Objectives**

- To understand the concept of energy transmission through mechanical, electrical and electromagnetic form.
- To analyze the use of PN Junction Diode and BJT for signal conditioning.
- To apply the working principle of PN Junction Diode and BJT for the design of basic Digital Logic.
- To analyze the working and characteristics of Special Purpose Semiconductor Electronic Devices.

**Course Outcomes (COs)**

1. Understand the need for electrical and electromagnetic signal transmission.
2. Analyze the working principle and characteristics of PN junction diode.
3. Analyze the working principle and characteristics of Bipolar Junction Transistor.
4. Apply the working principle of PN Junction diode and BJT for designing basic Digital Logic functions.
5. Analyze the energy conversion needs and working principle of Special purpose electronic devices.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2										2
2	3	2	3											2
3	2	3	3											2
4	2	3	3	3										2
5	1	2	3	2										2

**UNIT I****6 Hours****ENERGY TRANSFER AND SIGNALS**

Energy Transmission through Mechanical, Electrical and Electromagnetic means, Signal as Energy Transmission, Complexity in signal transmission (Volume of Information, Distance and Time taken), Limitations of Mechanical Energy Transmission, Electrical and Electromagnetic Signal Transmission, Need for Conversion between Electrical and Mechanical Signals.

**UNIT II****8 Hours****SIGNAL CONDITIONING USING DIODE**

Need for Vacuum Tubes in the Evolution of Electronics, Overview of Vacuum Tubes, Diode and Triode, Limitations of Vacuum Tubes. Semiconductor Group in Periodic Table, Overview of Semiconductor Materials, Flow of electrical energy through PN Junction Diode, Signal Clipping, Signal Clamping and Signal Multiplication using PN Junction Diode, Limitations of PN Junction Diode.

**UNIT III****6 Hours****SIGNAL CONDITIONING USING TRANSISTOR**

Need for controlling electrical signals, Principle of Bipolar Junction Transistor operation, Signal Switching and Amplification using BJT, Limitations of BJT, Principle of Field Effect Transistor operation.

**UNIT IV** **6 Hours**

**LOGIC SYNTHESIS USING DIODE AND TRANSISTORS**

Overview of Logic Gates, PN Junction and BJT as electronic switches, Digital Logic Synthesis using Diode and Transistor: Diode Logic, Resistor Transistor Logic, Diode Transistor Logic, Transistor Logic.

**UNIT V** **4 Hours**

**DEVICES FOR SPECIAL REQUIREMENTS**

Voltage Regulation using Zener Diode, Variable Capacitance using Varactor Diode, Electrical Energy to Light Energy conversion using Light Emitting Diode, Light to Energy to Electrical Energy conversion using Solar Cell.

**1** **4 Hours**

**EXPERIMENT 1**

Design and Implement a simple device to communicate basic information between two different small distance points using wired and wireless methods.

**2** **6 Hours**

**EXPERIMENT 2**

Design and Implement different wave shaping Circuits using PN Junction Diodes.

**3** **4 Hours**

**EXPERIMENT 3**

Design and Implement Voltage Multiplier Circuit using PN Junction Diodes and Capacitors.

**4** **4 Hours**

**EXPERIMENT 4**

Design and Implement a three Stage Circuit to convert 220V 50Hz AC mains supply to 12V DC supply.

**5** **4 Hours**

**EXPERIMENT 5**

Design and Implement a BJT Amplifier Circuit to amplify audio input signal.

**6** **4 Hours**

**EXPERIMENT 6**

Design and Implement Basic Logic Gates using PN Junction Diodes.

**7** **4 Hours**

**EXPERIMENT 7**

Design and Implement Basic Logic Gates using BJTs.

**Total: 60 Hours**

**Reference(s)**

1. Thomas L. Floyd, Electronic Devices: Electron Flow Version, Ninth Edition, Prentice Hall, 2012.
2. J Millman, C. Halkias & Satyabrata JIT, Electronic Devices and Circuits, Tata McGraw-Hill, 2007.
3. L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education 2006.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 2003.
5. Adel S. Sedra & Kenneth C. Smith, Micro Electronic Circuits Theory and Applications, Sixth Edition, Oxford University Press, 2013.
6. Behzad Razavi, Microelectronics, Wiley India Pvt. Ltd.; 2nd edition (2018)

**22HS002****STARTUP MANAGEMENT****1 0 2 2****Course Objectives**

- Promote entrepreneurial spirit and motivate to build startups
- Provide insights on markets and the dynamics of buyer behaviour
- Train to develop prototypes and refine them to a viable market offering
- Support in developing marketing strategies and financial outlay
- Enable to scale up the prototypes to commercial market offering

**Course Outcomes (COs)**

1. Generate valid and feasible business ideas
2. Create Business Model Canvas and formulate positioning statement
3. Invent prototypes that fulfills an unmet market need
4. Formulate business strategies and create pitch decks
5. Choose appropriate strategies for commercialization

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	2				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

**UNIT I****3 Hours****BUSINESS MODELS AND IDEATION**

Startups: Introduction, Types of Business Modes for Startups. Ideation: Sources of Ideas, Assessing Ideas, Validating Ideas, Tools for validating ideas, Role of Innovation and Design Thinking

**UNIT II****3 Hours****UNDERSTANDING CUSTOMERS**

Buyer Decision Process, Buyer Behaviour, Building Buyer Personas, Segmenting, Targeting and Positioning, Value Proposition (Business Model Canvas), Information Sourcing on Markets, Customer Validation

**UNIT III****3 Hours****DEVELOPING PROTOTYPES**

Prototyping: Methods-Paper and Digital, Customer Involvement in Prototyping, Product Design Sprints, Refining Prototypes



**UNIT IV** **3 Hours**

**BUSINESS STRATEGIES AND PITCHING**

Design of Marketing Strategies and Campaigns, Go-To-Market Strategy, Financial KPIs Financial Planning and Budgeting, Assessing Funding Alternatives, Pitching, Preparing Pitch Decks

**UNIT V** **3 Hours**

**COMMERCIALIZATION**

Implementation: Prototype to Commercialization, Test Markets, Institutional Support, Registration Process, IP Laws and Protection, Legal Requirements, Type of Ownership, Building and Managing Teams, Defining role of investors

**1** **1 Hours**

**EXPERIMENT 1**

Analysis of various business sectors

**2** **2 Hours**

**EXPERIMENT 2**

Developing a Design Thinking Output Chart

**3** **1 Hours**

**EXPERIMENT 3**

Creating Buyer Personas

**4** **3 Hours**

**EXPERIMENT 4**

Undertake Market Study to understand market needs and assess market potential

**5** **2 Hours**

**EXPERIMENT 5**

Preparation of Business Model Canvas

**6** **15 Hours**

**EXPERIMENT 6**

Developing Prototypes

**7** **2 Hours**

**EXPERIMENT 7**

Organizing Product Design Sprints

**8** **2 Hours**

**EXPERIMENT 8**

Preparation of Business Plans

9

2 Hours

## EXPERIMENT 9

Preparation of Pitch Decks

**Total: 45 Hours**

### Reference(s)

1. Rashmi Bansal, Connect the Dots, Westland and Tranquebar Press, 2012
2. Pavan Soni, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Penguin Random House India, 2020
3. Ronnie Screwvala, Dream with Your Eyes Open: An Entrepreneurial Journey, Rupa Publications, 2015
4. Stephen Carter, The Seed Tree: Money Management and Wealth Building Lessons for Teens, Seed Tree Group, 2021
5. Kotler Philip, Marketing Management, Pearson Education India, 15th Edition
6. Elizabeth Verkey and Jithin Saji Isaac, Intellectual Property, Eastern Book Company, 2nd Edition, 2021

**22MA201****ENGINEERING MATHEMATICS II****3 1 0 4****Course Objectives**

- To impart and analyze the concepts of differential equations to describe in real-world phenomena
- To provide basic understanding on differential equation models and vector field models
- Summarize and apply the methodologies involved in framing the real world problems related to fundamental principles of complex functions

**Course Outcomes (COs)**

1. Interpret the concept of differential equations through mathematical modeling and analyze its applications in engineering
2. Formulate the real world problems as second order linear differential equations and give solutions for the same
3. Demonstrate the real-world phenomena with magnitude and direction in the form of vector functions
4. Apply the concept of vector fields and line integrals through mathematical modeling in engineering
5. Determine complex functions and apply them to formulate problems arising in engineering

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3												
2	2	3												
3	2	3												
4	3	3												
5	1	3												

**UNIT I****9 Hours****FIRST ORDER LINEAR DIFFERENTIAL EQUATIONS**

Formation of differential equations- Solutions of first order linear ODE: Leibnitzs and method of separation of variables- Cooling/Heating of an object - A falling object- Modeling of electric circuits: RL and RC circuits - Modeling of population dynamics: Exponential growth and decay - Logistic growth model

**UNIT II****9 Hours****SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS**

Methods of solving second order linear ordinary differential equations -Models for linear oscillators: Simple harmonic motion - Mechanical vibrations with and without damping - Electric circuit system: RLC circuits

**UNIT III****9 Hours****VECTOR DIFFERENTIAL CALCULUS**

Vector and scalar functions - Fields - Derivative of vector function and geometrical interpretation- Velocity and acceleration - Gradient and its properties- Tangent and normal vectors - Directional derivative- Divergence of a vector field - Curl of a vector field - Projectile motion

**UNIT IV**

**9 Hours**

**VECTOR INTEGRAL CALCULUS**

Line integrals of vector point functions - Surface integral of vector point functions - Applications of line and surface integrals - Greens theorem in a plane - Stokes theorem - Gauss divergence theorem

**UNIT V**

**9 Hours**

**COMPLEX FUNCTIONS**

Basic concepts of Complex numbers Geometrical representation of complex number - Analytic functions and its properties - Construction of Analytic functions: Fluid flow Electric flow - Mapping of complex functions

**Total: 60 Hours**

**Reference(s)**

1. Richard E. Williamson, Introduction to Differential Equations and Dynamical Systems, McGraw Hill Companies. Inc, 1997
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass Thomas Calculus, 13/e, Pearson Publishers, 2013
4. Erwin Kreyszig, Advanced Engineering Mathematics Wiley, 10th editi5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017on ,2015
5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017

**22PH202****ELECTROMAGNETISM AND MODERN PHYSICS****2 0 2 3****Course Objectives**

- Understand the principles and mechanisms of electricity and magnetism
- Infer the classification of electromagnetic waves
- Analyze the theory of relativity and energy bands

**Course Outcomes (COs)**

1. Understand the principles and mechanism of electrostatics and current
2. Illustrate the principles and mechanism of magneto statics
3. Classify electromagnetic waves and infer the characteristics of visible light
4. Outline the importance of theory of relativity and analyze the wave nature of particles
5. Exemplify the electrical properties of semiconductor based on the band theory

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2	1							2					
3	2	1							2					
4	2	1												
5	2	1							2					

**UNIT I****6 Hours****ELECTRICITY**

Electric monopoles - Electric field- Electric flux - Electric potential - electrical energy- capacitor- conductors and insulators-Electric dipole and polarization - electric current -voltage sources- resistance

**UNIT II****6 Hours****MAGNETISM**

Sources of magnetism- monopoles-magnetic field and force-magnetic field and current distribution-magnetic dipole-magnetic potential energy-inductor- electric and magnetic field comparison

**UNIT III****6 Hours****ELECTROMAGNETIC WAVES AND LIGHT**

Electromagnetism: basic laws-electromagnetic energy-radiation. Electromagnetic waves: origin, nature and spectrum-visible light Principle of least time- geometrical optics-Human eye - Diffraction - Interference - polarization-LASER

**UNIT IV****6 Hours****MODERN PHYSICS**

Special theory of relativity - simultaneity and time dilation - length contraction - relativistic mass variation. Matter waves - de-Broglie hypothesis - wave nature of particles

**UNIT V** **6 Hours**

**ENERGY BANDS IN SOLIDS**

Band theory of solids - classification of materials - semiconductors - direct and indirect semiconductor - fermi energy - Intrinsic and extrinsic semiconductor - carrier concentration - electrical conductivity

**1** **5 Hours**

**EXPERIMENT 1**

Determination of V-I characteristics of a solar cell

**2** **5 Hours**

**EXPERIMENT 2**

Determination of Hall voltage of a given specimen by Hall Effect method

**3** **5 Hours**

**EXPERIMENT 3**

Determination of wavelength of a given laser source - Grating method

**4** **4 Hours**

**EXPERIMENT 4**

Determination of particle size using diode laser

**5** **3 Hours**

**EXPERIMENT 5**

Determination of refractive index of a given solid medium and liquid medium

**6** **4 Hours**

**EXPERIMENT 6**

Determination of energy loss per cycle of a ferromagnetic material using hysteresis curve

**7** **4 Hours**

**EXPERIMENT 7**

Determination of band gap energy of a given semiconducting material

**Total: 60 Hours**

**Reference(s)**

1. C J Fischer, The energy of Physics Part II: Electricity and Magnetism, Cognella Academic Publishing, 2019
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

**22CH203****ENGINEERING CHEMISTRY II****2023****Course Objectives**

- Understand the concept of electrochemistry for determination of electrode potential, pH and applications as energy storage devices
- Outline the chemistry of metal corrosion and analyze the methods of corrosion control
- Understand how catalyst increases the reaction rate
- Summarize the variation in properties and reactivity of isotopes

**Course Outcomes (COs)**

1. Apply the electrochemical principles to determine the electrode potential of a metal
2. Analyze the construction, cell reactions and working of energy storage devices
3. Analyze the specific operating conditions under which corrosion occurs and suggest a method to control corrosion
4. Illustrate reaction mechanisms and assess the role of catalyst in a chemical reaction
5. Analyze various types of nuclear transmutation including decay reactions

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

**UNIT I****5 Hours****ELECTROCHEMISTRY**

Origin of potential - electromotive force - electrical double layer - transport of charge within the cell - cell description - prediction of cell potentials

**UNIT II****7 Hours****ENERGY STORING DEVICES**

Relation between electrical energy and energy content of a cell - reversible and irreversible cell - charging and discharging reactions in a reversible cell - current challenges in energy storage technologies

**UNIT III****6 Hours****METAL CORROSION AND ITS PREVENTION**

Oxidation of metals: Electrochemical origin of corrosion - electromigration - electron transfer in the presence and absence of moisture - galvanic series. Strategies for corrosion control: Galvanic anode and impressed current.

**UNIT IV**

**6 Hours**

**CATALYSIS**

Energy profile diagram for a chemical reaction - activation energy - role of catalyst - homogeneous and heterogeneous catalysis - types

**UNIT V**

**6 Hours**

**NUCLEAR REACTIONS**

Radioactive and stable isotopes - variation in properties between isotopes - radioactive decay (alpha, beta and gamma) - half-life period - nuclear reactions - radiocarbon dating

**1**

**3 Hours**

**EXPERIMENT 1**

Electroplate copper on the given target object and estimate the amount of copper deposited at cathode

**2**

**3 Hours**

**EXPERIMENT 2**

Construct an electrochemical cell exhibiting valid output and compare its potential with the given standard cell

**3**

**3 Hours**

**EXPERIMENT 3**

Construct a microbial fuel using organic manure and measure its output

**4**

**4 Hours**

**EXPERIMENT 4**

Application of calomel electrode to determine the redox potential of Fe(II) solution

**5**

**5 Hours**

**EXPERIMENT 5**

Determination of percentage of corrosion inhibition in iron/mild steel using a natural inhibitor

**6**

**4 Hours**

**EXPERIMENT 6**

Determination of corrosion percentage of iron/steel by weight loss method /Tafel polarization method

**7**

**4 Hours**

**EXPERIMENT 7**

Conductometric titration of mixture of acids (HCl and CH<sub>3</sub>COOH)

**8**

**4 Hours**

**EXPERIMENT 8**

Determination of strength of hydrochloric acid in a given solution using pH meter

**Total: 60 Hours**



**Reference(s)**

1. Jain and Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2013.
2. P.H. Rieger, Electrochemistry, Second Edition (Reprint), Springer, Netherland, 2012
3. E.McCafferty, Introduction to Corrosion Science, Springer; 2010 Edition, January 2010
4. S. Vairam, Engineering Chemistry, John Wiley & Sons, 2014
5. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th edition, (revised) New Age International Publishers, 2011
6. U. Hanefeld, L. Lefferts, Catalysis: An Integrated Textbook for Students, Wiley- VCH, 2017

**22GE002****COMPUTATIONAL PROBLEM SOLVING****3 0 0 3****Course Objectives**

- Analyze the algorithm design techniques and development principles in solving the real life problems.
- Illustrate the different ways of organizing and storing the data in computing systems.
- Understand the basic network configuration and setup connections among different device systems.

**Course Outcomes (COs)**

1. Analyze a problem and formulate algorithms, pseudocodes and flowcharts.
2. Develop algorithmic solutions to simple computational problems and explore algorithmic approaches to problem solving.
3. Design and apply appropriate data structures for solving computing problems.
4. Compare the various storage devices used in a computer system.
5. Analyze the requirements for a given organizational structure and establish the connection between two or more computers to form a network.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2									3	
2	3	3	3	3									3	
3	2	2	2	3									3	
4	2	2	2	2										3
5	2	2	2	2									1	2

**UNIT I****6 Hours****VISUAL PROCESS MODELING**

Scenario decomposition - logical sequencing - drawing flowchart - preparing visual process model.

**UNIT II****12 Hours****ALGORITHMIC DESIGN THINKING**

Analysis - Verification - Brute force - Divide and conquer - Greedy - Backtracking.

**UNIT III****12 Hours****DATA ORGANIZATION**

Elementary Data Organization - Abstract Data Types - Fundamentals of Linear and Non Linear Data Structures.

**UNIT IV****7 Hours****DATA STORAGE**

Flat File and Relational database- Data Read &amp; Write in Local Storage, Server Storage and Cloud storage - Database Query Methods.

**UNIT V**

**8 Hours**

**NETWORKING ESSENTIALS**

Networking Components and Services - IP Addressing - Configuring and Managing the Campus Network  
- Network Security - Firewalls.

**Total: 45 Hours**

**Reference(s)**

1. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2011.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.
4. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill, 2015.
5. Behrouz A. Forouzan, "Data Communication and Networking", 5th Edition, Tata McGraw-Hill, 2014.

**22GE003****BASICS OF ELECTRICAL ENGINEERING****2023****Course Objectives**

- To understand the basic concepts of electrical charge and its properties
- To interpret the formation of electric field due to electric charges
- To illustrate the concept of magnetic fields due to revolving electron
- To illustrate the force on moving charges in electric and magnetic field
- To understand the energy transfer in electro mechanical conversion

**Course Outcomes (COs)**

1. Interpret the behavior of electric charges in different medium using coulombs law.
2. Analyse the electric field due to different charge distributions.
3. Analyse the magnetic field intensity due to long conductor, solenoid, toroid and magnetic dipoles.
4. Analyze the force on conductors due to the moving charges.
5. Interpret the energy conversion concepts in electromagnetic fields.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		1										2
2	3	2		1										2
3	1	1	3											2
4	2	1		3										2
5	3	2		1										2

**UNIT I****5 Hours****ELECTRIC CHARGE**

Properties of charge, additivity of charges, quantization of charge, conservation of charge, Forces between multiple charges, Electric charge in conductors, Drift of Electrons, Charges in Clouds.

**UNIT II****7 Hours****ELECTRIC FIELD**

Electric field due to system of charges, Significance of Electric field line. Electric Dipole and its significance, Continuous charge distribution, Field in infinite long uniform straight conductors, field in uniform charged uniform infinite plane sheet, field due to uniform thin spherical sheet.

**UNIT III****7 Hours****MAGNETIC FIELDS**

Concept of magnetic field, magnetic fields in infinitely long straight wire, straight and toroidal solenoids, Magnetic dipole moment of a revolving electron, Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to axis, Induced Electric field due to changing Magnetic Field.

**UNIT IV**

**6 Hours**

**FORCE ON CHARGES**

Force on a moving charge in uniform magnetic and electric fields, Force on a current carrying conductor in a uniform magnetic field, Force between two parallel current carrying conductors.

**UNIT V**

**5 Hours**

**ELECTRO MECHANICAL ENERGY CONVERSION**

Energy transfer in electromagnetic fields, Energy storage in magnetic field, Electromagnetic induction, induced emf, Eddy currents. Self and mutual inductance Linear Momentum and Angular Momentum carried by Electromagnetic Fields.

**1**

**15 Hours**

**EXPERIMENT 1**

Analyze and design of Electro mechanical energy conversion system.

**2**

**15 Hours**

**EXPERIMENT 2**

Develop an electrical machine and analyze its performance with supplied input of AC from 0 V to 230 V.

**Total: 60 Hours**

**Reference(s)**

1. Mathew N. O. Sadiku, Principles of Electromagnetics, 6th Edition, Oxford University 2020
2. William H. Hayt and John A. Buck, Engineering Electromagnetics, McGraw Hill 2020
3. Kraus and Fleisch, Electromagnetics with Applications, McGraw Hill International Editions, 2017
4. S.P.Ghosh, Lipika Datta, Electromagnetic Field Theory, First Edition, McGraw Hill Education(India) Private Limited 2017

**22CT206****DIGITAL COMPUTER ELECTRONICS****3 0 2 4****Course Objectives**

- Understand the operation of Arithmetic Logic unit in Microprocessors
- Interpret Data retrieval from Memory by Microprocessors
- Analyze the role of Control Unit in Microprocessors
- Analyze Instruction execution in Microprocessors

**Course Outcomes (COs)**

1. Analyze the Design of Arithmetic and Logic Unit in Microprocessors
2. Analyze the Data Storage and Retrieval from Random Access Memory
3. Analyze the working mechanism of Control Unit in Microprocessors
4. Analyze the execution of Arithmetic and Logical Instructions
5. Analyze the execution of Jump and Memory related Instructions

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2											3
2	2	2	2										2	3
3	2	2	2											3
4	2	2											1	2
5	2	2											2	2

**UNIT I****9 Hours****BINARY SYSTEM AND DESIGN OF ALU**

Conversion of Decimal, Hexadecimal, Octal and Binary Numbers - Representation of Negative Numbers in Binary - Design of Binary Arithmetic Logic Modules - Magnitude Comparator - Encoder - Decoder - Multiplexer - Demultiplexer - Design of Arithmetic and Logic Unit (ALU)

**UNIT II****9 Hours****SYNCHRONOUS CIRCUIT AND DESIGN OF RAM**

Latches and Flip Flops - Clock - Registers - Counters - Shift Registers - Storage and Retrieval of Binary Numbers from Registers - Design of Random Access Memory (RAM) - Encoding and Decoding of Memory address locations

**UNIT III****9 Hours****DESIGN OF CONTROL UNIT**

Design of Control Unit - Mechanism of Instruction Read, Data Read, Instruction Decode, Instruction Execute and Data Write.

**UNIT IV** **9 Hours**

**BASIC INSTRUCTION EXECUTION**

Arithmetic Instructions - Increments, Decrements and Rotate Instructions - Logic Instructions - Arithmetic and Logic instructions

**UNIT V** **9 Hours**

**ADVANCED INSTRUCTION EXECUTION**

Memory Reference Instructions - Register Instructions - Jump and Call Instructions - Concept of Flag - Extended Register Instructions - Indirect Instructions - Stack Instructions

**1** **2 Hours**

**EXPERIMENT 1**

Design and Simulation of Fundamental Gates using Universal Gates (NAND and NOR)

**2** **3 Hours**

**EXPERIMENT 2**

Design and Simulation of Half Adder, Full Adder, Half Subtractor, Full Subtractor

**3** **3 Hours**

**EXPERIMENT 3**

Design and Simulation of 4 bit Ripple Carry Adder

**4** **4 Hours**

**EXPERIMENT 4**

Design and Simulation of a 4 bit Arithmetic and Logic Unit

**5** **4 Hours**

**EXPERIMENT 5**

Design and Simulation of D Flip Flop and J K Flip Flop

**6** **4 Hours**

**EXPERIMENT 6**

Design and Simulation of 8 bit Register

**7** **4 Hours**

**EXPERIMENT 7**

Design and Simulation of an 8 bit SISO, SIPO, PISO, PIPO Shift Registers

**8** **3 Hours**

**EXPERIMENT 8**

Simulation of Data Read and Data Write from a RAM

**9** **3 Hours**

**EXPERIMENT 9**

Simulation of Control Unit Functionality

**Total: 75 Hours**

**Reference(s)**

1. Digital Logic & Computer Design, Morris Mano Pearson Education India, 2019
2. Digital Computer Electronics, Albert Paul Malvino and Jerald A Brown (3rd Edition), McGraw Hill Education India, 2001
3. Digital Design and Computer Architecture, David Money Harris and Sarah L Harris, Elsevier, 2007
4. But how do it know? The Basic Principles of Computers for Everyone, John C Schott, John C Scott Publishers, 2009
5. Code: The Hidden Language of Computer Hardware and Software (2nd Edition), Petzold Charles, Microsoft Press, 2022
6. Digital Computer Fundamentals (6th Edition), Thomas C Bartee, Tata Mcgraw Hill Education, 2011



**22HS003****HERITAGE OF TAMILS****1 0 0 1****Course Objectives**

1. Describe the linguistic diversity in India, highlighting Dravidian languages and their features.
2. Summarize the evolution of art, highlighting key transitions from rock art to modern sculptures.
3. Examine the role of sports and games in promoting cultural values and community bonding.
4. Discuss the education and literacy systems during the Sangam Age and their impact.
5. Outline the importance of inscriptions, manuscripts, and the print history of Tamil books in preserving knowledge and culture.

**Course Outcomes (COs)**

1. Understand the concept of language families in India, with a focus on Dravidian languages.
2. Trace the evolution of art from ancient rock art to modern sculptures in Tamil heritage.
3. Identify and differentiate various forms of folk and martial arts in Tamil heritage.
4. Understand the concepts of Flora and Fauna in Tamil culture and literature.
5. Evaluate the contributions of Tamils to the Indian Freedom Struggle.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

**UNIT I****3 Hours****LANGUAGE AND LITERATURE**

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT II****3 Hours****HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III****3 Hours****FOLK AND MARTIAL ARTS**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV**

**3 Hours**

**THINAI CONCEPT OF TAMILS**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT V**

**3 Hours**

**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**Total: 15 Hours**

**Reference(s)**

1. Dr.K.K.Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
2. Dr.S.Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies.
5. Keeladi, Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu.
7. Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
8. R.Balakrishnan, Journey of Civilization Indus to Vaigai, RMRL.

22HS003

தமிழர் மரபு

1001

**பாடத்திட்டத்தின் நோக்கம்**

1. இந்திய மொழிக்குடும்பத்துள் திராவிட மொழிகள் தனித்து இயங்கும் தன்மையை அதன் சிறப்புகள் வழி அறிதல்.
2. தொன்றுதொட்டு தமிழர், கலையில் அடைந்த வளர்ச்சியை இயம்புதல்.
3. சங்ககால தமிழரின் கற்றல் திறத்தை இலக்கியங்கள் வழி ஆராய்தல்.

**கற்றலின் விளைவு**

1. இந்திய மொழிக்குடும்பத்துள் திராவிட மொழிகள் தனித்து இயங்கும் தன்மையை அதன் சிறப்புகள் வழி அறிதல்.
2. தொன்றுதொட்டு தமிழர், கலையில் அடைந்த வளர்ச்சியை இயம்புதல்.
3. சங்ககால தமிழரின் கற்றல் திறத்தை இலக்கியங்கள் வழி ஆராய்தல்.
4. தமிழ் மொழியின் சிறப்புகளை அதன் படைப்பிலக்கியங்கள் மூலம் அறிந்து கொள்ளுதல்.
5. கற்காலம் தொடங்கி, இக்காலம் வரை சிறப்பக்கலை அடைந்த வளர்ச்சியை கண்டுகொள்ளல் .
6. தமிழர் தம் வாழ்வில் எங்கனம் இயற்கையை வணங்கி போற்றினர் என்பதை திணை கோட்பாட்டின் வழி தெளிதல்.
7. இந்திய விடுதலை போரில் தமிழர் ஆற்றிய பங்கினை தெரிந்து கொள்ளுதல்.

**அலகு I மொழி மற்றும் இலக்கியம்:**

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:**

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:** 3  
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:** 3  
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:** 3  
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

**TOTAL : 15 PERIODS**

#### TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருளை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.



**22CT301****PROBABILITY, STATISTICS AND QUEUING  
THEORY****3 1 0 4****Course Objectives**

- The students will be able to understand the basic concepts of probability and the distributions with characteristics and also two dimensional random variables
- Summarize and apply the methodologies of the statistics and queuing theory
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment

**Course Outcomes (COs)**

1. Demonstrate and apply the basic probability axioms and concepts in the core areas.
2. Apply the concepts of probability distributions in an appropriate place of computers and Engineering.
3. Implement basic statistical inference techniques for engineering problems.
4. Design an experiment using ANOVA technique and summarize the measurements for statistical quality control.
5. Identify and apply the queuing methodologies to optimize the result of the waiting line.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2	2	2												
3	2	2												
4	2	2												
5	2	2												

**UNIT I****9 Hours****PROBABILITY AND RANDOM VARIABLE**

Axioms of probability-Conditional Probability-Total probability-Bayes Theorem-Random Variable-Probability mass function-Probability density functions-Properties-Moments - Moment generating functions and their properties.

**UNIT II****9 Hours****STANDARD DISTRIBUTION**

Discrete distributions: Binomial - Poisson - Negative Binomial - Continuous distributions: Uniform - Exponential - Gamma - Normal distributions and their properties.

**UNIT III****9 Hours****TESTING OF HYPOTHESIS**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on normal distribution for single mean and difference of means -Small sample tests: t-test for mean -F- test - Chi-square test for Goodness of fit and Independence of attributes.

**UNIT IV**

**9 Hours**

**DESIGN OF EXPERIMENTS AND CONTROL CHART**

One-way and two-way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design - Control charts for measurements (X and R charts) - Control charts for attributes (p, c, and np charts).

**UNIT V**

**9 Hours**

**QUEUEING THEORY**

Pure Birth and Death Process -Characteristics of Queueing models- Kendalls notation- Single and multi server Markovian queueing models- M/M/1 and M/M/C (Finite and infinite capacity)- Pollaczek-Khinchine formula.

**Total: 60 Hours**

**Reference(s)**

1. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, PHL Publisher, 1996.
2. Kishore S Trivedi, Probability and Statistics with Reliability Queueing and Computer Science Applications, John Wiley and Sons, Second Edition, 2012.
3. Arnold O Allen, Probability Statistics and Queueing Theory with Computer Applications, New Age International, 2003.
4. Jay L Devore, Probability and Statistics for Engineering and The Sciences, Thomson Learning, Seventh Edition, 2002.
5. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists,

**22CT302****DATA STRUCTURES I****3 0 2 4****Course Objectives**

- Implement array and hash data structure for real world applications.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the performance of various data structures using asymptotic notations

**Course Outcomes (COs)**

1. Implement the array data structure and its types for searching and sorting operations
2. Outline the algorithm efficiency with different asymptotic notations for optimizing the code.
3. Implement the linear node-based data structure for real world applications.
4. Evaluate the performance of Hash over arrays and list in memory access.
5. Analyze the tree traversal algorithms for various non-linear data structures.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	
2	2	2	2	2	2						2	2	3	
3	2	3	3	2	2						2	2	3	
4	3	3	3	3	2						3	3	2	
5	3	2	3	3	3						3	3	2	

**UNIT I****10 Hours****FOUNDATIONAL DATA STRUCTURES**

Algorithms and Data Structures - Data Structures hierarchy -Types of Data- Singular Data and Plural Data  
 - Position indexing : Array - Sets - Ordered Arrays - Searching over Arrays and Ordered Arrays.

**UNIT II****7 Hours****ALGORITHM EFFICIENCY**

Algorithm efficiency using Asymptotic Notations - Optimizing code with and without Big O Notation -  
 Optimizing for optimistic scenarios - Trade- offs between Time and Space.

**UNIT III****10 Hours****ADT AND NODE BASED DATA STRUCTURES**

ADT : Stacks - Queues - Recursion - Recursive Algorithms for Speed - Node Based Data Structures :  
 Linked list - Need of Linked List - Arrays vs Linked List - Types of Linked List and its operations - Skip  
 Lists.

**UNIT IV****8 Hours****FAST LOOKUP WITH HASH**

Hash Table - Hash functions - Internal implementation of Hash - Iteration over Hash - Hash operations -  
 Hash of Hash - Array of Hash - Hash of Array.

**UNIT V** **10 Hours**

**TREES**

Tree - Binary Tree - Binary Search Tree - Tree traversal - AVL Tree - Red Black Tree - B Tree - B+ Tree - Heap.

**1** **8 Hours**

**EXPERIMENT 1**

Implement a python program for the supermarket application using Stack and Queue for basket storage and checkout respectively.

**2** **4 Hours**

**EXPERIMENT 2**

Implement a python program for using a singly linked list. managing a train station and need to keep track of passengers on a particular train

**3** **4 Hours**

**EXPERIMENT 3**

Create a python program that allows users to search for a person's phone number quickly in the phone directory.

**4** **2 Hours**

**EXPERIMENT 4**

Implement a Python program to sort the student grades for the quiz competition.

**5** **2 Hours**

**EXPERIMENT 5**

Implement a digital signature generator and verifier using hash functions and public-key cryptography. Users can sign documents and verify the authenticity of signed documents.

**6** **10 Hours**

**EXPERIMENT 6**

Implement a python program to give a direction for a Stranger. Landmark will be considered as a node and the path between the two landmark is the link

**Total: 75 Hours**

**Reference(s)**

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures & Algorithms in Python, Wiley, 2013.
2. Larry Wall, Tom Christiansen & Randal L. Schwartz, Programming Perl, O'Reilly, 3rd edition, 2000.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2016.
4. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
5. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011.
6. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009.



**22CT303****COMPUTER ORGANIZATION AND  
ARCHITECTURE****3 0 0 3****Course Objectives**

- Understand the computer architecture concepts related to design of processors, memory management and I/O system.
- Explore the GPU computing architecture and develop an environment for creating high performance GPU-accelerated applications using CUDA programming.
- Gain knowledge on modern processor architecture to design the best processor/computing system.

**Course Outcomes (COs)**

1. Analyze the processor architecture and instruction sets of x86/x64 and ARM architecture.
2. Design a data path for a simple processor and compare the various techniques related to simultaneous execution of multiple instructions from a program.
3. Organize the computer memory to speed up the performance and facilitate the transfer of data between the computers central processing unit and the external devices.
4. Analyze the GPU computing architecture and develop applications to run on NVIDIA GPUs using the CUDA programming environment
5. Analyze the modern processor architectures and instruction sets and implement a RISC-V processor in a low-cost FPGA board.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2								2		3
2	3	3	2	2								2		3
3	2	2	2									2		3
4	2	2	2	2	3							2		3
5	2	2	2	2								2		3

**UNIT I****9 Hours****UNDERSTANDING PROCESSOR ARCHITECTURE AND INSTRUCTION SETS**

Basic Computer Organization and Design - Instruction Set principles - x86 and x64 architecture & instruction sets - 32 bit and 64 bit ARM architecture & instruction sets

**UNIT II****9 Hours****PROCESSOR DESIGN**

Designing a Data path for a Simple Processor - DLX Pipeline - Super Pipelining - Super scalar processor - Instruction level parallelism (ILP) - Speculative Execution - Side channel attack (Spectre and Meltdown)

**UNIT III****9 Hours****MEMORY UNIT AND I/O ORGANIZATION**

Memory Hierarchy - Cache Architectures - Levels in Cache - Improving Cache Performance - Memory Prefetch - Tera MTA - Connecting I/O Devices to the Processor.

**UNIT IV**

**8 Hours**

**EXPLORING GPU ARCHITECTURE**

GPU Vs CPU architecture - GPU Architecture Basics - NVIDIA's CUDA Toolkit - CUDA Programming

**UNIT V**

**10 Hours**

**MODERN COMPUTER ARCHITECTURE**

Domain-Specific Computer Architectures - Sony PlayStation design PS3/PS5, MAC M1 chip, Xbox, Cerebras - Wafer Scale Computing, Accelerators (FPGA, ASIC) - RISC-V Architecture and Instruction Set - Implementing RISC-V in a field-programmable gate array (FPGA).

**Total: 45 Hours**

**Reference(s)**

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill, Third Reprint, 2015.
2. David A, Patterson and John L, Hennessy, Computer Organization and Design: The hardware/software interface, Morgan Kaufmann, 4th edition, 2014.
3. Jim Ledin, Modern Computer Architecture and Organization - Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers - Second Edition, 2022.

**22CT304****PRINCIPLES OF PROGRAMMING LANGUAGE****3 0 2 4****Course Objectives**

- Understand the history and evolution of programming language.
- Gain knowledge about the different data types and control flow statements.
- Impart knowledge about the subprograms, functions, debugging and error handling mechanisms.

**Course Outcomes (COs)**

1. Outline the programming paradigms and the basic structure of programming language.
2. Assess the implementation of different types of data, variable and types system.
3. Analyze suitable conditional statements and control structures for real world applications.
4. Develop programs using subprograms and explore their types for problem solving.
5. Determine the tools for error handling and event handling in Programming.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1	1	3						1	2	2	
2	2	3	3	1	3						2	2	3	
3	1	2	3	1	3						2	2	3	
4	1	2	3	1	3						2	2	3	
5	1	2	3	1	3						2	2	3	

**UNIT I****8 Hours****UNDERSTANDING PROGRAMMING PARADIGMS**

Natural Vs Artificial language - Common Programming Paradigms - Syntax and semantics - Language Evaluation Criteria - Programming Language Grammar.

**UNIT II****10 Hours****VARIABLES AND DATA TYPES**

Variable Declarations - Guidelines for Initializing Variables - Power of Variable names - Fundamental Data types - Type Systems - Type Inference and Polymorphism.

**UNIT III****10 Hours****STATEMENTS**

Expressions and Assignment statements - Organizing straight-line code - Using conditionals - Controlling loops - Unusual control structures - General control issues.

**UNIT IV****9 Hours****SUBPROGRAMS**

Fundamentals of Subprograms - Design issues - Parameter passing methods - Overloaded subprograms - Generic subprograms - Implementing subprograms.

## UNIT V

8 Hours

### DEBUGGING AND ERROR HANDLING

Debugging - Debugging Strategies - Debugging Tools - Error Messages - Documentation - Test cases - Debugging with print statements - Debugging with comments and questions - Exception handling and Event handling

1

6 Hours

### EXPERIMENT 1

Online shopping cart: Develop an application to implement online shopping cart and generate bill for the purchased products.

2

3 Hours

### EXPERIMENT 2

Pocket Bazaar: Develop an application to manage an inventory of products for grocery stores.

3

3 Hours

### EXPERIMENT 3

Vacation Destination Decision Maker: Create an application program that helps a user decide on their next vacation destination based on their preferences.

4

3 Hours

### EXPERIMENT 4

Temperature monitor: Develop an application for temperature monitoring system and provide an alert message.

5

3 Hours

### EXPERIMENT 5

Develop an access control system that simulates the granting access to authorized personnel based on their credentials, such as ID cards and PIN codes.

6

6 Hours

### EXPERIMENT 6

Math Quiz Generator: Design a math quiz generator that generates questions of various difficulty levels and arithmetic operations.

7

6 Hours

### EXPERIMENT 7

Build a maze solver application that finds a path from the entrance to the exit of a maze.

**Total: 75 Hours**

### Reference(s)

1. Code Complete, Steve McConnell, Microsoft Press, 2004.
2. Concepts of Programming Languages Robert. W. Sebesta 10/E, Pearson Education.
3. Programming Language Design Concepts, D. A. Watt, Wiley Dreamtech, 2007.
4. Programming Languages, 2nd Edition, A.B. Tucker, R. E. Noonan, TMH.
5. Programming Languages, K. C. Loudon, 2nd Edition, Thomson, 2003

**22CT305****SOFTWARE ENGINEERING****3 0 0 3****Course Objectives**

- Understand the systematic approach related to the design, development and maintenance of a software system
- Analyze the limitations of manual testing process and provide a succinct summary of those limitations with the help of automated testing tools.
- Understand the Enterprise Architecture (EA) framework that provides the building blocks for successful digital business transformation.

**Course Outcomes (COs)**

1. Apply the software development methodologies to various real life scenarios.
2. Apply modern tools and techniques to develop scalable, maintainable, and reliable software systems.
3. Analyze the coding strategies and techniques to write well-structured, efficient, and error-free code.
4. Apply specific modern testing tools to ensure the quality and reliability of software products.
5. Analyze the elements, structure, and positioning of an Enterprise Architecture framework used for successful digital business transformation.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	2	
2	3	3	2	2	3		2		2			2	3	
3	2	2	2				2		2			2	3	
4	2	2	2		3		2		2			2	3	
5	2	2	2						2				3	

**UNIT I****9 Hours****SOFTWARE DEVELOPMENT PROCESS**

Phases in Software Development - Traditional Software Development Models - Agile Methodologies - Agile Scaling Frameworks - Lean Software Development - Software Requirements Specification(SRS) - Project Scheduling and Estimation.

**UNIT II****10 Hours****TOOLS AND TECHNIQUES FOR SOFTWARE DEVELOPMENT**

DevOps - Version control with Git - Containerization Using Docker and Kubernetes- Application Performance Monitoring (APM) - Continuous Integration Continuous deployment (CICD) - Clean Room build.

**UNIT III****9 Hours****CODE QUALITY**

Software Metaphors - Upstream Prerequisites - Key Construction Decisions - Defensive Programming - Code Tuning Strategies and Techniques.

**UNIT IV**

**9 Hours**

**TESTING**

Writing good test cases - Test driven development - Test Automation - Testing using Selenium tool - Continuous Testing - Exploratory Testing - Testing in Agile and DevOps Environments.

**UNIT V**

**8 Hours**

**ENTERPRISE ARCHITECTURE AND MODELING**

Enterprise Architecture (EA) in Digital Transformation - Agility in Digital Business - Measuring EA: Metrics, KPIs and Risks.

**Total: 45 Hours**

**Reference(s)**

1. Charles Petzold, Code: The Hidden Language of Computer Hardware and Software, Microsoft Press books, 2009.
2. David D. Riley, Kenya. Hunt, Computational thinking for the modern problem Solver, CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliasz, Little Man Computer Programming: For The Perplexed From The Ground Up, The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill International edition, Seventh edition, 2010.

**22HS004 HUMAN VALUES AND ETHICS****2 0 0 2****Course Objectives**

- Understand the concept of good values and comprehend the importance of value-based living.
- Recognize the culture of peace through education.
- Identify and apply the practices for value development and clarification.

**Course Outcomes (COs)**

1. Understand the importance of human values and ethics in life.
2. Execute the importance of harmonious living in a diverse society.
3. Analyze the sensitivity to the crying needs of society such as ungodliness, corruption, poverty, and suffering, and play a vital role in eradicating them.
4. Plan intellectually mature, morally upright, ethically correct, and spiritually inspired decisions.
5. Execute a correct balance between professional excellence and social commitment.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1								3	2	1				
2								3	2	1				
3								3	2	1				
4								3	2	1				
5								3	2	1				

**UNIT I****6 Hours****COURSE INTRODUCTION - NEED, BASIC GUIDELINES AND ANALYSIS**

Importance of Human Values & Ethics in 21st Century - Understanding the theory of basic human values and ethics -Openness to change -Self enhancement -Conservation -Self transcendence - Schwartz Value Survey: Self-Assessment

**UNIT II****6 Hours****EMBRACING THE COMMON ETIQUETTE**

Altruism- Integrity-Freedom-Justice-Honesty-Truthfulness-Responsibility-Compassion

**UNIT III****6 Hours****CONTINUOUS HAPPINESS AND PROSPERITY**

An overview on basic Human Aspirations- Understanding and living in harmony at various levels of life- Embracing self-love and wellness-Understanding harmony in the family and society

**UNIT IV****6 Hours****UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS**

Reflection on growing global multifold problems: poverty, pollution, hunger, disease, unemployment, caste system, child labour, gender equality, politics and violence. Understanding the challenges in cultural, personal, social, political, and economic environment

**UNIT V**

**6 Hours**

**UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS CO-EXISTENCE**

Understanding the harmony in the Nature- Holistic perception of harmony at all levels of existence- Practice Exercises and Case Studies will be taken up in Practice Sessions

**Total: 30 Hours**

**Reference(s)**

1. Martin, G. The Little Book of Ethics: A Human Values Approach. Australia: G.P. Martin. 2011.
2. Gupta, N. L. Human Values For The 21St Century. India: Anmol Publications Pvt. Limited. 2002.
3. Mishra, A. Happiness Is All We Want. India: Bloomsbury Publishing.2017.
4. Universal Human Values. (n.p.): Booksclinic Publishing. 2023.
5. A Textbook on Professional Ethics And Human Values. India: New Age International (P) Limited.2007.



**22HS005****SOFT SKILLS AND EFFECTIVE COMMUNICATION****0 0 2 1****Course Objectives**

- Communicate proficiently in formal discussions at the workplace.
- Describe experiences and events, and briefly give reasons and explanations for opinions and plans.
- Interact with a degree of fluency and spontaneity that results in efficacious communication
- Convey agreement and disagreement in a polite but firm manner
- Communicate with coherence and imagination in both written and spoken formats

**Course Outcomes (COs)**

1. Enhance confidence in expressing thoughts in grammatically proper language and etiquette in waiting for the opportunity to provide input
2. Effectively communicate in English on formal occasions and proficiency in the use of link words and other discourse markers
3. Provide constructive feedback and file logical complaints
4. Analyse the understanding of oral and written communication in real-world situations.
5. Apply the improved spelling and punctuation in writing and heightened understanding of tone, pitch and stress in oral formats.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

**UNIT – I - SELF-EXPRESSION****10****Hours**

Group discussion/ Peer discussion - Communicating decisions and opinions - Tone, Pitch, Stress - Agreeing, Disagreeing, Suggesting, Speculating - Comparing and Contrasting - Comparatives and Superlatives - Discourse markers – Interjections - Decision making - Synthesis - Higher order thinking Group discussion/Peer discussion - Effective Communication Types of communication - Written vs Spoken - Contractions Intonation Stress Active voice - Question tags - Confidence and body language Guided writing- Outlining Main Points - Group discussion/Peer discussion - Avoiding common errors Reduction of MTI - Common errors - Barriers to communication Accent

**UNIT – II - CREATIVE EXPRESSION**

**10 Hours**

JAM, Debate, Review writing, Social media posts Synonyms - Antonyms Cloze test  
Phrasal verbs Spotting errors Collocation - Commonly mispronounced

**UNIT – III - FORMAL EXPRESSION**

**10 Hours**

Writing: Giving written feedback, Review writing, and Letter of complaint. Speaking:  
Giving constructive feedback and offering suggestions, asking for inputs, commenting  
politely on appropriate phrases - Giving written feedback, Review writing, and Letter  
of complaint. Critical reasoning - Modal verbs - Polite ways to express negatives

**Total: 30  
Hours**

**Reference(s)**

1. Word Power Made Easy by Norman Lewis, W. R. Goyal Pub. & Distributors, 2009.
2. Sasikumar, V, et al., A Course in Listening & Speaking Foundation Books, 2005.
3. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
4. Prasad, Hari Mohan. A Handbook of Spotting Errors, McGraw Hill Education, 2010.
5. Personality Development & Soft Skills, Barun K. Mitra, Oxford University Press, 2012
6. Business English by Ken Taylor, Orient Blackswan, 2011

22HS006

TAMILS AND TECHNOLOGY

1 0 0 1

**Course Objectives**

- Analyse graffiti on potteries as a form of historical and cultural documentation during the Sangam Age.
- Investigate the building materials and the historical context of Hero stones during the Sangam Age by Analysing the details of stage constructions in Silappathikaram and their cultural significance.
- Examine ancient knowledge of oceans and its impact on Tamil society.

**Programme Outcomes (POs)****Course Outcomes (COs)**

- Understand the significance of the weaving industry during the Sangam Age and its cultural importance.
- Understand the significance of dams, tanks, ponds, and sluices in the agricultural and irrigation practices of the Chola Period.
- Explore the architectural designs and structural construction methods used in household materials during the Sangam Age.
- Explore the art of shipbuilding in ancient Tamil culture and its role in maritime trade and transportation.
- Trace the development of scientific terminology and vocabulary in Tamil language.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1														
2														
3														
4														
5														

**UNIT I****3 Hours****WEAVING AND CERAMIC TECHNOLOGY**

Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

**UNIT II****3 Hours****DESIGN AND CONSTRUCTION TECHNOLOGY**

Designing and Structural construction House and designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period

**UNIT III**

**3 Hours**

**MANUFACTURING TECHNOLOGY**

Art of Ship Building-Metallurgical studies-Iron industry-Iron smelting,steel-Copper and gold-Coins as source of history-Minting of Coins-Beads making-industries Stone beads -Glass beads-Terracotta beads-Shell beads-bone beads-Archeological evidences-Gem stone types described in Silappathikaram.

**UNIT IV**

**3 Hours**

**AGRICULTURE AND IRRIGATION TECHNOLOGY**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry-Wells designed for cattle use- Agriculture and Agro Processing-Knowledge of Sea-Fisheries-Pearl-Conche diving-Ancient Knowledge of Ocean-Knowledge Specific Society.

**UNIT V**

**3 Hours**

**SCIENTIFIC TAMIL**

Development of Scientific Tamil-Tamil computing-Digitalization of Tamil Books-Development of Tamil Software-Tamil Virtual Academy-Tamil Digital Library-Online Tamil Dictionaries-Sorkuvai Project.

**Total: 18 Hours**

**Reference(s)**

1. Dr. K. K. Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL
2. Dr. S. Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr. S. V. Subatamanian , Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr. M. Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies
5. Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr. K. K. Pillay, Studies in the History of India with Special Reference to Tamil Nadu.

**22CT401****DISCRETE MATHEMATICS****3 1 0 4****Course Objectives**

- Implement the definitions of relevant vocabulary from graph theory and combinatorics and be able to perform related calculations
- Understand and use the terms Cardinality, finite, countably infinite and uncountably infinite, and determine which of these characteristics is associated with a given set
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment

**Programme Outcomes (POs)**

- a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**Course Outcomes (COs)**

1. Understand and apply the concepts of Boolean algebra and characteristics in computers.
2. Apply formalized arguments to classify and assess real-world arguments.
3. Represent the characteristics of predicate logic in computer engineering.
4. Apply different properties of injection, surjection, bijection, composition and inverse functions in software engineering.
5. Interpret the concepts of Permutations, Combinations and Mathematical induction in the phenomena of real world.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1												
3	1	2												
4	2	2												
5	1	2												

**UNIT I****9 Hours****BOOLEAN ALGEBRA**

Introduction of Boolean algebra - Truth table - Basic logic gate - Basic postulates of Boolean algebra - Principle of duality- Canonical form - Karnaugh map.

**UNIT II****9 Hours****PROPOSITIONAL CALCULUS**

Propositions- Logical connectives-Compound propositions-Conditional and biconditional propositions- Truth tables - Tautologies and Contradictions - Logical and equivalences and implications-DeMorgans Laws-Normal forms-Principal conjunctive and disjunctive normal forms -Rules of inference-Arguments-Validity of arguments.

### UNIT III

9 Hours

#### PREDICATE CALCULUS

Predicates-Statement Function - Variables-free and bound variables- Quantifiers-Universe of discourse- Logical equivalences and implications for quantified statements- Theory of inference- The rules of universal specification and generalization-Validity of arguments.

### UNIT IV

9 Hours

#### SET THEORY AND FUNCTIONS

Set Operations-properties-Power set-Relations-Graph and matrix of a relation- Partial Ordering- Equivalence relations-Partitions- Functions -Types of Functions- composition of relation and functions- inverse functions.

### UNIT V

9 Hours

#### COMBINATORICS

Basics of Counting - Counting arguments- Pigeonhole Principle- Permutations and Combinations- Recursion and recurrence relations-Generating Functions- Mathematical Induction- Inclusion - Exclusion

**Total: 60 Hours**

#### Reference(s)

1. Trembly J P and Manohar R, Discrete Mathematical Structures with Applications to computer Science, Tata McGraw Hill Publications Co. Ltd., New Delhi 30th Re-print 2007.
2. Alan Doerr and Kenneth Levasseur, Applied Discrete Structures for Computer Science, Galgotia Publications Pvt. Ltd. Delhi. 2010.
3. Ralph P Girmaldi and Ramana B.V. Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education Asia, Delhi, 2007.
4. Kolman Busby Ross, Discrete Mathematical Structures , Prentice-Hall India, New Delhi, Fifth Edition, 2007.
5. Rosen K.H Discrete Mathematics and its Applications, Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.

**22CT402 DATA STRUCTURES II****3 0 2 4****Course Objectives**

- Understand and use the various major modern data structures like Trie, Rope, Segment tree and Octree.
- Apply the graph data structure and tree traversal algorithms for solving real time problems.
- Analyze the performance of algorithm design techniques with different data structures.

**Course Outcomes (COs)**

1. Implement the Trie data structure and its basic search operations.
2. Outline the traversal algorithm and its types with graph data structure.
3. Implement Minimum Spanning tree algorithms and analyze their performance.
4. Design and implement different problems using the backtracking and branch and bound techniques and analyze the time complexities of them.
5. Implement modern data structures like Segment tree, Quadtree and Octree for real world applications.

**Articulation Matrix**

C O No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	2	2	2	2						2	2	2	
2	2	2	2	2	2						2	2	2	
3	2	3	3	2	2						2	2	2	
4	3	3	3	3	2						3	3	3	
5	3	2	3	3	3						3	3	3	

**UNIT I****TRIE DATA STRUCTURES****9 Hours**

Trie Structure - Types - Prefix-Based Search - Space Efficiency - Time Complexity - Compact Tries - Applications - Suffix Array and Suffix Tree - Rope.

**UNIT II****GRAPH****9 Hours**

Graph representation - Breadth-first traversal - Depth-first traversal - Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm - Travelling Salesman Problem - Analysis of shortest path algorithms.

**UNIT III****GRAPH MST****9 Hours**

Minimum Spanning Tree: Prim's Algorithm - Kruskal's Algorithm- Disjoint-Set Union (Union-Find) - A\* algorithm - Flood filling algorithm - Analysis of MST algorithms.

**UNIT IV****ALGORITHM DESIGN TECHNIQUES****9 Hours**

NP Complete problems- Backtracking: N-Queens Problem and Subset-Sum problem - Branch and bound: Knapsack problem - Approximation algorithms for NP hard problems: Traveling salesman - P, NP, NP-Complete and NP-Hard Problems.

## UNIT V

### MODERN DATA STRUCTURES

**9 Hours**

Segment Tree - Interval Tree - Fenwick Tree - K-D Tree - Quadtree and Octree - Circular Buffer (Ring Buffer) - Marshaling / Unmarshaling - JSON - benefits - Schema - limitations - Protobuf.

#### Reference(s)

1. Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley publications, 2013.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2016.
3. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
4. Aho, J.E. Hopcroft and J.D. Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.
5. Reema Thareja, Data Structures Using C, Second Edition, Oxford University Press, 2011

### LAB EXPERIMENTS

**1** **4 Hours**

#### EXPERIMENT 1

Implement a Trie data structure and perform prefix based search.

**2** **4 Hours**

#### EXPERIMENT 2

For a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

**3** **4 Hours**

#### EXPERIMENT 3

Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.

**4** **6 Hours**

#### EXPERIMENT 4

Implement the Flood fill algorithm for replacing the color from the source row to source column in 2D array.

**5** **4 Hours**

#### EXPERIMENT 5

Implement N Queen's problem using Backtracking.

**6** **4 Hours**

#### EXPERIMENT 6

Construct a segment tree for computing sum of the elements in a given range.

**7** **4 Hours**

#### EXPERIMENT 7

Implement a Quad tree for locating a node in the given quad.

**Total: 75 Hours**



**22CT403 OPERATING SYSTEMS****3 1 0 4****Course Objectives**

- Establish a solid foundation in the introductory concepts of operating systems and gain insights into the structures, services, and roles of operating systems in computing environments.
- To apply process scheduling algorithms in a multi-programming environment and implement the various deadlock strategies effectively to prevent each other from accessing the computer resources
- To gain knowledge on the operations of memory management and File management.

**Course Outcomes (COs)**

1. Analyze the basic structure and architectural components of the operating system and interpret how application programs interact with the operating system through APIs.
2. Apply the various scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. Analyze memory allocation and deallocation mechanisms involved in memory management for a specific system.
4. Apply the various file handling strategies to manage files on a secondary storage structure and in a distributed environment.
5. Analyze the virtualization technologies and their types to simulate hardware functionality and create a virtual computer system.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	2	
2	3	3	2	2	3		2		2			2	2	
3	2	2	2				2		2			2	2	
4	2	2	2		3		2		2			2	2	1
5	2	2	2						2				2	2

**UNIT I****8 Hours****INTRODUCTION TO OPERATING SYSTEMS**

Basic Operating System Concepts - Operating System Structure and Components - Operating System Services and Interfaces - Role of the Kernel and User Space - System calls and System Programs - Open Source and Closed source operating systems.

**UNIT II****12 Hours****PROCESS MANAGEMENT**

Processes and Threads - Process Scheduling and CPU Scheduling Algorithms - Process Synchronization and Concurrency Control - Deadlocks and Handling Strategies - Inter-Process Communication (IPC) - Multi-Core and Multi-Processor Management

### **UNIT III**

**9 Hours**

#### **MEMORY MANAGEMENT**

Memory Hierarchy - Address Spaces and Memory Allocation - Paging and Segmentation - Page Replacement Algorithms - NUMA (Non-Uniform Memory Access) - Memory Compression - Memory Tiering.

### **UNIT IV**

**8 Hours**

#### **FILE SYSTEM DESIGN AND AND IMPROVEMENTS**

File System Structures - Storage Technologies - SSD and Flash Storage Optimization - Copy-on-Write (CoW) File Systems - File System Journaling - Distributed File Systems and Cloud Storage - File System Monitoring and Analytics.

### **UNIT V**

**8 Hours**

#### **VIRTUALIZATION AND RECENT DEVELOPMENTS**

Virtualization Principles and Types (Hardware, Software, Network, Storage) - Hypervisors and Virtual Machine Monitors - Microkernels and Exokernels - Security and Integrity in Virtualized Environments - Security in Operating Systems - Operating Systems for Quantum Computers - Cross-Platform Compatibility.

**Total: 60 Hours**

#### **FOR FURTHER READING**

Microkernel Architectures - Exokernels - Ubiquitous and Pervasive Computing - Cognitive Operating Systems

#### **Reference(s)**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2. Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. Ltd, 2014
3. William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4. Harvey M. DeitelM, Operating Systems, Pearson Education Pvt. Ltd, 2007.
5. Distributed file system for cloud: A Clear and Concise Reference Kindle Edition by Gerardus Blokdyk
6. <https://www.redhat.com/en/topics/virtualization>

**22CT404 WEB TECHNOLOGY AND FRAMEWORKS****2023****Course Objectives**

- Understand the Web Application Architectures and trace the evolution of the web and introduce concepts like Web 3.0 and Decentralized Web.
- Familiar with the different Web development Frameworks and Full stack development.
- Explore the emerging web technologies and implement best practices for making web applications accessible to all users

**Course Outcomes (COs)**

1. Analyze the architecture of various web applications and develop simple use cases for the real time web applications
2. Implement web applications using client-side scripting language and server-side scripting languages.
3. Integrate the web applications with databases using Web frameworks.
4. Develop a complete, functional web application that incorporates both front-end and back-end components.
5. Implement the emerging web technologies in web application development projects.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	
2	2	2	2	2	2						2	2	2	
3	2	3	3	2	2						2	2	2	
4	3	3	3	3	2						3	3	3	
5	3	2	3	3	3						3	3	3	

**UNIT I****5 Hours****INTRODUCTION TO WEB APPLICATIONS**

Evolution of the web - Understanding Web Application Architectures: Server Side Rendered Applications- Single Page Application (SPA) - Mobile Application Development – Comparison of Monolithic and Microservice architectures - Serverless computing - HTTP Protocol and Methods - Web Browsers and Rendering Engines - Use cases of various web applications, including Flipkart, BIT Discourse, BIP, Wiki and Moodle.

**UNIT II****7 Hours****SCRIPTING LANGUAGES**

Client-side Scripting vs Server-Side Scripting - Client-side Scripting: Execution Location - Languages: JavaScript Fundamentals - Document Object Model (DOM).  
Server-Side Scripting: Execution Location - Language(s) - PHP Programming fundamentals.

**UNIT III****6 Hours****WEB DEVELOPMENT FRAMEWORKS**

Introduction to Web Development Frameworks - MVC Architecture - Building APIs with a Framework - RESTful APIs and API Design - Building a RESTful API - Database Integration with ORM/ODM -Building a Basic Front-End Application.

## UNIT IV

6 Hours

### FULL STACK DEVELOPMENT

Full-Stack Development - Combining Front-End and Back-End Technologies - Building a Full-Stack Web Application- 12 factor application model - Deployment and Hosting Options - Continuous Integration and Continuous Deployment (CI/CD) - Performance Optimization and Scalability.

## UNIT V

6 Hours

### EMERGING WEB TECHNOLOGIES

Emerging Web Technologies: Progressive Web Apps (PWAs) - WebAssembly and WebRTC - Web Security Best Practices – Open Web Application Security Project (OWASP) - Web Accessibility and Inclusive Design - Web Performance Optimization.

### FOR FURTHER READING

Machine Learning in Web Development - Voice and Chatbot Interfaces - Edge Computing and WebVR

#### Reference(s)

1. P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education, 2009.
2. James Gillies and Robert Cailliau, How the Web Was Born: The Story of the World Wide Web, 2000
3. D Crockford , JavaScript: The Good Parts, O Reilly , 2009
4. Mark Masse , REST API Design Book, O Reilly, 2011
5. Matti Luukkainen and Jarkko Moilanen , Fullstack Open: Deep Dive Into Modern Web Development"
6. Michal Zalewski , The Tangled Web: A Guide to Securing Modern Web Applications" 2011
7. <https://www.theodinproject.com/lessons/foundations>.

### LIST OF EXPERIMENTS

1

3 Hours

#### EXPERIMENT 1

Create a simple HTML page and use the browser's developer tools to inspect and manipulate elements.

2

3 Hours

#### EXPERIMENT 2

Write JavaScript to validate the following fields of the Registration page.

- a) First Name (Name should contain alphabets and the length should not be less than 6 characters).
- b) Password (Password should not be less than 6 characters length).
- c) E-mail id (should not contain any invalid and must follow the standard pattern [name@domain.com](#))
- d) Mobile Number (Phone number should contain 10 digits only).
- e) Last Name and Address (should not be Empty).

**3**

**3 Hours**

**EXPERIMENT 3**

Develop a multi-page website using HTML and CSS and apply responsive design techniques to make the site mobile-friendly.

**4**

**3 Hours**

**EXPERIMENT 4**

Develop a QR code generator using PHP and connect to a database to store and retrieve data.

**5**

**3 Hours**

**EXPERIMENT 5**

Developing a Simple Web Application using a server-side framework (e.g., Flask, Django, or Ruby on Rails) and apply security measures to protect against common web vulnerabilities

**6**

**4 Hours**

**EXPERIMENT 6**

Create a single-page application (SPA) using the front-end framework (e.g., React, Angular, or Vue.js) and implement routing and state management.

**7**

**3 Hours**

**EXPERIMENT 7**

Develop a RESTful API using a back-end framework (e.g., Node.js or Express), perform the CRUD operations and Test the API using tools like Postman

**8**

**4 Hours**

**EXPERIMENT 8**

Create a full-stack web application to implement user authentication and authorization connected to a database to store and retrieve data for the application

**9**

**4 Hours**

**EXPERIMENT 9**

Deploy a web application in a hosting platform (e.g., Heroku, AWS, or Azure) and set up a continuous integration and continuous deployment (CI/CD) pipeline to monitor the deployed application for performance and errors.

**Total: 60 Hours**

**22CT405 DATABASE MANAGEMENT SYSTEMS****3 0 2 4****Course Objectives**

- Analyze the data models, conceptualize and Design a database system using E-R diagrams.
- Gain knowledge on the design principles of relational and modern database systems like SQL, NoSQL and NewSQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

**Course Outcomes (COs)**

1. Analyze the data models and the types of data used in databases.
2. Implement SQL queries for creating databases and performing the relational operations.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes.
5. Analyze the performance of NoSQL and NewSQL databases related to design.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
1	2	2	2	2	2						2	2	2	
2	2	2	2	2	2						2	2	2	
3	2	3	3	2	2						2	2	2	
4	3	3	3	3	2						3	3	3	
5	3	2	3	3	3						3	3	3	

**UNIT I****8 Hours****INTRODUCTION TO DATABASES AND DBMS**

Understanding Data and Information - Database vs DBMS - Modern Databases - DBMS Architecture and Components - Data Models - Relational Model - Codd's 12 Rules - Object-Relational Mapping (ORM).

**UNIT II****10 Hours****STRUCTURED QUERY LANGUAGE (SQL)**

SQL Basic Commands - Constraints - Database Objects - SQL Functions - Subqueries- Correlated Subqueries- Nested subqueries - Recursive queries - Common Table Expressions (CTEs) - Triggers and Stored procedures.

**UNIT III****9 Hours****DATABASE DESIGN AND NORMALIZATION**

Database Design fundamentals - Entity-Relationship Diagrams (ERD) - ERD to tables - Functional Dependencies and Normal Forms: 1NF, 2 NF, 3 NF, BCNF, 4 NF, 5NF and 6 NF - Domain-Key Normal Form (DKNF) - Nested Normal Form (NNF) - Denormalization and Trade-offs - Emerging trends in Database Design - Dealing with real-world complexities in Database Design- CASE Tools for Database Design.

## **UNIT IV**

**9 Hours**

### **QUERY OPTIMIZATION AND TRANSACTION MANAGEMENT**

Query Optimization and Execution Plans -Optimization Visualization Tool - DB Sharding - Vitess – Vitess vs MySQL- Table partitioning - Transaction Management and ACID Properties - Concurrency Control: Lock based protocols -Deadlock handling – Multi version concurrency control (MVCC) - Transaction isolation.

## **UNIT V**

**9 Hours**

### **NOSQL AND NEWSQL DATABASES**

NoSQL Vs NewSQL- NoSQLDatabases: MongoDB and Cassandra - NewSQL databases: Redis and NuoDB -Selection of NoSQL or NewSQL over RDBMS - CAP Theorem and BASE Properties - HeidiSQL - In-Memory Databases and Caching - Database Security and Encryption - Database Performance Tuning

### **FOR FURTHER READING**

Parallel, Distributed and Object-Oriented Databases- Temporal and Geospatial Databases - Database Performance Tuning.

### **Reference(s)**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, McGraw -Hill, Sixth Edition, 2018
2. Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems,Pearson Education, Seventh Edition, 2016
3. Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management, Thompson Learning Course Technology, Ninth edition, 2011
4. Guy Harrison , Next Generation Databases: NoSQLand Big Data, Apress.

## **LAB EXPERIMENTS**

**1**

**4 Hours**

### **EXPERIMENT 1**

Create a simple relational database with tables and write SQL queries for basic CRUD operations (Create, Read, Update, Delete).

**2**

**3 Hours**

### **EXPERIMENT 2**

Create multiple tables and perform Database Querying - Simple queries, Nested queries, Sub queries, Joins and views.

**3**

**3 Hours**

### **EXPERIMENT 3**

Create a database with multiple tables. Add constraints (e.g., primary key, foreign key, check constraints) to database tables. Create indexes for performance optimization. Implement triggers to automate actions based on data changes.

**4**

**3 Hours**

**EXPERIMENT 4**

Design an ERD for a simple database schema. Normalize the schema to eliminate redundancy and improve data integrity.

**5**

**3 Hours**

**EXPERIMENT 5**

Implement the normalized schema in the RDBMS and populate it with sample data.

**6**

**3 Hours**

**EXPERIMENT 6**

Install and set up a NoSQL database (e.g., MongoDB). Write queries to insert, update, and query data in MongoDB.

**7**

**4 Hours**

**EXPERIMENT 7**

Set up a distributed database cluster using open-source tools (e.g: Apache Cassandra). Store and retrieve data in a distributed environment.

**8**

**4 Hours**

**EXPERIMENT 8**

Implement in-memory caching using technologies (Redis) and measure the performance improvements achieved through caching.

**9**

**3 Hours**

**EXPERIMENT 9**

Implement access control and user authentication in an RDBMS. Encrypt sensitive data at rest and in transit

**Total: 75 Hours**



**22HS007****ENVIRONMENTAL SCIENCE****2 0 0 0****Course Objectives**

- Understand the interdisciplinary and holistic nature of the environment
- Identify the significance of natural resources and environment on the quality of life and stimulate the quest for sustainable development
- Assess the socio-economic, political and ethical issues in environmental science

**Course Outcomes (COs)**

1. Examine the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources
2. Analyze the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation
3. Impact the existing environmental challenges related to pollution and its management
4. Select suitable strategies for sustainable management of components of environmental science
5. Correlate the impacts of population and human activities on environment

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2	1	1										
3	2	2					1					
4	1											
5	2											

**UNIT I****6 Hours****NATURAL RESOURCES**

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer-pesticide problems (eutrophication, blue baby syndrome, biomagnification). Energy resources: renewable (solar, wind, and hydro).

**UNIT II****6 Hours****ECOSYSTEMS AND BIODIVERSITY**

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features: desert ecosystem. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**UNIT III****6 Hours****ENVIRONMENTAL POLLUTION**

Pollution: Definition - causes - effects - control measures of air pollution - water pollution : (Sewage water treatment by activated sludge and trickling filter process) - noise pollution- thermal pollution. Disaster management: causes - effects - control measures of floods - earthquake

**UNIT IV**

**7 Hours**

**SOCIAL ISSUES AND ENVIRONMENT**

Sustainable development : Definition - Unsustainable to sustainable development - solid waste management - causes - effects - 5R Principles (landfills, incineration, composting). Water conservation - rain water harvesting - watershed management. Climate change - global warming - acid rain - ozone layer depletion. E-waste

**UNIT V**

**5 Hours**

**HUMAN POPULATION AND ENVIRONMENT**

Human population: Population growth - characteristics - variation among nations - population explosion - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

**Total: 30 Hours**

**Reference(s)**

1. Anubha Kaushik, C.P. Kaushik, Environmental Science and Engineering , 4th Multi Colour Edition, New Age International Publishers, New Delhi, 2014
2. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons
3. T. G. Jr. Miller, S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi, 2014
4. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press
5. A. K. De, Environmental Chemistry, 7th Edition , New age international publishers, New Delhi, 2014

**22HS008****ADVANCED ENGLISH AND TECHNICAL  
EXPRESSION****0 0 2 1****Course Objectives**

- To enable students to achieve proficiency in academic writing
- effectively use the language to persuade others
- appreciate the nuances of the language and engage an audience
- use advanced tools of language to improve communicative competence
- prepare for professional demands at the workplace
- give concrete expression to the plans and goals

**Course Outcomes (COs)**

1. Understand the clarity in articulating the objectives and aims and improved proficiency in using the English language
2. Communicate effectively and with good interpersonal skills; speak in public, engage the audience, and lead a group discussion
3. Critically evaluate the ethics of persuasive appeals and confidence to influence opinion
4. Analyse a specific piece of information; take in what is read, and use good writing techniques with proper grammar and syntax in all formal situations
5. Create awareness and empathy to emotional signals in communication

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

**UNIT – 1 - CREATIVE EXPRESSION****15 Hours**

Proposals & Grant applications, Argumentative essays & editorials, Sales Pitches, Campaigning, Commercials/advertisements, effectively answering the famous interview question: ‘Why should we hire you?’ Sentence and paragraph formation - Rhetorical questions - Emphasis & effective repetition - Empathetic expression, knowing the audience, capturing attention - Creating Memes, Comic Strips, Stand-up comedy, Caption writing, and Limericks, Vocabulary and slang words for comedy - Similes & Metaphors - Homophones, homonyms, alliteration, wordplay

## UNIT 2 - FORMAL EXPRESSION

**15 Hours**

Writing: Action plans, Cover letters, Mind-Mapping, Paragraph writing Logical reasoning SVA - Advanced level - Style: Clarity, Concision, Coherence, Evocativeness, Efficacious Vocabulary - Conditional Clause - Be verbs- Tenses- advanced - Opening and closing sentences - Action plans, Anecdotal references, order of communication/ narration, complete communication- Wh-questions - Effective beginning and closing - Rhetorical questions - Appraising target audience - Pronunciation, Enunciation, Tone, Pace and Volume. - Writing: SOPs, Research Objectives, Thesis Statement, Indexing, Scholarly Articles, Academic Writing, Executive Summary, Survey Questionnaires, Citations and Bibliography - Reading: Quantitative & qualitative analysis, Analysis and paraphrasing of reference materials Speaking: Commentate live events, give instructions to operate machines/ conduct experiments Listening: Informational listening, Reflective listening, - Discriminative listening - Connective words - Prefixes and Suffixes - Quoting and paraphrasing Proofreading - Directed writing and writing formats - Note taking - Active verbs

**Total: 30 Hours**

### Reference(s)

1. Sangeeta Sharma et.al. Communication Skills for Engineers and Scientists, PHI Learning Pvt. Ltd, 2011
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001
4. Personality Development, Harold R. Wallace & L. Ann Masters, Cengage Learning, New Delhi
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi
6. English Grammar, Composition and Usage by N.K. Agrawal & F.T. Wood, Macmillan India Ltd., New Delhi

**22CT501****COMPILER DESIGN****3 1 0 4****Course Objectives**

- Acquire knowledge in different phases of a Compiler and its applications.
- Understand the categorization of tokens using lexical analyzer and pattern recognition using parsers.
- Familiar with the code generation schemes and optimization methods.

**Course Outcomes (COs)**

1. Analyze the output generated in each phase of the compiler
2. Construct Finite automata for Regular Expression and apply minimization techniques.
3. Construct Top down and Bottom up parser for context free grammars.
4. Generate intermediate code for programming constructs
5. Apply optimization techniques in code generation and analyze the issues in code generation.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		1	1										2	1
2		2	3		1								2	1
3		3	3		1								2	1
4		2	2										2	1
5		2	1										2	1

**UNIT I****8 Hours****INTRODUCTION TO COMPILER**

Language processors - Structure of a compiler - Grouping of phases into passes- Compiler construction tools - Applications of compiler technology: Implementation of high-level programming languages - Optimizations for computer architectures - Design of new computer architecture - Program Translations Software productivity tools

**UNIT II****9 Hours****LEXICAL ANALYSIS**

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Lexical Errors - Specification of tokens - Recognition of Tokens - Finite automata - Regular expression to finite automation- Optimization of DFA based Pattern Matchers-LEX-Design of Lexical Analyzer for a sample Language.

**UNIT III****11 Hours****SYNTAX ANALYSIS**

Introduction-Role of the parser - Context-Free Grammars -Writing a Grammar-Top Down parsing - Recursive Descent Parsing – Non-recursive Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing- LR Parsers: Simple LR Parser - Canonical LR Parser - LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.

**UNIT IV**

**8 Hours**

**SEMANTIC ANALYSIS**

Syntax Directed Translation - Construction of Syntax Tree - Variants of Syntax Trees -Three-Address Code - Types and Declarations - Translation of Expressions - Control Flow - Backpatching - Switch-Statements - Intermediate Code for Procedures.

**UNIT V**

**9 Hours**

**CODE OPTIMIZATION**

Principal Sources of Optimization-DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

**Total: 60 Hours**

**FOR FURTHER READING**

The evolution of programming languages-The science of building a compiler - Run Time Environments - Storage Organization - Stack Allocation of Space- Heap Management.

**Reference(s)**

1. Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman Compilers: Principles, Techniques and Tools , 2nd Edition, Pearson, 2012.
2. D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, Modern Compiler Design, Wiley, 2012
3. Kennath C. Loudon, Compiler Construction Principles and Practice. New Delhi: Vikas publishing House, 2003.
4. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2003.

**22CT502****COMPUTER NETWORKS****3 0 2 4****Course Objectives**

- Understand the state-of-the-art in network protocols, architectures and applications
- Gain knowledge about the functions of different network layers
- Familiarize in the various aspects of computer networks

**Course Outcomes (COs)**

1. Illustrate the basic concept in modern data communication and computer networking
2. Apply the functions of different layers and in depth knowledge of data link layer
3. Analyze the different protocols and network layer components
4. Outline the basic functions of transport layer and congestion in networks
5. Analyze the working of application layer along with the protocols used

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		3	2		1									2
2		3	2		2								1	2
3		2			2								2	1
4		1			2							2	2	
5		2			1								3	

**UNIT I****10 Hours****INTRODUCTION**

Data Communications - Data Flow - Networks - The Internet - Protocols and Standards - Network Models: Layered Tasks - The OSI Model - TCP/IP Protocol Suite - Addressing - Transmission Media - Connecting LANs, Backbone Networks, and Virtual LANs: Connecting Devices-Circuit Switching and Packet Switching

**UNIT II****10 Hours****DATA LINK LAYER**

Introduction - Block Coding - Cyclic codes - Checksum -Data Link Control: Framing - Flow and Error Control - Noiseless Channels - Noisy Channels - HDLC -Multiple Access: Random Access - Channelization - Wired LANs: IEEE Standards- Standard Ethernet - Encoding (NRZ, NRZI, Manchester, 4B/5B- WiMax

**UNIT III****9 Hours****NETWORK LAYER**

IPv4 Addresses- IPv6 Addresses - Internetworking - IPv4 - IPv6 - Transition from IPv4 to IPv6 - Network Layer: Delivery, Forwarding, and Routing: Address Mapping - Internet Control Message Protocol (ICMP) - Internet Group Management Protocol (IGMP) - Network Layer: Delivery, Forwarding, and Routing.

**UNIT IV****9 Hours****TRANSPORT LAYER**

Process-to-Process Delivery - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Stream Control Transmission Protocol (SCTP) - Congestion Control and Quality of Service: Data Traffic - Congestion Control - Quality of Services (QoS)-POP3- IMAP.

## UNIT V

7 Hours

### APPLICATION LAYER

Domain Name System (DNS): Domain Name Space - Distribution of Name Space - DNS in the Internet World Wide Web and HTTP - Simple Mail Transfer Protocol - File Transfer Protocol -Secure Shell (SSH)- TELNET - PGP - Firewalls.

### FOR FURTHER READING

Network Management: Simple Network Management Protocol (SNMP) - Symmetric key cryptography - Security services - PGP - Firewalls.

1

4 Hours

#### EXPERIMENT 1

Study of Color coding Jack RJ45 and do the following Cabling works in a network a. Cable Crimping  
b. Standard Cabling  
c. Cross Cabling and  
d. Establish a LAN connection using three systems using any topology.

2

2 Hours

#### EXPERIMENT 2

Configure IP Address in a system in LAN (TCP/IP Configuration) and Implement the client server communication using socket connection.

3

2 Hours

#### EXPERIMENT 3

Write a program for transferring a file between nodes in a network.

4

2 Hours

#### EXPERIMENT 4

Perform Bit Stuffing and CRC computation.

5

2 Hours

#### EXPERIMENT 5

By varying the no of frames, design the Sliding Window Protocol.

6

2 Hours

#### EXPERIMENT 6

Simulation of ARP/RARP

7

2 Hours

#### EXPERIMENT 7

Display the routing table for the nodes in a network using Distance Vector Routing (DVR) algorithm.

8

2 Hours

#### EXPERIMENT 8

Find the minimum cost in the node to node communication by Open Shortest Path First (OSPF) protocol

9

2 Hours

#### EXPERIMENT 9

Write a program for downloading a file from HTTP server



**10** **4 Hours**

**EXPERIMENT 10**

Develop a client that contacts a given DNS server to resolve a given host name.

**11** **2 Hours**

**EXPERIMENT 11**

Configure a Network topology using Packet tracer software.

**12** **4 Hours**

**EXPERIMENT 12**

Study of Network simulator (NS) and Simulation of any one of routing protocol using NS2.

**Total: 75 Hours**

**Reference(s)**

1. Behrouz A.Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw-Hill, 2014
2. James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005
3. Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009
4. Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008
5. William Stallings, Data and Computer Communication, Pearson Education, 2007
6. Douglas E.Comer and M.S.Narayanan, Computer Networks and Internets, Pearson Education, 2008

**22CT503****EMBEDDED SYSTEMS****3 0 0 3****Course Objectives**

- To understand the basics of Embedded Systems
- Understand the basics of Embedded Hardware and Software.
- Design and analyze embedded systems.

**Course Outcomes (COs)**

1. Explore the concepts of embedded computing with 8051 microcontrollers.
2. Elucidate the embedded Hardware concepts.
3. Elucidate the embedded Software concepts.
4. Design and analyze the Embedded System.
5. Develop embedded systems using case studies

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3													2
2		3												2
3		3											2	
4			2											2
5			2											2

**UNIT I****9 Hours****INTRODUCTION TO EMBEDDED COMPUTING**

Language processors - Structure of a compiler - Grouping of phases into passes- Compiler construction tools - Applications of compiler technology: Implementation of high-level programming languages - Optimizations for computer architectures - Design of new computer architecture - Program Translations Software productivity tools

**UNIT II****9 Hours****EMBEDDED HARDWARE**

The Embedded Board and the Von-Neumann Model - Basic Hardware Materials: Embedded Processors - ISA Architecture Models - Internal processor design - Processor Performance - Memory - Board I/O - Board Buses - Component Interfacing.

**UNIT III****9 Hours****EMBEDDED SOFTWARE**

Device Drivers for Interrupt-Handling - Memory Device Drivers - Onboard Bus Device Drivers - Board I/O Driver Examples - Embedded Operating Systems - Process - Multitasking and Process Management - I/O and File System Management - Middleware and Application Software

**UNIT IV****9 Hours****PROGRAM DESIGN AND ANALYSIS**

Models of Programs - Basic Compilation Techniques - Program Optimization - Program-Level Performance Analysis - Software Performance Optimization - Program Validation and Testing, Clear-Box Testing, Black-Box Testing, Evaluating Function Tests

**UNIT V**

**9 Hours**

**EMBEDDED SYSTEM DEVELOPMENT**

Design issues and techniques - Design Methodologies, System Analysis, and Architecture Design, Quality Assurance - Case studies - Complete design of example embedded systems.

**Total: 45 Hours**

**FOR FURTHER READING**

Embedded programming in C, C++ - Real-time operating systems – the study of Micro C/OS II.

**Reference(s)**

1. Wayne Wolf, Computers as Components: Principles of Embedded Computer System Design, Elsevier, 2008.
2. Michael J. Pont, Embedded C, Pearson Education , 2007.
3. Tammy Noergaard, “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Second Edition, Elsevier Embedded Technology Series, Newnes Publication, 2012.
4. Steve Heath, Embedded System Design, Elsevier, 2005.
5. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education, Second edition, 2007

**22CT504****INTERNET PROGRAMMING****2023****Course Objectives**

- Impart the knowledge of web application development platforms.
- Develop the front end user interface using HTML, CSS.
- Analyze the user experience design methodologies like Java script, JSON and JQuery for responsive web design.

**Course Outcomes (COs)**

1. Identify working model and learn basic web concepts to develop Static and Dynamic web pages.
2. Create web pages that demonstrate proficiency in the use of HTML.
3. Present a professional document using Cascaded Style Sheets.
4. Implement the knowledge of HTML and CSS code to create personal and/or business websites following current professional and/or industry standards.
5. Apply static and dynamic web page design techniques to construct an interactive web page using Client side technologies.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3			3								1	
2	1	3	2		3								1	
3	1	3	3		3								2	
4	1	3	3		3								2	
5	1	3	3		3								2	

**UNIT I****6 Hours****INTRODUCTION TO HTML**

Basic Web Concepts – Web based Client/Server model – Web Protocols – Working of web browser – Browser & Server Communication – Basics of HTML – Elements and Attributes of HTML. HTML Layouts – HTML forms – HTML Lists and Tables – HTML frames- HTML Media – Getting started with HTML5 – HTML Graphics

**UNIT II****8 Hours****CASCADING STYLE SHEETS**

Basics of CSS – HTML Style attributes – CSS Syntax – CSS Selectors – Three ways to insert CSS – Element based CSS – CSS Layouts – CSS Image Gallery – Gradients and Shadows - 2D and 3D transforms with CSS – CSS Pagination and Columns – Basics of Responsive UI Design – Basics of CSS frameworks

**UNIT III****6 Hours****JAVA SCRIPT**

An introduction to JavaScript – Data Types – Conditionals and Loops – Functions – Classes and Objects – Inbuilt Methods – Arrays - Regular Expressions.

**UNIT IV** **5 Hours**

**AJAX AND JQUERY**

Introduction to AJAX – JS vs jQuery – jQuery Load - jQuery Get/Post.

**UNIT V** **5 Hours**

**ANGULAR**

Introduction to AngularJS - Expressions - Modules - Data binding - Controllers - Scope - Services.

**1** **6 Hours**

**EXPERIMENT 1**

Develop a Event page for Conference using HTML

**2** **6 Hours**

**EXPERIMENT 2**

Build a Restaurant website using HTML and CSS

**3** **6 Hours**

**EXPERIMENT 3**

Develop a Random Quote Generator using JavaScript.

**4** **6 Hours**

**EXPERIMENT 4**

Design a snake game using JQuery.

**5** **6 Hours**

**EXPERIMENT 5**

Design online voting system using angularJS.

**Total: 60 Hours**

**REFERENCE(S)**

1. Thomas a Powell, “HTML & CSS: The Complete Reference”, 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
2. Russ Ferguson, “Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development”, Apress Publishers, 3rd Edition, 2019.
3. Jon Duckett, “HTML and CSS: Design and build websites”, John Wiley & Sons, 2011.
4. David Flanagan, “JavaScript: The Definitive Guide”, 5th Edition, O’Reilly, 2011
5. Deitel Deitel Goldberg, “Internet and World Wide Web – How to program”, 5th Edition, Prentice Hall Publishers, 2012.
5. Robert W Sebesta, “Programming the World Wide Web”, 7th Edition, Pearson Education Inc., 2014.

**22CT507****MINI PROJECT I****0 0 2 1****Course Objectives**

- Identify the problem statement and apply the engineering concepts to find the solution.
- Improve the analysing capability of the students.
- Increase the exuberance in finding the solution to various problems.

**Course Outcomes (COs)**

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, and techniques that contribute to obtaining the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis of the cost-effectiveness.
5. Prepare the report and present oral demonstrations.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2			2	2	2			1	1
2	1	2	1	1	2			2	2	2			1	1
3	1	2	1	1	2			2	2	2	2		1	1
4	1	2	1	1	2			2	2	2	2		1	1
5	1	2			2			2	2	2			1	1

**Total: 30 Hours**

**22CT601****DISTRIBUTED COMPUTING****3 0 0 3****Course Objectives**

- Understand the basic client server communication
- Design and implement a distributed system over other networks
- Diagnose the cause of defects in the deadlocks

**Course Outcomes (COs)**

1. Apply the various distributed computing system strategies
2. Implement the inter-process communication and communication between distributed objects.
3. Analyze the concept of distributed transactions and concurrency control.
4. Implement the resource management techniques in distributed system.
5. Analyze the concept of distributed file system, name services and multimedia systems.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		1		1									2
2	2		2		2								2	
3	2		2		2									2
4	2		2		2									2
5	2		2		2								2	

**UNIT I****8 Hours****BASIC CONCEPTS**

Characterization of Distributed Systems - Examples - Resource Sharing and the Web - Challenges - System Models - Architectural and Fundamental Models - Networking and Internetworking - Types of Networks - Network Principles-Internet Protocols.

**UNIT II****10 Hours****INTERPROCESS COMMUNICATION AND DISTRIBUTED OBJECTS**

Interprocess Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client - Server Communication - Group Communication - Case Study - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call - Events and Notifications

**UNIT III****9 Hours****DISTRIBUTED TRANSACTIONS AND CONCURRENCY CONTROL**

Transactions - Locks - Optimistic Concurrency Control - Timestamp Ordering - Comparison - Flat and Nested - Distributed Transactions - Atomic Commit Protocols - Concurrency Control in Distributed Transactions - Distributed Deadlocks - Transaction Recovery

**UNIT IV**

**9 Hours**

**RESOURCE MANAGEMENT**

Time and Global States-Introduction - Clocks, Events and Process states - Synchronizing physical clocks  
Logical time and logical clocks - Global states-Distributed debugging - Coordination and Agreement-  
Introduction - Distributed mutual exclusion - Elections Algorithm - Multicast communication - Consensus  
and related problems.

**UNIT V**

**9 Hours**

**DISTRIBUTED FILE SYSTEM AND NAME SERVICES**

Distributed File Systems - Introduction - File service architecture - Network File System- Name Services  
and the Domain Name System - Directory Services. Distributed multimedia systems- characteristics -  
Quality of service management - Resource management

**Total: 45 Hours**

**FOR FURTHER READING**

Ethernet and WiFi - Interprocess Communication in UNIX and Java RMI - Transactions with  
Replicated Data - Amoeba- Mach - Sun Network File System - Global Name Service

**Reference(s)**

1. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, 2017
2. Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems, Principles and Paradigms, Pearson Education, 2014
3. Mugesh Singhal, Niranjana G Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Edition, 2008
4. M. L. Liu, Distributed Computing Principles and Applications, Pearson Education, 2004



**22CT602****MACHINE LEARNING****3 0 2 4****Course Objectives**

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

**Course Outcomes (COs)**

1. Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning
2. Explain theory of probability and statistics related to machine learning
3. Investigate concept learning, ANN, Bayes classifier, k nearest neighbor.
4. Implement classification algorithms using Python
5. Implement solutions for different real time problems using supervised and unsupervised algorithms.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	2										
2	1	2	2	2	1	1								
3	1		2	1	1	1							2	
4														
5	1	2	2	2									2	

**UNIT I****9 Hours****INTRODUCTION**

Well posed learning problems, designing a Learning system, Perspective and Issues in Machine Learning - Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

**UNIT II****9 Hours****DECISION TREE LEARNING**

Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

**UNIT III****9 Hours****ARTIFICIAL NEURAL NETWORKS**

Introduction, Neural Network representation, Appropriate problems, Perceptrons, Back propagation algorithm.

#### UNIT IV

9 Hours

##### BAYESIAN LEARNING

Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm

#### UNIT V

9 Hours

##### HYPOTHESIS, INSTANCE BASED AND REINFORCEMENT LEARNING

Evaluating Hypothesis: Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning Reinforcement Learning: Introduction, Learning Task, Q Learning

1

4 Hours

##### EXPERIMENT 1

Study of Color coding Jack RJ45 and do the following Cabling works in a network a. Cable Crimping  
b. Standard Cabling  
c. Cross Cabling and  
d. Establish a LAN connection using three systems using any topology.

2

2 Hours

##### EXPERIMENT 2

Configure IP Address in a system in LAN (TCP/IP Configuration) and Implement the client server communication using socket connection.

3

2 Hours

##### EXPERIMENT 3

Write a program for transferring a file between nodes in a network.

4

2 Hours

##### EXPERIMENT 4

Perform Bit Stuffing and CRC computation.

5

2 Hours

##### EXPERIMENT 5

By varying the no of frames, design the Sliding Window Protocol.

6

2 Hours

##### EXPERIMENT 6

Simulation of ARP/RARP

7

2 Hours

##### EXPERIMENT 7

Display the routing table for the nodes in a network using Distance Vector Routing (DVR) algorithm.

- |   |  |                |
|---|--|----------------|
| <b>8</b>  |  | <b>2 Hours</b> |
| <b>EXPERIMENT 8</b>   |  |                |
| Find the minimum cost in the node to node communication by Open Shortest Path First (OSPF) protocol |  |                |
|   |  |                |
| <b>9</b>  |  | <b>2 Hours</b> |
| <b>EXPERIMENT 9</b>   |  |                |
| Write a program for downloading a file from HTTP server   |  |                |
|   |  |                |
| <b>10</b>   |  | <b>4 Hours</b> |
| <b>EXPERIMENT 10</b>  |  |                |
| Develop a client that contacts a given DNS server to resolve a given host name.                     |  |                |
|   |  |                |
| <b>11</b>   |  | <b>2 Hours</b> |
| <b>EXPERIMENT 11</b>  |  |                |
| Configure a Network topology using Packet tracer software.  |  |                |
|   |  |                |
| <b>12</b>   |  | <b>4 Hours</b> |
| <b>EXPERIMENT 12</b>  |  |                |
| Study of Network simulator (NS) and Simulation of any one of routing protocol using NS2.            |  |                |

**Total: 75 Hours**

**Reference(s)**

1. Behrouz A.Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw-Hill, 2014
2. James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005
3. Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009
4. Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008
5. William Stallings, Data and Computer Communication, Pearson Education, 2007
6. Douglas E.Comer and M.S.Narayanan, Computer Networks and Internets, Pearson Education, 2008

**22CT603****CLOUD COMPUTING****3 0 2 4****Course Objectives**

- Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud based applications
- Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure
- Identify major security and privacy problems in cloud computing environment

**Course Outcomes (COs)**

- Analyze the components of cloud computing showing how business agility in an organization can be created.
- Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud.
- Analyze the key concepts of AWS storage for load balancing in cloud architecture.
- Investigate how a Windows Azure solution can be optimized so that it can be delivered successfully from the windows cloud
- Identify the risks and benefits of implementing cloud computing.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3										
2			1	3	2									
3			2	1	3				1					
4	1		2	1	3									
5	1		3		2									

**UNIT I****9 Hours****INTRODUCTION TO CLOUD COMPUTING**

Cloud computing at a glance - Historical developments -building cloud computing environments -Cloud Computing Architecture: The cloud reference model, deployment model & service model - computing platforms and technologies.

**UNIT II****9 Hours****VIRTUALIZATION**

Introduction & benefit of Virtualization -Implementation Levels of Virtualization- Virtualization at OS level - Virtualization structure - Xen Virtualization Architecture - Binary Translation with full Virtualization - Para Virtualization with Compiler Support - Virtualization in Intel x86processor

**UNIT III****9 Hours****AMAZON WEB SERVICES**

AWS Infrastructure - AWS ecosystem - AWS API & security - Amazon Storage - Simple Storage Service(S3) - Elastic Block Storage (EBS) - AWS Security policies, AWS compliance initiatives, Understanding public/private keys - AWS networking and databases service.

**UNIT IV** **9 Hours**

**WINDOWS AZURE**

Windows Azure Architecture and components of the Windows Azure Platform, Role of the Fabric Controller - Web worker, VM in Windows Azure, Azure Storage, SQL Azure - Windows Azure Web roles - Windows Azure API- Windows Azure local storage- Blob Storage & Table Storage

**UNIT V** **9 Hours**

**SECURITY**

Security for Virtualization Platform - Host security for SaaS, PaaS and IaaS - Data Security - Data Security Concerns - Data Confidentiality and Encryption - Data Availability - Data Integrity - Cloud Storage Gateways - Cloud Firewall.

**1** **3 Hours**

**EXPERIMENT 1**

Experiments on Networking Fundamentals

**2** **3 Hours**

**EXPERIMENT 2**

Installation and configuration of Oracle Virtualbox

**3** **5 Hours**

**EXPERIMENT 3**

Installation of Operating System in Virtualbox

**4** **3 Hours**

**EXPERIMENT 4**

Openstack Administration- I

**5** **6 Hours**

**EXPERIMENT 5**

Openstack Administration- II

**6** **4 Hours**

**EXPERIMENT 6**

Create and Deploy applications on Microsoft Windows Azure

**7** **3 Hours**

**EXPERIMENT 7**

Create and Deploy applications on Amazon Web Services

**8** **3 Hours**

**EXPERIMENT 8**

Create and Deploy applications on Google Cloud

**Total: 75 Hours**

**Reference(s)**

1. Matthew Portney, virtualization Essentials, John Wiley & Sons, Second Edition, 2016
2. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. devan Shah, Cloud Computing Black Book, Dreamtech press, 2015
3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S, Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013
4. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
5. <http://www.microsoft.com/learning/default.msp>  
<https://www.oreilly.com/library/view/cloud-security-and/9780596806453/ch04.html>

**22CT607****MINI PROJECT II****0 0 2 1****Course Objectives**

- Identify the problem statement and apply the engineering concepts to find the solution.
- Improve the analysing capability of the students.
- Increase the exuberance in finding the solution to various problems.

**Course Outcomes (COs)**

1. Formulate a real-world problem, identify the requirement, and develop the design solutions.
2. Identify technical ideas, strategies, and methodologies.
3. Utilize the new tools, algorithms, and techniques that contribute to obtaining the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis of the cost-effectiveness.
5. Prepare the report and present oral demonstrations.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2			2	2	2			1	1
2		-	1	1	2			2	2	2			1	1
3			1	1	2			2	2	2	2		1	1
4		-	1	1	2			2	2	2	2		1	1
5			-		2			2	2	2			1	1

**Total: 30 Hours**

**22CT701****BLOCKCHAIN TECHNOLOGY****3 0 2 4****Course Objectives**

- Understand the concepts of block chain technology (mainly Bitcoin and Ethereum).
- Develop the models for block chain design for an application.
- Apply the security in block chain applications.
- Apply the concept of implementation support and design the evaluation techniques for block chain
- Analyze the cognitive models and explicate the concept of cognitive architecture.

**Course Outcomes (COs)**

1. Analyze the functional/operational aspects of cryptocurrency ECOSYSTEM.
2. Develop the emerging abstract models for block chain Technology.
3. Apply the research challenges and technical gaps existing between theory and practice in cryptocurrency domain.
4. Apply the concept of implementation block chain system by sending and reading transactions.
5. Design, build, and deploy a distributed application.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2		2	2	2										
3	3	3	3		2								2	
4		2	2		3								2	
5		2	3		2									

**UNIT I****9 Hours****BASICS**

The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for Blockchain - Garay model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).

**UNIT II****9 Hours****CRYPTOCURRENCY**

cryptographic basics for cryptocurrency - short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography

**UNIT III****9 Hours****CRYPTOCURRENCY REGULATION**

Bitcoin - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin



**UNIT IV**

**9 Hours**

**ETHEREUM**

Ethereum - Ethereum Virtual Machine ( EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts

**UNIT V**

**9 Hours**

**TRENDS AND MODELS**

Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash

**1**

**4 Hours**

**EXPERIMENT 1**

Creating wallets and sending cryptocurrency

**2**

**4 Hours**

**EXPERIMENT 2**

Starting a Wordpress website

**3**

**4 Hours**

**EXPERIMENT 3**

Create blockchain explorer, Introduction to bitcoin (history, distributed P2P network, immutable ledger, forks and Byzantine Fault Tolerance

**4**

**4 Hours**

**EXPERIMENT 4**

Create your own cryptocurrency

**5**

**4 Hours**

**EXPERIMENT 5**

Tokenization and trading cryptocurrencies

**6**

**4 Hours**

**EXPERIMENT 6**

Start your own ICO

**7**

**6 Hours**

**EXPERIMENT 7**

Business applications and assessing blockchain projects

**TOTAL: 75 HOURS**

**Reference(s)**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015
3. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOI 9057, (Vol. II ), pp 281-310.
4. R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017, ([eprint.iacr.org/2016/454](http://eprint.iacr.org/2016/454)) . A significant progress and consolidation of several principles)
5. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.

**22CT702****MOBILE APPLICATION DEVELOPMENT****3 0 2 4****Course Objectives**

- Understand the basics of mobile application development
- Work with mobile app development platforms

**Course Outcomes (COs)**

1. Understand the basics of mobile application development
2. Design the architecture of android application development
3. Develop software using android
4. Develop applications using components of android framework
5. Develop android applications including files and databases

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2	2										3	
2		2	2										2	
3		3	3										2	
4		2	2										2	
5		2	2										2	

**UNIT I****9 Hours****INTRODUCTION**

Introduction to Android, Android versions and its feature set The various Android devices on the market, The Android Market application store, Android Development Environment - System Requirements, Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE), Creating Android Virtual Devices (AVDs)

**UNIT II****9 Hours****ANDROID ARCHITECTURE OVERVIEW**

The Android Software Stack, The Linux Kernel, Android Runtime - Dalvik Virtual Machine, Android Runtime Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Creating a New Android Project, Defining the Project Name and SDK Settings, Project Configuration Settings, Configuring the Launcher Icon, Creating an Activity, Running the Application in the AVD, Stopping a Running Application, Modifying the Example Application, Reviewing the Layout and Resource Files

**UNIT III****9 Hours****ANDROID SOFTWARE DEVELOPMENT PLATFORM**

Understanding Java SE and the Dalvik Virtual Machine, The Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes, Launching Your Application: The AndroidManifest.xml File, Creating Your First Android Application

#### UNIT IV

9 Hours

##### ANDROID FRAMEWORK OVERVIEW

Android Application Components, Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool

#### UNIT V

9 Hours

##### FILES, CONTENT PROVIDERS, AND DATABASES

Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers

##### FOR FURTHER READING

Mobile networking applications-network emulators

1

4 Hours

##### EXPERIMENT 1

Installation of Android studio and Development of Hello World Application

2

4 Hours

##### EXPERIMENT 2

Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button

3

4 Hours

##### EXPERIMENT 3

Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout)

4

4 Hours

##### EXPERIMENT 4

Design an android application to create page using Intent and one Button and pass the Values from one Activity to second Activity

5

4 Hours

##### EXPERIMENT 5

Design an android application Send SMS using Intent

6

6 Hours

##### EXPERIMENT 6

Create an android application using Fragments, Radio buttons and menu.

**7**

**4 Hours**

**EXPERIMENT 7**

Create a user registration application that stores the user details in a database table.

**Total: 75 Hours**

**Reference(s)**

1. Code Complete: A Practical Handbook of Software Construction, 2nd Edition by Steve McConnell.
2. Mobile Apps Made Simple: The Ultimate Guide to Quickly Creating, Designing and Utilizing Mobile Apps for Your Business, 2nd Edition by Jonathan McCallister
3. Android Application Development Cookbook- Second Edition by Rick Boyer and Kyle Mew

**22CT707****PROJECT WORK I****0042****Course Objectives**

- Work in teams to propose, formulate, and solve a challenging open-ended design problem of significant scope, depth, and breadth.
- Understand and incorporate engineering standards and multiple realistic constraints, within realistic design time, budget, and performance objectives.
- Develop a prototype of the proposed design and demonstrate the prototype in accordance with the specifications.
- Effectively communicate information relating to all aspects of the design process in written, oral, and graphical form.

**Course Outcomes (COs)**

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present the oral demonstrations.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	3	1	3	3	3	3	3		2	3	3
2	2	2	3	3	1	3	3	3	3	3	-	2	3	3
3	2	2	3	3	3	3	3	3	3	3	3	2	3	3
4	2	2	3	3	3	3	3	3	3	3	3	2	3	3
5	2	2			2			3	3	3		2	3	3

**Total: 60 Hours**

**22CT801****PROJECT WORK II****0 0 20 10****Course Objectives**

- Work in teams to propose, formulate, and solve a challenging open-ended design problem of significant scope, depth, and breadth.
- Understand and incorporate engineering standards and multiple realistic constraints, within realistic design time, budget, and performance objectives.
- Develop a prototype of the proposed design and demonstrate the prototype in accordance with the specifications.
- Effectively communicate information relating to all aspects of the design process in written, oral, and graphical form.

**Course Outcomes (COs)**

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present the oral demonstrations.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	3	1	3	3	3	3	3		2	3	3
2	2	2	3	3	1	3	3	3	3	3		2	3	3
3	2	2	3	3	3	3	3	3	3	3	2	2	3	3
4	2	2	3	3	3	3	3	3	3	3	2	2	3	3
5	2	2			2			3	3	3		2	3	3

**Total: 300 Hours**

22HS201

COMMUNICATIVE ENGLISH II

1 0 2 2

**Course Objectives**

- Command over the English language for day-to-day transactions.
- Improve listening and reading skills
- Increase ability to comprehend complex content
- Enhance confidence in expressing with clarity and elegance
- Enthusiastic and reflective use of the language through sufficient and focused practice
- Articulate fluently and confidently in challenging situations

**Course Outcomes (COs)**

1. Engage with the English language in functional contexts
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3		3		
2									3	3		3		
3									3	3		3		
4									3	3		3		
5									3	3		3		

**UNIT I****15 Hours****SELF-EXPRESSION**

Personal Goals and Values - Being a Team Player-Expressing strengths and weaknesses-Abstract nouns -Adjectives-Active Listening skills-Note making-Pronunciation and Accent  
 Personal goals and values - Reading for Gist and Details-Professional ethics-Reported Speech-  
 Conjunctions Reading skills - phonemics, word/phrase recognition, sight words  
 Personal Goals and Values-Conditional clauses- Hypothetical questions and answers-Sentence  
 Structure-Simple Present Tense-Perfect tense

**UNIT II****15 Hours****CREATIVE EXPRESSION**

Instructive and Expository Expression - Creating brochures, catalogues, and manuals for products/ services, Giving directions, Process writing, Sequencing experiments, Concept explanation-Reported speech-Voice Sentence equivalence-Proofreading



### UNIT III

15 Hours

#### FORMAL EXPRESSION

Notices and Announcements-Writing: Creating notices and circulars for events, announcing college tours and lost and found-Variety Vocabulary - Gender Sensitive Vocabulary, Non-discriminatory Vocabulary, Concise Vocabulary-Paragraph writing - Effective titles, topics and supporting sentences, calling in registrations and queries. Effective communication- Understanding purpose, reach and target audience, achieving complete communication Punctuation - Capitalization, Numeration, Use of proper nouns and articles-Spelling-Reading: Analyzing and interpreting notices and circulars-Understanding the gist of short real-world notices, and messages. Culling out keywords Information words vs Supporting Words-Interpreting Abbreviations, Acronyms and Short-forms-Listening: Analyzing and interpreting announcements Decoding - Screening for salient points-Note Making-Raising queries for clarification-Speaking: Announcements-Giving complete information-Pronunciation and Enunciation Pace, Intonation, and Pitch-Conducting Events-Speaking: Master of ceremonies, short speeches - welcome speech, the vote of thanks/ valedictory speech, award-acceptance speech Writing: Invitations, Preparation of script/draft after interviewing someone. Adjectives-Pronunciation/ Punctuation Precision and Concision-Politeness markers

**Total: 45 Hours**

#### Reference(s)

1. Sasikumar, V, et.al. A Course in Listening & Speaking FoundationBooks, 2005.
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010.
4. Reynolds, John. Cambridge First Language English. 2018th ed., Hodder Education, 2018.
5. Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

22HSH01

HINDI

1 0 2 2

**Course Objectives**

- To help students acquire the basics of Hindi
- To teach them how to converse in Hindi on simple day- to -day situations
- To help students understand a simple technical text in Hindi

**Course Outcomes (COs)**

1. Construct simple sentences and use vocabulary required for day- to -day conversation.
2. Distinguish and understand the basic sounds of Hindi language.
3. Apply appropriate grammar to write and speak in Hindi language
4. Comprehend the conversation and give correct meaning
5. Take up Hindi examinations conducted by Dakshin Bharat Hindi Prachar Sabha

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

**UNIT I****9 Hours****VOWELS AND CONSONANTS**

Hindi Alphabet: Introduction (Self introduction) - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu & Visarg -Table of Alphabet -Vocabulary.

**UNIT II****9 Hours****NOUNS**

Nouns: Genders -Masculine & Feminine -Reading Exercises

**UNIT III****9 Hours****PRONOUNS AND TENSES**

Pronouns and Tenses - Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

**UNIT IV****9 Hours****CLASSIFIED VOCABULARY**

Classified Vocabulary: Parts of body -Relatives Spices Eatables -Fruit & Vegetables -Clothes - Directions -Seasons Professions.

**UNIT V**

**9 Hours**

**CONVERSATIONS**

Speaking -Telling the times -Saying the Numbers from 1 to 50  
Speaking practice for various occasions.

**Total: 45 Hours**

**Reference(s)**

1. B.R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi, 2009.
2. Hindi Prachar Vahini - 1
3. Videos, Stories, Rhymes and Songs.

**22HSG01****GERMAN****1 0 2 2****Course Objectives**

- To help students appear for the A1 level Examination
- To teach them how to converse fluently in German in day-to-day scenarios

**Course Outcomes (COs)**

1. Listen and identify individual sounds of German
2. use basic phonemes and words while speaking
3. read and understand short passages on familiar topics
4. use basic sentence structures while writing
5. understand basic grammar and appropriate vocabulary in completing language tasks

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

**UNIT I****9 Hours****INTRODUCTION**

Introduction to the German language-Alphabets-Numbers Greetings -Days and Seasons-Working with Dictionary.

**UNIT II****9 Hours****LANGUAGE AND ITS COMMON USE**

Nouns -articles-Speaking about oneself-Listening to CD supplied with books-paying special attention to pronunciation

**UNIT III****9 Hours****TECHNICAL DEUTSCHE**

Regular &Irregular verbs -Personal pronouns-family-Introduction to types of sentences

**UNIT IV****9 Hours****INTERROGATION**

Question words -Types of Questions -Nominative case-Verb Conjugation -country -nationalities

**UNIT V****9 Hours****IMPLEMENTATION**

Verbs to be & to have -conjugation -Hobbies -Framing basic Questions and answers

**Total: 45 Hours**

**Reference(s)**

1. Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALS FREMDSPRACHE, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2015.
2. Langenscheidt Eurodictionary, German English / English German, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2009.
3. Grundkurs, DEUTSCH Lehrbuch Hueber Munichen, 2007.

22HSJ01

JAPANESE

1022

**Course Objectives**

- To train students for N5 Level Examination
- To teach them use basic Japanese sentences in day-to-day conversation
- To make students familiar with the Japanese cultural facets and social etiquette

**Course Outcomes (COs)**

1. Recognize and write Japanese alphabet
2. Speak using basic sounds of the Japanese language
3. Apply appropriate vocabulary needed for simple conversation in Japanese language
4. Apply appropriate grammar to write and speak in Japanese language
5. Comprehend the conversation and give correct meaning

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

**UNIT I****9 Hours****SELF INTRODUCTION / DEMONSTRATIVES / NOUN MODIFIERS**

Introduction to Japanese Japanese script - Pronunciation of Japanese(Hiragana (Katakana) Long vowels  
 - Pronunciation of in,tsu,ga -Letters combined with ya,yu,yo - Daily Greetings and Expressions -  
 Numerals. Speaking: Self Introduction -  
 Listening: Listening to Greetings, Listening to specific information: Numbers, Time

**UNIT II****9 Hours****TIME EXPRESSION / VERBS - PAST**

Introduction to time -Introduction of verbs -Listening to specific information

**UNIT III****9 Hours****ADJECTIVES**

Word Sentence -Introduction to Adjectives -Technical Japanese Vocabulary -Pair Activity Day to day situational conversation  
 Listening to Japanese Alphabet Pronunciation -Simple Conversation

**UNIT IV****9 Hours****CONJUGATION OF II ADJECTIVE**

Past tense of Noun sentences and Na adjective sentences -Past tense of ii adjective sentences -houga adjective desu -Technical Japanese Vocabulary -Individual Activity - Listening to conversation with related particles

**UNIT V**

**9 Hours**

**CONJUGATION OF VERBS - TE FORM / TA FORM / NAI FORM / PLAIN FORM**

N gahoshidesu - V masu form tai desu - Verb te form - Technical Japanese Vocabulary -Listening to different Counters, simple conversations with verbs and adjectives

**Total: 45 Hours**

**Reference(s)**

1. Minna no Nihongo Japanese for Everyone Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. Minna no Nihongo Japanese for Everyone Elementary Main Textbook 1-2 Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

**22HSF01****FRENCH****1 0 2 2****Course Objectives**

- To prepare the students for DELF A1 Examination
- To teach them to converse fluently in French in day-to-day scenarios

**Course Outcomes (COs)**

1. Help students acquire familiarity in the French alphabet & basic vocabulary
2. Listen and identify individual sounds of French
3. Use basic sounds and words while speaking
4. Read and understand short passages on familiar topics
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3		-		

**UNIT I****9 Hours****ENTRER EN CONTACT**

La langue française, alphabets, les numéros, les jours, les mois. Grammaire Les verbes s'appeler, être, avoir, les articles définis, indéfinis Communication Saluer, s'informer sur quelqu'un, demander de se présenter Lexique L'alphabet, les nationalités, l'âge, les pays, les couleurs, les jours de la semaine, les mois de l'année, les professions

**UNIT II****9 Hours****PARTAGER SON LIEU DE VIE**

Les français et leur habitat, des habitations insolites -Grammaire Verbes Conjugaison Présent (Avoir / Être / ER, IR, RE Régulier et Irrégulier) Adjectifs les propositions de lieu Communication Chercher un logement, décrire son voisin, s'informer sur un logement - Lexique L'habitat, les pièces, l'équipement, la description physique

**UNIT III****9 Hours****VIVRE AU QUOTIDIEN LES LOISIRS DES FRANÇAIS, LES GOUTS DES AUTRES, LES ACTIVITÉS QUOTIDIENNES**

Grammaire Articles contractés, verbes vouloir, pouvoir, devoir, adjectifs interrogatifs, future proche Communication Exprimer ses goûts, parler de ses loisirs, justifier un choix, exprimer une envie - Lexique le temps libre et les loisirs, les saisons, les activités quotidiennes, le temps (le matin, le soir, la nuit)



**UNIT IV**

**9 Hours**

**COMPRENDRE SON ENVIRONNEMENT SOUVENIR A LA CULTURE**

Grammaire Verbes Finir, Sortir, les adjectifs demonstratifs, le passe compose, l imparfait  
Communication Propose a quelqu un de faire quelque chose, raconter une sortie au passe, parler d un film  
Lexique Les sorties, la famille, l art, les vetements et les accessoires

**UNIT V**

**9 Hours**

**GOUTER A LA CAMPAGNE**

Grammaire La forme negative, les verbes acheter, manger, payer, articles partitifs, le pronom en de quantite

Communication Accepter et refuser une invitation, donner des instructions, commander au restaurant  
Lexique Les services et les commerces, les aliments, les ustensiles, l argent

**Total: 45 Hours**

**Reference(s)**

1. Grammaire Progressive du Francais, CLE International, 2010
2. Saison1, Marie Noelle Cocton et al, Didier, 2014.
3. Preparation a l examen du DELF A1 Hachette
4. Reussir le DELF A1 Bruno Girardeau
5. Website: Francais Linguaphone Linguaphone Institute Ltd., London, 2000.
6. Francais Harrisonburg : The Rosetta Stone : Fairfield Language Technologies, 2001

22CT001 / 22CTH01

**EXPLORATORY DATA ANALYSIS**

2023

**Course Objectives**

- To outline an overview of exploratory data analysis.
- To implement data cleaning and preparation techniques.
- To perform descriptive statistics and data visualization techniques to present insights from the data.
- To apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high dimensional data.

**Course Outcomes (COs)**

1. Understand the fundamentals of exploratory data analysis.
2. Implement the data cleaning and preparation techniques.
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data.
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns.
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3								2	
2	2	2	2	3	3								3	
3	2	3	2	2	3								2	
4	2	2	2	2	3								2	
5	2	2	3	2	1								2	

**UNIT I****6 Hours****EXPLORATORY DATA ANALYSIS**

Overview of Exploratory Data Analysis- importance of EDA - data analysis process: data collection, data cleaning, and data exploration- Introduction to common data types and formats - Introduction to Python - data analysis libraries.

**UNIT II****6 Hours****DATA CLEANING AND PREPARATION**

Introduction to data quality issues and common data cleaning techniques - Handling missing data and outliers - Data transformation techniques - Feature engineering and variable creation.

**UNIT III** **6 Hours**

**DESCRIPTIVE STATISTICS AND DATA VISUALIZATION**

Descriptive statistics: measures of central tendency, dispersion, and shape - Data visualization principles and best practices - Exploratory data visualization using Matplotlib and Seaborn

**UNIT IV** **6 Hours**

**EXPLORATORY DATA ANALYSIS TECHNIQUES**

Univariate analysis: exploring single variables - Bivariate analysis: exploring relationships between variables - Multivariate analysis: analyzing relationships among multiple variables - Exploring time series data.

**UNIT V** **6 Hours**

**DIMENSIONALITY REDUCTION TECHNIQUES**

Introduction to dimensionality reduction - Principal Component Analysis (PCA) and its applications - Distributed Stochastic Neighbor Embedding (t-SNE) for visualization.

**1** **5 Hours**

**EXPERIMENT 1**

Explore the Titanic dataset using descriptive statistics and data visualization.

1. Load the Titanic dataset.
2. Calculate the descriptive statistics for each variable.
3. Create a variety of data visualizations to explore the relationships between variables.
4. Interpret the results of the descriptive statistics and data visualizations.

**2** **5 Hours**

**EXPERIMENT 2**

Clean and prepare the California housing dataset for analysis.

1. Identify and handle missing data.
2. Identify and remove outliers.
3. Convert categorical variables to numerical variables.
4. Explore the distribution of the data after cleaning and preparing it.

**3** **5 Hours**

**EXPERIMENT 3**

Perform univariate analysis on the Iris dataset.

1. Calculate the descriptive statistics for each variable.
2. Create a variety of data visualizations to explore the distribution of each variable.
3. Interpret the results of the descriptive statistics and data visualizations.

**4** **5 Hours**

**EXPERIMENT 4**

Perform bivariate analysis on the Boston housing dataset.

1. Explore the relationship between housing prices and different features of the houses, such as the number of rooms, the lot size, and the crime rate.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the bivariate analysis.

**5**

**5 Hours**

**EXPERIMENT 5**

Perform multivariate analysis on the Wine dataset.

1. Explore the relationships between different features of the wine, such as the color, the acidity, and the alcohol content.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the multivariate analysis.

**6**

**5 Hours**

**EXPERIMENT 6**

Apply dimensionality reduction techniques to the MNIST dataset.

1. Use PCA to reduce the dimensionality of the dataset from 784 dimensions to 2 dimensions.
2. Visualize the reduced data using a scatter plot.
3. Interpret the results of the dimensionality reduction.

**Total: 60 Hours**

**Reference(s)**

1. Provost, Foster, and Tom Fawcett. "Data Science for Business: What you need to know about data mining and data-analytic thinking " O'Reilly Media, Inc.", 2013. (Unit 1)
2. McKinney, Wes. "Python for Data Analysis." O'Reilly Media, Inc.", 2022. (Unit 1, 3, 5)
3. Knafllic, Cole Nussbaumer. "Storytelling with data: A data visualization guide for business professionals". John Wiley & Sons, 2015. (Unit 2)
4. Kazi, Jacqueline, and Katharine Jarmul. "Data wrangling with python: tips and tools to make your life easier. " O'Reilly Media, Inc.", 2016. (Unit 3)
5. Wickham, Hadley, and Garrett Grolemund. "R for data science: import, tidy, transform, visualize, and model data. " O'Reilly Media, Inc.", 2016. (Unit 4, 5)
6. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015

**22CT002 / 22CTH02 RECOMMENDER SYSTEMS****3 0 0 3****Course Objectives**

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender Systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering

**Course Outcomes (COs)**

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
4. Implement a simple recommender system.
5. Learn about Evaluating Paradigms of recommender systems and its applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1								2	
2	1	2	1	1	1								3	
3	2	3	1	1	1								2	
4	3	2	2	2	1								2	
5	2	2	1	2	1								3	

**UNIT I****9 Hours****INTRODUCTION**

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

**UNIT II****9 Hours****CONTENT-BASED RECOMMENDATION SYSTEMS**

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

**UNIT III****9 Hours****COLLABORATIVE FILTERING**

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection)

**UNIT IV**

**9 Hours**

**ATTACK-RESISTANT RECOMMENDER SYSTEMS**

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

**UNIT V**

**9 Hours**

**EVALUATING RECOMMENDER SYSTEMS**

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

**Total: 45 Hours**

**Reference(s)**

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020

**22CT003 / 22CTH03****BIG DATA ANALYTICS****3 0 0 3****Course Objectives**

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in mapreduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics

**Course Outcomes (COs)**

1. Understand the big data and use cases from selected business domains.
2. Understand NoSQL big data management.
3. Utilize map reduce analytics and related tools.
4. Understand the basics of Hadoop.
5. Apply the usage of Hadoop related tools for Big Data Analytics

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								3	
5	2	2	1		3								3	

**UNIT I****9 Hours****UNDERSTANDING BIG DATA**

Introduction to big data – Convergence of key trends – Unstructured data – Industry examples of big data – Web analytics – Big data applications– Big data technologies – Introduction to Hadoop – Open source technologies – Cloud and big data – Mobile business intelligence – Crowd sourcing analytics – Inter and trans firewall analytics.

**UNIT II****9 Hours****NOSQL DATA MANAGEMENT**

Introduction to NoSQL – Aggregate data models – Key-value and document data models –Relationships – Graph databases – Schema less databases – Materialized views – Distribution models – Master-slave replication – Consistency - Cassandra – Cassandra data model – Cassandra examples –Cassandra clients

**UNIT III****9 Hours****MAP REDUCE APPLICATIONS**

MapReduce workflows – Unit tests with MRUnit – Test data and local tests – Anatomy of MapReduce job run – Classic Map-reduce – YARN – Failures in classic Map-reduce and YARN – Job scheduling – Shuffle and sort – Task execution – MapReduce types – Input formats – Output formats

#### **UNIT IV**

**9 Hours**

##### **BASICS OF HADOOP**

Data format – Analyzing data with Hadoop – Scaling out – Hadoop streaming – Hadoop pipes – Design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – Data flow – Hadoop I/O – Data integrity – Compression – Serialization – Avro – File-based data structures - Cassandra – Hadoop integration.

#### **UNIT V**

**9 Hours**

##### **HADOOP RELATED TOOLS**

Hbase – Data model and implementations – Hbase clients – Hbase examples – Praxis. Pig – Grunt – Pig data model – Pig Latin – Developing and testing Pig Latin scripts. Hive – Data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

##### **FOR FURTHER READING**

Selecting NoSQL / SQL based on applications – Bigquery – Data analytics with R language – Connecting to Mongo DB – Connecting to Cassandra – Linear Regression – Clustering – Collaborative filtering – Association rule mining – Decision tree.

**Total: 45 Hours**

#### **Reference(s)**

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Sadalage, Pramod J. "NoSQL distilled", 2013
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
6. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
7. Alan Gates, "Programming Pig", O'Reilley, 2011.



**22CT004 / 22CTH04 NEURAL NETWORKS AND DEEP LEARNING****2023****Course Objectives**

- To understand the major concepts in deep neural networks.
- To apply Convolutional Neural Network architectures for any real-life applications
- To analyze the key computations underlying deep learning to build and train deep neural networks for various tasks

**Course Outcomes (COs)**

1. Apply Convolution Neural Network for any suitable applications.
2. Analyze the various categories of associative memory and unsupervised learning networks.
3. Apply Convolutional Neural Networks and its variants for any suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
5. Apply autoencoders and generative models for suitable applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1		1								2	
2	2	2	3		3								2	
3	2	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

**UNIT I****6 Hours****UNDERSTANDING NEURAL NETWORKS**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction  
Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

**UNIT II****6 Hours****ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS**

Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

**UNIT III****6 Hours****THIRD-GENERATION NEURAL NETWORKS**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

**UNIT IV** **6 Hours**

**DEEP FEEDFORWARD NETWORKS**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

**UNIT V** **6 Hours**

**RECURRENT NEURAL NETWORKS**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.

**FOR FURTHER READING**

Neocognition architecture – Neocognition Data processing – Generative Deep Learning- Deep Learning for Time Series

**1** **3 Hours**

**EXPERIMENT 1**

Implement simple vector addition in TensorFlow.

**2** **3 Hours**

**EXPERIMENT 2**

Implement a regression model in Keras.

**3** **3 Hours**

**EXPERIMENT 3**

Implement a perceptron in TensorFlow/Keras Environment.

**4** **3 Hours**

**EXPERIMENT 4**

Implement a Feed-Forward Network in TensorFlow/Keras.

**5** **3 Hours**

**EXPERIMENT 5**

Implement an Image Classifier using CNN in TensorFlow/Keras.

**6** **3 Hours**

**EXPERIMENT 6**

Improve the Deep learning model by fine tuning hyper parameters.

**7** **3 Hours**

**EXPERIMENT 7**

Implement a Transfer Learning concept in Image Classification.

**8** **3 Hours**

**EXPERIMENT 8**

Using a pre trained model on Keras for Transfer Learning

**9** **3 Hours**

**EXPERIMENT 9**

Perform Sentiment Analysis using RNN

**10**

**3 Hours**

**EXPERIMENT 10**

Implement an LSTM based Autoencoder in TensorFlow/Keras.

**Total: 60 Hours**

**Reference(s)**

1. S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications”, PHI Learning, 2017
2. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.
3. James A Freeman, David M S Kapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
5. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021.
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.

**22CT005 / 22CTH05 NATURAL LANGUAGE PROCESSING****3 0 0 3****Course Objectives**

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

**Course Outcomes (COs)**

1. Understand basics of linguistics, probability and statistics associated with NLP
2. Implement a Part-of-Speech Tagger
3. Design and implement a sequence labeling problem for a given domain
4. Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP
5. Implement a simple chatbot using dialogue system concepts

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	1	2	3		3								2	
3	2	3	3		3								2	
4	3	2	2		3								2	
5	2	2	1		3								2	

**UNIT I****9 Hours****INTRODUCTION**

Natural Language Processing – Components - Basics of Linguistics and Probability and Statistics – Words-Tokenization-Morphology-Finite State Automata.

**UNIT II****9 Hours****STATISTICAL NLP AND SEQUENCE LABELING**

N-grams and Language models –Smoothing -Text classification- Naïve Bayes classifier –Evaluation - Vector Semantics – TF-IDF - Word2Vec- Evaluating Vector Models –Sequence Labeling – Part of Speech – Part of Speech Tagging -Named Entities –Named Entity Tagging

**UNIT III****9 Hours****CONTEXTUAL EMBEDDING**

Constituency –Context Free Grammar –Lexicalized Grammars- CKY Parsing – Earley's algorithm Evaluating Parsers -Partial Parsing – Dependency Relations- Dependency Parsing –Transition Based - Graph Based.

**UNIT IV**

**9 Hours**

**COMPUTATIONAL SEMANTICS**

Word Senses and WordNet – Word Sense Disambiguation – Semantic Role Labeling – Proposition Bank  
FrameNet- Selectional Restrictions - Information Extraction - Template Fill

**UNIT V**

**9 Hours**

**DISCOURSE ANALYSIS AND SPEECH PROCESSING**

Discourse Coherence – Discourse Structure Parsing – Centering and Entity Based Coherence – Question  
Answering –Factoid Question Answering – Classical QA Models – Chatbots and Dialogue systems –  
Frame-based Dialogue Systems – Dialogue–State Architecture.

**FOR FURTHER READING**

Frame-based Dialogue Systems – Dialogue–State Architecture

**Total: 45 Hours**

**Reference(s)**

1. Daniel Jurafsky and James H.Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition” (Prentice Hall Series in Artificial Intelligence), 2020.
2. Jacob Eisenstein. “Natural Language Processing “, MIT Press, 2019.
3. Samuel Burns “Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.
4. Christopher Manning, “Foundations of Statistical Natural Language Processing”, MIT Press,2009.
5. Nitin Indurkha,Fred J. Damerau, “Handbook of Natural Language Processing”, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010.

**22CT006 / 22CTH06****COMPUTER VISION****3 0 0 3****Course Objectives**

- To understand the fundamental concepts related to Image formation and processing
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image-based rendering and recognition

**Course Outcomes (COs)**

1. To understand basic knowledge, theories and methods in image processing and computer vision.
2. To implement basic and some advanced image processing techniques in OpenCV.
3. To apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To apply 3D image reconstruction techniques
5. To design and develop innovative image processing and computer vision applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		1		2	1	2	2	3	
3	3	3	2	2	3				1	1	2	2	3	
4	2	3	3	2	3				2	1	2	3	2	
5	2	3	3	2	2	2			2	1	2	3	3	

**UNIT I****9 Hours****INTRODUCTION TO IMAGE FORMATION AND PROCESSING**

Computer Vision - Geometric primitives and transformations - Photometric image formation – The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

**UNIT II****9 Hours****FEATURE DETECTION, MATCHING AND SEGMENTATION**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

**UNIT III****9 Hours****FEATURE-BASED ALIGNMENT & MOTION ESTIMATION**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

**UNIT IV****9 Hours****3D RECONSTRUCTION**

Shape from X - Active range finding - Surface representations - Point-based representations Volumetric representations – Model-based reconstruction - Recovering texture maps and albedos.

## UNIT V

9 Hours

### IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes – Video based Rendering-Object detection - Face recognition - Instance recognition - Category recognition -Context and scene understanding- Recognition databases and test sets.

**Total: 45 Hours**

### Reference(s)

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

22CT007

**AGILE SOFTWARE DEVELOPMENT****3 0 0 3****Course Objectives**

- To provide students with a theoretical as well as practical understanding of agile software development practices.
- To understand the Agile Scrum framework and development practices.
- To apply software design principles and refactoring techniques to achieve agility.
- To understand Agile requirements and perform testing activities within an agile project.
- To understand the benefits and pitfalls of working in an Agile team in terms of quality assurance.

**Course Outcomes (COs)**

1. Understand genesis of Agile and driving forces for choosing Agile techniques.
2. Apply the Agile Scrum framework and development practices.
3. Apply iterative software development processes by planning and executing them.
4. Analyze the impact of the success of social aspects behind the software testing.
5. Analyze techniques and tools for improving team collaboration and management.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2									2	2	1
2	2	2	2										2	
3	1		2		2							2	2	
4	1		2		2							2	2	
5	1		2		2							2		2

**UNIT I****9 Hours****AGILE METHODOLOGY**

Theories for Agile management – agile software development – traditional model vs. agile model – classification of agile methods – agile manifesto and principles – agile project management – agile team interactions – ethics in agile teams – agility in design, testing – agile documentations – agile drivers, capabilities and values.

**UNIT II****9 Hours****AGILE PROCESSES**

Extreme Programming: Method overview – lifecycle – work products, roles and practices- Lean production – SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Kanban model.

**UNIT III****9 Hours****AGILITY AND KNOWLEDGE MANAGEMENT**

Agile information systems – agile decision making – Early schools of KM – institutional knowledge evolution cycle – development, acquisition, refinement, distribution, deployment, leveraging – KM in software engineering – managing software knowledge – challenges of migrating to agile methodologies – agile knowledge sharing – role of story-cards – Story-card Maturity Model (SMM).

**UNIT IV****9 Hours****AGILITY AND REQUIREMENTS ENGINEERING**

Impact of agile processes in RE – current agile practices – variance – overview of RE using agile – managing unstable requirements – requirements elicitation – agile requirements abstraction model – requirements management in agile environment, agile requirements prioritization – agile requirements modeling and generation – concurrency in agile requirements generation



**UNIT V**

**9 Hours**

**AGILITY AND QUALITY ASSURANCE**

Agile Interaction Design - Agile product development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile approach to Quality Assurance - Test Driven Development – Pair programming: Issues and Challenges - Agile approach to Global Software Development.

**Total: 45 Hours**

**Reference(s)**

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), —Agile Software Development, Current Research and Future Directions, Springer-Verlag Berlin Heidelberg, 2010
2. David J. Anderson; Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003
3. Hazza & Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, VIII edition, 2009
4. Craig Larman, —Agile and Iterative Development: A manager's Guide, Addison-Wesley, 2004
5. Kevin C. Desouza, —Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007.

**22CT008****UI AND UX DESIGN****3 0 0 3****Course Objectives**

- Study about designing web pages and understand the difference between UI and UX Design.
- To understand the concept of UX design and how it has evolved. Able to understand UX design process and methodology.
- Learning the Importance and scope of Interaction design, User centered design

**Course Outcomes (COs)**

1. Understand to do user research, persona mapping, customer journey mapping
2. Design of interactive products Methods of interaction design Tools for interaction design
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests Learning steps for digital products.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													2
2	1	2	2		1									2
3		3	3		1									2
4		2	2											2
5		2	2											2

**UNIT I****9 Hours****USER-CENTERED DESIGN PROCESS**

Scripting Languages – HTML, CSS - Fundamentals of graphics design, principles of visual design - Overview of UI & UX Design - Overview of the UX Design Process - Difference between User Interface (UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation –Primary and Secondary persona - Requirement definition - Creative ideation – brainstorming and ideation techniques- Scenarios and functionality extraction - Information Architecture - Task flows - Wireframe design

**UNIT II****9 Hours****FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN**

Design Principles for UX and UI Design - UI Elements-Patterns - Material Design (Google) and Human Interface Design (Apple) guidelines - Interaction Principles & Interaction Behaviour - Master the Brand Platforms & Style Guides - comments and current UI patterns - Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

**UNIT III****9 Hours****ELEMENTARY SKETCHING & WIREFRAMING**

Principles of Sketching - Core Responsive Design - Wireframing vs Wireflows - Click through Wireframing Prototyping - Wireflow Creation - Work with different tools – Figma - Low-High Fidelity Design: Inclusive Design and Designing for Accessibility - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Designing animations and interactions

#### UNIT IV

9 Hours

##### UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING

Building a Design System – Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration - Use of grids in UI design - Design animations and interaction patterns for key UI elements

#### UNIT V

9 Hours

##### USABILITY EVALUATION AND PRODUCT DESIGN

Type of usability evaluation – Qualitative & Quantitative evaluation - Guerilla testing, A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud - Think aloud – Introduction and advantages - Designing evaluation protocol - Conducting usability evaluation study - Conduct Usability Test explicit - Synthesize Test Findings - practices in corporate World - Product Design : Types of products & solutions - Design Psychology for e-commerce sites , CMS - Design Thinking Life Cycle

**Total: 45 Hours**

#### Reference(s)

1. Norman, Donald A. The Design of Everyday Things. Basic Books, 2002. ISBN: 9780465067107.
2. Nielsen, Jakob. Usability Engineering. Morgan Kaufmann, 1993. ISBN: 9780125184069.
3. Mullet, Kevin, and Darrell Sano. Designing Visual Interfaces: Communication Oriented Techniques. Prentice Hall, 1994. ISBN: 9780133033892.
4. Wilbent. O. Galitz, “The Essential Guide To User Interface Design”, John Wiley & Sons, 2001.
5. Ben Sheiderman, “Design the User Interface”, Pearson Education, 1998.
6. Alan Cooper, “The Essential of User Interface Design”, Wiley – Dream Tech Ltd., 2002.
7. Baecker, Ronald M., Jonathan Grudin, et al. Readings in Human-Computer Interaction: Toward the Year 2000. 2nd ed. Morgan Kaufmann, 1995. ISBN: 9781558602465.
8. Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed. Addison Wesley, 2004. ISBN: 9780321197863.
9. Dix, Alan J., Janet E. Finlay, et al. Human-Computer Interaction. 2nd ed. Prentice Hall, 1998. ISBN: 9780132398640.
10. Olsen, Dan R. Developing User Interfaces (Interactive Technologies). Morgan Kaufmann, 1998. ISBN: 9781558604186.

**22CT009****WEB FRAMEWORKS****3 0 0 3****Course Objectives**

- Understand the architecture behind an Angular application and how to use it
- To understand the significance of using MongoDB as a database system
- To understand the role of React in designing front-end components
- Build a Web Server in Node and understand how it really works
- Develop a web application and API using web frameworks

**Course Outcomes (COs)**

1. Apply modules and components and Animations for creating Forms and developing webpages
2. Create web applications by performing CRUD operations in database using webframeworks
3. Design Progressive Web Application with dynamic HTML web pages using Angular.
4. Design single page applications with reusable UI components using React CSS andSaaS
5. Use Node Package Manager and Node packages for Server-Side programming.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		2								2	
2	1		1		3								3	
3	1		2		2								3	
4	1		1		3								2	
5	1		1		3								2	

**UNIT I****9 Hours****ANGULAR FRONT-END FRAMEWORK**

Introduction - Setup - Architecture: Modules, Components, Services and DI fundamentals - Components and Templates – Configuration- Forms - Observables & RxJS - Boot Strapping - NgModules - Dependency Injection - Http Client - Routing and Navigation - Animations

**UNIT II****9 Hours****FRAMEWORKS WITH DATABASES**

MongoDB - MongoDB Basics - Documents - Collections - Query Language - Installation - The mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB - CRUD operations - projections - Indexing - Aggregation - Replication - Sharding - Creating backup – Deployment

**UNIT III****9 Hours****ANGULAR TECHNIQUES**

Service workers & PWA - Server-side rendering - Angular Libraries - Schematics - CLI Builders - Angular Ivy - Web Workers

**UNIT IV****9 Hours****REACT**

React Introduction - React ES6 - React Render HTML - React JSX - Components -React Classes - Composing Components - Passing Data - Dynamic Composition - React state - setting State - Async State Initialization - Event Handling Communicating from Child to Parent - Stateless Components - Designing components- React Forms - React CSS - React SaaS

**UNIT V**

**9 Hours**

**NODE JS BACK-END FRAMEWORK**

Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js Event Emitter - Frameworks for Node.js -Express.js Web App - Serving static Resource - Node.js Data Access

**Total: 45 Hours**

**Reference(s)**

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasanth Subramanian, A Press Publisher, 2019.
2. Christoffer Noring, Pablo Deeleman, Learning Angular, Packt Publishing Limited, 2nd Revised edition, 2017.
3. Caleb Dayley Brad Dayley, Brendan Dayley, Node.js, MongoDB and Angular Web Development, 2nd Edition, Pearson, 2018.
4. Shyam Seshadri, Angular: Up and Running- Learning Angular, Step by Step, O'Reilly; First edition, 2018

**22CT010****WEB APPLICATION SECURITY****2023****Course Objectives**

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

**Course Outcomes (COs)**

1. Understanding the basic concepts of web application security and the need for it
2. Be acquainted with the process for secure development and deployment of web applications
3. Acquire the skill to design and develop Secure Web Applications that use Secure APIs
4. Be able to get the importance of carrying out vulnerability assessment and penetration testing
5. Acquire the skill to think like a hacker and to use hackers tool sets

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	1	3							1	2	
2	2	1	2	1	3								2	
3	1	1	1	2	3							1	2	
4	1	2	1	1	2								2	
5	1	2	2	2	2							1	2	

**UNIT I****6 Hours****FUNDAMENTALS OF WEB APPLICATION SECURITY**

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

**UNIT II****5 Hours****SECURE DEVELOPMENT AND DEPLOYMENT**

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

**UNIT III****6 Hours****SECURE API DEVELOPMENT**

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

**UNIT IV****6 Hours****VULNERABILITY ASSESSMENT AND PENETRATION TESTING**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

**UNIT V**

**7 Hours**

**HACKING TECHNIQUES AND TOOLS**

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

**1**

**6 Hours**

**EXPERIMENT 1**

Install wireshark and explore the various protocols

- a. Analyze the difference between HTTP vs HTTPS
- b. Analyze the various security mechanisms embedded with different protocols

**2**

**6 Hours**

**EXPERIMENT 2**

Identify the vulnerabilities using OWASP ZAP tool

**3**

**6 Hours**

**EXPERIMENT 3**

Create simple REST API using python for following operation

- a) GET,
- b) PUSH,
- c) POST
- d) DELETE

**6 Hours**

**4**

**EXPERIMENT 4**

Install Burp Suite to do following vulnerabilities:

- a) SQL injection
- b) cross-site scripting (XSS)

**5**

**6 Hours**

**EXPERIMENT 5**

Attack the website using Social Engineering method

**Total: 60 Hours**

**Text Books**

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

**Reference(s)**

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.  
Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
4. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron
5. Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.



**22CT011**  
**Course Objectives**
**SOFTWARE TESTING AND AUTOMATION**
**3 0 0 3**

- Understand the importance of software testing in the software development process
- Analyze different testing methodologies and techniques to create test plans, test cases, and test scripts
- Apply automation testing tools and frameworks to design and implement automated test suites

**Course Outcomes (COs)**

1. Understand the importance of testing in the software development process
2. Compare the different test case design strategies
3. Analyze the different levels of testing and their importance
4. Apply test management techniques and the role of a test specialist
5. Analyze the software test automation and its requirements

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		1									2
2	2	3	2		2								1	2
3	2	2	2		2								1	2
4	2	3	2		3									2
5	3	2	1		3								2	2

**UNIT I**
**9 Hours**
**INTRODUCTION**

Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples- Developer/Tester Support of Developing a Defect Repository.

**UNIT II**
**9 Hours**
**TEST CASE DESIGN STRATEGIES**

Test Scenarios - Test Cases - Test case Design Strategies - Black Box Approach to Test Case Design - Using White Box Approach to Test design – Test Adequacy Criteria – Static testing vs. Structural testing – Code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Code complexity testing – Additional White box testing approaches - Test Coverage

**UNIT III**
**9 Hours**
**LEVELS OF TESTING**

Types of testing - manual and automation - Introduction to testing methods - White-box, Black-box and Grey-box - Functional testing - Non-functional testing - Introduction to levels of testing– Unit Testing, Integration Testing, System Testing, User Acceptance Testing - Introduction to types of testing – Regression Testing, Smoke Testing, Database Testing, Usability Testing, Load Testing, Stress Testing, Performance Testing, Compatibility Testing, Security Testing, Internationalization Testing, Localization Testing

#### **UNIT IV**

**9 Hours**

##### **TEST MANAGEMENT**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group - The Technical Training Program.

#### **UNIT V**

**9 Hours**

##### **TEST AUTOMATION**

Software test automation – Design and Architecture for Automation - Automation testing - Automation Tools - Selenium Web Driver - Create Selenese Commands - TestNG - TestNG Annotations - Jmeter - Assertions in JMeter - Junit

**Total: 45 Hours**

#### **Text Books**

1. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2006.
2. Ron Patton, “Software Testing”, Second Edition, Sams Publishing, Pearson Education, 2007.

#### **Reference(s)**

1. Ilene Burnstein, “Practical Software Testing”, Springer International Edition, 2003.
2. Edward Kit,” Software Testing in the Real World – Improving the Process”, Pearson Education, 1995.
3. Boris Beizer,” Software Testing Techniques” – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, “Foundations of Software Testing \_ Fundamental Algorithms and Techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

**22CT012****DEVOPS****3 0 0 3****Course Objectives**

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real-world problems

**Course Outcomes (COs)**

1. Understand different actions performed through Version control tools like Git.
2. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
3. Ability to Perform Automated Continuous Deployment.
4. Ability to do configuration management using Ansible.
5. Understand to leverage Cloud-based DevOps tools using Azure DevOps.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2								2	
2	3	3	3	3	2								2	
3	2	2	2	3	2								2	
4	2	2	2	2	2								2	
5	2	2	2	2	2								2	

**UNIT I****7 Hours****INTRODUCTION TO DEVOPS**

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and GitHub

**UNIT II****10 Hours****COMPILE AND BUILD USING MAVEN & GRADLE**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, build phases (compile build, test, package) Maven Profiles-Maven repositories (local, central, global)- Maven plugins- Maven create and build Artifacts- Dependency Management-Installation of Gradle- understanding build using Gradle.

**UNIT III****12 Hours****CONTINUOUS INTEGRATION USING JENKINS**

Install &amp; Configure Jenkins- Jenkins Architecture Overview- creating a Jenkins Job- Configuring a Jenkins job- Introduction to Plugins- Adding Plugins to Jenkins-commonly used plugins (Git Plugin, Parameter Plugin- HTML Publisher- Copy Artifact, and Extended choice parameters). Configuring Jenkins to work with Java- Git- and Maven- Creating a Jenkins Build and Jenkins workspace

#### UNIT IV

9 Hours

##### CONFIGURATION MANAGEMENT USING ANSIBLE

Ansible Introduction- Installation-Ansible master/slave configuration- YAML basics-Ansible Modules- Ansible Inventory files- Ansible playbooks- Ansible Roles- and ad-hoc commands in Ansible

#### UNIT V

7 Hours

##### BUILDING DevOps PIPELINES USING AZURE

Create GitHub Account, Create Repository- Create Azure Organization- Create a new pipeline- Build a sample code- Modify azure-pipelines- yaml file

**Total: 45 Hours**

##### Textbook(s)

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014

##### Reference(s)

1. Hands-On Azure DevOps: Cidc Implementation for Mobile, Hybrid, And Web Applications Using Azure DevOps and Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni.
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.
5. <https://www.jenkins.io/user-handbook.pdf>
6. <https://maven.apache.org/guides/getting-started/>

**22CT013****VIRTUALIZATION IN CLOUD COMPUTING****3 0 0 3****Course Objectives**

- Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud-based applications.
- Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure.
- Identify major security and privacy problems in cloud computing environment.
- Apply the ability to use the architecture of cloud, service and delivery models.
- Implement the key enabling technologies that help in the development of cloud.

**Course Outcomes (COs)**

1. Analyze the concept of virtualization and its properties.
2. Apply different forms of virtualization.
3. Implement various architectures for implementing virtualization methods.
4. Create virtual machines and installing various operating systems.
5. Evaluate the performance of the virtual machines and deployed applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3										1	2
2		1	3	2									1	2
3		2	1	3									1	2
4	1	2	1	3									1	2
5	1	3		2									1	2

**UNIT I****9 Hours****UNDERSTANDING VIRTUALIZATION**

Describing Virtualization-Microsoft Windows Drives Server Growth -Explaining Moore's Law-Understanding the Importance of Virtualization -Examining Today's Trends -Virtualization and Cloud Computing -Understanding Virtualization Software Operation -Virtualizing Servers -Virtualizing Desktops -Virtualizing Applications

**UNIT II****9 Hours****HYPERVISORS**

Describing a Hypervisor -Exploring the History of Hypervisors -Understanding Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor -Holodecks and Traffic Cops -Resource Allocation -Comparing Today's Hypervisors -VMware ESX -Citrix Xen -Microsoft Hyper-V -Other Solutions.

**UNIT III****9 Hours****VIRTUAL MACHINES**

Introduction to Virtual Machine - CPUs in a Virtual Machine -Memory in a Virtual Machine -Network Resources in a Virtual Machine - Storage in a Virtual Machine -Understanding How a Virtual Machine Works -Working with Virtual Machines -Virtual Machine Clones -Templates -Snapshots -OVF -Containers

#### **UNIT IV**

**9 Hours**

##### **CREATION OF VIRTUAL MACHINES & CONFIGURATIONS**

Understanding Configuration Options-Installing Windows on a Virtual Machine- Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions- Managing CPUs for a Virtual Machine-Configuring VM CPU Options-Managing Storage for a Virtual Machine- Managing Networking for a Virtual Machine- Copying a Virtual Machine- Managing Additional Devices in Virtual Machines

#### **UNIT V**

**9 Hours**

##### **AVAILABILITY & APPLICATIONS IN A VIRTUAL MACHINE**

Increasing Availability-Protecting a Virtual Machine-Protecting Multiple Virtual Machines-Protecting Data Centers - Examining Virtual Infrastructure Performance Capabilities -Deploying Applications in a Virtual Environment-Understanding Virtual Appliances and vApps -Open Stack and Containers.

**Total: 45 Hours**

#### **Reference(s)**

1. Matthew Portney, Virtualization Essentials, John Wiley & Sons, Second Edition, 2016
2. Kailash Jayaswal, Jagannath Kallakurchi,Donald J.Houde,Dr.devan Shah, Cloud Computing Black Book, Dreamtech press, 2015
3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S,Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013
4. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
5. <http://www.microsoft.com/learning/default.msp>
6. <https://www.oreilly.com/library/view/cloud-security-and/9780596806453/ch04.html>

22CT014

**CLOUD SERVICES AND DATA MANAGEMENT**

3 0 0 3

**Course Objectives**

- Analyze the basic concepts of Cloud and capabilities across the various Cloud service models.
- Analyze virtualization technology to derive the best practice model for deploying cloud-based applications.
- Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and Open Stack.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment.

**Course Outcomes (COs)**

1. Evaluate the performance of the virtual machines and deployed applications. Apply Cloud Computing reference architecture for developing clouds
2. Analyze the different forms of cloud service models
3. Apply the characteristics and architecture of IaaS using various real-world applications.
4. Evaluate PaaS concepts and architectures with real-world examples.
5. Analyze, and synthesize concepts related to the SaaS delivery model.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3											2
2		1	3	2										2
3		2	1	3									1	2
4	1	2	1	3									1	2
5	1	3		2									1	2

**UNIT I****9 Hours****CLOUD COMPUTING REFERENCE ARCHITECTURE (CCRA)**

Introduction to Cloud Computing Reference Architecture (CCRA), Benefits of CCRA, Architecture Overview, Versions and Application of CCRA for Developing Clouds

**UNIT II****9 Hours****INTRODUCTION OF DELIVERY MODELS IN CLOUD COMPUTING**

Introduction to Cloud Delivery Models, List Various Cloud Delivery Models, Advantages of Delivery Models in Cloud, Trade-off in Cost to Install Versus Flexibility, Cloud Service Model Architecture.

**UNIT III****9 Hours****INFRASTRUCTURE AS A SERVICE (IaaS)**

Introduction to Infrastructure as a Service Delivery Model, Characteristics of IaaS, Architecture, Examples of IaaS, Applicability of IaaS in the Industry.

**UNIT IV**

**9 Hours**

**PLATFORM AS A SERVICE (PaaS)**

Introduction to Platform as a Service Delivery Model, Characteristics of PaaS, Patterns, Architecture and Examples of PaaS, Applicability of PaaS in the Industry.

**UNIT V**

**9 Hours**

**SOFTWARE AS A SERVICE (SaaS)**

Introduction to Software as a Service Delivery Model, Characteristics of SaaS, Architecture, Examples of SaaS, Applicability of SaaS in the Industry.

**Total: 45 Hours**

**Reference(s)**

1. (IBM ICE), Cloud Computing Architecture, IBM Global Technology Services Thought Leadership White Paper, April 2011
2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
3. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, 2011
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, 2011



**22CT015****CLOUD STORAGE TECHNOLOGIES****3 0 0 3****Course Objectives**

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

**Course Outcomes (COs)**

1. Analyze the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
2. Apply the usage of advanced intelligent storage systems and RAID.
3. Evaluate various storage networking architectures - SAN, including storage subsystems and virtualization.
4. Execute the different roles in providing disaster recovery and remote replication technologies.
5. Implement the security needs and security measures to be employed in information storage management.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	3	3									2
2	3	1	2	3	3									1
3	1	1	3	2	2									2
4	3	2	1	2	2									1
5	1	3	2	1	2									2

**UNIT I****8 Hours****STORAGE SYSTEMS**

Cloud Storage Fundamentals and Architecture - Cloud Storage Providers and Services - Access methods (RESTful APIs, SDKs) for cloud object storage - Block storage technologies in cloud environments - File Storage in the Cloud: Network File System (NFS) and Server Message Block (SMB) protocols -Hybrid Cloud Storage - Data Migration - Data Lifecycle Management in the Cloud

**UNIT II****9 Hours****INTELLIGENT STORAGE SYSTEMS AND RAID**

Storage Tiering and Caching - Automated Data Placement and Load Balancing: Intelligent Algorithms for Data Placement, Load Balancing Strategies for Distributed Storage Systems, Dynamic Resource Allocation - RAID Technologies in Cloud Storage: RAID Levels - Data Striping, Mirroring, and Parity for Fault Tolerance - RAID Configuration and Performance Optimization

**UNIT III****10 Hours****STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION**

Storage Networking in Cloud Environments - Understanding storage protocols - Network-attached storage (NAS) vs. storage area network (SAN) - Storage virtualization techniques and technologies - Network-Attached Storage (NAS) - Storage Area Network (SAN) - iSCSI and Fiber Channel over IP (FCIP) in Cloud Storage - Network Virtualization and Overlay Networks - Storage Virtualization and Abstraction - Network Performance Optimization - Network Security in Cloud Storage

#### UNIT IV

9 Hours

##### BACKUP, ARCHIVE AND REPLICATION

Understanding Configuration Options-Installing Windows on a Virtual Machine- Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions- Managing CPUs for a Virtual Machine-Configuring VM CPU Options-Managing Storage for a Virtual Machine- Managing Networking for a Virtual Machine- Copying a Virtual Machine- Managing Additional Devices in Virtual Machines

#### UNIT V

9 Hours

##### SECURING STORAGE INFRASTRUCTURE

Storage Security Fundamentals: Key Security Principles, Threats and Vulnerabilities in Storage Infrastructure, Access Control and Authentication: Role-based Access Control (RBAC) and Permissions Management, Multi-factor authentication (MFA) for Storage Systems - Storage-level Encryption and Application-level Encryption - Storage infrastructure Management Functions and Processes.

**Total: 45 Hours**

#### Reference(s)

1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice) I, O'Reilly, 2009.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud ComputingI, Tata Mcgraw Hill, 2013.
4. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and SecurityI, CRC Press, 2017.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical ApproachI, Tata Mcgraw Hill, 2009.

**22CT016 CLOUD AUTOMATION TOOLS AND APPLICATIONS****3 0 0 3****Course Objectives**

- To learn the options for running automation tools, and load balancers in the cloud-native applications.
- To learn the configuration management in the cloud.
- To know why cloud automation is important.
- To learn what types of cloud automation tools can be used.
- To learn load balancing and auto scaling in the cloud

**Course Outcomes (COs)**

1. Implement cloud native applications on AWS, Terraform etc.
2. Apply VM provisioning and migration in the cloud.
3. Analyze cloud automation and configuration.
4. Apply balance load and auto scaling in the cloud.
5. Analyze the AWS cloud formation use-case.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2	1	3									2
2		2			3									1
3			3	2	3									2
4			2		3								2	
5			2		3									2

**UNIT I****7 Hours****UNDERSTANDING THE CLOUD AUTOMATION**

Introduction to Automation & Configuration Tools. Introduction to Terraform. Understanding Terraform Vs CloudFormation. Deploying & Destroying AWS environment with Terraform. Introduction to Packer.

**UNIT II****9 Hours****ABSTRACTION AND VIRTUALIZATION**

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding hypervisors Porting Applications, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Centre Automation.

**UNIT III****9 Hours****AUTOMATION AND CONFIGURATION MANAGEMENT IN THE CLOUD**

Cloud automation at scale, Cloud Configuration Management –unmanaged and managed configuration management, Modification of the capacity of the service, horizontal and vertical scaling, and automatic versus manual scaling. Migrating the business to Cloud. Automating cloud deployments –Balancers.

#### UNIT IV

9 Hours

##### LOAD BALANCING AND AUTO SCALING IN CLOUD

Managed instance groups, Auto scaling and health check, Overview of HTTP(S) load balancing. Example: HTTP load balancer, HTTP(S) load balancing, Configuring an HTTP Load Balancer with Auto scaling, SSL proxy load balancing, TCP proxy load balancing, Network load balancing, Internal load balancing, Configuring an Internal Load Balancer, Choosing a load balancer.

#### UNIT V

11 Hours

##### AWS CLOUDFORMATION USE-CASE

Introduction to AWS CloudFormation, AWS CloudFormation Features and Components, Working of AWS CloudFormation, setting up AWS CloudFormation, building a Pipeline for Test and Production Stacks, AWS CloudFormation Artifacts, Parameter Override Functions with Code Pipeline, Using AWS CLI. AWS CloudFormation, Terraform, VMware vs Center Configuration Manager (VCM), and Puppet.

**Total: 45 Hours**

#### Reference(s)

1. Bernd Ruecker, Practical Process Automation: Orchestration and Integration in Micro services and Cloud Native Architectures, O'Reilly Media, First Edition, 2021.
2. Douglas Comer, The Cloud Computing Book: The Future of Computing Explained, Chapman and Hall/CRC, First Edition, 2021.
3. Karen Tovmasyan, Mastering AWS CloudFormation: Plan, develop, and deploy your cloud infrastructure effectively using AWS CloudFormation, Packt Publishing Limited, First Edition, 2020.
4. Mikael Krief, Mitchell Hashimoto, Terraform Cookbook: Efficiently define, launch, and manage Infrastructure as Code across various cloud platforms, Packet Publishing Limited, 2020.
5. Yogesh Raheja, Dennis McCarthy, Automation with Puppet 5.0, Wiley, First Edition, 2018.

22CT017

**SOFTWARE DEFINED NETWORKS**

2023

**Course Objectives**

- To understand the need for SDN and its data plane operations.
- To understand the functions of control plane.
- To comprehend the migration of networking functions to SDN environment.
- To explore various techniques of network function virtualization.
- To comprehend the concepts behind network virtualization.

**Course Outcomes (COs)**

1. Apply the motivation behind SDN
2. Analyze the functions of the data plane and control plane
3. Evaluate and develop network applications using SDN
4. Execute network services using NFV
5. Implement various use cases of SDN and NFV

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3											2
2		1	3	2										2
3		2	1	3										2
4	1	2	1	3										2
5	1	3		2										2

**UNIT I****6 Hours****SDN: INTRODUCTION**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Data Planes.

**UNIT II****6 Hours****SDN DATA PLANE AND CONTROL PLANE**

Data Plane functions and protocols - OpenFlow Protocol - Packet Processing and Performance Optimization – Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, Open Daylight, ONOS - Distributed Controllers.

**UNIT III****6 Hours****VIRTUALMACHINES SDN APPLICATIONS**

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking – Wide Area Networks (WAN) – Service Provider Networks – Internet Service Providers (ISPs).

**UNIT IV** **6 Hours**

**NETWORK FUNCTION VIRTUALIZATION**

Network Virtualization - NFV Architecture – Virtual LANs – OpenFlow VLAN Support – NFV Standards and Frameworks – NFV Concepts – Benefits and Requirements – Reference Architecture.

**UNIT V** **6 Hours**

**NFV FUNCTIONALITY**

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use Cases: Virtual Customer Premises Equipment, Virtual Evolved Packet Core, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV.

**1** **6 Hours**

**EXPERIMENT 1**

Setup your own virtual SDN lab

i) Virtual box/Mininet Environment for SDN - <http://mininet.org>

ii) <https://www.kathara.org>

iii) GNS3

**2** **6 Hours**

**EXPERIMENT 2**

Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.

**3** **6 Hours**

**EXPERIMENT 3**

Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.

**4** **6 Hours**

**EXPERIMENT 4**

Create a simple end-to-end network service with two VNFs using vim-emu  
<https://github.com/containernet/vim-emu>

**5** **6 Hours**

**EXPERIMENT 5**

Install OSM and onboard and orchestrate network service.

**Total: 60 Hours**

**Reference(s)**

1. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design, 1<sup>st</sup> Edition, CRC Press, 2014.
2. Ken Gray, Thomas D. Nadeau, Network Function Virtualization, Morgan Kauffman, 2016.
3. Oswald Coker, Siamak Azodolmolky, Software-Defined Networking with OpenFlow, 2<sup>nd</sup> Edition, O'Reilly Media, 2017.
4. Paul Goransson, Chuck Black Timothy Culver, Software Defined Networks: A Comprehensive Approach, 2<sup>nd</sup> Edition, Morgan Kaufmann Press, 2016.
5. Thomas D Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013.
6. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud, Pearson Education, 1<sup>st</sup> Edition, 2015.

**22CT018****SECURITY AND PRIVACY IN CLOUD****3 0 0 3****Course Objectives**

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

**Course Outcomes (COs)**

1. Understand the cloud security concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Analyze the cloud policy, identity and Access Management.
4. Delivers various risks, audit and monitoring mechanisms in the cloud.
5. Applying the various architectural and design considerations for security in the cloud.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1	2								2	
2	1	3	2	3	1									2
3	3	2	2	3	2								2	
4	2	1	2	3	3									2
5	1	3	3	1	1									2

**UNIT I****8 Hours****FUNDAMENTALS OF CLOUD SECURITY CONCEPTS**

Overview of Cloud Security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of Cryptography - Conventional and Public-key cryptography, Hash Functions, Authentication and Digital Signatures.

**UNIT II****11 Hours****SECURITY DESIGN AND ARCHITECTURE FOR CLOUD**

Security Design Principles for Cloud Computing - Comprehensive Data Protection - End-to-end access control - Common Attack Vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data Redaction, Tokenization, Obfuscation, PKI and Key

**UNIT III****9 Hours****ACCESS CONTROL AND IDENTITY MANAGEMENT**

Access Control Requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization – Verified and measured boot - Intruder Detection

**UNIT IV**

**8 Hours**

**CLOUD SECURITY DESIGN PATTERNS**

Introduction to Design Patterns, Cloud Bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

**UNIT V**

**9 Hours**

**MONITORING, AUDITING AND MANAGEMENT**

Proactive Activity Monitoring – Incident Response, Monitoring for Unauthorized Access, Malicious Traffic, Abuse of System Privileges – Events and Alerts – Auditing – Record generation, Reporting and Management, Tamper-Proofing Audit logs, Quality of Services, Secure Management, User Management, Identity Management, Security Information and Event Management

**Total: 45 Hours**

**Reference(s)**

1. Dave Shackleford, Virtualization Security, SYBEX a Wiley Brand, 2013
2. Mark C. Chu-Carroll, Code in the Cloud, CRC Press, 2011.
3. Mather, Kumaraswamy and Latif, Cloud Security and Privacy, Oreilly, 2011.
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, 2013.
5. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing, Wiley 2013.



22CT019

CYBER SECURITY

3 0 0 3

**Course Objectives**

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

**Course Outcomes (COs)**

1. Understand the basics of cyber security, cybercrime and cyber law.
2. Classify various types of attacks and learn the tools to launch the attacks.
3. Apply various tools to perform information gathering for data security and integrity.
4. Apply intrusion techniques to detect intrusion and to observe network traffic for malicious transactions in the network.
5. Apply intrusion prevention techniques to prevent intrusion and to protect against known and unknown threats.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	2								2	
2	1	3	1	3	3								2	
3	2	1	1	1	2								2	
4	3	3	2	2	1								3	
5	3	2	2	2	3								3	

**UNIT I****9 Hours****INTRODUCTION**

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – A Global Perspective on Cyber Crimes - Classification of Cybercrimes

**UNIT II****9 Hours****ATTACKS AND COUNTER MEASURES**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

### UNIT III

9 Hours

#### RECONNAISSANCE

Harvester – Who is – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Fingerprinting Techniques.

### UNIT IV

9 Hours

#### INTRUSION DETECTION

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort -Cyber Laws – The Indian IT Act – Cyber Crime and Punishment.

### UNIT V

9 Hours

#### INTRUSION PREVENTION

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

**Total: 45 Hours**

#### TEXTBOOKS

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”,Notion Press, 2021
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011
3. <https://owasp.org/www-project-top-ten/>

#### Reference(s)

1. David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones& Bartlett Learning Publishers, 2013.
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011.
3. Kimberly Graves, “CEH Official Certified Ethical Hacker Review Guide”, Wiley Publishers,2007.
4. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, ThirdEdition, Pearson Education, 2015.
5. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No StarchPress, 2014.

**22CT020****MODERN CRYPTOGRAPHY****3 0 0 3****Course Objectives**

- To learn about the basics of modern cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudo random permutation.
- To construct the basics of cryptanalytic techniques for ensuring data integrity.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

**Course Outcomes (COs)**

1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authentication.
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Apply the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Demonstrate the use of Message Authentication Code to authenticate information transmitted between the users.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1								2	
2	1	3	2	1	2								2	
3	1	1	2	3	2								1	
4	3	1	2	1	3								2	
5	2	3	3	3	3								2	

**UNIT I****9 Hours****INTRODUCTION**

Basics of Symmetric Key Cryptography - Basics of Asymmetric Key Cryptography - Hardness of Functions - Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI – Hard Core Predicate - Trap-door permutation - Goldwasser-Micali Encryption - Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

**UNIT II****9 Hours****FORMAL NOTIONS OF ATTACKS**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2) - Attacks under Message Non-malleability: NM-CPA and NMCCA2 - Inter-relations among the attack model

**UNIT III****9 Hours****RANDOM ORACLES**

Provable Security and asymmetric cryptography - hash functions - One-way functions: Weak and Strong one-way functions - Pseudo-random Generators (PRG): Blum-Micali-Yao Construction - Construction of more powerful PRG - Relation between One-way functions and PRG - Pseudorandom Functions (PRF).

**UNIT IV**

**9 Hours**

**BUILDING A PSEUDORANDOM PERMUTATION**

The Luby Rackoff Construction: Formal Definition, Application of the Luby Rackoff Construction to the construction of Block Ciphers -The DES in the light of Luby Rackoff Construction.

**UNIT V**

**9 Hours**

**MESSAGE AUTHENTICATION CODES**

Introduction to Left or Right Security (LOR) - Formal Definition of Weak and Strong MACs - Using a PRF as a MAC - Variable length MAC - Public Key Signature Schemes: Formal Definitions, Signing and Verification - Formal Proofs of Security of Full Domain Hashing - Assumptions for Public Key Signature Schemes: One-way functions - Imply Secure One-time Signatures -Shamir's Secret Sharing Scheme - Analyzing Cryptographic Protocols - Zero Knowledge Proofs and Protocols.

**Total: 45 Hours**

**Reference(s)**

1. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 7th Edition, 2017.
2. Oded Goldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), 2009.
3. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2007.
4. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2004.

**22CT021****CYBER FORENSICS****3 0 0 3****Course Objectives**

- To understand the principles and concepts of computer forensics.
- To learn to utilize forensic tools for network-based attacks.
- To identify and apply appropriate methodologies for forensics data.
- To identify and analyze the vulnerabilities in the network.
- To analyze the various hacking techniques and their impacts.

**Course Outcomes (COs)**

1. To understand the basics of computer forensics, legal and ethical considerations, and the importance of maintaining the integrity of digital evidence.
2. Apply different types of computer forensic tools to preserve the integrity of data in the network.
3. Analyze and validate forensics data from the communicating devices to detect intruders.
4. Apply the various firewall techniques to detect the vulnerabilities in the networks.
5. Implement real-world hacking techniques to test system security and to ensure the system's safety from hackers.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	2			2					2	
2	2	2	3	2	3			2					2	
3	2	1	3	2	2			3					2	
4	2	1	2	3	3			3					3	
5	2	2	2	2	3			3					3	

**UNIT I****8 Hours****INTRODUCTION TO COMPUTER FORENSICS**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II****9 Hours****EVIDENCE COLLECTION AND FORENSICS TOOLS**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

**UNIT III****10 Hours****ANALYSIS AND VALIDATION**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

**UNIT IV**

**9 Hours**

**E-MAIL SECURITY & FIREWALLS**

PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

**UNIT V**

**9 Hours**

**ETHICAL HACKING IN WEB**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**Total: 45 Hours**

**Reference(s)**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
4. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Cengage Learning, 2nd Edition, 2005.
5. Man Young Rhee, “Internet Security: Cryptographic Principles”, “Algorithms and Protocols”, Wiley Publications, 2003.

**22CT022****ETHICAL HACKING****3 0 0 3****Course Objectives**

- To learn about the importance of information security.
- To learn different scanning and enumeration methodologies and tools.
- To understand various hacking techniques and attacks.
- To be exposed to programming languages for security professionals.
- To understand the different phases in penetration testing

**Course Outcomes (COs)**

1. Analyze the AWS cloud formation use-case. Enumerate the numerous assaults carried out during ethical hacking and penetration testing.
2. Apply the hacking techniques and understand the tools to be used for hacking
3. Understand the various vulnerabilities of Windows and Linux OS
4. Apply the techniques to hack web servers and tools for it
5. Determine the characteristics of the firewall, the intruder detection mechanisms, and the malicious software to protect the system.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	2	2								2	
2	1	2	2	1	2								2	
3	1	2		2	2								2	
4	1	2	2	3	3								2	
5	1	2	1	2	2								2	

**UNIT I****9 Hours****INTRODUCTION**

Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies - Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing - Network and Computer Attacks - Malware - Protecting Against Malware Attacks- Intruder Attacks - Addressing Physical Security

**UNIT II****9 Hours****SCANNING AND ENUMERATION**

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools

**UNIT III****9 Hours****SYSTEM HACKING**

Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges – Executing Applications – Keyloggers and Spyware

#### **UNIT IV**

**9 Hours**

##### **PROGRAMMING FOR SECURITY PROFESSIONALS**

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities –Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures

#### **UNIT V**

**9 Hours**

##### **NETWORK PROTECTION SYSTEMS**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

**Total: 45 Hours**

#### **Reference(s)**

1. EC-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Cengage Learning,2010.
2. Jon Erickson, “Hacking, 2nd Edition: The Art of Exploitation”, No Starch Press Inc.,2008.
3. Michael T. Simpson, Kent Backman, James E. Corley, “Hands-On Ethical Hacking andNetwork Defense”, Cengage Learning, 2013.
4. Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hackingand Penetration Testing Made Easy”, Second Edition, Elsevier, 2013.
5. Rafay Boloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2014.



22CT023

**SECURE SOFTWARE SYSTEMS**

2023

**Course Objectives**

- To Know the importance and need for software security.
- To Know about various attacks.
- To Learn about secure software design.
- To Understand risk management in secure software development.
- To Know the working of tools related to software security.

**Course Outcomes (COs)**

1. Identify various vulnerabilities related to memory attacks.
2. Apply security principles in software development.
3. Evaluate the extent of risks.
4. Involve selection of testing techniques related to software security in the testing phase of software development.
5. Use tools for securing software.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	3	2								2	
2	2	2	2	3	3									3
3	1	2	2	2	1								2	
4	2	3	2	2	2								2	
5	2	1	2	2	3								2	

**UNIT I****6 Hours****NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS**

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – MemoryBased Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

**UNIT II****7 Hours****SECURE SOFTWARE DESIGN**

Requirements Engineering for secure software - SQUARE process Model – Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

**UNIT III****5 Hours****SECURITY RISK MANAGEMENT**

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

**UNIT IV**

**8 Hours**

**SECURITY TESTING**

Traditional Software Testing – Comparison - Secure Software Development Life Cycle – Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing

**UNIT V**

**4 Hours**

**SECURE PROJECT MANAGEMENT**

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

**1**

**5 Hours**

**EXPERIMENT 1**

Implement the SQL injection attack.

**2**

**5 Hours**

**EXPERIMENT 2**

Implement the Buffer Overflow attack.

**3**

**5 Hours**

**EXPERIMENT 3**

Implement Cross Site Scripting and Prevent XSS.

**4**

**5 Hours**

**EXPERIMENT 4**

Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux

**5**

**5 Hours**

**EXPERIMENT 5**

Develop and test the secure test cases.

**6**

**5 Hours**

**EXPERIMENT 6**

Penetration test using kali Linux

**Total: 60 Hours**

### **Text Books**

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011.
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006

### **Reference(s)**

1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012
5. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing, 2012
6. Jason Grembi, “Developing Secure Software”

**22CT024****MALWARE ANALYSIS****3 0 0 3****Course Objectives**

- Understand the fundamentals of malware, types and its effects.
- Identify and analyze various malware types by static and dynamic analysis.
- To deal with detection, analysis, understanding, controlling, and eradication of malware.

**Course Outcomes (COs)**

1. Understand the various concepts of malware analysis and their technologies used.
2. Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.
3. Understand the methods and techniques used by professional malware analysts.
4. To be able to safely analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	2								2	
2	3	3	2	2	2								2	
3	3	3	3	3	3								3	
4	3	3	3	3	3								3	
5	3	3	3	3	3								3	

**UNIT I****9 Hours****INTRODUCTION AND BASIC ANALYSIS**

Introduction to Malware - Malware threats - Malware types: Viruses, Worms, Rootkits, Trojans, Bots, Spyware, Adware, Logic Bombs - Goals of Malware Analysis - AV Scanning – Hashing - Finding Strings - Packing and Obfuscation - PE file format – Static - Linked Libraries and Functions - Static Analysis tools - Virtual Machines and their usage in Malware analysis – Sandboxing - Basic dynamic analysis - Malware execution - Process Monitoring - Viewing processes - Registry snapshots

**UNIT II****10 Hours****ADVANCED STATIC ANALYSIS**

The Stack – Conditionals – Branching - Rep Instructions – Disassembly - Global and local variables - Arithmetic operations – Loops - Function Call Conventions - C Main Method and Offsets. Portable Executable File Format - The PE File Headers and Sections - IDA Pro - Function analysis – Graphing - The Structure of a Virtual Machine - Analyzing Windows programs - Anti-static analysis techniques – obfuscation – packing – metamorphism - polymorphism.

**UNIT III****10 Hours****ADVANCED DYNAMIC ANALYSIS**

Live malware analysis - dead malware analysis - analyzing traces of malware - system calls - api calls – registries - network activities. Anti-dynamic analysis techniques - VM detection techniques- Evasion techniques - Malware Sandbox - Monitoring with Process Monitor - Packet Sniffing with Wireshark - Kernel vs. User-Mode Debugging – OllyDbg – Breakpoints – Tracing - Exception Handling – Patching

#### **UNIT IV**

**8 Hours**

##### **MALWARE FUNCTIONALITY**

Downloaders and Launchers – Backdoors - Credential Stealers - Persistence Mechanisms- Handles – Mutexes - Privilege Escalation - Covert malware launching- Launchers - Process Injection- Process Replacement - Hook Injection – Detours - APC injection

#### **UNIT V**

**8 Hours**

##### **ANDROID MALWARE ANALYSIS**

Android Malware Analysis: Android architecture - App development cycle – APKTool- APKInspector - Dex2Jar - JD-GUI - Static and Dynamic Analysis - Case Study: Smartphone (Apps) Security

**Total: 45 Hours**

#### **TEXT BOOKS:**

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press, 2012, ISBN: 9781593272906
2. Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System”, Second Edition, Jones & Bartlett Publishers, 2009.

#### **REFERENCES:**

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel” by 2005, Addison-Wesley Professional.
2. Bruce Dang, Alexandre Gazet, Elias Bachaalany, Sébastien Josse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
3. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O'Reilly, 2015.
4. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis", CRC Press, Taylor & Francis Group, 2015.
5. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015.

**22CT025****MULTIMEDIA AND ANIMATION****2023****Course Objectives**

- Understand the basic knowledge of multimedia Systems and related technologies.
- To learn about multimedia elements in a comprehensive way.
- Understand the basics of digital 2D animation to create story and multimedia production
- Design the technical and artistic skills to produce 3D animations.

**Course Outcomes (COs)**

1. Apply the multimedia elements, image processing and animation.
2. Analyze the encode and decode the multimedia elements
3. Apply the author 2D and 3D creative and interactive presentations for different targetmultimedia applications.
4. Create the 2D animation and develop the storyboards.
5. Create and animate the 3D models using software tools.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1		2									2
2	2	2	2	2	2									3
3	3													3
4	2	2	2											3
5	2	3	2											3

**UNIT I****6 Hours****INTRODUCTION TO MULTIMEDIA ELEMENTS**

Multimedia - Medium - Properties of a Multimedia System - Traditional Data Stream Characteristics -Text  
- Basic Sound Concepts – Speech. Image – Computer Image Processing

**UNIT II****6 Hours****MULTIMEDIA COMPRESSION**

Storage Space - Coding Requirements - Hybrid Coding - JPEG: Image Preparation, Lossy Mode, Lossless Mode, Hierarchical Mode - H.261 - MPEG: Video Encoding, Data Stream, MPEG 3, MPEG 7, MPEG 21

**UNIT III****6 Hours****MULTIMEDIA AUTHORING**

Authoring metaphors, Tools Features and Types: Card and Page Based Tools - Icon and Object Based Tools, Time Based Tools - 3D Modeling and Animation Tools - Image Editing Tools - audio Editing Tools - Digital Movie Tools - Creating interactive presentations - virtual learning, simulations.

**UNIT IV** **6 Hours**

**2D ANIMATION**

Introduction to 2D Animation, Colour theory & basics - Layout & Designing Basic of sketching - Composition of basic elements - Graphics and advertising - Creating Digital Layout, Professional image editing - Story Boarding, stop motion animation - Production / Post-Production-Background composition - 2D animation and techniques.

**UNIT V** **6 Hours**

**3D ANIMATION**

3D Modeling - Modeling Techniques - Types of Modeling - 3D Shading-Use of Material, Shader and Texture editing - Introduction to 3D Animation -3D Animation and Rigging - Setting up controllers for joints - Simple Skeleton structure with proper joint orientation - 3D Lighting and Rendering.

**1** **3 Hours**

**EXPERIMENT 1**

Image Editing and Manipulation - Basic Operations on images using any image editing software

**2** **3 Hours**

**EXPERIMENT 2**

Implementation of audio and Video Editing techniques

**3** **3 Hours**

**EXPERIMENT 3**

Sketching of cartoon characters

**4** **3 Hours**

**EXPERIMENT 4**

Design 2D Logo using the image editing tool.

**5** **3 Hours**

**EXPERIMENT 5**

Creating gif animated images in 2D Animation

**6** **3 Hours**

**EXPERIMENT 6**

Exploring the Interface of 3D application & Primitive Modelling

**7** **3 Hours**

**EXPERIMENT 7**

Create different types of Materials and Shading

**8** **3 Hours**

**EXPERIMENT 8**

Create a simple walk cycle using the character Rigs

**9** **3 Hours**

**EXPERIMENT 9**

Create a 3-point Light Setup

**10** **3 Hours**

**EXPERIMENT 10**

Create particle Simulation & Rendering

**Total: 60 Hours**

## Reference(s)

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia”, Third Edition, Springer Texts in Computer Science, 2021.
2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”, PHI, 2003.
3. Multimedia: Making It Work, Tay Vaughan, 9th Edition,
4. The Illusion of Life: Disney Animation - Frank Thomas and Ollie Johnston
5. Maraffi, Chris, Maya Character Creation: Modeling and Animation Controls. New Riders, 2008.
6. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
7. Mark Gaimbruno, “3D Graphics and Animation”, Second Edition, New Riders, 2002.
8. Rogers David, “Animation: Master – A Complete Guide (Graphics Series)”, Charles RiverMedia, 2006.
9. Rick parent, “Computer Animation: Algorithms and Techniques”, Morgan Kauffman, 3rd Edition, 2012.



**22CT008****UI AND UX DESIGN****3 0 0 3****Course Objectives**

- Study about designing web pages and understand the difference between UI and UX Design.
- To understand the concept of UX design and how it has evolved Able o to understand UX designprocess and methodology.
- Learning the Importance and scope of Interaction design, User centered design

**Course Outcomes (COs)**

1. Understand to do user research, persona mapping, customer journey mapping
2. Design of interactive products Methods of interaction design Tools for interaction design
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests learning steps for digital products.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1												1	1
2	1	2	2		1								2	1
3		3	3		1								2	1
4		2	2										1	2
5		2	2										1	2

**UNIT I****9 Hours****USER-CENTERED DESIGN PROCESS**

Scripting Languages – HTML, CSS - Fundamentals of graphics design, principles of visual design - Overview of UI & UX Design - Overview of the UX Design Process - Difference between User Interface (UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation –Primary and Secondary persona - Requirement definition - Creative ideation – brainstorming and ideation techniques - Scenarios and functionality extraction - Information Architecture - Task flows - Wireframe design

**UNIT II****9 Hours****FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN**

Design Principles for UX and UI Design - UI Elements-Patterns - Material Design (Google) and Human Interface Design (Apple) guidelines - Interaction Principles & Interaction Behaviour - Masterthe Brand Platforms & Style Guides - comments and current UI patterns - Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

**UNIT III****9 Hours****ELEMENTARY SKETCHING & WIREFRAMING**

Principles of Sketching - Core Responsive Design - Wireframing vs Wireflows - Click through Wireframing Prototyping - Wireflow Creation - Work with different tools – Figma - Low-High Fidelity Design: Inclusive Design and Designing for Accessibility - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Designing animations and interactions.

#### **UNIT IV**

**9 Hours**

##### **UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING**

Building a Design System – Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration - Use of grids in UI design - Design animations and interaction patterns for key UI elements.

#### **UNIT V**

**9 Hours**

##### **USABILITY EVALUATION AND PRODUCT DESIGN**

Type of usability evaluation – Qualitative & Quantitative evaluation - Guerilla testing , A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud - Think aloud – Introduction and advantages - Designing evaluation protocol - Conducting usability evaluation study – Conduct Usability Test explicit - Synthesize Test Findings - practices in corporate World - Product Design Types of products & solutions - Design Psychology for e-commerce sites , CMS - Design Thinking Life Cycle

**Total: 45 Hours**

#### **Reference(s)**

1. Norman, Donald A. The Design of Everyday Things. Basic Books, 2002. ISBN: 9780465067107.
2. Nielsen, Jakob. Usability Engineering. Morgan Kaufmann, 1993. ISBN: 9780125184069.
3. Mullet, Kevin, and Darrell Sano. Designing Visual Interfaces: Communication Oriented Techniques. Prentice Hall, 1994. ISBN: 9780133033892.
4. Wilbent. O. Galitz ,“The Essential Guide To User Interface Design”, John Wiley&Sons, 2001.
5. Ben Sheiderman, “Design The User Interface”, Pearson Education, 1998.
6. Alan Cooper, “The Essential Of User Interface Design”, Wiley – Dream Tech Ltd.,2002.
7. Baecker, Ronald M., Jonathan Grudin, et al. Readings in Human-Computer Interaction: Towardthe Year 2000. 2nd ed. Morgan Kaufmann, 1995. ISBN: 9781558602465.
8. Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for EffectiveHuman-Computer Interaction. 4th ed. Addison Wesley, 2004. ISBN: 9780321197863.
9. Dix, Alan J., Janet E. Finlay, et al. Human-Computer Interaction. 2nd ed. Prentice Hall, 1998.ISBN: 9780132398640.
10. Olsen, Dan R. Developing User Interfaces (Interactive Technologies). Morgan Kaufmann, 1998.ISBN: 9781558604186

**22CT026****AUGMENTED REALITY/VIRTUAL REALITY****2023****Course Objectives**

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.

**Course Outcomes (COs)**

1. Analyze the tools and technologies related to AR/VR.
2. Design various models using modeling techniques.
3. Apply programming concepts and techniques specific to VR development, including 3D graphics.
4. Develop AR/VR applications in different domains.
5. Apply the technologies related to AR to build AR-enabled devices.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2			2	2	2		2	2	2
2	2	3	3	3	3			2	2	2		2	3	3
3	2	2	2	2	2			2	2	2		2	3	3
4	3	3	3	3	3			2	2	2		2	3	3
5	3	3	3	3	3			2	2	2		2	3	3

**UNIT I****6 Hours****INTRODUCTION**

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – Types of Trackers – Human Visual System – Personal Graphics Displays – Human Auditory System

**UNIT II****6 Hours****VR MODELING**

Modelling – Geometric Modelling – Virtual Object Shape – Object Visual Appearance – Kinematics Modelling – Transformation Matrices – Object Position – Transformation Invariants – Object Hierarchies – Physical Modelling – Behavior Modelling – Model Management

**UNIT III****6 Hours****VR PROGRAMMING**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D.

**UNIT IV** **6 Hours**

**APPLICATIONS**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society- Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR.

**UNIT V** **6 Hours**

**AUGMENTED REALITY**

Introduction to Augmented Reality – Computer vision for AR – Interaction – Modelling and Annotation Navigation – Wearable devices.

**1** **3 Hours**

**EXPERIMENT 1**

Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.

**2** **3 Hours**

**EXPERIMENT 2**

Use the primitive objects and apply various projection types by handling camera.

**3** **3 Hours**

**EXPERIMENT 3**

Download objects from asset store and apply various lighting and shading effects

**4** **3 Hours**

**EXPERIMENT 4**

Model three dimensional objects using various modelling techniques and apply textures over them.

**5** **3 Hours**

**EXPERIMENT 5**

Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity

**6** **3 Hours**

**EXPERIMENT 6**

Add audio and text special effects to the developed application.

**7** **3 Hours**

**EXPERIMENT 7**

Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity

**8** **3 Hours**

**EXPERIMENT 8**

Develop AR enabled applications with interactivity like E learning environment, Virtual walk throughs and visualization of historic places.

**9** **3 Hours**

**EXPERIMENT 9**

Develop AR enabled simple applications like human anatomy, DNA/RNA structure visualization

**10**

**3 Hours**

**EXPERIMENT 10**

Develop simple MR enabled gaming applications

**Total: 60 Hours**

**Reference(s)**

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018.
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016.
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003.

**22CT027****GAME DEVELOPMENT****2023****Course Objectives**

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

**Course Outcomes (COs)**

1. Understand the foundations of 2D and 3d Graphics
2. Design game design documents
3. Implementation of gaming engines.
4. Survey gaming environments and frameworks.
5. Develop and construct a simple game in Pygame.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								1	1
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

**UNIT I****6 Hours****3D GRAPHICS FOR GAME DESIGN**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

**UNIT II****6 Hours****GAME DESIGN PRINCIPLES**

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

**UNIT III****6 Hours****GAME ENGINE DESIGN**

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine – Collision Detection – Game Logic – Game AI – Pathfinding.

#### UNIT IV

6 Hours

##### OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

#### UNIT V

6 Hours

##### GAME DEVELOPMENT USING PYGAME

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics Algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based Arcade Games – Puzzle Games.

1

3 Hours

##### EXPERIMENT 1

Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game

2

3 Hours

##### EXPERIMENT 2

Character design, sprites, movement and character control

3

3 Hours

##### EXPERIMENT 3

Level design: design of the world in the form of tiles along with interactive and collectible objects

4

4 Hours

##### EXPERIMENT 4

Design of interaction between the player and the world, optionally using the physics engine.

5

4 Hours

##### EXPERIMENT 5

Developing a 2D interactive using Pygame

6

4 Hours

##### EXPERIMENT 6

Developing a Puzzle game

7

3 Hours

##### EXPERIMENT 7

Design of menus and user interaction in mobile platforms.

8

3 Hours

##### EXPERIMENT 8

Developing a 3D Game using Unreal

9

3 Hours

##### EXPERIMENT 9

Developing a Multiplayer game using unity

**Total: 60 Hours**

**Reference(s)**

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley, 2013.
2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress, 2007.
3. Paul Craven, “Python Arcade games”, Apress Publishers, 2016.
4. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press, 2006.
5. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.



**22CT028****VIDEO CREATION AND EDITING****2023****Course Objectives**

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

**Course Outcomes (COs)**

1. Compare the strengths and limitations of Nonlinear editing.
2. Identify the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Address the core issues of advanced editing and training techniques.
5. Design and develop projects using AVID XPRESS DV 4.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	1	1				1	2	3	2	3	1
2	2	3	3	3	1				1	2	2	1	1	1
3	2	2	3	3	1				3	1	1	1	2	1
4	2	2	2	2	1				3	1	1	1	2	2
5	2	1	3	3	1				3	2	1	2	2	2

**UNIT I****6 Hours****FUNDAMENTALS**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

**UNIT II****6 Hours****STORYTELLING**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - Understanding video color - Color Correcting Basics - Color Enhancement Effects mechanics of digital editing - pointer files - media management.

**UNIT III****6 Hours****USING AUDIO AND VIDEO**

Audio: Timeline Audio Tracks - Editing Audio- Gaining, Fading and Balancing Audio- Video: Capturing digital and analog video - importing audio on putting video - exporting digital video to tape - recording to CDs and VCDs

**UNIT IV** **6 Hours**

**WORKING WITH FINAL CUT PRO**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

**UNIT V** **6 Hours**

**WORKING WITH AVID XPRESS DV 4**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

**1** **3 Hours**

**EXPERIMENT 1**

Write a Movie Synopsis (Individual/Team Writing)

**2** **3 Hours**

**EXPERIMENT 2**

Present team stories in class

**3** **4 Hours**

**EXPERIMENT 3**

Script/Storyboard Writing (Individual Assignment)

**4** **4 Hours**

**EXPERIMENT 4**

Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements

**5** **4 Hours**

**EXPERIMENT 5**

Production: Single camera production personnel & equipment, Documentary Production

**6** **3 Hours**

**EXPERIMENT 6**

Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching

**7** **4 Hours**

**EXPERIMENT 7**

Write Documentary & Animation Treatment

**8** **5 Hours**

**EXPERIMENT 8**

Post-production: Editing, Sound design, Finishing

**Total: 60 Hours**

**Reference(s)**

1. William Stallings, Cryptography and Network Security Principles and Practice, 7th Edition – Global Edition, Pearson Education Limited, 2017.
2. David Kleidermacher and Mike Kleidermacher, Newnes, Embedded Systems Security - Practical Methods for Safe and Secure Software and Systems Development, 2012.
3. Timothy Stapko, Newnes, Practical Embedded Security - Building Secure Resource-Constrained Systems, 2008.

**22CT029****DIGITAL MARKETING****3 0 0 3****Course Objectives**

- Understand the overview of Digital Marketing.
- Examine the role and importance of digital marketing in the business environment.
- Determine the focuses on digital marketing and its measure

**Course Outcomes (COs)**

1. Identify some of the latest digital marketing trends and skills sets needed for today's Marketer.
2. Compare the strengths and limitations of search engine optimisation.
3. Apply the suitable techniques for E-Mail Marketing.
4. Discover the hottest techniques to help to successfully plan, predict, and manage your digitalMarketing campaigns.
5. Evaluate the importance of your digital marketing assets, which ones actually matter the most to your business.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								1	1
2	2	2	3		3								2	3
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

**UNIT I****9 Hours****INTRODUCTION TO ONLINE MARKET**

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

**UNIT II****9 Hours****SEARCH ENGINE OPTIMISATION**

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

**UNIT III****9 Hours****E- MAIL MARKETING**

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

**UNIT IV**

**9 Hours**

**SOCIAL MEDIA MARKETING**

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

**UNIT V**

**9 Hours**

**DIGITAL TRANSFORMATION**

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

**Total: 45 Hours**

**Reference(s)**

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; Firstedition ( July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373
2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press ( April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition(April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Michael Millerth, B2B Digital Marketing: Using the Web to Market Directly to Businesses,firstedition, Que Biz-Tech series2012.
5. Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice,Paperback - Import, 2012.

**22CT030 REAL TIME OPERATING SYSTEM****3 0 0 3****Course Objectives**

- Analyze the students to the fundamentals of interaction of OS with a computer and User computation.
- Apply the fundamental concepts of how processes are created and controlled with the OS.
- Analyze on programming logic of modeling Process based on range of OS features.
- Evaluate types and Functionalities in commercial OS, application development using RTOS
- Analyze the involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

**Course Outcomes (COs)**

1. Analyze Operating System structures and types.
2. Apply into scheduling, disciplining of various processes execution.
3. Implement knowledge on various RTOS support modelling
4. Evaluate commercial RTOS Suite features to work on real time processes design.
5. Analyze Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in RTOS and embedded automation design.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		2								2	
2			2		3	1							2	
3	2		2	1	2	2								1
4	2	2	3	2	1	3								2
5			1		3	1								2

**UNIT I****9 Hours****REVIEW OF OPERATING SYSTEMS**

Basic Principles – Operating System Structures – System Calls – Files – Processes – Design and Implementation of Processes – Communication between Processes – Introduction to Distributed Operating System – Embedded Operating Systems.

**UNIT II****9 Hours****OVERVIEW OF RTOS**

RTOS Task and Task State – Multithreaded Preemptive Scheduler- Process Synchronization – Message Queues – Mailboxes – Pipes – Critical Section – Semaphores – Classical Synchronization Problem – Deadlocks.

**UNIT III**

**9 Hours**

**REALTIME MODELS AND LANGUAGES**

Event Based – Process based and Graph based Models – Real Time Languages – RTOS Tasks – RT Scheduling – Interrupt Processing – Synchronization – Control Blocks – Memory Requirements.

**UNIT IV**

**9 Hours**

**REALTIME KERNEL**

Principles – Design Issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and basic Study of Various RTOS like – VX works – Linux Supportive RTOS – C Executive.

**UNIT V**

**9 Hours**

**APPLICATION DEVELOPMENT**

Discussions on basics of Linux Supportive RTOS –  $\mu$ C/OS-System Level Functions- Task Service and Time Functions and their Exemplary Uses –Time Delay Functions – Memory Allocation Related Functions- C Executive for Development of RTOS

**Total: 45 Hours**

**Reference(s)**

1. Charles Crowley, Operating Systems-A Design Oriented approach, McGraw Hill, 2006.
2. Karim Yaghmour, Building Embedded Linux System,O'reilly Pub,2008.
3. Mukesh Sigal and N G Shi , Advanced Concepts in Operating System, McGraw Hill, 2017
4. Raj Kamal,Embedded Systems- Architecture, Programming and Design,Tata McGraw Hill,2006.
5. Silberschatz,Galvin,Gagne, Operating System Concepts, 9th ed, John Wiley, 2012.

**22CT031****WIRELESS AND MOBILE COMMUNICATION****3 0 0 3****Course Objectives**

- Analyze the Channel planning for Wireless Systems
- Apply the Mobile Radio Propagation and Equalization and Diversity
- Implement study the Equalization and Diversity
- Analyze the provide insight about wideband code division based access.
- Execute the study of Wireless multiple access and IP

**Course Outcomes (COs)**

1. Analyze Cellular communication concepts
2. Analyze the Mobile radio propagation
3. Execute the Wireless network different type of MAC protocols
4. Analyze the Equalization and Diversity
5. Implement the Wireless multiple access and IP

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1										1
2	3	3	2	2										2
3	3	3	2	3	2	2								1
4		2	2		3									
5		2	3		2									

**UNIT I****9 Hours****WIRELESS COMMUNICATION SYSTEM**

Introduction to Wireless Communication System – The Cellular Concept: Introduction – Frequency Reuse – Channel Assignment Strategies – Handoff Strategies – Interference and System Capacity – Trunking – Improving Coverage & Capacity in Cellular Systems.

**UNIT II****9 Hours****MOBILE RADIO PROPAGATION: LARGE-SCALE PATH LOSS**

Introduction to Radio Wave Propagation – Free Space Propagation Model – Relating Power to Electric Field – The Three Basic Propagation Mechanisms – Reflections – Diffraction – Scattering – Practical Link Budget Detection using Path Loss models – Outdoor Propagation Models – Indoor Propagation Models – Signal penetration into buildings – Ray Tracing and Site Specific Modelling.

**UNIT III****9 Hours****MOBILE RADIO PROPAGATION: SMALL SCALE FADING & MULTIPATH**

Small Scale Multipath propagation – Impulse Response Model of a multipath channel – Small-Scale Multipath Measurements – Parameters of Mobile Multipath Channels: Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time – Types of Small-Scale Fading – Rayleigh



and Ricean Distributions – Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a Communication Receiver, Linear Equalizers, Nonlinear Equalization.

**UNIT IV**

**9 Hours**

**WIDEBAND CODE DIVISION MULTIPLE ACCESS**

CDMA System Overview – Air Interface – Physical and Logical Channel – Speech Coding, Multiplexing and Channel Coding – Spreading and Modulation: Frame Structure, Spreading Codes-Uplink-Downlink – Physical Layer Procedures: Cell Search and Synchronization – Establishing a Connection – Power Control – Handover-Overload Control.

**UNIT V**

**9 Hours**

**IP MOBILITY FRAMEWORK**

Challenges of IP Mobility – Address Management – Dynamic Host Configuration Protocol and Domain Name Server Interfaces – Security – Mobility-based AAA Protocol – IP Mobility Architecture Framework – x Access Network – IPv6 Challenges for IP Mobility.

**Total: 45 Hours**

**Reference(s)**

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005.
2. Gottapu Sasibhushana Rao, Mobile Cellular Communication, Pearson Education, 2012.
3. Kaveh PahLavan and P. Krishna Murthy, Principles of Wireless Networks , 2002.
4. Theodore, S. Rappaport, Wireless Communications, Principles, Practice, 2nd Ed., 2002.
5. William Stallings, Wireless Communication and Networking, 2003.

22CT032

**DESIGN OF EMBEDDED SYSTEMS**

2023

**Course Objectives**

- Apply knowledge on the basics, building blocks of Embedded systems.
- Apply Input/output Interfacing & Bus Communication with processors.
- Execute automation using scheduling algorithms and Real time operating systems.
- Evaluate modeling of embedded systems with hardware and software design approaches
- Implement different Phases & Modeling of a new embedded product.

**Course Outcomes (COs)**

1. Apply the functionalities of processor internal blocks, with their requirement.
2. Analyze that Bus standards are chosen based on interface overheads without sacrificing processor performance
3. Execute the role and features of the RT operating system, that makes multi task execution possible by processors.
4. Evaluate that using multiple CPUs based on either hardcore or softcore helps data overhead management with processing- speed reduction for uC execution.
5. Apply Embedded consumer product design based on phases of product development.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1			3	2	1								2	
2	2		1	2										2
3		2	2	3										
4	2		3	3										3
5	2		1	2										3

**UNIT I****6 Hours****INTRODUCTION TO EMBEDDED SYSTEMS**

Introduction to Embedded Systems – Built in Features for Embedded Target Architecture - Selection of Embedded Processor – DMA – Memory Devices – Memory Management Methods – Memory Mapping, Cache Replacement Policies – Timer and Counting Devices, Watchdog Timer, Real Time Clock Software Development Tools – IDE, Assembler, Compiler, Linker, Simulator, Debugger, In-circuit Emulator, Target Hardware Debugging – Overview of Functional Safety Standards for Embedded Systems.

**UNIT II****6 Hours****EMBEDDED NETWORKING BY PROCESSORS**

Embedded Networking: Introduction, I/O Device Ports & Buses – Multiple Interrupts and Interrupt Service Mechanism – Serial Bus Communication Protocols – RS232 Standard – RS485 – USB – Inter Integrated Circuits (I2C) – CAN Bus – Wireless Protocol based on Wifi, Bluetooth, Zigbee – Introduction to Device Drivers.

**UNIT III** **6 Hours**

**RTOS BASED EMBEDDED SYSTEM DESIGN**

Introduction to Basic Concepts of RTOS – Need, Task, Process & Threads, Interrupt Routines in RTOS, Multiprocessing and Multitasking, Preemptive and Non-Preemptive Scheduling, Task Communication Context Switching, Interrupt Latency and Deadline Shared Memory, Message Passing, Interprocess Communication – Synchronization between Processes – Semaphores, Mailbox, Pipes, Priority Inversion, Priority Inheritance, Comparison of Real Time Operating Systems: VxWorks, uC/OS-II, RT Linux.

**UNIT IV** **6 Hours**

**MODELING WITH HARDWARE/SOFTWARE DESIGN APPROACHES**

Modeling Embedded Systems – Embedded Software Development Approach – Overview of UML Modeling with UML, UML Diagrams – Hardware/Software Partitioning, Co-Design Approaches for System Specification and Modeling – CoSynthesis – Features Comparing Single – Processor Architectures & Multi-Processor Architectures – Design Approach on Parallelism in Uniprocessors & Multiprocessors.

**UNIT V** **6 Hours**

**EMBEDDED SYSTEM APPLICATION DEVELOPMENT**

Phases & Modelling of the EDLC - Target Architectures for Control Dominated Embedded Application Development – Data Dominated Systems – Case Studies: Digital Camera, Car Adaptive Cruise Control, Mobile Software for Key Inputs.

**1** **6 Hours**

**EXPERIMENT 1**

Programming with 8 bit Microcontrollers # Assembly programming

**2** **6 Hours**

**EXPERIMENT 2**

Programming with 8 bit Microcontrollers # C programming.

**3** **6 Hours**

**EXPERIMENT 3**

I/O Programming with 8 bit Microcontrollers I/O Interfacing : Serial port programming/ LCD/Sensor Interfacing /PWM Generation/ Motor Control.

**4** **6 Hours**

**EXPERIMENT 4**

Programming with PIC Microcontrollers: a) Assembly b) C programming

**5** **6 Hours**

**EXPERIMENT 5**

I/O Programming with PIC Microcontrollers I/O Interfacing : PWM Generation/ Motor Control/ADC/DAC/ LCD/Sensor Interfacing

**Total: 60 Hours**

**Reference(s)**

1. Bruce Powel Douglass, Real-Time UML Workshop for Embedded Systems, Elsevier, 2011.
2. EliciaWhite, Making Embedded Systems,O'Reilly Series, SPD, 2011.
3. JohnWiley & Sons, Embedded system Design, Peckol, 2010.
4. Lyla B Das, Embedded Systems - An Integrated Approach, Pearson, 2013.
5. Rajkamal, Embedded system - Architecture, Programming, Design, TMH, 2011.

22CT033

**EMBEDDED SYSTEM NETWORKING**

3 0 0 3

**Course Objectives**

- Apply the foundations and building blocks of an Embedded system.
- Analyze introduce the concepts of Embedded Ethernet.
- Evaluate expose the students to the fundamentals of Embedded Networking Protocols & Standards.
- Execute develop the control strategies and algorithms to optimize the operation of building systems.
- Implement optimize the operation and management of Electrical Systems in Industrial Environment.

**Course Outcomes (COs)**

1. Analyze the different bus communication protocols used for embedded networking.
2. Evaluate the concepts of embedded networking.
3. Apply the embedded networking concepts in wireless networks.
4. Implement the appropriate security measures to protect the building automation system.
5. Analyze system automation for different industrial applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2			3	1								1
2		2			2	1								
3	3	2	2	3	2	3								3
4	2		3	3		2								
5	3		3	3		2								3

**UNIT I****9 Hours****EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS**

Embedded Networking: Introduction – Serial and Parallel Communication, Address Resolution Protocol (ARP) – Cluster of Instruments in System: Introduction to Embedded Communication Protocol – UART, SPI, I2C, USB, CAN Bus, LIN Bus, RS 232, RS 422, RS 485 and Embedded Ethernet.

**UNIT II****9 Hours****EMBEDDED ETHERNET**

Elements of a Network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and Network Speed – Design Choices: Selecting Components – Ethernet controllers – Inside the Internet Protocol – Exchanging Messages using UDP and TCP – Serving Web Pages with Dynamic Data – Email for Embedded Systems using FTP – Keeping Devices and Network Secure.

**UNIT III** **9 Hours**  
**WIRELESS EMBEDDED NETWORKING**

Wireless Sensor Networks: Introduction – Applications – Network Topology – Localization – Time Synchronization – Energy Efficient MAC Protocols – SMAC – Energy Efficient and Robust Routing – Data Centric Routing.

**UNIT IV** **9 Hours**  
**BUILDING SYSTEM AUTOMATION**

Sensor Types & Characteristics: Sensing Voltage, Current, Flux, Torque, Position, Proximity, Accelerometer – Data Acquisition System – Signal Conditioning Circuit Design – UC Based & PC based Data Acquisition – UC for Automation and Protection of Electrical Appliances – Processor based Digital Controllers for Switching Actuators: Stepper Motors, Relays – System Automation with Multi-channel Instrumentation and Interface.

**UNIT V** **9 Hours**  
**INDUSTRIAL ELECTRICAL SYSTEM AUTOMATION**

Data Acquisition: Monitoring, Communication, Event Processing, and Polling Principles, SCADA System for Electrical Distribution: Components – Communication System – Operator Workstation – Electrical Automation System: Substation Automation, Extended Control Feeder Automation, End User Load Control Automation – SCADA Data Models and Interface.

**Total: 45 Hours**

**Reference(s)**

1. Dogan Ibrahim, Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series, Elsevier, 2008.
2. James Northcote-Green, Robert Wilson, CRC, Taylor and Francis, Control and automation of electrical power distribution systems, 2006.
3. Jan Axelson, Embedded Ethernet and Internet Complete, Penram publications, 2013.
4. Krzysztof Iniewski, Smart Grid, Infrastructure and Networking, TMcGH, 2012.
5. William Stallings, Cryptography and Network Security Principles and Practice, 7th Edition – Global Edition, Pearson Education Limited, 2017.

**22CT034****EMBEDDED SECURITY****3 0 0 3****Course Objectives**

- Analyze introduce the fundamentals related to Cryptography and Data Security
- Apply the mathematical foundations for Cryptography.
- Execute impart knowledge about Embedded Cryptography and Data Protection Protocols
- Apply them understand the practical aspects of Embedded System Security.
- Execute the students in Discussions/Tutorials/Programming to familiarize the concepts for improved employability skills.

**Course Outcomes (COs)**

1. Understand the significance of Security.
2. Understand the major concepts and techniques related to Cryptography.
3. Show thorough knowledge about the aspects of Embedded System Security.
4. Delivers insight into the role of Security Aspects during Data Transfer and Communication.
5. Applying the Security Algorithms for Real-time Applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1		1	1									
2	3	2	2			2								
3	1	3		1										
4	3	1	2		3	1				2				3
5	3	2	3	2	3	3							2	

**UNIT I****9 Hours****INTRODUCTION ON SECURITY**

Computer and Network Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms – Fundamentals of Security Design Principles – Attack Surfaces and Attack Trees – A Model for Network Security. Introduction to Number Theory: Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic – Prime Numbers – Fermat's and Euler's Theorems – Testing for Primality – The Chinese Remainder Theorem – Discrete Logarithms.

**UNIT II****9 Hours****SYMMETRIC CIPHERS**

Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques. Block Ciphers and the Data Encryption Standard (DES): Traditional Block Cipher Structure – Advanced Encryption Standard (AES): Finite Field Arithmetic, Structure, Transformation Functions, Key Expansion and Implementation.

### **UNIT III**

**9 Hours**

#### **EMBEDDED SYSTEMS SECURITY**

Embedded Security Trends – Security Policies – Security Threats. System Software Considerations: The Role of Operating System – Microkernel versus Monolithic – Core Embedded OS Security Requirements – Access Control and Capabilities – Hypervisors and System Virtualization – I/O Virtualization – Remote Management – Assuring Integrity of the TCB.

### **UNIT IV**

**9 Hours**

#### **EMBEDDED CRYPTOGRAPHY AND DATA PROTECTION PROTOCOLS**

The One-time Pad – Cryptographic Modes – Block Ciphers – Authenticated Encryption – Public Key Cryptography – Public Key Authentication – Elliptic Curve Cryptography – Cryptographic Hashes – Message Authentication Codes – Random Number Generation – Key Management for Embedded Systems – Cryptographic Certifications – Data Protection Protocols for Embedded Systems.

### **UNIT V**

**9 Hours**

#### **PRACTICAL EMBEDDED SYSTEM SECURITY**

Network Communications Protocols and Built-in Security – Security Protocols and Algorithms – The Secured Socket Layer – Embedded Security – Wireless – Application Layer and Client/Server Protocols – Choosing and Optimizing Cryptographic Algorithms for Resource-Constrained Systems – Hardware Based Security.

**Total: 45 Hours**

#### **Reference(s)**

1. William Stallings, Cryptography and Network Security Principles and Practice, 7th Edition – Global Edition, Pearson Education Limited, 2017.
2. David Kleidermacher and Mike Kleidermacher, Newnes, Embedded Systems Security - Practical Methods for Safe and Secure Software and Systems Development, 2012.
3. Timothy Stapko, Newnes, Practical Embedded Security - Building Secure Resource-Constrained Systems, 2008.



**22CT035****EMBEDDED PROCESSOR DEVELOPMENT****3 0 0 3****Course Objectives**

- Analyze introduce the architecture of the ARM processor.
- Apply train students in ARM programming.
- Analyze the On-chip peripherals
- Implement design innovative applications by interfacing the processors with real world
- Analyze various ARM cortex processors

**Course Outcomes (COs)**

1. Analyze the architectures of different Embedded Processors
2. Apply the specialty of RISC processor Architecture.
3. Analyze an appropriate on chip peripherals for serial and parallel communication
4. Execute real time applications using ARM processors
5. Implement innovative products using Embedded processors

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1	1		3								
2	3		3	3	2									1
3			2	2	3									
4			3		2									3
5	2		3	2	3									3

**UNIT I****9 Hours****ARM7, ARM9, ARM11 PROCESSORS**

Introduction to ARM Processors and its Versions, ARM7, ARM9 & ARM11 Features, Advantages and Suitability in Embedded Application, ARM7 Data Flow Model, Programmer's Model, Modes of Operations, Instruction Set, Programming in Assembly Language.

**UNIT II****9 Hours****ARM ASSEMBLY LANGUAGE**

Assembler Rules and Directives, Loads, Stores, and Addressing, ARM general Instruction Set – Thumb Instruction Set, Mixing C and Assembly, Introduction to DSP on ARM – Basic Programming.

**UNIT III****9 Hours****EMBEDDED PROCESSORS ON CHIP PERIPHERALS**

Memory — Interrupts – I/O Ports-Timers & Real Time Clock (RTC), Watchdog timer – CCP Modules – Capture Mode – Compare Mode – PWM Mode – Serial Communication Module – USART – SPI Interface – I2C Interface, Analog Comparator, Analog Interfacing and Data Acquisition.

#### **UNIT IV**

**9 Hours**

##### **REAL WORLD INTERFACING USING ARM PROCESSOR**

Interfacing the Peripherals to LPC2148: GSM and GPS using UART, On-chip ADC using Interrupt (VIC), EEPROM using I2C, SD Card Interface using SPI, On-chip DAC for Waveform Generation.

#### **UNIT V**

**9 Hours**

##### **ARM CORTEX PROCESSORS**

Introduction to ARM CORTEX Series, Improvement over Classical Series and Advantages for Embedded System Design. CORTEX A, CORTEX M, CORTEX R Processors Series, Versions, Features and Applications, Need of Operating System in Developing Complex Applications in Embedded System, Firmware Development for ARM Cortex, Survey of CORTEX M3 based Controllers, its Features and Comparison.

**Total: 45 Hours**

#### **Reference(s)**

1. Mark Fisher, ARM Cortex M4 Cookbook, Packt Publishing, 2016.
2. Rajkamal, Microcontrollers Architecture, Programming, Interfacing, & System Design, Pearson, 2nd Edition, 2012.
3. S. Pasricha and N. Dutt, Morgan Kaufmann, On-Chip Communication Architectures, System on Chip Interconnect, Elsevier Publishers, 2008.
4. Steve Furber, ARM System on Chip Architecture, Addison Wesley Professional, 2nd Edition, 2000.
5. William Hohl, ARM Assembly Language Fundamentals and Techniques, CRC Press, 2nd Edition 2014.

**22CT036 XML AND WEB SERVICES****3 0 0 3****Course Objectives**

- Understand the proficiency in creating, manipulating, and validating XML documents, including understanding XML syntax, structure, and key concepts and use XML technologies such as XML Schema, XPath, and XSLT.
- Understanding of web services and their role in distributed systems. Explore SOAP and REST architectures, understand their differences.
- Acquire practical skills in implementing XML-based web services using industry-standard technologies like SOAP and WSDL.

**Course Outcomes (COs)**

1. Infer XML technologies including XML Schema, XPath, and XSLT, enabling effective data transformation and manipulation in XML-based systems.
2. Design scalable and secure web service architectures using industry-standard protocols like SOAP and REST, ensuring interoperability and efficient communication between distributed systems.
3. Building web services by creating service interfaces, defining operations, and implementing message exchange patterns, ensuring seamless integration and communication between heterogeneous systems.
4. Design and implement XML-based solutions for electronic data interchange (EDI), data validation, and interoperability, ensuring compliance with industry standards and optimizing e-business processes.
5. Design and implement XML-based content management solutions, including content modeling, metadata management, and content transformation.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3					2	2	1		1	2	
2	2	2	3					2	2	1		2	2	
3	2	3	3					2	2	2		2	2	
4	2	3	3					2	2	2		3	2	1
5	2	3	3					2	2	2		3	2	

**UNIT I****9 Hours****XML TECHNOLOGY FAMILY**

XML – benefits – Advantages of XML over HTML – EDL –Databases – XML based standards – DTD –XML Schemas – X- Files – XML processing – DOM –SAXpresentation technologies – XSL – XFORMS – XHTML – voice XML – Transformation – XSLT – XLINK – XPATH –XQ

**UNIT II** **9 Hours**  
**ARCHITECTING WEB SERVICES**

Business motivations for web services – B2B – B2C- Technical motivations – limitations of CORBA and DCOM – Service – oriented Architecture (SOA) – Architecting web services – Implementation view – web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer – process view – life in the runtime.

**UNIT III** **9 Hours**  
**WEB SERVICES BUILDING BLOCK**

Transport protocols for web services – messaging with web services – protocols – SOAP – describing web services – WSDL – Anatomy of WSDL – manipulating WSDL – web service policy – Discovering web services – UDDI – Anatomy of UDDI- Web service inspection –Ad-Hoc Discovery – Securing web services

**UNIT IV** **9 Hours**  
**IMPLEMENTING XML IN E-BUSINESS**

B2B - B2C Applications – Different types of B2B interaction – Components of ebusiness XML systems – ebXML – Rosetta Net Applied XML in vertical industry – Web services for mobile devices.

**UNIT V** **9 Hours**  
**XML AND CONTENT MANAGEMENT**

Semantic Web – Role of Meta data in web content – Resource Description Framework – RDF schema – Architecture of semantic web – content management workflow – XLANG –WSFL.

**Total: 45 Hours**

**Reference(s)**

1. Ron schmelzer et al, “XML and Web Services”, Pearson Education, 2002.
2. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Prentice Hall, 2004. Reference(s):
3. Frank P. Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.
4. Keith Ballinger, “.NET Web Services Architecture and Implementation”, Pearson Education, 2003.
5. Henry Bequet and Meeraj Kunnumpurath, “Beginning Java Web Services”, Apress, 2004.
6. Russ Basiura and Mike Batongbacal, “Professional ASP.NET Web Services”, Apress,2. ASP .NET Web Services”, Apress, 2003.

**22CT037 SOFTWARE PROJECT MANAGEMENT****3 0 0 3****Course Objectives**

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle.
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization's strategic goals.

**Course Outcomes (COs)**

1. Understand Project Management principles while developing software.
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques.
4. Estimate the risks involved in various project activities.
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		2								2	
2			2		3	1							2	
3	2		2	1	2	2								1
4	2	2	3	2	1	3								2
5			1		3	1								2

**UNIT I****9 Hours****PROJECT EVALUATION AND PROJECT PLANNING**

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II****9 Hours****PROJECT LIFE CYCLE AND EFFORT ESTIMATION**

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

### **UNIT III**

**9 Hours**

#### **ACTIVITY PLANNING AND RISK MANAGEMENT**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

### **UNIT IV**

**9 Hours**

#### **PROJECT MANAGEMENT AND CONTROL**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

### **UNIT V**

**9 Hours**

#### **STAFFING IN SOFTWARE PROJECTS**

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**Total: 45 Hours**

#### **Reference(s)**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki “Effective Software Project Management” – Wiley Publication, 2011.
3. Walker Royce: “Software Project Management”- Addison-Wesley, 1998.
4. Gopalaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint 2013

**22CT038 HUMAN COMPUTER INTERACTION****3 0 0 3****Course Objectives**

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To learn the model and theories of human computer interaction
- To be aware of mobile computer systems and its applications.
- To learn the guidelines for designing web user interfaces.

**Course Outcomes (COs)**

1. Collect fundamental design and evaluation methodologies of computer
2. Design effective HCI for individuals and persons with disabilities.
3. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.
4. Design mobile application framework using HCI tools
5. Develop a web interface using various tools.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2				2	2			2	
2	1	2	2	2	2				2	2			2	
3	1	2	2	3					3	3			2	
4	2	2	3	2	3				2	2			2	
5	2	2	1	2	3				2	2			2	

**UNIT I****9 Hours****FOUNDATIONS OF HCI**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

**UNIT II****9 Hours****DESIGN & SOFTWARE PROCESS**

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

**UNIT III**

**9 Hours**

**MODELS AND THEORIES**

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

**UNIT IV**

**9 Hours**

**MOBILE HCI**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies

**UNIT V**

**9 Hours**

**WEB INTERFACE DESIGN**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

**Total: 45 Hours**

**Reference(s)**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Brian Fling, —Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, —Designing Web Interfaces, First Edition, O'Reilly, 2009.



**22CT039****VISUAL EFFECTS****3 0 0 3****Course Objectives**

- To Gain a comprehensive understanding of the principles, techniques, and workflows involved in creating visual effects.
- To Acquire knowledge and skills in compositing techniques.
- To Learn the process of creating 3D models, rigging characters, and animating them realistically.
- To Enhance problem-solving skills by tackling various challenges

**Course Outcomes (COs)**

1. To analyze 2D / 3D animation principles and techniques
2. To use CGI, color and light elements in VFX applications
3. To create special effects using any of the state of the art tools
4. To apply popular visual effects techniques using advanced tools
5. To use compositing tools for creating VFX for a variety of applications

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												1
2	1	2												1
3			2		2									2
4	2				2									2
5					3									3

**UNIT I****9 Hours****FOUNDATIONAL ASPECTS OF ANIMATION**

Principles of Animation - Frame Rate and Timings - Foundational Aspects: Key frame and In-betweening, Character Design, Storyboarding, Squash and Stretch, Timing and Spacing, Walk Cycles, Lip Sync and Dialogue Animation, Expressions and Emotions.

**UNIT II****9 Hours****CGI, COLOR, LIGHT**

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

**UNIT III****9 Hours****SPECIAL EFFECTS**

Special Effects – props, scaled models, animatronics, pyrotechniques, Schufftan process, Particle effects – wind, rain, fog, fire

**UNIT IV**

**9 Hours**

**VISUAL EFFECTS TECHNIQUES**

Green Screen and Blue Screen Techniques - Tracking and Match moving: Tracking, Camera Reconstruction, Planar Tracking, Calibration, Point Cloud Projection, Ground Plane Determination, 3D Match Moving - CGI Integration - Matte Painting and Rigging - Rotoscoping and Masking.

**UNIT V**

**9 Hours**

**ADVANCED COMPOSITING TECHNIQUES**

Deep Compositing – 3D Projection Mapping - Advanced Keying Techniques - Advanced Rotoscoping - Multi-Pass Compositing - Virtual Reality (VR) Compositing - Advanced Color Grading and Finishing - VFX tools: Blender, Natron, GIMP.

**Total: 45 Hours**

**Reference(s)**

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

**22CT040 BUSINESS ANALYTICS****3 0 0 3****Course Objectives**

- Comprehend the process of acquiring Business Intelligence.
- Understand various types of analytics for Business Forecasting.
- Apply analytics for different functions of a business.

**Course Outcomes (COs)**

1. Infer the real-world business problems and model with analytical solutions.
2. Interpret the business processes for extracting Business Intelligence
3. Apply predictive analytics for business fore-casting
4. Apply analytics for supply chain and logistics management
5. Apply analytics for marketing and sales

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2											2	
2	2	2		2									2	
3	3	3		3	3								2	2
4	3	3		3	3								2	
5	3	3		3	3								2	2

**UNIT I****9 Hours****INTRODUCTION TO BUSINESS ANALYTICS**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

**UNIT II****9 Hours****BUSINESS INTELLIGENCE**

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions

**UNIT III****9 Hours****BUSINESS FORECASTING**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling –Machine Learning for Predictive analytics.

**UNIT IV**

**9 Hours**

**HR & SUPPLY CHAIN ANALYTICS**

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain. Apply HR Analytics to make a prediction of the demand for hourly employees for a year.

**UNIT V**

**9 Hours**

**MARKETING & SALES ANALYTICS**

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales. Do predictive analytics for customers' behaviour in marketing and sales.

**Total: 45 Hours**

**Reference(s)**

1. R. Evans James, Business Analytics, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition, Pearson Education,2018

**22CT041 IoT and Use Cases****3 0 0 3****Course Objectives**

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

**Course Outcomes (COs)**

1. Explain the concept of IoT.
2. Analyze various protocols for IoT.
3. Design a PoC of an IoT system using Raspberry Pi/Arduino
4. Apply data analytics and use cloud offerings related to IoT.
5. Analyze applications of IoT in real time scenario

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3													2
2	1	3											1	
3		1	3										2	3
4			2	3									3	
5			1		3								2	

**UNIT I****9 Hours****FUNDAMENTALS OF IoT**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

**UNIT II****9 Hours****IoT PROTOCOLS**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

### **UNIT III**

**9 Hours**

#### **DESIGN AND DEVELOPMENT**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

### **UNIT IV**

**9 Hours**

#### **DATA ANALYTICS FOR IoT**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning– No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Flexible NetFlow Architecture- FNF Components - Flexible NetFlow in Multiservice IoT Networks

### **UNIT V**

**9 Hours**

#### **CASE STUDIES/INDUSTRIAL APPLICATIONS**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**Total: 45 Hours**

#### **Reference(s)**

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
4. Jan Hoeller, 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.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.
6. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

**22CTM01 Problem Solving using Python****2 0 2 3****Course Objectives**

- To understand the basics of python programming.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

**Course Outcome:**

CO1: Develop and execute simple Python programs.

CO2: Write simple Python programs using conditionals and loops for solving problems.

CO3: Decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, dictionaries etc.

CO5: Read and write data from/to files in Python programs.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3		2							2	3	
2	3	3	3	3	2							2	3	
3	2	2		2	2								3	
4	1	2			1								3	
5	2	2			2								3	

**UNIT I****INTRODUCTION TO PYTHON PROGRAMMING****5 Hours**

Identification of Computational Problems – Pseudo Code and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms Overview of Python and its history, Installation and setup of Python development environment. Basic syntax and structure of Python programs

**Unit II****6 Hours****DATA TYPES, EXPRESSIONS, STATEMENTS**

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**Unit III****7 Hours****CONTROL FLOW, FUNCTIONS, STRINGS**

Conditionals: Boolean values and operators, conditional statements, Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

#### Unit IV

6 Hours

##### LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

#### Unit V

6 Hours

##### FILES, MODULES, PACKAGES

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

##### EXPERIMENTS

1

3 Hours

##### EXPERIMENT 1

Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

2

3 Hours

##### EXPERIMENT 2

Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

3

3 Hours

##### EXPERIMENT 3

Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern).

4

3 Hours

##### EXPERIMENT 4

Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)

5

3 Hours

##### EXPERIMENT 5

Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)

6

3 Hours

##### EXPERIMENT 6

Implementing programs using Functions. (Factorial, largest number in a list, area of shape)

3 Hours



7

**EXPERIMENT 7**

Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)

8

**3 Hours**

**EXPERIMENT 8**

Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy).

9

**3 Hours**

**EXPERIMENT 9**

Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word).

10

**3 Hours**

**EXPERIMENT 10**

Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)

**Total: 60 Hours**

**Reference:**

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. <https://www.python.org/> 6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, McGraw Hill, 2018.

## 22CTM02 Data Structures and Algorithms using Python 3 0 0 3

### Course Objectives

- Understand the basic principles of data structures and algorithms.
- Implement common data structures in Python, including lists, stacks, queues, linked lists, trees, and graphs.
- Apply various searching and sorting algorithms to real-world problems.
- Analyze the efficiency of algorithms using time and space complexity.
- Design and implement algorithms for solving problems in various domains.

### Course Outcomes (COs)

1. Implement various data structures efficiently in Python (including user-defined lists)
2. Apply searching and sorting algorithms to solve real-world problems
3. Design and implement algorithms for solving problems in different domains using appropriate data structures
4. Analyze the performance of algorithms and choose the most efficient approach for a given problem
5. Develop effective problem-solving and critical thinking skills through algorithm design and implementation

### Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	3	
2	2	2	2	2	2						2	3	3	
3	2	3	3	2	2						2	2	2	
4	3	3	3	3	2						3	2	2	
5	3	3	3	3	3						2	2	2	

### UNIT I

9 Hours

#### ABSTRACT DATA TYPES

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying Introduction to analysis of algorithms – asymptotic notations – divide & conquer – recursion – analyzing recursive algorithms

### UNIT II

9 Hours

#### LINEAR STRUCTURES

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – Stack ADT – Queue ADT – double ended queues – applications

### UNIT III

9 Hours

#### SORTING AND SEARCHING

Bubble sort – selection sort – insertion sort – merge sort – quick sort – analysis of sorting algorithms – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency

#### **UNIT IV**

**9 Hours**

##### **TREE STRUCTURES**

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multiway search trees

#### **UNIT V**

**9 Hours**

##### **GRAPH STRUCTURES**

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – greedy algorithms – dynamic programming – shortest paths – minimum spanning trees – introduction to complexity classes and intractability

**Total: 45 Hours**

#### **TEXT BOOKS:**

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, An Indian Adaptation, John Wiley & Sons Inc., 2021

#### **REFERENCES:**

1. Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015
2. Rance D. Nicaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014
4. Udi Manber, Introduction to algorithms : A Creative approach, Addison-Wesley Publishing Company Inc.

**22CTM03 Relational Database Systems****3 0 0 3****Course Objectives**

- Understand the basic concepts of relational database systems.
- Design and implement relational databases.
- Use SQL to query and manipulate data.
- Analyze recovery techniques.
- Analyze Database Recovery Systems.

**Course Outcomes (COs)**

1. Understand the fundamental concepts of Database Management Systems
2. Design and implement relational databases using the Entity-Relationship (ER) model and normalization techniques.
3. Use SQL to query and manipulate data in relational databases.
4. Use ACID properties, Concurrency control mechanisms and recovery techniques
5. Analyze and the Recovery System to retrieve the data.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	3	
2	2	2	2	2	2						2	3	3	
3	2	3	3	2	2						2	2	2	
4	3	3	3	3	2						3	2	2	
5	3	3	3	3	3						2	2	2	

**UNIT I****9 Hours****INTRODUCTION TO DATABASE MANAGEMENT SYSTEM**

Database Systems, Advantages of using a DBMS, Overview of Data Model, Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Engine, Database and Application Architecture, Three-schema architecture

**Unit II****9 Hours****INTRODUCTION TO RELATIONAL MODEL**

Relational Database Concepts, Structure of Relational Databases, Database schema design, keys, Schema diagram, Relational Query Language, Entity-Relationship (ER) modeling, Normalization techniques, Data integrity constraints.

### **Unit III**

**9 Hours**

#### **STRUCTURED QUERY LANGUAGE (SQL)**

Introduction to SQL, SQL Query Language- Data Definition Language(DDL)- Data Manipulation Language(DML) – Data Query Language (DQL), Basic Structure of Query Language – Three clauses – Select – From – Where, Single Relation Query – Multiple Relation Query, Advanced SQL Features- Subqueries – Joins – Views.

### **Unit IV**

**9 Hours**

#### **TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL**

Transaction Management – Transaction Concepts, ACID Properties, Simple Transaction Model, Volatile and Non-Volatile Storage, Transaction Atomicity and Durability, State Diagram, Transaction Isolation. Concurrency Control – Lock Based Protocol, Two-Phase Locking Protocol, Deadlock Handling.

### **Unit V**

**9 Hours**

#### **DATABASE RECOVERY TECHNIQUES**

Recovery Concepts, Caching of Disk Blocks, Fuzzy checkpointing, Transaction Rollback, Cascading Rollback, Recovery Techniques Based on Immediate Update, Shadow paging, ARIES Recovery Algorithm.

**Total: 45 Hours**

#### **Reference:**

1. Elmasri, R., & Navathe, S. B. (2016). Fundamentals of Database Systems (7th Pearson Education)
2. Korth, H. F., & Silberschatz, A. (2019). Database System Concepts (7th ed.). McGraw Hill Education.

#### **Additional Resources:**

1. [https://docs.oracle.com/cd/E11882\\_01/appdev.112/e25519/toc.htm](https://docs.oracle.com/cd/E11882_01/appdev.112/e25519/toc.htm)
2. MySQL Documentation: <https://dev.mysql.com/doc/refman/8.0/en/introduction.html>
3. PostgreSQL Documentation: <https://www.postgresql.org/docs/current/index.html>

**22CT0XA MEAN Stack for Dynamic Web App Development 0 0 1 1****Course Objectives**

- To understand full-stack web applications using the MEAN stack and build a web application using MongoDB, ExpressJS, Angular, and Node.js.

**Course Outcomes (COs)**

1. Apply the different technologies in the MEAN stack to build different features of a web application.
2. Analyze full-stack web applications using a well-supported stack.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2				2			1		1	1	
2		1	2	2		1		1					1	

Introduction to JavaScript - Functions and DOM Manipulation- Events and Event Handling - Introduction to Angular - Angular Components and Directives- - Building a Simple Angular App - Introduction to MEAN stack - MongoDB basics- Creating a MongoDB database - Node.js basics - Creating a NestJS, Angular and Node.js Application-Integrating MongoDB, Express, Angular, and Node.js-Building a complete MEAN stack application.

**Total: 15 Hours****Reference(s)**

1. Schwarzmüller, Maximillian. MEAN Stack: The Complete Developer's Guide. Packt Publishing, 2015.
2. Hanson, Jeff. MEAN Stack Handbook. Packt Publishing, 2016.
3. Nadel, Ben. MEAN Stack with Angular 2. Apress, 2016.
4. Papa, John. MEAN Stack with MongoDB, Express, AngularJS and Node.js. Packt Publishing, 2014.
5. SitePoint. MEAN Stack Quick Start Guide. SitePoint, 2014.

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**22CT0XB****Component based UI Development****0 0 1 1****Course Objectives**

- To Learn how to create dynamic and interactive user interfaces using React.
- To Build reusable UI components that respond to user interactions, enabling the development of modern and engaging web applications.
- To Learn how to build composable user interfaces and web applications.

**Course Outcomes**

- Understand the basics of reactjs, including components, and Hooks.
- Apply reactjs to create interactive and dynamic user interfaces.

**Articulation Matrix**

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	-	-	-	1	-	-	1	-	1	1	-
2	-	1	2	2	-	1	-	1	-	-	-	-	1	-

**Course Syllabus**

JavaScript: Overview - ES6 and Expressions - Node Package Manager (NPM) - React: Basics - Functional vs Class based Components – HTML Components – Grid Layouts - List Layouts and Keys - React Hooks: Use State - Use Effect – React Forms – Event handling – React Routers

**Total: 15 Hours****References**

1. Alex Banks and Eve Porcello, "Learning React: Modern Patterns for Developing React Apps", 2020.
2. Stoyan Stefanov, "React Up and Running: Building Web Applications", 2015.
3. Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", 2017.
4. Anthony Accomazzo, Ari Lerner, and David Guttman, "Fullstack React: The Complete Guide to ReactJS and Friends", 2017.

**Resource Person**

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**22OCE01****ENERGY CONSERVATION AND MANAGEMENT****3 0 0 3****Course Objectives**

- To develop an understanding and analyze the energy data of industries
- To carryout energy accounting and balancing
- To conduct energy audit and suggest methodologies for energy savings and
- To utilize the available resources in optimal ways

**Course Outcomes (COs)**

1. Classify and characterize the various energy utilization techniques.
2. Identify suitable technique to provide an energy efficient system.
3. Identify the need for thermal systems with latest technologies.
4. Choose suitable techniques doe conserving energy with respect to emerging trends.
5. Assess the impact economics on the conservation of energy.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1										1	3
2	1	3									1	3
3	1	3									2	3
4	1	3	2								3	3
5	1	2	2								1	3

**UNIT I****9 Hours****INTRODUCTION**

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

**UNIT II****9 Hours****ELECTRICAL SYSTEMS**

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

**UNIT III****9 Hours****THERMAL SYSTEMS**

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and Encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories



**UNIT IV**

**9 Hours**

**ENERGY CONSERVATION IN MAJOR UTILITIES**

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

**UNIT V**

**9 Hours**

**ECONIMICS**

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept .

**Total: 45 Hours**

**Reference(s)**

1. Energy Manager Training Manual (4 Volumes) available at [www.energymanagertraining.com](http://www.energymanagertraining.com), a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.
2. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.
3. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
4. Dryden. I.G.C., “The Efficient Use of Energy” Butterworths, London, 1982
5. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
6. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

**22OEC01 BASICS OF ANALOG AND DIGITAL ELECTRONICS****3 0 0 3****Course Objectives**

- Understand the working of diodes and transistors in electronic circuits.
- Understand the analog operational amplifier and its applications.
- Understand the implementation of combinational and sequential circuits in digital systems.

**Course Outcomes (COs)**

1. Apply the diodes and transistors in regulators and amplifiers and analyze their characteristics.
2. Illustrate the working of analog IC with different configurations and its applications.
3. Simplification of Boolean expressions using K-map and implementation of combinational circuits.
4. Analyze the Flip flops and memory configurations in digital circuits.
5. Classify and analyze A/D and D/A converters with its parameters.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2	3	1								
2	2	2	3									
3	2	2	3	2								
4	2	2	3	3								
5	2	2	3	3								

**UNIT I****9 Hours****SEMICONDUCTORS DEVICES**

Conductor, Semiconductors & Insulators, Semiconductors: intrinsic & extrinsic, energy band diagram - Mobility - Electrons and holes - The P-N junction diode - Zener diode - Avalanche effect- Rectifier Circuits Half wave, Full wave circuits, Efficiency, PIV, Ripple factor and AC and DC current and voltage in rectifier. PNP and NPN Bipolar junction Transistors - H parameters equivalent circuit - Common emitter amplifier - DC behavior: the load slope and the Q point - AC behavior - Emitter follower amplifier - Field effect transistors: JFET and MOSFET.

**UNIT II****9 Hours****OPERATIONAL AMPLIFIERS: DC PERFORMANCE**

The operational amplifier - Input resistance, Output resistance, Open loop gain - Bias currents - Offset currents - Offset voltage - Differential mode gain - Common mode gain - Common mode rejection ratio - Negative feedback - Open loop gain and closed loop gain - Inverter amplifier - Non-inverter amplifier - The voltage follower - Transimpedance amplifier (Current to voltage converter) - Differential amplifier. Adders, Subtractors, Comparator, Integrator and Differentiator.

**UNIT III****9 Hours****DIGITAL TECHNIQUES: COMBINATIONAL CIRCUITS**

Numbering systems - Binary, octal and hexadecimal numbers - Boole algebra - Conversion and operations - AND gate- OR gate - Inverter - NAND gate - NOR gate - Exclusive OR gate. Morgans laws. Combinational Circuits: Truth tables, logic expressions, Logic simplification using K- map, half and full adder/subtractor, multiplexers, demultiplexers, Logic families :TTL and CMOS.

#### UNIT IV

9 Hours

##### DIGITAL TECHNIQUES: SEQUENTIAL CIRCUITS

Gated Latches & Flip Flops- Level triggered and Edge triggered Flip-Flops, Flop (FF) types: RS type. JK FF. JK FF Master slave. D FF. T FF. Flip Flop Conversion. Shift registers, Counters. Memories Structure: address and data bus. ROM, PROM, EPROM and flash RAM. Volatiles Memories: RAM, SRAM, DRAM. Addressing modes.

#### UNIT V

9 Hours

##### DIGITAL TO ANALOG CONVERTERS AND ANALOG TO DIGITAL CONVERTERS

DIGITAL TO ANALOG CONVERTERS : Input latch. Binary Weighted Resistor Network. R-2R Ladder Resistor Network. Pulse Width Modulation . Resolution. Accuracy. Linearity. Zero Offset. Settling Time. Glitches. ANALOG TO DIGITAL CONVERTERS: Sampling. Real time sampling and equivalent time sampling. Sampling frequency. Sampling theorem (Nyquist). Anti-aliasing filtering. Sampling and holding. Conversion.

**Total: 45 Hours**

#### Reference(s)

1. L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, 2012.
2. J Millman, C. Halkias & Satyabrata Jit, Electronic Devices and Circuits, Tata McGraw- Hill, 2010.
3. Ramakant A. Gayakwad, OP-AMP and Linear IC's , Prentice Hall of India, 2002.
4. D. Roy Choudhry, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.
5. Thomas L. Floyd, Digital Fundamentals, Prentice Hall, 11th Edition, 2015.
6. M. Morris Mano, Michael D Ciletti Digital Design 4th edition Pearson, 2011.

22OEC02

**MICROCONTROLLER PROGRAMMING****3 0 0 3****Course Objectives**

- Understand Series of Microcontrollers in terms of architecture, Programming and Interfacing.
- Learn Programming of PIC series of microcontrollers and learn building of hardware circuits using PIC 16F series of Microcontrollers
- Learn the emerging trends in the design of advanced Microcontrollers.

**Course Outcomes (COs)**

1. Interpret the components and functionalities of 8051 Microcontrollers.
2. Develop microprocessor applications using the Assembly Language Program
3. Illustrate the working nature of PIC microcontroller on various versions
4. Illustrate the interfacing of different peripherals using PIC Microcontroller
5. Analyze the architecture and instruction set of ARM Microcontroller

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1									
2	1	3	1									
3	1	1	2		1							
4	1	1	2		3							
5	1	1	3		2							

**UNIT I****9 Hours****8-BIT MICROCONTROLLER**

Introduction-Intel 8051 architecture-Counters and Timers-Serial Interface- Interrupts- Interfacing to external memory and 8255- Instruction set- Address modes.

**UNIT II****9 Hours****8051 ALP AND APPLICATIONS**

Assembly language program- Timers and Counters programming- DAC- ADC- Sensor- Keyboard and LCD.

**UNIT III****9 Hours****PIC MICROCONTROLLER**

PIC Microcontroller features- PIC Architecture, Program Memory, Addressing Modes, Instruction Set, Instruction Format- Byte-oriented Instructions- Bit-oriented Instructions- Literal Instructions- Control Instructions (CALL & GOTO)- Destination Designator. MPLAB overview: Using MPLAB, Toolbars, Select Development Mode and Device type, Project, Text Editor, Assembler, MPLAB operations.

**UNIT IV****9 Hours****PIC HARDWARE**

Reset, Clock, Control registers, Register banks, Program Memory Paging, Ports, Interrupts, Timer and Counter, Watchdog Timer, Power up timer, Sleep mode, I2C bus- A/D converter.

## UNIT V

9 Hours

### HIGH PERFORMANCE RISC ARCHITECTURE

ARM: The ARM architecture- ARM organization and implementation- The ARM instruction set- The THUMB instruction set- Basic ARM Assembly Language Program- ARM CPU Cores.

### FOR FURTHER READING

Introduction- Architecture- Registers- Memory- Instruction set- Addressing Modes- I/O Pins- Timers- Counters- Interrupts.

**Total: 45 Hours**

### Reference(s)

1. Ayala, Kenneth, "The 8051 Microcontroller", Thomson, 3rd Edition, 2004.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, " The 8051 Microcontroller and Embedded Systems", Person Education, 2nd Edition, 2004.
3. John B.Peatman, "Design with Microcontrollers", Person Education", 1st Edition, 2004.
4. Steave Furber, "ARM system-on-chip architecture" Addison Wesley, 2nd Edition, 2000.
5. A.V.Deshmukh, "Microcontrollers: Theory and Applications", Tata Mc Graw Hill, 12th reprint, 2005.

22OEC03

**PRINCIPLES OF COMMUNICATION SYSTEMS****3 0 0 3****Course Objectives**

- To study the various analog and digital modulation techniques
- To study the various digital communication techniques
- To enumerate the idea of spread spectrum modulation
- To study the design concepts of satellite and optical communication

**Course Outcomes (COs)**

1. Illustrate the process involved in Amplitude, Frequency and phase modulation systems.
2. Analyze the performance of different digital modulation /demodulation techniques.
3. Analyze Pulse Code Modulation scheme for the transmission of analog data in digital format.
4. Apply the concepts of spread spectrum modulation techniques to eradicate interference in wireless communication.
5. Analyze the system design of satellite and optical communication.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	2									
2	3	2										
3	3	2										
4	2	2	2									
5	3	2										

**UNIT I****9 Hours****FUNDAMENTALS OF ANALOG COMMUNICATION**

Principles of amplitude modulation, AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM Voltage distribution, AM power distribution, Angle modulation. FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation, Frequency analysis of angle modulated waves. Bandwidth requirements for Angle modulated waves

**UNIT II****9 Hours****DIGITAL COMMUNICATION**

Introduction, Shannon limit for information capacity, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) Minimum Shift Keying (MSK), Phase Shift Keying (PSK), BPSK, QPSK, 8 PSK Quadrature Amplitude Modulation (QAM), Bandwidth Efficiency, Comparison of various Digital Communication System (ASK - FSK - PSK - QAM).

**UNIT III****9 Hours****DIGITAL TRANSMISSION**

Introduction, Pulse modulation, PCM, PCM sampling, sampling rate, signal to quantization noise rate, companding, delta modulation, adaptive delta modulation, differential pulse code modulation, pulse transmission, Intersymbol interference, eye patterns.

#### **UNIT IV**

**9 Hours**

##### **SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES**

Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques, wireless communication, TDMA and CDMA in wireless communication systems, source coding of speech for wireless communications.

#### **UNIT V**

**9 Hours**

##### **SATELLITE AND OPTICAL COMMUNICATION**

Satellite Communication Systems-Keplers Law, LEO and GEO Orbits, footprint, Link model- Optical Communication Systems-Elements of Optical Fiber Transmission link, Types, Losses, Sources and Detectors.

**Total: 45 Hours**

#### **Reference(s)**

1. Wayne Tomasi, Advanced Electronic Communication Systems, 6/e, Pearson Education, 2007.
2. Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons., 2001.
3. H.Taub, D L Schilling, G Saha, Principles of Communication, 3/e, 2007.
4. B.P.Lathi, Modern Analog And Digital Communication systems, 3/e, Oxford University Press, 2007
5. Dennis Roddy, "Satellite Communications", Third Edition, Mc Graw Hill International Editions, 2001.
6. Gerd Keiser, Optical Fiber Communication, McGraw-Hill International, Singapore, 4th edition., 2011.

**21OEC04****PRINCIPLES OF COMPUTER COMMUNICATION  
AND NETWORKS****3 0 0 3****Course Objectives**

- To understand the concept of data communication and networking models.
- To study the various networking Components and Networks.
- To explore the routing, addressing and security and management aspects of computer networks.

**Course Outcomes (COs)**

1. Classify the types of computer networks and analyze the seven layers of OSI model.
2. Analyze the basic operations of Routing Algorithms and Routing devices
3. Analyze the local and wide area networking technologies.
4. Apply the ISDN and ATM interface connections in broadband networks.
5. Analyze the security and management techniques related with networks.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	1	1								
2	1	2	2	3								
3	1	1	2	3								
4	1	1	3									
5	1	2	3	3								

**UNIT I****9 Hours****NETWORK FUNDAMENTALS**

Types of Computer Networks: by Area, by Topology ; Communication Services: Serial and Parallel, Synchronous and Asynchronous, Simplex and Duplex, Analog and Digital; Speed and Capacity; Multiplexing and Switching; Network Architecture: OSI Seven-Layer Network model.

**UNIT II****9 Hours****INTERNETWORKING AND COMPONENTS**

Routing Concepts: Routing Algorithms, RIP, RIP-2, OSPF and other routing Protocols; Switches and Hubs: Store and Forward Switch, Cut-Through Switch, Hybrid Switch, Performance of Switches ; Repeaters; Repeater Vs Hubs; Bridges: Standards, Bridges Vs Repeaters; Routers and Gateways.

**UNIT III****9 Hours****LOCAL AND WIDE AREA NETWORKING TECHNOLOGIES**

LAN Components and Topologies; Access Techniques; Transmission Protocols and Media; Ethernet and IEEE 802.3 Networks: History, 10-MBPS Ethernet, Switched Ethernet, 100-MBPS Ethernet, Gigabit Ethernet.



#### **UNIT IV**

**9 Hours**

##### **BROADBAND NETWORKS**

ISDN: Evolution, ISDN Channel and Interface Structures; Broadband ISDN: Basics, Principles and General Architecture; Asynchronous Transfer Mode(ATM): Introduction, Concepts, Components, Connection Supported by ATM network and Concept of Virtual Channel and Virtual Path, Traffic control and Congestion Control, Operation and Maintenance aspects.

#### **UNIT V**

**9 Hours**

##### **NETWORK SECURITY AND MANAGEMENT**

Security: Need of Security, Security Threats, Vulnerabilities, Methods, tools and Techniques for Attacks; Network Security: Levels of Security, Cryptosystems; Data Encryption Standard (DES), Public Key Cryptography, Firewalls; Network Management: Functions and Elements, Distribution of Management; Simple Network Management Protocol (SNMP), Remote Network Management Services.

**Total: 45 Hours**

#### **Reference(s)**

1. Michael A.Gallo, William M. Hancock, Computer Communications and Networking Technologies, 1 Ed, Thomson Learning, 2002.
2. Kenneth C. Mansfield, Jr.James L. Antonakos, An Introduction to Computer Networking, 1Ed, Prentice Hall of India, 2002
3. A Shanmugam, S Rajeev, Computer Communication Networks, 1Ed, ISTE Learning Materials Centre, 2001
4. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer, 3rd edition, 2010, Prentice Hall
5. Digital Signal Processing by Sanjit Mitra, 4th edition, 2011, McGraw-Hill, New York, NY

**22OEI01****PROGRAMMABLE LOGIC CONTROLLERS****3 0 0 3****Course Objectives**

- To impart knowledge about automation and architecture of PLC
- To understand the PLC programming using timers, counters and advanced PLC functions
- To familiarize the student with PLC based applications

**Course Outcomes (COs)**

1. Outline the fundamental Concepts of Automation
2. Conclude the architecture, interfacing and communication techniques of PLC
3. Execute the suitable PLC Programming languages
4. Attribute the various functions and instruction sets of PLC
5. Generate a suitable logical programming for given applications

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1		2	2		3							
2	2	1		2	2		3							
3	2	1		2	2		3							
4	2	1		2	2		3							
5	2	1		2	2		3							

**UNIT I****10 Hours****INTRODUCTION TO AUTOMATION**

Evolution of automation -Types of automation - Fixed, flexible and programmable automation - Batch process and continuous process - open loop system and closed loop system - Function of sensors - Proximity sensors: Capacitive and Inductive - Infrared and Laser Push-buttons and toggle switches - Actuators: Solenoid valve - servo motor - electromagnetic relays.

**UNIT II****9 Hours****ARCHITECTURE OF PLC**

Components of PLC - sink and source I/O cards - Processor - Memory: Types of memory, Input and Output modules: Discrete, Analog -Scan time of PLC -Interfacing computer and PLC: RS232, RS485, Ethernet - Selection criteria for PLC.

**UNIT III****8 Hours****PLC PROGRAMMING**

Programming languages - Ladder logic components: User and bit Instructions, branch instructions, internal relay instruction Boolean logic using ladder logic programming, Latching -Timers: On Delay timer, OFF Delay timer and Retentive timer - Counters: Up Counter and Down Counter.

**UNIT IV**

**10 Hours**

**ADVANCED PLC FUNCTIONS**

Instructions in PLC: Program Control Instructions, Math Instructions, Data Manipulation Instructions: Data compare operations, Data transfer operations - Sequencer and Shift register instructions- Analog Instructions: PID Controller - Scaling Instructions.

**UNIT V**

**8 Hours**

**APPLICATIONS OF PLC**

Case Studies: Bottle filling system - Pick and place robot - Car Parking - Traffic light control (4 ways with pedestrian signal) -Elevators - Pneumatic stamping system - alarm annunciator system.

**Total: 45 Hours**

**Reference(s)**

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2015.
2. Benjamin C Kuo, Automatic Control Systems, Prentice Hall of India, New Delhi, 2014.
3. John Park, Steve Mackay, Edwin Wright, Practical data communications for instrumentation and control, Newnes, Elsevier, 2015.
4. K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2014.
5. John W Webb and Ronald A Resis, Programmable Logic Controller, Prentice Hall of India Pvt. Ltd., New Delhi, 2013.

**22OEI02****SENSOR TECHNOLOGY****3 0 0 3****Course Objectives**

- To impart knowledge about various sensors in multidisciplinary engineering domain
- To familiarize students with different applications and its material handling technology
- To understand the concept of sensing circuits and its static and dynamic characteristics

**Course Outcomes (COs)**

6. Conclude the static and dynamic characteristics of measuring instruments
7. Compare the characteristics and working principles of Resistance, Inductance and Capacitance type sensors
8. Construct the interfacing and signal conditioning circuit for measurement system using different types of sensor
9. Analyze and select the suitable sensor for different industrial applications
10. Combine the modern technologies and smart materials to design various sensors

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	2	3	2	1	1									
3	1	2	3	3	1									
4	2	1	1	3	3									
5	1	2	1	2	3									

**UNIT I****8 Hours****SENSORS FUNDAMENTALS AND CHARACTERISTICS**

Sensors: Principles of Sensing - Sensor Classification and terminology- Units of Measurements - Measurands- Sensor Characteristics: Static and Dynamic.

**UNIT II****8 Hours****PHYSICAL PRINCIPLES OF SENSING**

Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements.

**UNIT III****9 Hours****INTERFACE ELECTRONIC CIRCUITS**

Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.

**UNIT IV****10 Hours****SENSORS IN DIFFERENT APPLICATION AREA**

Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors.

**UNIT V**

**10 Hours**

**SENSOR MATERIALS AND TECHNOLOGIES**

Materials, Surface Processing- MEMS microsystem components- Microfluidics microsystem components - Nano Technology- Smart Materials.

**Total: 45 Hours**

**Reference(s)**

1. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer, 2016.
2. D. Patranabis, Sensors and Transducers, 2nd Edition, Prentice Hall India Pvt. Ltd, New Delhi, 2009.
3. Guozhen Shen, Zhiyong Fan, "Flexible Electronics: From Materials to Devices", 1st Edition, World Scientific Publishing Co, Singapore, 2015.
4. Horowitz, P., and W. Hill. The Art of Electronics. 2nd ed. Cambridge University Press, 1989.

**22OEI03****FUNDAMENTALS OF VIRTUAL INSTRUMENTATION****3 0 0 3****Course Objectives**

- Understand the basic components of Virtual Instrumentation system.
- Learn the developing VIs based on Lab VIEW software.
- To learn to develop applications based on Virtual Instrumentation system.

**Course Outcomes (COs)**

11. Outline the concepts of traditional instruments and virtual instruments
12. Conclude the overview of modular programming and the structuring concepts in VI programming
13. Attribute the procedure to install DAQ in various OS and its interfacing methods
14. Implement the VI toolsets for specific applications
15. Generate the applications using Virtual Instrumentation software

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1										
2	3	3	2	2	2					2	2	2		
3	2	2	2	1										
4	3	3	3	1	2					1	2	2		
5	3	2	2	1	2				-	1	2	2		

**UNIT I****9 Hours****INTRODUCTION**

Virtual Instrumentation: Historical perspective - advantages - block diagram and architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

**UNIT II****9 Hours****VI PROGRAMMING TECHNIQUES**

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, State machine, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

**UNIT III****9 Hours****DATA ACQUISITION**

Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards - Data acquisition cards with serial communication - VI Chassis requirements. SCSI, PCI, PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

#### **UNIT IV**

**9 Hours**

##### **VI TOOLSETS**

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, windowing and filtering. Application of VI in process control designing of equipments like oscilloscope, Digital multimeter, Design of digital Voltmeters with transducer input Virtual Laboratory, Web based Laboratory.

#### **UNIT V**

**9 Hours**

##### **APPLICATIONS**

Distributed I/O modules- Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

**Total: 45 Hours**

##### **Reference(s)**

1. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.
2. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newness, 2000.

**22OEI04****OPTOELECTRONICS AND LASER INSTRUMENTATION****3 0 0 3****Course Objectives**

- To enhance the student knowledge in fiber optics fundamentals and fabrication
- To be recognized with industrial applications of fibers
- To understand the fundamental concepts about lasers
- To identify and describe various fiber optic imaging and optoelectronic sensor applications

**Course Outcomes (COs)**

16. Attribute the properties of optical fibers, their light sources and detectors.
17. Implement the fiber-optic sensor for the measurement of various physical quantities.
18. Conclude the fundamentals of laser, types of laser and its working.
19. Outline the applications of laser for industrial applications.
20. Differentiate the use of laser instruments for various medical applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	3	2	1	2										
3	3	2	1											
4	3	2	2	2										
5	3	2	2	2										

**UNIT I****9 Hours****OPTICAL FIBERS AND THEIR PROPERTIES**

Introduction to optical fibers - Light guidance - Numerical aperture - Dispersion - Different types of fibers and their properties - Light Sources for fiber optics, Photo detectors, source coupling, splicing and connectors.

**UNIT II****9 Hours****INDUSTRIAL APPLICATION OF OPTICAL FIBERS**

Fiber optics instrumentation system - optical fiber sensors, Measurement of pressure, temperature, current, voltage and liquid level - fiber optic communication set up - different types of modulators - detectors.

**UNIT III****9 Hours****LASER FUNDAMENTALS**

Fundamental characteristics of lasers: laser rate equation - three level system - four level system - properties of laser beams - laser modes - resonator configuration - Q- switching and mode locking - cavity dumping - types of lasers: gas lasers, solid state lasers, liquid lasers and semiconductor lasers.

**UNIT IV****9 Hours****INDUSTRIAL APPLICATION OF LASERS**

Lasers for measurement of distance and length, velocity, acceleration, atmospheric effects, sonic boom, pollutants - material processing: laser heating, melting, welding and trimming of materials - removal and vaporization - calculation of power requirements of laser for material processing.



**UNIT V**

**9 Hours**

**HOLOGRAM AND MEDICAL APPLICATIONS**

Holography: basic principle, methods - holographic interferometry and application, holography for non-destructive - medical applications of lasers, laser and tissue interactive - laser instruments for surgery, removal of tumors of vocal cords, brain surgery, plastic surgery, gynaecology and oncology.

**Total: 45 Hours**

**Reference(s)**

1. John M. Senior, Optical Fiber Communications - Principles and Practice, Prentice Hall of India, 2010.
2. John F. Ready, Industrial Applications of Lasers, Academic Press, 2012.
3. Gerd Keiser, Optical Fiber Communication, Mc Graw Hill, New York, 2013.
4. S.C. Gupta, Textbook on Fiber Optics Communications and its application, Prentice Hall of India, 2012.
5. John Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2011.
6. R. P. Khare, Fiber Optics and Optoelectronics, Oxford University Press, 2011.

22OME01

DIGITAL MANUFACTURING

3 0 0 3

**Course Objectives**

- To understand the process of generating 3D Computer Aided Design (CAD) model by different method.
- To explain the constructional features and develop simple program for CNC lathe and Milling machines.
- To provide an exhaustive knowledge on various generic process and benefits of Additive Manufacturing.
- To familiarize about materials and process parameters of liquid and solid based AM techniques.
- To educate powder based methodology and emerging trends with case studies, applications of AM techniques.

**Programme Outcomes (POs)**

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- Design, analyse and evaluate the performance of mechanical systems.
- Choose the appropriate methodology, materials, tools and machinery to manufacture quality products at economical cost.

**Course Outcomes (COs)**

- Design a 3D model from the 2D data.
- Develop a CNC program for simple components.
- Generate stl file and manipulate parameters of AM machine
- Select appropriate liquid or solid materials based AM process to the respective application
- Select appropriate process to fabricate a functional/prototype for aerospace, automotive, electronics, manufacturing and medical applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2		2								1	2	
2	2	2	2		2								1	2	
3	2	2	2		2								1	2	
4	2	2	2		2								1	3	
5	2	2	2		2								1	2	

## **UNIT I**

**9 Hours**

### **CAD MODELING**

Introduction - Design process - Stages. CAD - Input and Output devices, Modeling methods - Wire frame modelling, Surface modelling, Solid modelling - Constructive Solid Geometry and Boundary Representation Techniques. CAD/CAM data exchange - IGES, STEP. Product Life cycle management (PLM).

## **UNIT II**

**10 Hours**

### **AUTOMATION AND CNC MACHINES**

Introduction to Automation - Definition, types, reasons for automating. CNC Machines - Principles, types, features, advantages, applications. CNC Machine structure - Linear motion bearings, Recirculating ball bearings, drive system, and control system. CNC Lathe and Milling programming - Linear and circular interpolation, threading and drilling programs.

## **UNIT III**

**7 Hours**

### **ADDITIVE MANUFACTURING**

Introduction - Impact of Additive Manufacturing (AM) and Tooling on Product Development - Distinction between AM and CNC Machining - The Generalized AM Process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing - AM Benefits - Classification of AM process

## **UNIT IV**

**8 Hours**

### **LIQUID AND SOLID MATERIAL BASED SYSTEMS**

Stereo lithography Apparatus (SLA), Digital Light Processing (DLP), Fused Deposition Modelling (FDM) and Laminated Object Manufacturing (LOM) - Working Principle, Construction, Process, Materials and Applications

## **UNIT V**

**11 Hours**

### **POWDER BASED PROCESSES AND APPLICATIONS OF ADDITIVE MANUFACTURING**

Selective Laser Sintering (SLS), Color Jet Printing (CJP), Electron Beam Melting (EBM) and Laser Engineered Net Shaping (LENS) - Working Principle, Construction, Process Variables, Materials and Applications. Reverse Engineering using 3D scanner. Application of Additive Manufacturing in Medical field, Manufacturing, Automotive industries, Aerospace and Electronics and Retail industries.

**Total: 45 Hours**

### **Reference(s)**

1. Ibrahim Zeid, R.Sivasubramania, CAD/CAM Theory and Practice, Tata McGraw Hill, 2010.
2. M. Aditan, B.S. Pabala, CNC Machines, New age International, 2012.
3. C. K. Chua, K. F. Leong and C. S. Lim, Rapid prototyping: Principles and applications, Cambridge University Press, 2010.
4. D. T.Pharm, S. S.Dimov, Rapid manufacturing, Springer-Verlag, London, 2001.
5. I. Gibson, D. W. Rosen, and B. Stucker, Additive Manufacturing Technologies 3D Printing, Rapid Prototyping and Direct Digital Manufacturing, Springer, 2015 <http://www.springer.com/978-1-4939-2112-6>

22OME02

**INDUSTRIAL PROCESS ENGINEERING****3 0 0 3****Course Objectives**

- To impart the knowledge on production planning methodologies and layout design
- To learn about production planning and its control methods
- To provide the knowledge of work study, process charts and ergonomic condition
- To impart the knowledge on inventory control and material handling
- To learn about system analysis and different types of maintenance processes

**Programme Outcomes (POs)**

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Choose the appropriate methodology, materials, tools and machinery to manufacture quality products at economical cost.

**Course Outcomes (COs)**

- Select proper plant layout for the required production system
- Plan the resources required for the production and to perform the control methods
- Apply work study method, prepare charts to outline the process and develop ergonomic condition suitable for the processes.
- Analyze the inventory required based on production needs and material handling
- Perform system analysis and use different types of maintenance process for smooth operations.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	1		1									2	
2	3	3	1		2						2			2	
3	1	3	3		2									2	
4	2	3	1		2									2	
5	2	3	1		2									2	

## **UNIT I**

**9 Hours**

### **INDUSTRIAL ENGINEERING AND PRODUCTION SYSTEM**

Industrial engineering - Concept, History and development, Applications, Roles of Industrial engineer- Production management, Industrial engineering versus production management, operations management. Plant layout, Criteria for good layout, Types of layout - Process layout, Product layout, Combination layout and fixed position layout, Flow (material movement) pattern, Workstation Selection and design.

## **UNIT II**

**10 Hours**

### **PROCESS PLANNING AND PRODUCTION CONTROL**

Introduction to Process planning-Definition, Procedure, Process selection, Machine capacity, Process sheet. Process analysis - Group technology, classification and coding system, formation of component family - Production planning, loading, scheduling. Production control -dispatching, routing - Progress control bar, curve, Gantt chart, route and schedule chart.

## **UNIT III**

**8 Hours**

### **WORK STUDY AND ERGONOMICS**

Work study - Definition, Need, Advantages, objectives of method study and work measurement, method study procedure, Process chart - symbols, outline process chart, flow process chart, principles of motion economy, ergonomics- applications of ergonomic principles in the shop floor- work benches-seating arrangement, Industrial physiology.

## **UNIT IV**

**10 Hours**

### **INVENTORY MANAGEMENT**

Inventory control, classification, management, objectives, functions. Economic order quantity, Economic batch quantity, inventory models, ABC analysis, Material Requirement Planning(MRPI), Manufacturing Resource Planning (MRPII), Operating cycle, lean manufacturing, Supply chain management - Material handling.

## **UNIT V**

**8 Hours**

### **SYSTEM ANALYSIS AND MAINTENANCE**

System concept - system analysis, systems engineering, value engineering, value control, types of values. Plant maintenance - objectives, importance. Maintenance engineer - duties, functions and responsibilities. Types - breakdown, scheduled, preventive and predictive - Plant maintenance schedule, Condition monitoring.

**Total: 45 Hours**

### **Reference(s)**

1. Khanna O.P., Industrial Engineering and management, Dhanpat Rai Publications.,2010
2. Martand T.Telsang, Industrial Engineering and Production Management, S Chand Publishers,2006
3. Panneerselvam R., Production and operations management, Heritage Publishers, 2006
4. Ravi Shankar, Industrial Engineering and Management, Golgotia Publications Pvt. Ltd., New Delhi, 2009

22OME03

**MAINTENANCE ENGINEERING****3 0 0 3****Course Objectives**

- To understand the principles, objectives and importance of maintenance adopted in industry for successful progress.
- To introduce different maintenance categories, its merits and types of lubrication.
- To expose the idea of condition monitoring, methods and instruments used for allied measurements.
- To learn about failure analysis and repair methods for few mechanical elements.
- To promote computerization in maintenance and inventory management.

**Programme Outcomes (POs)**

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Choose the appropriate methodology, materials, tools and machinery to manufacture quality products at economical cost.

**Course Outcomes (COs)**

1. Explain the principles, objectives and importance of maintenance adopted in industry.
2. Select the suitable maintenance category and lubrication type.
3. Apply the appropriate methods and instruments for condition monitoring.
4. Analyze the failures of mechanical systems and select suitable repair methods.
5. Utilize computers in maintenance and inventory management.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2												2	
2	2	2												2	
3					2	2	1							2	
4	1	2	1		2	2	2							2	
5	2	2	2		1	1	1							2	

**UNIT I** **9 Hours**

**PRINCIPLES OF MAINTENANCE PLANNING**

Basic principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound maintenance systems - Maintenance organization - Maintenance economics.

**UNIT II** **9 Hours**

**MAINTENANCE CATEGORIES AND LUBRICATION**

Maintenance categories - Comparative merits of each category - Preventive maintenance, Maintenance schedules, Repair cycle - Total Productive Maintenance - Principles and methods of lubrication.

**UNIT III** **9 Hours**

**CONDITION MONITORING**

Condition based maintenance - Cost comparison with and without Condition Monitoring - Methods and instruments for condition monitoring - Noise, vibration, wear and temperature measurement.

**UNIT IV** **9 Hours**

**FAILURE ANALYSIS AND REPAIR METHODS**

Failure analysis - Failures and their development - Role of Non Destructive Testing in failure analysis - Repair methods for bearings, cylinder block, fuel pump, shaft.

**UNIT V** **9 Hours**

**COMPUTER AIDED MAINTENANCE MANAGEMENT**

Approach towards Computerization in maintenance - computer-aided maintenance management system (CAMMS) - Advantages of CAMMS - spare parts and inventory centre performance reporting.

**FURTHER READING**

Retrofitting, objectives, classification of retrofitting, cost effectiveness through retrofitting (economical aspects), circumstances leading to retrofitting, features and selection for retrofitting.

**Total: 45 Hours**

**Reference(s)**

1. Srivastava S.K, Maintenance Engineering, S Chand and Company, 2010.
2. Mishra R.C, Pathak K, Maintenance Engineering and Management, Second edition, Prentice Hall India Learning Pvt. Ltd., 2012.
3. Keith Mobley R, Lindley R. Higgins and Darrin J. Wikoff, Maintenance Engineering Handbook, Seventh edition, McGraw-Hill Professional, 2008.
4. Davies A, Handbook of Condition Monitoring: Techniques and Methodology, Springer, 2012.
5. Otegui Jose Luis, Failure Analysis, Fundamentals and Applications in Mechanical Components, Nineteenth edition, Springer, 2014.

**22OME04****SAFETY ENGINEERING****3 0 0 3****Course Objectives**

- To study the principles of safety management system.
- To introduce the provisions contained in the industrial laws.
- To provide knowledge on safety requirements for engineering industry.
- To learn safety requirement for chemical industry.
- To study the various safety measures adopted in construction industries.

**Programme Outcomes (POs)**

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- Design, analyse and evaluate the performance of mechanical systems.
- Choose the appropriate methodology, materials, tools and machinery to manufacture quality products at economical cost.
- Address all the fluid flow and heat transfer related problems of mechanical systems.

**Course Outcomes (COs)**

1. Explain safety management system of an industry.
2. Implement the provisions of acts and rules in industries.
3. Implement and review the safety performance followed in various industries
4. Evaluate safety appraisal in chemical industries.
5. Generate safety reports on construction industries.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1					2	1		1						2	2
2					1			3					2	1	
3	2											3	1		2
4	2	3							2				2		1
5					2					3				3	



## **UNIT I**

**8 Hours**

### **SAFETY MANAGEMENT**

Concepts - Evolution, International Labour Organization (ILO), National Safety Council, Techniques - Job Safety Analysis (JSA), Safety survey, Safety inspection, Safety Sampling, Accident Reporting and Investigation - Concept of an accident, Accident causation models, cost of accident, investigation, Safety Performance Monitoring - Safety indices.

## **UNIT II**

**10 Hours**

### **SAFETY AND LAW**

Factory Act 1948-Safety and Health chapters, Tamil Nadu Factories Rules- Safety and Health chapters, Environment and Pollution Laws, Building and other construction works act 1996, Electricity Rules.

## **UNIT III**

**10 Hours**

### **SAFETY IN ENGINEERING INDUSTRIES**

Safety in machine shop,- Principles of machine guarding - Personal protective equipment- Safety in handling industrial gases - Safety in cold forming and hot working of metals- Safety in finishing, inspection and testing, heat treatment, electro plating, leak test, radiography.

## **UNIT IV**

**9 Hours**

### **SAFETY IN CHEMICAL INDUSTRIES**

Safety in process design, unit operations, pressure vessel, heat exchanger, safety valves -Plant commissioning and inspection, pressure vessel, Plant maintenance and emergency planning, management of maintenance HAZOP study.

## **UNIT V**

**8 Hours**

### **SAFETY IN CONSTRUCTION INDUSTRY**

Construction regulations, contractual clauses, permit to work, - Education and training-Hazards of construction and prevention- excavation, scaffolding, dismantling, road works, construction of high rise buildings - Working at heights,-Working on fragile roofs, work permit systems-Construction machinery, cranes, chain pulley blocks, earth moving equipment, conveyors- Manual handling, Safety in demolition work, - Safety in confined spaces

### **FOR FURTHER READING**

Case Studies- Major accidents at Flixborough, UK, Seveso, Italy, Victoria Dock, India, Bhopal, India.

**Total: 45 Hours**

### **Reference(s)**

1. Blake R.B., Industrial Safety, Prentice Hall, Incorporated, New Jersey,1973.
2. National Safety Council, Accident Prevention Manual for Industrial Operations, Chicago, 1988
3. Subramanian V., The Factories Act, 1948, with Tamil Nadu Factories Rules , 1950, Madras
4. Environmental Pollution Control Act, 1986
5. BOCW Act,1996, Madras Book agency, Chennai-1
6. Explosive Act, 1884, Eastern Book Company, Lucknow -266 001.

**22OBT01 BIOFUELS****3 0 0 3****Course Objectives**

- To understand and explore the scope of biofuels the most efficient renewable source of energy.
- To develop the expertise in the technology pertaining to their generation and employment in order to surrogate the existing conventional fuels and hence strives towards sustainable development
- To give way to the bolster green technology and incline towards more ecofriendly options.

**Course Outcomes (COs)**

1. Apply the bio resources that can be used for the production of biofuels.
2. Analyze the physical and chemical properties of the biodiesel.
3. Analyze the mechanisms of improvising the quality and performance of engines using biofuels
4. Analyze the bio-fuel conversion technologies and their environmental attributes
5. Evaluate the designing aspects of major unit processes/operations of an integrated bio-refinery

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1		2				3								1
2	2						1								3
3	1						3								2
4	2						3								3
5	1						1								

**UNIT I****9 Hours****CLASSIFICATION AND RESOURCES**

Introduction, biofuel as a renewable energy, classification of biofuels - First, second, third and fourth generation biofuels, different plant sources as biofuel feed stocks, Biogases, physical and chemical characteristics of vegetable oils - iodine number, hydroxyl, acid values, rancidity, hydrogenolysis and hydrolysis, Food vs energy.

**UNIT II****9 Hours****BIODIESEL**

Definition, basics and chemistry of biodiesel, vegetable oils in biodiesel production, Trans esterification: Chemical methods, enzymatic methods and types of catalysts, separation and purification, physical properties and characterization of biodiesel - Cloud point, pour point, cold filter plugging point, flash point, viscosity and cetane number.

### **UNIT III**

**9 Hours**

#### **QUALITY BIODIESEL AND ENVIRONMENT**

Producing Quality Biodiesel, quality control, test methods, ASTM specifications. Oxidative and thermal stability, estimation of mono, di, triglycerides and free glycerol, engine performance test, blending of ethanol with biodiesel, blending of biodiesel with high speed diesel (HSD) and their combustion properties.

### **UNIT IV**

**9 Hours**

#### **BIOETHANOL AND BIOGASES**

Ethanol as a fuel, microbial and enzymatic production of ethanol from biomass - lignocellulose, sugarcane, sugar beet, corn, wheat starch, purification - wet and dry milling processes, saccharification-chemical and enzymatic. Production of bio methane and bio hydrogen.

### **UNIT V**

**9 Hours**

#### **BIOREFINERIES**

Definition and types of biorefineries, co-products of biorefineries-oil cake and glycerol, purification of glycerol obtained in biodiesel plant; anaerobic and thermal gasification of biomass, economics of biorefineries.

**Total: 45 Hours**

#### **Reference(s)**

1. Caye Drapcho, John Nghiem and Terry Walker, Biofuels Engineering process technology, McGraw Hill Professional, 2008.
2. Mousdale, Biofuels, CRC Press, 2008
3. Ahindra Nag, Biofuels Refining and Performance, McGraw-Hill Professional, 2007.
4. Lisbeth Olsson, Biofuels (Advances in Biochemical Engineering/ Biotechnology), Springer, 2007

**22OFD01****TRADITIONAL FOODS****3 0 0 3****Course Objectives**

- Understand the importance of traditional foods and food habits
- Know the traditional processing of snack, sweet and dairy food products
- Infer the wide diversity and common features of traditional Indian foods and meal patterns.

**Course Outcomes (COs)**

1. Justify the processing methods of traditional foods in terms of its health benefits
2. Assess the production methods of traditional sweets, snacks and dairy products
3. Differentiate Traditional fermented foods products based on its raw material
4. Implement a large scale production of tradition foods for its increased consumption
5. Compare the health aspects of traditional foods with modern foods

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													
2		1												
3	2	1	1											
4								2						
5								2						

**UNIT I****9 Hours****TRADITIONAL METHODS OF FOOD PROCESSING**

Introduction - food culture -geographical features and food. Traditional methods of milling grains - rice, wheat and corn - equipment and processes as compared to modern methods. Equipment and processes for edible oil extraction- comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation - sun-drying, osmotic drying, brining, pickling and smoking.

**UNIT II****9 Hours****TRADITIONAL SWEETS, SNACKS AND DAIRY PRODUCTS**

Production, formulation, preparation and processing of Indian traditional sweet and snack food products:- Rasgolla, Gulab jamun; formulation and preparation of namkeen, potato chips, banana chips. Acid coagulated and fermented dairy products- paneer, dahi, shrikhand, lassi - processing conditions, defects etc. Fat rich products- Butter, ghee and its processing.

**UNIT III****9 Hours****TRADITIONAL FERMENTED FOOD PRODUCTS**

Idli, Soya sauce, fish pickle, dry fish, meat and vegetable fermented products. Various alcohol based products. Ways to increase nutritional quality of food such as enrichment, fortification, fermentation and mutual supplementation. Best cooking and processing methods to retain nutrients

**UNIT IV**

**10 Hours**

**COMMERCIAL PRODUCTION OF TRADITIONAL FOODS**

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods -types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods - ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters

**UNIT V**

**8 Hours**

**HEALTH ASPECTS OF TRADITIONAL FOODS**

Comparison of traditional foods with typical fast foods / junk foods - cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

**Total: 45 Hours**

**Reference(s)**

1. Sen and Colleen Taylor, Food Culture in India, Greenwood Press, 2005.
2. Davidar, Ruth N. "Indian Food Science: A Health and Nutrition Guide to Traditional Recipes:" East West Books, 2001.
3. Steinkrus.K.H. Handbook of Indigenous Fermented Foods, CRC press, 1995.
4. Aneja. R.P, Mathur.BN, R.C. Chandan,and Banerjee.A.K. Technology of Indian Milk Products. Dairy India Year Book, 2009.

22OFD02

**FOOD LAWS AND REGULATIONS**

3 0 0 3

**Course Objectives**

- Introduce the concept of food hygiene, importance of safe food and laws governing it
- Learn common causes of food borne illness - viz. physical, chemical and biological and identification through food analysis
- Understand food inspection procedures employed in maintaining food quality

**Course Outcomes (COs)**

1. Analyse the food safety strategies and nutritional quality of the food
2. Check the food regulatory mechanism and mandatory laws for food products
3. Determine the national and international regulatory agencies
4. Understand and apply the voluntary regulatory standards
5. Assess the implementation of food safety for a food processing industry

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1											
2		1				1	2	1						
3		1												
4	1	2												
5	1	2												

**UNIT I****10 Hours****INTRODUCTION**

Introduction, concept of food safety and standards, food safety strategies. Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical hazards. Preventive food safety systems - monitoring of safety, wholesomeness and nutritional quality of food. Prevention and control of physical, chemical and microbiological hazards. Principles of food safety - Establishment: design and facilities - emergency preparedness - Maintenance cleaning and sanitation - personal hygiene - packaging and labelling - transportation - traceability - recall procedure - visitor policy. Adulteration: Intentional and unintentional - Preservatives - antioxidants, sweeteners, flavours, colours, vitamins, stabilizers - indirect additives - organic residues - inorganic residues and contaminants.

**UNIT II****10 Hours****FOOD LAWS**

Indian and Food Regulatory Regime (Existing and new), PFA Act and Rules, Food Safety and Quality Requirements, Additives, Contaminants and Pesticide Residue. Food Safety and Standards Act, 2006, FSSAI roles and responsibilities, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR) WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.

### **UNIT III**

**10 Hours**

#### **REGULATIONS**

Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Role of Agricultural and Processed Food Products Export Development Authority (APEDA), Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK. Nutritional Labelling, Health claims.

### **UNIT IV**

**10 Hours**

#### **STANDARDS**

Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices ISO 9000, ISO 22000, ISO 14000, ISO 17025, PAS 22000, FSSC 22000, BRC, BRCIOP, IFS, SQF 1000, SQF 2000. Role of NABL, CFLS.

### **UNIT V**

**5 Hours**

#### **IMPLEMENTATION AND RISK ASSESSMENT**

Implementation of food safety for a desired food processing industry. Risk assessment studies: Risk management, risk characterization and communication.

**Total: 45 Hours**

#### **Reference(s)**

1. Singal RS (1997). Handbook of indices of food quality and authenticity. Woodhead Publ. Cambridge, UK.
2. Shapton DA (1994). Principles and practices of safe processing of foods. Butterworth Publication, London. Winton AL (1999) Techniques of food analysis, Allied Science Publications New Delhi.
3. Pomeranze Y (2004). Food analysis - Theory and Practice CBS Publications, New Delhi.
4. Jacob MB (1999). The chemical analysis of foods and food products. CBS Publ. New Delhi

**22OFD03****POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES****3 0 0 3****Course Objectives**

- To understand the importance and different methods of post harvest handling and storage of fruits and vegetables.
- To gain knowledge on different preservation methods of fruits and vegetables
- To familiarize with the value added products from fruits and vegetables

**Course Outcomes (COs)**

1. Implement the different post harvest handling practices for the storage of fruits and vegetables
2. Analyze the suitable preservation method (sugar, salt or dehydration) to produce value added products from fruits and vegetables
3. Evaluate the requirement of low temperature and irradiation methods to preserve specific fruits and vegetables
4. Apply the concentration and fermentation methods to preserve fruits and vegetables
5. Implement the canning method to preserve fruits and vegetables

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	2	1			1							
2	1	1												
3	1	2												
4	1		1											
5	2	1	1											

**UNIT I****9 Hours****POST-HARVEST PRACTICES AND PROCESSING**

Maturity indices for harvesting; pathological spoilage's during storage, ripening and control measures, Post-harvest handling, sorting & grading, packaging, storage, transportation, Methods of pre-cooling, post-harvest treatments to hasten and delay ripening; Methods of storage at farm level - cold storage, controlled/modified atmosphere storage, Quality management, export requirements, Nutritive value, nutraceutical properties

**UNIT II****9 Hours****PRESERVATION AND VALUE ADDITION**

General principles and methods of fruit and vegetable preservation. Preservation using sugar: Principle and Preparation of jam, jelly, marmalade, squash, RTS, carbonated beverages, crush, nectar, cordial, fruit bar, preserves, candies and carbonated fruit beverages. Processing using salt: Principle - Brining - Preparation of pickles, chutney and sauces, ketchup.



### UNIT III

9 Hours

#### PRESERVATION BY LOW TEMPERATURE AND IRRADIATION

Preservation by low temperature: definition, principle, methods - Refrigeration, freezing. Methods of freezing-changes during freezing. Preparation of frozen foods. Minimal Processing of Fruits and Vegetables - techniques involved - Preservation by irradiation: definition- principle, application, irradiation unit.

### UNIT IV

9 Hours

#### PRESERVATION BY DRYING

Machineries involved in processing of fruits and vegetables products. Drying and dehydration: definition, principle, Types of driers: Solar, cabinet, spray drier, drum drier, fluidized bed drier. Preparation of product for dehydration. Dehydration principles and equipment. Preparation of fruits - powder production. Problems related to storage of dehydrated products.

### UNIT V

9 Hours

#### PRESERVATION BY CANNING

Canning: principles, Types of cans, packing of canned products-preparation of canned products - general considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit- spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations.

**Total: 45 Hours**

#### Reference(s)

1. S.Ranganna, HandBook of Analysis and Quality Control for Fruit and Vegetable Products, McGraw Hill Education (India) Private Limited, Chennai, 2017
2. N.W. Desrosier, the Technology of Food Preservation, CBS Publisher & Distributions, New Delhi, 1987.
3. R.P. Srivastava and S. Kumar, Fruit and Vegetable Preservation: Principles and Practices, Second Edition, International Book Distribution Co., Lucknow, 1998.
4. G. Lal, G. Siddappa and G.L. Tondon, Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi, 1986.
5. Chakraverty, A.S. Mujumdar, G.S.V. Raghavan and H.S. Ramaswamy, Handbook of Post-harvest Technology, Marcel Dekker Press, USA, 2001.
6. D.K. Salunkhe, and S.S. Kadam, Handbook of Fruit Science and Technology: Production, Composition and Processing, Marcel Dekker, New York, 1995.

**22OFD04****CEREAL, PULSES AND OILSEED TECHNOLOGY****3 0 0 3****Course Objectives**

- Understand the application of scientific principles in the processing technologies specific to the materials
- Understand the storage methods and handling techniques followed for cereals, pulses and oil seeds
- Develop the knowledge in the area of Cereals, pulses and oil seed processing and technology

**Course Outcomes (COs)**

1. Identify the specific processing technologies employed for cereals
2. Analyse the composition of millets and their nutritional importance
3. Relate the compositional changes and processing methods of pulses and legumes
4. Create the competence in processing of oilseeds technology
5. Relate the storage processing of food grains with quality aspects

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		2		2								
2	1	2		2		1								
3	2	2		1		2								
4	2	3		2		2								2
5	2	2		2		3								

**UNIT I****9 Hours****CEREALS**

Cereal Grains- Basic agricultural aspects, structure and composition; Storage, Insect control; Processing: Wheat- milling, (Atta and maida), quality aspects of flour, wheat proteins and their function, rheology of flour; wheat based baked products - Bread, Biscuit, Cakes, Extruded products, Pizza, Chapatis, malting and malt products; Rice-Milling, Parboiling, Quick cooking rice, Traditional Indian Products- Puffed Rice, flaked rice, Idli/Dosa/vada mixes and other savouries; Corn- Wet and dry milling, Corn Products - Corn flakes, Corn starch, canned corn products, puffed product; Oats-Milling, Oat Products - Steel cut, rolled oats, quick cooking; Traditional and Fermented cereal products.

**UNIT II****9 Hours****OTHER CEREALS AND MILLETS**

Sorghum, Pearl Millet, Finger millet, Foxtail Kodo Millet - Basic agricultural millet, aspects, structure and composition; storage, insect control; processing - pearling, Milling, Malting, Malt based foods, flaked and fermented products; Traditional and Nutritional products based on finger millet.

**UNIT III****9 Hours****PULSES AND LEGUMES**

Basic agricultural aspects, structure, composition, storage, insect control, processing Milling/splitting, dhal milling, products - puffed, flakes, flour, legume-based traditional products, flour based Indian sweets and savouries, soya milk, soy protein Isolate, soya paneer

#### **UNIT IV**

**9 Hours**

##### **OIL SEEDS AND NUTS**

Basic agricultural aspects structure, composition, Storage, Insect control; processing: traditional and modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation; oil blends; applications of different oils and fats in food processing & products.

#### **UNIT V**

**9 Hours**

##### **STORAGE AND HANDLING**

Bag Storage - Advantages and Disadvantages, Cover Plinth Storage Structures, CAP storage (Cover and Plinth Storage). Protection against Rodents, Fungi, Pests and Mites. Fumigation Processes for bag storage piles. Bulk Storage in silos and large Bins. Conveyors and Elevators for feeding and discharging.

**Total: 45 Hours**

#### **Reference(s)**

1. Chakraverty, A.: Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Co, Calcutta, 1995.
2. Delcour, Jan A. and R. Carl Hoseney., Principles of Cereal Science and Technology, 3rd Edition, American Association of Cereal Chemists, 2010.
3. Karl Kulp, Handbook of Cereal Science and Technology, 2nd Rev. Edition, CRC Press, 2000.
4. N.L.Kent and A.D.Evans, Technology of Cereals (4th Edition) Elsevier Science (Pergaman),Oxford, UK, 1994.
5. Matz, Samuel A., The Chemistry and Technology of Cereals as Food and Feed, 2nd Edition,CBS, 1996.
6. Morris, Peter C. and J.H. Bryce., Cereal Biotechnology, CRC/Wood head publishing, 2004.

**22OFT01****FASHION CRAFTSMANSHIP****3 0 0 3****Course Objectives**

- To impart theoretical and practical knowledge about various handi-craft techniques
- To enhance innovative skills on hand crafts.
- To build confidence on doing handicrafts.

**Course Outcomes (COs)**

1. Outline the classification, techniques and criteria for selecting raw materials for making various handicraft materials and produce textile based handicrafts. Produce various decorative and appealing products
2. Design and construct various wall hangings and fashion accessories.
3. Design and construct toys and accessories
4. Design and construct head accessories, home furnishings and paintings
5. Design and construct various decorative and appealing products for interiors

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	3				2		2	2		2	2	
2	3	2	3				1		2	3		2	2	
3	3	2	3				2		2	3		2	2	
4	3	2	3				2		2	3		2	2	
5	3	2	3				2		2	3		2	2	

**UNIT I****9 Hours****TECHNIQUES OF HANDICRAFT MATERIALS**

Definition of Handicraft, Classification: Reusable, Non reusable, Raw materials used in various craft materials: printed, embroidered, stitched and handmade, Criteria for selection of raw materials: material types and end uses.

**UNIT II****9 Hours****DECORATIVE AND APPEALING PRODUCTS - INTERIORS**

Designing and Construction procedures for following various decorative and appealing products: Wall hangings - String Art on plywood, Pressed Flower Art frames.

**UNIT III****9 Hours****DECORATIVE AND APPEALING PRODUCTS - ACCESSORIES**

Designing and Construction procedures for following various decorative and appealing products: Handbags, Hats, footwear.

#### **UNIT IV**

**9 Hours**

##### **DECORATIVE AND APPEALING PRODUCTS - ORNAMENTS**

Designing and Construction procedures for following various decorative and appealing products: Stone necklace using Macrame Technique, Tribal Jewellery using woollen threads, Floral Jewellery using Resin Technique, Fabric Jewellery using Tie and Dye Technique.

#### **UNIT V**

**9 Hours**

##### **DECORATIVE AND APPEALING PRODUCTS - FANCY ITEMS**

Designing and Construction procedures for following various decorative and appealing products: Jewellery Box, Utility Holder, Gift items. Lampshade decors from cardboard, Driftwood Frames for pictures and Mirrors.

**Total: 45 Hours**

#### **Reference(s)**

1. Handmade in India: A Geographic Encyclopaedia of India Handicrafts. Abbeville press; 1 edition (October 20,2009)
2. Encyclopaedia of Card making Techniques (Crafts), Search Press Ltd, illustrated edition, 2007
3. All about Techniques in Illustration, Barron Educational Series, 2001
4. Printing by Hand: A Modern Guide to printing with Handmade stamps, Stencils and Silk Screens, STC Craft/A Melanie Falick Book, 2008
5. Materials & Techniques in the Decorative Arts: An Illustrated Dictionary, University of Chicago Press, 2000
6. <https://www.marthastewart.com/274411/fashion-crafts>

**22OFT02****INTERIOR DESIGN IN FASHION****3 0 0 3****Course Objectives**

- To impart knowledge on interior design.
- To improve the design skills, sustainable with socially-conscious designs

**Course Outcomes (COs)**

1. Interpret the elements of interior design concepts and resolve the personality requirements
2. Develop graphical representations of interior design concepts
3. Resolve the space planning requirements of residential home as per CPWD guidelines
4. Determine the aesthetic requirements of interior design components.
5. Appraise the roles and responsibilities of interior designer.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3		-	1							2	
2	3	2	3		2	3		2					3	
3	3	3	3		2	2		2					2	
4	3	3	3		2	3		2					2	
5	3	2			2			3					3	

**UNIT I****9 Hours****INTRODUCTION**

Interior designing - definition, importance, requirements and types - Structural design, Decorative Design - Designing interiors, Good taste; Design themes, types and application. Personality of the Home - Art elements - Line: types, characteristics and importance; form: size and shape, characteristics; Colour - sources, qualities, emotional effects, colour wheel and schemes.

**UNIT II****9 Hours****GRAPHICAL PRESENTATIONS**

3D composition; Isometric and Axonometric- Still life- Furniture Sketching- Object Drawing with color rendering - Interior elements, Lighting, plants. Perspective, Axonometric Isometric drawing. Orthographic Projection - Lifts and escalators.

**UNIT III****9 Hours****SPACE PLANNING**

Space planning concepts- interiors, circulation. Definition, application of ergonomic principals in interiors. Residential house space planning case study- CPWD guidelines. Lighting for different locations and activities, measurement, ventilation and indoor air quality, noise control methods.

**UNIT IV****9 Hours****INTERIOR COMPONENTS**

Application of colour in interiors; Texture - types and significance; Pattern: types and effects; Light - importance. Importance of Furniture Design for Interiors- Ancient Age / Middle Age / Contemporary. Doors, Windows, Staircase designs, False Ceiling, Partitions, Wall Panelling, Comics, Mosaic, Cladding- Flooring and Wall Cladding

**UNIT V**

**9 Hours**

**ROLES AND RESPONSIBILITIES OF INTERIOR DESIGNER**

Role of an Interior Designer- Responsibility towards society and need of an Interior Designer to better the environment- Ethics and Code of Conduct- Responsibility towards client, contractor and supplier, Estimation. Professional Fees- Work of an Interior Designer- Making of portfolio, JD Annual Design Awards.

**Total: 45 Hours**

**Reference(s)**

1. Joanna Gaines, Homebody: A guide to creating spaces you never want to leave, Harper design, 2018.
2. Erin gates, Elements of Style: Designing a Home and a life, Simon and Schuster, 2014.
3. Simon Dodsworth, The Fundamentals of Interior Design, AVA publishing, 2009.
4. V. Mary. Knackstedt, The Interior Design Business Handbook: A Complete Guide to Profitability, Wiley, New Jersey; 2006.
5. M. G. Shah, C. M. Kale, and S.Y. Patki, Building Drawing with an Integrated Approach to Build Environment, Tata McGraw Hill, 2002.
6. <https://eclectictrends.com>

**22OFT03****SURFACE ORNAMENTATION****3 0 0 3****Course Objectives**

- To familiarize the students about the various techniques of surface embellishment with relevance to garment embellishments.
- To aware of various types of embroidery and methods of producing it.
- To make the students confident about doing surface embellishment work

**Course Outcomes (COs)**

1. Analyze the raw material requirements for surface ornamentation and its application
2. Implement hand embroidery stitches on fabric and show the stitch development procedure in diagrammatic representations
3. Apply the machine and computerized embroidery stitches
4. Analyze the surface embellishment techniques and its application
5. Assess the quality maintenance parameters of all embroidered products and analyze the 6 traditional embroidery techniques

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2					1						
2	2	3	2						2				2	2
3	2	3	2		3								2	2
4	2	2	2						2				2	2
5	2	2	2						2					2

**UNIT I****9 Hours****INTRODUCTION TO SURFACE ORNAMENTATION**

Introduction, Definition, Need, Types, Raw materials, Importance of surface ornamentation, Selection of needle, thread and fabric for hand embroidery and machine embroidery. various methods of surface embellishment- embroidery and surface ornamentation.

**UNIT II****9 Hours****HAND EMBROIDERY**

General rules for hand embroidery. Types of hand embroidery stitches-Running, Couching, Button hole, Satin, Long & Short, Wheat, Chain, Stem, Herringbone, Cross stitch, Knotted stitches, Fish bone, Fly stitch, Braids, Back, Hem, Seed, Needle weaving, Whip stitches.

**UNIT III****9 Hours****MACHINE EMBROIDERY**

General rules for machine embroidery. Types of frames and methods of transferring the designs. Attachments to sewing machines for embroidery, Types of machine embroidery stitches- Eyelet work, Cut work, patch work, Mirror work, Applique, Shaded embroidery, Shadow work, Bead and Sequins work, Vermicelli, Zigzag, Granite stitch. Computerized embroidery machine- Concept of design and development, software used in embroidery machines, process of designing, method and types of stitch application, punching and digitizing.



#### UNIT IV

9 Hours

##### EMBELLISHMENT TECHNIQUES

Materials used and Applications. Types of embellishment techniques- fabric painting-hand, Stencil-dabbing and Spraying. Dyeing and printing-advanced tie and dye techniques, batik and block printing. Trimmings and decorations-Laces, Pompons, Fringes, Tassels, Tucks, Show buttons, Crocheting.

#### UNIT V

9 Hours

##### TRADITIONAL EMBROIDERIES OF INDIA AND CARE

Care and maintenance of embroidered articles-care and maintenance methods for embroidered apparel, pressing. Traditional Embroideries of India-Phulkari, Kasuti, Kashmiri embroidery, Kutch work, Chikkankari, Kantha.

**Total: 45 Hours**

##### Reference(s)

1. Ruth Chandler, Modern Hand Stitching-Dozens of stitches with creative free-form variations,2014
2. Sophie Long, Mastering the Art of Embroidery: Traditional Techniques and Contemporary Applications for Hand and Machine Embroidery, Heritage Publishers, London, 2013
3. Christen Brown ,Embroidered & Embellished, C&T Publishing, 2013
4. Sheila Paine, Embroidered Textiles, Thames and Hudson Publisher, UK, 1990.
5. Gail Lawther, Inspirational Ideas for Embroidery on Clothes & Accessories, Search Press Ltd, UK, 1993.
6. <http://www.needlenthread.com/tag/hand-embroidery-stitches>

**22OPH01****NANOMATERIALS SCIENCE****3 0 0 3****Course Objectives**

- Impart knowledge on Nanoscience
- Explore different techniques of producing nanomaterials
- Create expertise on the applications of nanomaterials in various fields

**Course Outcomes (COs)**

1. Summarize the origin and advance of nanomaterials and its classification
2. Compare the different types of methods adopted for synthesizing nanomaterials
3. Analyze the characterization techniques for analyzing nanomaterials
4. Explain the physical properties exhibited by nanomaterials
5. Organize the nanomaterials developed for advanced technological applications

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	1	1												
2	2	2												
3	3	1												
4	1	1												
5	2	3												

**9 Hours****UNIT I****NANO SCALE MATERIALS**

Introduction-Feynman's vision-national nanotechnology initiative (NNI) - past, present, future -classification of nanostructures, nanoscale architecture - effects of the nanometer length scale - changes to the system total energy, and the system structures- effect of nanoscale dimensions on various properties -differences between bulk and nanomaterials and their physical properties.

**UNIT II****9 Hours****NANOMATERIALS SYNTHESIS METHODS**

Top down processes - mechanical milling, nanolithography and types based on radiations - Bottom up process physical method: physical vapour deposition, RF sputtering, CVD- chemical method: colloidal and sol-gel methods - template based growth of nanomaterials - ordering of nanosystems, self-assembly and self-organization.

### UNIT III

9 Hours

#### CHARACTERIZATION TECHNIQUES

General classification of characterization methods - analytical and imaging techniques - microscopy techniques - electron microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy - diffraction techniques - X-ray spectroscopy - thermogravimetric analysis of nanomaterials.

### UNIT IV

9 Hours

#### SEMICONDUCTOR NANOSTRUCTURES

Quantum confinement in semiconductor nanostructures - quantum wells, quantum wires, quantum dots, super lattices-epitaxial growth of nanostructures-MBE, metal organic VPE, LPE - carbon nano tubes- structure, synthesis and electrical properties -applications- quantum well laser- quantum efficiency of semiconductor nanomaterials

### UNIT V

9 Hours

#### NANOMACHINES AND NANODEVICES

Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS)-fabrication, actuators-organic FET- principle, description, requirements, integrated circuits- single electron transistor - - organic photovoltaic cells- spintronics

**Total: 45 Hours**

#### Reference(s)

1. Willam A. Goddard, Donald W.Brenner, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, 2012
2. Charles P. Poole Jr and. Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2007
3. Guozhong Cao, Y. Wang, "Nanostructures and Nanomaterials-Synthesis, Properties & Applications", Imperials College Press, 2011.
4. T. Pradeep, "NANO: The Essentials Understanding Nanoscience and Nanotechnology", McGraw - Hill Education (India) Ltd, 2012
5. Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley and Sons Ltd, 2006
6. Viswanathan B, AuliceScibioh M, "Fuel cells: Principles and Applications", University Press, 2009.

**22OPH02****SEMICONDUCTOR PHYSICS AND DEVICES****3 0 0 3****Course Objectives**

- Impart knowledge in physical properties of semiconducting materials
- Analyze the factors affecting the operation of semiconductor devices
- Apply the physics of semiconductors to develop semiconductor devices

**Course Outcomes (COs)**

1. Exemplify the band gap, drift and diffusion current densities due to carrier transport in semiconductors
2. Analyze the energy band diagram in thermal equilibrium and space charge width of PN junction
3. Illustrate the operation of Bipolar Junction transistor at different modes and different configurations
4. Illustrate the operation of metal oxide field effect transistor and their memory devices
5. Represent the working mechanism of opto-electronic devices

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

**UNIT I****9 Hours****ENERGY BANDS AND CARRIER TRANSPORT PROPERTIES**

Energy Bands: Formation of energy bands - doping effects - energy levels - electron and hole concept in semiconductor. Carrier transport: Carrier drift-drift current density - conductivity- diffusion current density - total current density

**UNIT II****9 Hours****P-N JUNCTION**

Basic structure and fabrication process of p-n junction - current - voltage characteristics - energy band diagram - equilibrium Fermi levels - depletion region - junction breakdown phenomena - zener - avalanche breakdown.

**UNIT III****9 Hours****BIPOLAR JUNCTION TRANSISTOR**

The basic transistor action - operation in the active mode - current gain - static characteristics - carrier distribution in emitter, base and collector region - modes of operation - current - voltage characteristics of common base and emitter configuration - frequency response and switching of bipolar transistor

**9 Hours**

## **UNIT IV**

### **MOSFET**

The ideal MOS diode - basic fundamentals and characteristics - types - CMOS and BiCMOS - CMOS inverter - MOSFET on insulator - thin film transistor (TFT) - silicon on insulators (SOI) devices - MOS Memory structures - DRAM and SRAM

**9 Hours**

## **UNIT V**

### **PHOTONIC DEVICES**

Radiative transitions and optical absorption-light emitting diodes-organic LED - infrared LED - semiconductor laser - temperature effect - photo detector - photo diode - silicon and compound semiconductor solar cells - efficiency

**Total: 45 Hours**

### **Reference(s)**

1. Donald A Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, 2012
2. S. M. Sze and M. K. Lee, "Semiconductor Devices, Physics and Technology", John-Wiley & Sons, 2015
3. Ben. G. Streetman and S. K. Banerjee, "Solid State Electronic Devices", Pearson Education Ltd, 2015
4. C. Kittel, "Introduction to Solid State Physics", John-Wiley & Sons, 2012
5. J. Millman and C. Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, 2010
6. Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006

**22OPH03****APPLIED LASER SCIENCE****3 0 0 3****Course Objectives**

- Impart knowledge on laser science
- Explore different strategies for producing lasers
- Create expertise on the applications of lasers in various fields

**Course Outcomes (COs)**

1. Illustrate the transition mechanisms and the components of a laser system
2. Compare the different types of lasers based on pumping method, active medium and energy levels
3. Compute the rotation of earth, velocity and distance using lasers and apply the same for day today applications
4. Analyze the role of lasers in surgical and endoscopy applications
5. Apply the laser techniques in industrial applications

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	1												
4	2	1												
5	1	2												

**UNIT I****9 Hours****LASER FUNDAMENTALS**

Introduction - principle - absorption and emission of light - thermal equilibrium - Einstein's prediction - Einstein's relations - A and B coefficients - condition for large stimulated emission - spontaneous and stimulated emission in optical region - light amplification - condition for light amplification - population inversion- Components of lasers - pumping methods - pumping mechanisms - optical resonator

**UNIT II****9 Hours****LASER BEAM CHARACTERISTICS AND TYPES**

Characteristics of laser - Classification of lasers - principle, construction, working, energy level diagram and applications of molecular gas laser (CO<sub>2</sub> laser) - liquid laser (dye laser) - excimer laser - Solid state laser (Nd:YAG laser) - semiconductor laser (homojunction laser).

### UNIT III

9 Hours

#### LASERS IN SCIENCE

Introduction - Harmonic generation (SHG) - Stimulated Raman emission - lasers in chemistry - laser in nuclear energy - lasers and gravitational waves - rotation of the earth - measurement of distance - Light detection And Ranging (LIDER) - velocity measurement - holography

### UNIT IV

9 Hours

#### LASERS IN MEDICINE AND SURGERY

Light induced biological hazards: Eye and skin - Eye laser surgery - photocoagulations - homeostasis - dentistry - laser angioplasty - different laser therapies - advantages & disadvantages - laser endoscopy.

### UNIT V

9 Hours

#### LASERS IN INDUSTRY

Applications in material processing: laser welding - hole drilling - laser cutting - Lasers in electronics industry: information storage - bar code scanner- Lasers in defence: laser based military weapons - laser walls.

**Total: 45 Hours**

#### Reference(s)

1. K. Thiyagarajan and A. K. Ghatak, "LASERS: Fundamentals and Applications", Springer, USA, 2015
2. M. N. Avadhanulu, "An Introduction to Lasers Theory and Applications", S. Chand Publisher, 2013
3. W. Koechner, M. Bass, "Solid State Lasers: a graduate text", Springer Verlag, New York, 2006
4. K. P. R. Nair, "Atoms, Molecules and Lasers", Narosa Publishing House, 2009
5. K. R. Nambiar, "Lasers: Principles Types and Applications", New Age International Publications, 2006
6. A. Sennaroglu, "Solid-State Lasers and Applications", CRC Press, 2006

**22OPH04 BIO-PHOTONICS****3 0 0 3****Course Objective:**

- To understand the light-matter interaction in biological cells or tissues by using the principles of optics and lasers.
- To apply the properties of biological cells or tissues in biomedical applications by various optical imaging, sensing and activation techniques.
- To analyze the concepts of Modern optical measurement techniques and devices in early detection of disease and cure them.

**Course Outcomes (COs)**

1. Infer the laws of optics and lasers to interpret the biological cells and tissues.
2. Identify the properties of different optical instruments in biological systems to represent their behavior in structure and design of detection engineering instruments.
3. Use laser tweezers techniques to infer the activities of cells (tissues) and explain the single molecule detection processes in medical diagnosis.
4. Outline the properties of ultra short laser pulses and tissue engineering to rectify the affecting factors in biological cells.
5. Compare the various types of bio-imaging methods to detect the infected cells and molecules in biological science.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	3	2												
3	3	2							3					
4	3	2							3					
5	3	2												

**UNIT I****9 Hours****INTRODUCTION TO BIOPHOTONICS**

Light as Photon Particles – Coherence of light - lasers – classification of lasers – Mechanisms of Non-linear Optics (NLO) processes associated with Biophotonics - Light scattering mechanisms: Rayleigh scattering, Miescattering, Brillouin Scattering, Raman Scattering -Different light sources – Quantitative description of light: Radiometry



## **UNIT II**

**9 Hours**

### **PHOTOBIOLOGY**

Interaction of light with cells and tissues – Light – Tissue Interaction Variables – Light –Tissue Interaction Theory: Radiative Transport Theory – Photo process in biopolymers – In Vivo Photoexcitation – photo-induced physical, chemical, thermal and mechanical effects in biological systems – Optical biopsy – Single molecule detection

## **UNIT III**

**9 Hours**

### **BIO-NANO-PHOTONICS**

Laser Microtools, Semiconductor quantum dots for bioimaging, Metallic nanoparticles and nanorods for biosensing – Optical biosensors: Fibre-Optic, evanescent wave, surface Plasmon resonance (SPR) based biosensors – biomaterials for photonics – Principle and design of laser tweezers – laser trapping and dissection for biological manipulation.

## **UNIT IV**

**9 Hours**

### **TISSUE ENGINEERING WITH LIGHT**

Basics of tissue optics: Light absorption and scattering in tissues, Wavelength effects and spectra– the therapeutic window, Light penetration in tissues – Absorbing agents in tissues and blood –Skinoptics, response to the UV radiation, Optical parameters of tissues – tissue welding – tissue contouring – tissue regeneration – Femto laser surgery – low level light therapy and photo dynamic therapy

## **UNIT V**

**9 Hours**

### **BIO-IMAGING TECHNIQUES AND ITS APPLICATIONS**

An overview of optical imaging – Fluorescence Microscopy – Scanning Microscopy – In vivo Confocal Microscopy – Multi photon Microscopy – Optical Coherence Tomography (OCT) – Fluorescence Resonance Energy Transfer (FRET) imaging – fluorescence lifetime imaging Microscopy (FLIM) – Nonlinear optical imaging – Coherent Anti-stokes Raman Scattering – Bioimaging Applications.

**Total: 45 Hours**

### **Reference(s)**

1. Introduction to Biophotonics, ParasN.Prasad, WileyInter-science, AJohnWiley & Sons, Inc., Publication (Class notes are developed mainly based on this book.)
2. Introduction to Biomedical Imaging, Andrew G.Webb, 2002, IEEE Press.
3. Biomedical Optics: Principles and Imaging, Lihong.V.Wang, Hsin.-I.Wu, 2007, Wiley Interscience 2007. & "An Introduction to Biomedical Optics", R.Splinterand B.A.Hooper, Taylor & Francis
4. Bioimaging Current Concepts in Light and Electron Microscopy, DouglasE.Chandler & Robert W.Roberson, Jones and Bartlett publishers.
5. Optical Imaging and Microscopy : Techniques and Advanced Systems, Peter Török and Fu-JenKao, 2004, Springer.

**22OPH05 PHYSICS OF SOFT MATTER****3 0 0 3****Course Objectives**

- To recognize the properties of soft matter and hard matter
- To understand the fundamental interactions of colloids and gels
- To explain the structure and phase behavior of liquid crystals and supramolecules
- To summarize the soft matter properties of structures and components of life

**Course Outcomes (COs)**

1. Identify the salient features of soft matter and hard matter
2. Exemplify the fundamental interactions and stability of colloids and gels
3. Illustrate the structure and properties of liquid crystals
4. Outline the aggregation and phase behavior of surfactants, polymers, copolymers and block copolymers
5. Analyze the soft matter behavior of nucleic acids, proteins, polysaccharides and membranes

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	2												
4	2	2												
5	2	2												

**UNIT I****9 Hours****CONDENSED MATTER**

Intermolecular forces-Condensation and freezing-mechanical response: Hookean solid-Newtonian liquid-viscoelasticity. Glasses: relaxation time-viscosity- glass forming liquids. Soft matter: length scales-fluctuations and Brownian motion

**UNIT II****9 Hours****COLLOIDAL DISPERSIONS & GELS**

Forces between colloidal particles: vander Waals forces-electrostatic double layer forces-steric hindrance-depletion interactions. Stability and phase behaviour: Crystallisation-strong colloids-weak colloids. Physical and chemical gels-classical theory of gelation-elasticity of gels

### **UNIT III**

**9 Hours**

#### **LIQUID CRYSTALS**

Liquid crystal phases-distortions and topological defects-electrical and magnetic properties-polymer liquid crystals-Fredricks transition and liquid crystal displays

### **UNIT IV**

**9 Hours**

#### **SUPRAMOLECULAR SELF ASSEMBLY**

Aggregation and phase separation-types of micelles- bilayers and vesicles. Phase behaviour of concentrated surfactant solutions-phase separation in polymers, copolymers and block copolymers

### **UNIT V**

**9 Hours**

#### **SOFT MATTER IN NATURE**

Components and structures of life-Nucleic acids-proteins-interaction between proteins-polysaccharides-membranes

**Total: 45 Hours**

#### **REFERENCES**

1. Richard A L Jones, *Soft Condensd Matter*, Oxford University Press, UK, 2002
2. Masao Doi, *Soft Matter Physics*, Oxford University Press, UK, 2013.
3. Ian W. Hamley, *Introduction to Soft Matter*, John Wiley & Sons, 2007
4. A. Fernandez-Nieves, A M Puertas, *Fluids, Colloids and Soft materials: An Introduction to Soft Matter Physics*, John Wiley & Sons, 2016
5. Maurice Kleman, Oleg D. Lavrentovich, *Soft Matter Physics: An Introduction*, Springer-Verlag, New York, 2003.

**22OCH01****CORROSION SCIENCE AND ENGINEERING****3 0 0 3****Course Objectives**

- Analyse the loss incurred due to corrosion in different sectors and terminologies related to corrosion
- Identify forms and types of corrosion with suitable mechanism
- Apply various methods of corrosion control, corrosion testing and monitoring

**Course Outcomes (COs)**

1. Explain if corrosion can occur under specific operating conditions in a given equipment or construction and indicate regions of immunity, corrosion and passivity of a metal
2. Compare different corrosion types on metals when exposed to air, water and at high temperatures (> 100 C)
3. Identify the corrosion mechanism on steel, iron, zinc and copper metal surfaces
4. Calculate the rate of corrosion on metals using electrochemical methods of testing
5. Propose the correct materials, design and operation conditions to reduce the likelihood of corrosion in new equipment and constructions

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

**UNIT I****9 Hours****CORROSION**

Importance of corrosion - spontaneity of corrosion - units of corrosion rate (mdd and mpy) - direct and indirect damage by corrosion - importance of corrosion prevention in industries - Pilling Bedworth ratio and its significance - passivation - area relationship in both active and passive states of metals - Pourbaix diagrams of Mg, Al and Fe and their advantages and disadvantages

**UNIT II****7 Hours****TYPES OF CORROSION**

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion-Catastrophic oxidation corrosion

**UNIT III****9 Hours****MECHANISM OF CORROSION**

Hydrogen embrittlement - corrosion fatigue - filiform corrosion - fretting damage and microbes induced corrosion. Corrosion mechanism on steel, iron, zinc and copper metal surfaces

#### **UNIT IV**

**10 Hours**

##### **CORROSION RATE AND ITS ESTIMATION**

Rate of corrosion: Factors affecting corrosion. Electrochemical methods of polarization: Tafel extrapolation polarization and linear polarization. Weight loss method - testing for intergranular susceptibility and stress corrosion. Non destructive testing methods: Visual testing - liquid penetrant testing - magnetic particle testing - Ultrasonic monitoring, and eddy current testing

#### **UNIT V**

**10 Hours**

##### **CORROSION CONTROL METHODS**

Fundamentals of cathodic protection - types of cathodic protection(sacrificial anodic and impressed current cathodic protection). Stray current corrosion, problems and its prevention. Protective coatings: Metal coatings: Hot dipping (galvanizing, tinning and metal cladding) - natural inhibitors. Selection of suitable design for corrosion control

**Total: 45 Hours**

#### **Reference(s)**

1. Mouafak A. Zaher, "Introduction to Corrosion Engineering", CreateSpace Independent Publishing Platform, 2016.
2. E.McCafferty, "Introduction to Corrosion Science", Springer; 2010 Edition, January 2010.
3. R. Winstone Revie and Herbert H. Uhlig, "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, John Wiley & Science, 2008.
4. Mars G. Fontana, "Corrosion Engineering", Tata McGraw Hill, Singapore, 2008
5. David E.J. Talbot (Author), James D.R. Talbot, "Corrosion Science and Technology", Second Edition (Materials Science & Technology), CRC Press; 2nd Edition, 2007.
6. <http://corrosion-doctors.org/Corrosion-History/Eight.html>

**22OCH02****POLYMER SCIENCE****3 0 0 3****Course Objectives**

- Explain the properties of different polymers with its mechanism
- Select the appropriate polymerization techniques to synthesize the polymers
- Identify suitable polymers for various industrial applications

**Course Outcomes (COs)**

1. Illustrate the types of mechanism of polymerization reactions and analyze the natural and synthetic polymers
2. Identify the suitable polymerization techniques to synthesize the high quality polymers
3. Identify the structure, thermal, and mechanical properties of polymers for different applications
4. Apply the polymer processing methods to design polymer products
5. Analyze the polymers used in electronic and biomedical applications.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	2												
4	1	1	2											
5	1	3	2											

**UNIT I****10 Hours****POLYMERS AND ELASTOMERS**

Classification of polymers - Mechanism: Addition polymerization - free radical, cationic, anionic and co-ordination (Ziegler-Natta) polymerization - copolymerization - condensation polymerization (nylon-6,6) -ring opening polymerization (nylon-6). Elastomers: Natural rubber and synthetic rubber: styrene-butadiene rubber (SBR), butyl, neoprene, thiocol rubbers. High performance polymers: polyethers, polyether ether ketone (PEEK), polysulphones and polyimides

**UNIT II****8 Hours****POLYMERIZATION TECHNIQUES**

Homogeneous and heterogeneous polymerization - bulk polymerization (PMMA, PVC) - solution polymerization - polyacrylic acid, suspension polymerization (ion-exchange resins) - emulsion polymerization (SBR) - advantages and disadvantages of bulk and emulsion polymerization. Melt solution and interfacial poly-condensation

**UNIT III****8 Hours****CHARACTERIZATION AND TESTING**

Characterization of polymers by Infrared Spectroscopy (IR) and Nuclear Magnetic Spectroscopy (NMR) - Thermal properties: TGA and DSC - Testing tensile strength - Izod impact - Compressive strength - Rockwell hardness - Vicot softening point - water absorption

#### **UNIT IV**

**9 Hours**

##### **POLYMER PROCESSING**

Moulding: Compression - injection - extrusion and blow mouldings. Film casting - calendering. Thermoforming and vacuum formed polystyrene - foamed polyurethanes. Fibre spinning: melt, dry and wet spinning. Fibre reinforced plastics fabrication: hand-layup - filament winding and pultrusion

#### **UNIT V**

**10 Hours**

##### **SPECIALITY POLYMERS**

Preparation and properties of heat resistant and flame retardant polymers. Polymers for electronic applications: liquid crystalline, conducting and photosensitive polymers – E waste management. Polymer for biomedical applications: artificial organs, controlled drug delivery, Scaffolds in tissue Engineering –waste management.

**Total: 45 Hours**

#### **Reference(s)**

1. V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International (P) Ltd., New Delhi, 2021
2. Joel R. Fried, "Polymer Science and Technology", Prentice Hall of India (P). Ltd., 2014
3. F. W. Billmeyer, "Text Book of Polymer Science", John Wiley & Sons, New York, 2008
4. Barbara H. Stuart, "Polymer Analysis", John Wiley & Sons, New York, 2008
5. George Odian , "Principles of Polymerization", John Wiley & Sons, New York, 2004
6. R. J. Young and P. A. Lovell, "Introduction to Polymers", CRC Press, New York, 2011
7. Common Biocompatible Polymeric Materials for Tissue Engineering and Regenerative Medicine (2019), Materials Chemistry and Physics <https://doi.org/10.1016/j>.

**22OCH03****ENERGY STORING DEVICES****3 0 0 3****Course Objectives**

- Compare the energy density of commercialized primary and secondary batteries.
- Classify the fuel cells and compare their efficiency in different environmental conditions.
- Demonstrate the various energy storage devices and fuel cells.

**Course Outcomes (COs)**

1. Find the parameters required for operation of a cell to evaluate the capacity of energy storage devices.
2. Identify the electrodes, electrolyte and cell reactions of different types of primary, secondary batteries and infer the selection criteria for commercial battery systems with respect to commercial applications.
3. Differentiate fuel cells based on its construction, production of current and applications.
4. Compare different methods of storing hydrogen fuel and its environmental applications.
5. Classify the solar cell based on the materials used in it.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1												
2	2	3					1							
3	3	1												
4	2	2					1							
5	3	3					1							

**UNIT I****6 Hours****BASICS OF CELLS AND BATTERIES**

Components - classification - operation of a cell - theoretical cell voltage - capacity - specific energy - energy density of lithium and lead acid battery - charge efficiency- charge rate - charge retention - closed circuit voltage - open circuit voltage current density - cycle life - discharge rate-over charge-over discharge

**UNIT II****10 Hours****BATTERIES FOR PORTABLE DEVICES AND ELECTRIC VEHICLES**

Primary batteries: zinc-carbon - magnesium, and mercuric oxide - recycling/safe disposal of used cells. Secondary batteries: lead acid - nickel-cadmium - lithium ion batteries - rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide - lithium anode cell - photogalvanic cells. Battery specifications for cars and automobiles. Extraction of metals from battery materials.



### UNIT III

10 Hours

#### TYPES OF FUEL CELLS

Importance and classification of fuel cells: Description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells - phosphoric acid - solid oxide - molten carbonate and direct methanol fuel cells

### UNIT IV

10 Hours

#### HYDROGEN AS A FUEL

Sources and production of hydrogen: Electrolysis and photocatalytic water splitting. Methods of hydrogen storage: High pressurized gas - liquid hydrogen type - metal hydride. Hydrogen as engine fuel - features, application of hydrogen technologies in the future – limitations.

### UNIT V

9 Hours

#### ENERGY AND ENVIRONMENT

Future prospects of renewable energy and efficiency of renewable fuels - economy of hydrogen energy. Solar Cells: First, second, third and fourth generation solar cell - photobiochemical conversion cell.

**Total: 45 Hours**

#### Reference(s)

1. N. Eliaz, E. Gileadi, Physical Electrochemistry, Fundamentals, Techniques and Applications, Wiley, 2019.
2. J. Garche, K. Brandt, Electrochemical Power sources: Fundamentals Systems and Applications, Elsevier, 2018
3. S.P. Jiang, Q. Li, Introduction to Fuel Cells, Springer, 2021.
4. A. Iulianelli, A. Basile, Advances in Hydrogen Production, Storage and Distribution, Elsevier, 2016.
5. M.M. Eboch, The Future of Energy, From Solar Cells to Flying Wind Farms, Capstone, 2020.

**22OMA01****GRAPH THEORY AND COMBINATORICS****3 0 0 3****Course Objectives**

- This course comprehends the graphs as a modeling and analysis tool in computer science & Engineering
- It introduces the structures such as graphs & trees and techniques of counting and combinations, which are needed in number theory based computing and network security studies in Computer Science.

**Programme Outcomes (POs)**

- Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**Course Outcomes (COs)**

1. Recognize the basic ideas of Graph and its characteristics.
2. Assess the characteristics of trees and its properties.
3. Predict the coloring of graphs and its applications in the respective areas of engineering.
4. Compute the permutations and combinations in the engineering field.
5. Demonstrate the types of generating functions and their applications in engineering.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2													
2	1	3													
3	2	3													
4	2	3													
5	3	3													

**UNIT I****9 Hours****INTRODUCTION**

Graphs - Introduction - Isomorphism - Sub graphs - Walks, Paths, Circuits - Connectedness - Components - Euler graphs - Hamiltonian paths and circuits - Trees - Properties of trees - Distance and centers in tree - Rooted and binary trees.

## UNIT II

9 Hours

### TREES, CONNECTIVITY

Spanning trees - Fundamental circuits - Spanning trees in a weighted graph - cut sets - Properties of cut set - All cut sets - Fundamental circuits and cut sets - Connectivity and separability - Network flows - 1-Isomorphism - 2-Isomorphism - Combinational and geometric graphs - Planer graphs - Different representation of a planer graph.

## UNIT III

9 Hours

### MATRICES, COLOURING AND DIRECTED GRAPH

Chromatic number - Chromatic partitioning - Chromatic polynomial - Matching - Covering - Four color problem - Directed graphs - Types of directed graphs - Digraphs and binary relations - Directed paths and connectedness - Euler graphs.

## UNIT IV

9 Hours

### PERMUTATIONS

Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.

## UNIT V

9 Hours

### GENERATING FUNCTIONS

Generating functions - Partitions of integers - Exponential generating function - Summation operator - Recurrence relations - First order and second order - Non-homogeneous recurrence relations - Method of generating functions.

**Total: 45 Hours**

### Reference(s)

1. Narsingh Deo, Graph Theory: With Application to Engineering and Computer Science, Prentice Hall of India, 2003
2. Grimaldi R.P., Discrete and Combinatorial Mathematics: An Applied Introduction, Addison Wesley, 1994.
3. Rosen K.H., Discrete Mathematics And Its Applications, McGraw Hil, 2007
4. Clark J. & Holton D.A., A First Look at Graph Theory, Allied Publishers, 1995.
5. Mott J.L., Kandel A. & Baker T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India, 1996.
6. Liu C.L., Elements of Discrete Mathematics, McGraw Hill, 1985.

**22OGE01 PRINCIPLES OF MANAGEMENT****3 0 0 3****Course Objectives**

- To develop cognizance about importance of management principles.
- Extract the functions and responsibilities of managers.
- To Study and understand the various HR related activities.
- Learn the application of the theories in an organization.
- Analyze the position of self and company goals towards business.

**Course Outcomes (COs)**

1. Students will be able to understand the basic concepts of Management.
2. Have some basic knowledge on planning process and its Tools & Techniques.
3. Ability to understand management concept of organizing and staffing.
4. Ability to understand management concept of directing.
5. Ability to understand management concept of controlling.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1									2		3				
2									2		2				
3									2		2				
4									3		2				
5									2		2				

**UNIT I****9 Hours****BASICS OF ENTREPRENEURSHIP**

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurship process. Role of entrepreneurship in economic development

**UNIT II****9 Hours****GENERATION OF IDEAS**

Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractional, Reversal Method, Brain Storming, Analogies

**UNIT III****9 Hours****LEGAL ASPECTS OF BUSINESS**

Contract act-Indian contract act, Essential elements of valid contract, classification of contracts, sale of goods act- Formation of contract of sale, negotiable instruments- promissory note, bills and cheques, partnership, limited liability partnership (LLP), companies act-kinds, formation, memorandum of association, articles of association.

**UNIT IV**

**9 Hours**

**BUSINESS FINANCE**

Project evaluation and investment criteria (cases), sources of finance, financial statements, break even analysis, cash flow analysis.

**UNIT V**

**9 Hours**

**OPERATIONS MANAGEMENT**

Importance- functions-deciding on the production system- facility decisions: plant location, plant layout (cases), capacity requirement planning- inventory management (cases)-lean manufacturing, Six sigma.

**FURTHER READING**

Retrofitting, objectives, classification of retrofitting, cost effectiveness through retrofitting (economical aspects), circumstances leading to retrofitting, features and selection for retrofitting.

**Total: 45 Hours**

**Reference(s)**

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005.
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006.

**22OGE02 ENTREPRENEURSHIP DEVELOPMENT I****3 0 0 3****Course Objectives**

- Learn the basics and scope of the Entrepreneurship
- Understand the generation of ideas of the Entrepreneurship
- Evolve the legal aspects of the business
- Learn to analyze the various business finance
- Learn the basics of the Operations Management

**Course Outcomes (COs)**

1. Analyze the role of entrepreneurship in economic development.
2. Explain the types of ideas that to be used for entrepreneurship development.
3. Examine the legal aspects of business and its association.
4. Examine the sources of business and its analysis.
5. Analyse the different modes of operation management.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1						1	2		2						
2						1	2		2						
3						1	2		2						
4						1	2		2						
5						1	2		2						

**UNIT I****9 Hours****BASICS OF ENTREPRENEURSHIP**

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurship process. Role of entrepreneurship in economic development

**UNIT II****9 Hours****GENERATION OF IDEAS**

Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractional, Reversal Method, Brain Storming, Analogies

**UNIT III****9 Hours****LEGAL ASPECTS OF BUSINESS**

Contract act-Indian contract act, Essential elements of valid contract, classification of contracts, sale of goods act- Formation of contract of sale, negotiable instruments- promissory note, bills and cheques, partnership, limited liability partnership (LLP), companies act-kinds, formation, memorandum of association, articles of association.

**UNIT IV**

**9 Hours**

**BUSINESS FINANCE**

Project evaluation and investment criteria (cases), sources of finance, financial statements, break even analysis, cash flow analysis.

**UNIT V**

**9 Hours**

**OPERATIONS MANAGEMENT**

Importance- functions-deciding on the production system- facility decisions: plant location, plant layout (cases), capacity requirement planning- inventory management (cases)-lean manufacturing, Six sigma.

**Total: 45 Hours**

**Reference(s)**

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006

**22OGE03 ENTREPRENEURSHIP DEVELOPMENT II****3 0 0 3****Course Objectives**

- Evolve the marketing mix for promotion the product / services
- Handle the human resources and taxation
- Learn to analyze the taxation
- Understand the Government industrial policies and supports
- Preparation of a business plan

**Course Outcomes (COs)**

1. Examine the strategies and plans in marketing management.
2. Analyse the cases involved in human resource management.
3. Classify the direct and indirect taxes in business.
4. Analyze the supports given by government for improving the business.
5. Examine the various steps involved in preparing the business plan.

**Articulation Matrix**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1						1	2		2						
2						1	2		2						
3						1	2		2						
4						1	2		2						
5						1	2		2						

**UNIT I****9 Hours****MARKETING MANAGEMENT**

Marketing environment, Segmentation, Targeting and positioning, Formulating marketing strategies, Marketing research, marketing plan, marketing mix (cases)

**UNIT II****9 Hours****HUMAN RESOURCE MANAGEMENT**

Human Resource Planning (Cases), Recruitment, Selection, Training and Development, HRIS, Factories Act 1948 (an over view)

**UNIT III****9 Hours****BUSINESS TAXATION**

Direct taxation, Income tax, Corporate tax, MAT, Tax holidays, Wealth tax, Professional tax (Cases). Indirect taxation, Excise duty, Customs, Sales and Service tax, VAT, Octroi, GST (Cases)



**UNIT IV** **9**  
**Hours**

**GOVERNMENT SUPPORT**

Industrial policy of Central and State Government, National Institute-NIESBUD, IIE, EDI. State Level Institutions-TIIC, CED, MSME, Financial Institutions

**UNIT V** **9**  
**Hours**

**BUSINESS PLAN PREPARATION**

Purpose of writing a business plan, Capital outlay, Technical feasibility, Production plan, HR plan, Market survey and Marketing plan, Financial plan and Viability, Government approvals, SWOT analysis.

**Total: 45 Hours**

**Reference(s)**

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Philip Kotler., Marketing Management, Prentice Hall of India, New Delhi: 2003
3. Aswathappa K, Human Resource and Personnel Management - Text and Cases, Tata McGraw Hill:2007.
4. Jain P C., Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi: 2002.
5. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006.
6. <http://niesbud.nic.in/agencies.html>

**22OGE04****NATION BUILDING, LEADERSHIP AND SOCIAL RESPONSIBILITY****3 0 0 3****Course Objectives**

- To understand the importance of National Integration, Patriotism and Communal Harmony
- To outline the basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality
- To analyze the different types of responsibility role of play for the improvement of society

**Course Outcomes (COs)**

1. Understand religio-cultural diversity of the country and its impact on the lives of the people and their beliefs
2. Acquire a sense of responsibility, smartness in appearance and improve self confidence
3. Develop the sense of self-less social service for better social & community life
4. Apply the importance of Physical and Mental health and structure of communication organization and various mode of communication
5. Acquire awareness about the various types of weapon systems in the Armed Forces.

**Articulation Matrix**

C O No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	2		1				1					3			
2	2		2				2					2			
3	2		1				1					2			
4	2		3				3					3			
5	2		1				1					2			

**UNIT I****9 Hours****NATIONAL INTEGRATION**

Importance & Necessity, Factors Affecting National Integration, Unity in Diversity. Threats to National Security. Water Conservation and Rain Harvesting, Waste Management and Energy Conservation. Leadership Capsule-Traits-Indicators-Motivation-Moral Values-Honor Code-Case Studies: Shivaji, Jhansiki Rani, Case Studies-APJ Abdul kalam, Deepa Malik, Maharana Pratap, N Narayan Murthy Ratan Tata Rabindra Nath Tagore, role of NCC cadets in 1965 war.

**UNIT II****9 Hours****PERSONALITY DEVELOPMENT AND LEADERSHIP**

Intra & Interpersonal skills - Self-Awareness- & Analysis, Empathy, Critical & creative thinking, Decision making and problem solving, Communication skills, Group Discussion – coping with stress and emotions, changing mindset, Public Speaking, Time Management, Social skills, Career counseling, SSB procedure and Interview skills.

### UNIT III

9 Hours

#### **SOCIAL SERVICE, COMMUNITY DEVELOPMENT AND ENVIRONMENTAL AWARENESS**

Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare. Protection of children & women safety, Road/ Rail Travel Safety, New initiatives, Cyber and mobile security awareness. Disaster management Capsule-Organization-Types of Disasters-Essential Services-Assistance-Civil Defence Organization

### UNIT IV

9 Hours

#### **HEALTH, HYGIENE AND COMMUNICATION**

Sanitation, First Aid in Common Medical Emergencies. Health, Treatment and Care of Wounds. Yoga-Introduction, Definition, Purpose, Benefits. Asanas-Padamsana, Siddhasana, Gyan Mudra, Surya Namaskar, Shavasana, Vajrasana, Dhanurasana, Chakrasana, Sarvaangasana, Halasanaetc. Obstacle Training Contact: Obstacle training - Intro, Safety measures, Benefits, Straight balance, Clear Jump, Gate Vault, ZigZagBalance, High Wall etc. COMMUNICATION: Basic Radio Telephony (RT) Procedure-Introduction, Advantages, Disadvantages, Need for standard- Procedures-Types of Radio Telephony Communication-Radio telephony procedure, Documentation.

### UNIT V

9 Hours

#### **ARMED FORCES AND NCC GENERAL**

Introduction to Digital Signal Processors- Basic Classification-Features TMS320C6713 Architecture-Functional Unit-Pipelining- Addressing Modes -Instruction set Simple Assembly Language Program.

**Total: 45 Hours**

#### **Reference(s)**

1. Director General NCC Website: <https://indiancc.nic.in/ncc-general-elective-subject-course-design/>
2. Grooming Tomorrow's Leaders, published by DG, NCC. <https://indiancc.nic.in/>
3. Youth in Action, published by DG, NCC. <https://indiancc.nic.in/>
4. The Cadet, Annual Journal of the NCC. <https://indiancc.nic.in/>
5. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material. <https://indiancc.nic.in/>