

B.E. (Computer Science and Design)

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 excel in the field of Computer Science and Design through the appropriate use of Computing and Design approaches.

MISSION OF THE DEPARTMENT

- To adopt the latest industry trends in teaching learning process in order to make students competitive in the job market.
- To build technologically proficient individuals in Computer Science and Design to meet industry and entrepreneurial ventures by providing infrastructure and human resources.
- To Prepare students for full and ethical participation in a diverse society and encourage lifelong learning.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- I. To perform well in their professional career by acquiring enough knowledge in the domain of Computer Science and Design.
- II. To improve communication skills, follow professional ethics and involve in team work in their profession.
- III. To update with evolving technology and use it for career advancement.

PROGRAMME OUTCOMES (POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. 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. 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. 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.
6. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. 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. 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. 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)

1. Apply the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering problems.
2. Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.
3. Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

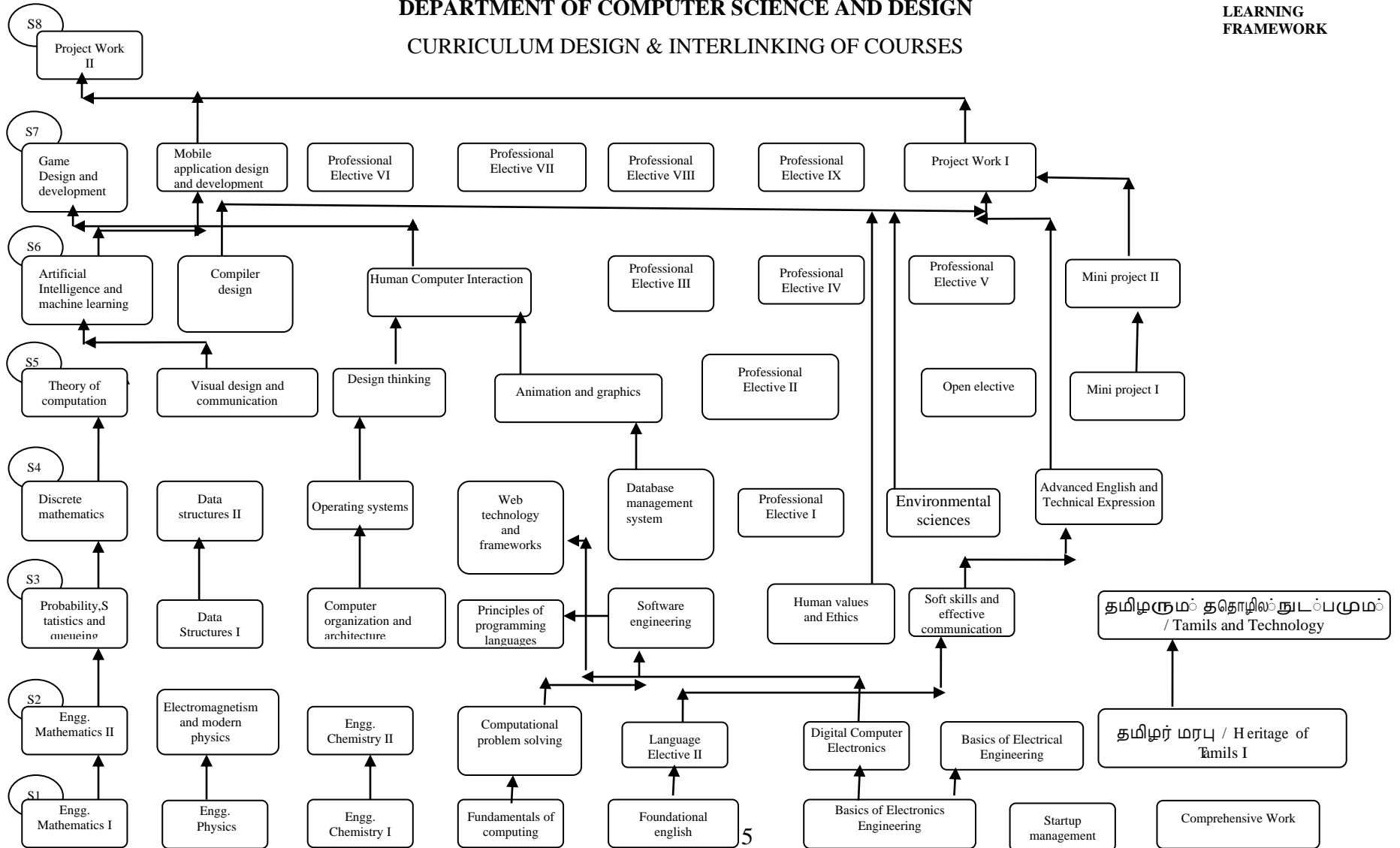
MAPPING OF PEOs AND POs

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					
II								X	X	X	X	
III	X	X	X		X							X

CONNECTIVITY CHART

DEPARTMENT OF COMPUTER SCIENCE AND DESIGN CURRICULUM DESIGN & INTERLINKING OF COURSES

360° FLEXIBLE
LEARNING
FRAMEWORK



Curriculum R2022

B.E COMPUTER SCIENCE AND DESIGN											
Minimum Credits to be Earned : 163											
I SEMESTER											
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category	
							CA	ESE	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	EEC	
*22HS003	தமிழர் மரபு / Heritage of Tamils	1	0	0	1	1	100	0	100	HSS	
Total		15	1	10	21	26	-	-	-	-	
II SEMESTER											
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category	
							CA	ESE	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	
22CD206	Digital Computer Electronics	3	0	2	4	5	50	50	100	ES	
	Language Elective	1	0	2	2	3	100	0	100	HSS	
*22HS006	தமிழரும் தொழில்நுட்பமும் / TAMILS AND TECHNOLOGY	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 III and IV semester.

III SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ESE	Total	
22CD301	Probability, Statistics and Queuing theory	3	1	0	4	4	40	60	100	ES
22CD302	Data Structures I	3	0	2	4	5	50	50	100	PC
22CD303	Computer Organization and Architecture	3	1	0	4	4	40	60	100	PC
22CD304	Principles of Programming Languages	3	0	2	4	5	50	50	100	PC
22CD305	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	EEC
Total		17	2	6	22	25	-	-	-	-
IV SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ESE	Total	
22CD401	Discrete Mathematics	3	1	0	4	4	40	60	100	ES
22CD402	Data Structures II	3	0	2	4	5	50	50	100	PC
22CD403	Operating Systems	3	1	0	4	4	40	60	100	PC
22CD404	Web Technology and Frameworks	2	0	2	3	4	50	50	100	PC
22CD405	Database Management System	3	0	2	4	5	40	60	100	PC
	Professional Elective I	3	0	0	3	3	40	60	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		19	2	8	23	29	-	-	-	-

V SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ESE	Total	
22CD501	Theory of Computation	3	1	0	4	4	40	60	100	PC
22CD502	Visual Design and Communication	3	0	0	3	3	40	60	100	PC
22CD503	Design Thinking	3	0	0	3	3	40	60	100	PC
22CD504	Animation & Graphics	3	0	2	4	5	50	50	100	PC
	Professional Elective II	3	0	0	3	3	40	60	100	PE
	Open Elective	3	0	0	3	3	40	60	100	PE
22CD507	Mini Project I	0	0	2	1	2	100	0	100	EEC
Total		18	1	4	21	23	-	-	-	-
VI SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ESE	Total	
22CD601	Artificial Intelligence and Machine Learning	3	0	2	4	5	50	50	100	PC
22CD602	Compiler Design	3	1	0	4	4	40	60	100	PC
22CD603	Human Computer Interaction	3	0	0	3	3	40	60	100	PC
	Professional Elective III	3	0	0	3	3	40	60	100	PE
	Professional Elective IV	3	0	0	3	3	40	60	100	PE
	Professional Elective V	3	0	0	3	3	40	60	100	PE
22CD607	Mini Project II	0	0	2	1	2	100	0	100	EEC
Total		18	1	4	21	23	-	-	-	-

VII SEMESTER										
Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CA	ESE	Total	
22CD701	Game Design and Development	3	1	0	4	5	40	60	100	PC
22CD702	Mobile Application Design and Development	3	0	2	4	5	50	50	100	PC
	Professional Elective VI	3	0	0	3	3	40	60	100	PE
	Professional Elective VII	3	0	0	3	3	40	60	100	PE
	Professional Elective VIII	3	0	0	3	3	40	60	100	PE
	Professional Elective IX	3	0	0	3	3	40	60	100	PE
22CD707	Project Work I	0	0	4	2	4	60	40	100	EEC
Total		18	1	6	22	26	-	-	-	-
VIII SEMESTER										
Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CA	ESE	Total	
22CD801	Project Work II	0	0	20	10	20	60	40	100	EEC
Total		0	0	20	10	20	-	-	-	-

ELECTIVES										
LANGUAGE ELECTIVES										
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
DISCIPLINE ELECTIVES										
VERTICAL I – DATA SCIENCE										
22CD001	Exploratory Data Analysis	2	0	2	3	3	50	50	100	PE
22CD002	Recommender Systems	3	0	0	3	3	40	60	100	PE
22CD003	Big Data Analytics	3	0	0	3	3	40	60	100	PE
22CD004	Neural Networks and Deep Learning	2	0	2	3	3	50	50	100	PE
22CD005	Natural Language Processing	3	0	0	3	3	40	60	100	PE
22CD006	Computer Vision	3	0	0	3	3	40	60	100	PE
VERTICAL II – FULL STACK DEVELOPMENT										
22CD007	Agile Software Development	3	0	0	3	3	40	60	100	PE
22CD008	UI and UX Design	3	0	0	3	3	40	60	100	PE
22CD009	Web Frameworks	3	0	0	3	3	40	60	100	PE
22CD010	Web Application and Security	3	0	0	3	3	40	60	100	PE
22CD011	Software Testing and Automation	3	0	0	3	3	40	60	100	PE
22CD012	Devops	3	0	0	3	3	40	60	100	PE
VERTICAL III – CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22CD013	Virtualization in Cloud Computing	3	0	0	3	3	40	60	100	PE
22CD014	Cloud Services and Data Management	3	0	0	3	3	40	60	100	PE
22CD015	Cloud Storage Technologies	3	0	0	3	3	40	60	100	PE

22CD016	Cloud Automation Tools and Applications	3	0	0	3	3	40	60	100	PE
22CD017	Software Defined Networks	2	0	2	3	3	50	50	100	PE
22CD018	Security and Privacy in Cloud	3	0	0	3	3	40	60	100	PE
VERTICAL IV – CREATIVE MEDIA										
22CD019	Multimedia and Animation	2	0	2	3	3	50	50	100	PE
22CD008	UI and UX Design	3	0	0	3	3	40	60	100	PE
22CD020	Augmented Reality/Virtual Reality	2	0	2	3	3	50	50	100	PE
22CD021	Digital Audio and Video Design	3	0	0	3	3	40	60	100	PE
22CD022	Video Creation and Editing	2	0	2	3	3	50	50	100	PE
22CD023	Digital Marketing	3	0	0	3	3	40	60	100	PE
VERTICAL V – MARKETING AND MANAGEMENT										
22CD024	Human Resource Management for Entrepreneurs	3	0	0	3	3	40	60	100	PE
22CD025	Supply Chain Management	3	0	0	3	3	40	60	100	PE
22CD026	Social Text and Media Analytics	3	0	0	3	3	40	60	100	PE
22CD027	Financial Management	3	0	0	3	3	40	60	100	PE
22CD023	Digital Marketing	3	0	0	3	3	40	60	100	PE
22CD028	Marketing Research and Marketing Management	3	0	0	3	3	40	60	100	PE
VERTICAL VI – MEDIA PROCESSING										
22CD029	Multimedia Data Compression	3	0	0	3	3	40	60	100	PE
22CD030	Streaming Media Tools and Technologies	2	0	2	3	3	50	50	100	PE
22CD031	Metaverse	2	0	2	3	3	50	50	100	PE
22CD032	Image and Video Analytics	3	0	0	3	3	40	60	100	PE
22CD033	Wearable Devices Applications	3	0	0	3	3	40	60	100	PE
22CD034	3d Printing and Design	3	0	0	3	3	40	60	100	PE

ONE CREDIT COURSES										
22CD0XA	Streaming Analytics with Deep Learning	1	0	0	1	-	100	0	100	EEC

OPEN ELECTIVES										
Code No.	Course	L	T	P	C	Ho urs/ We ek	Maximum Marks			Cate gory
							CA	ES	Total	
22OCE01	Energy Conservation and Management	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

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	PSO3
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: 45+15=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	PSO3
1	2	1						2							
2	2	1						2							
3	2	1						2	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 Meldes 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 Youngs 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

- J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
- 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)

- Understand nuclear transmutation reactions that lead to the formation of elements in the universe
- Illustrate atomic structure of elements in the periodic table and interpret the periodic trends in properties of elements with its anomaly
- Apply the conditions for the formation of different types of chemical bonds and predict the minimum energy required for a reaction to occur
- Analyse endothermic and exothermic processes and exchange of energy during chemical reactions
- 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
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 & its limitations - types of chemical bonds - bond energy - bond cleavage - activation energy of reactions

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

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										
2	3	3	3	1										
3	2	2	2	1										
4	2	2	2	1										
5	2	2	2	1										

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, Kenya. 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****SELF-EXPRESSION**

Self-Introduction-Recreating Interview Scenarios (with a focus on verbal communication)-Subject Verb Concord - Tenses - Common Errors in verbal communication Be-verbs Self-Introduction-Recreating interview scenarios-Haptics-Gestures-Proxemics-Facial expressions- Paralinguistic / Vocalic- Body Language- Appearance-Eye Contact-Artefacts 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****CREATIVE EXPRESSION**

Descriptive Expression-Picture Description and Blog Writing -Vocabulary-One-word substitution- Adjectives-Similes, Metaphors, Imagery & Idioms -Link words - Inclusive language 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****FORMAL EXPRESSION**

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- Conjunctive clause Punctuation-Formal Idioms-Phrases-Articles - Definite & Indefinite-Types of sentences-Modal verbs 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 IGCSEA, 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
1	3	3	3	1								
2	3	3	3	2								
3	3	3	3	2								
4	3	3	3	2								
5	3	3	3	1								

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 t 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 porotypes 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							1	2	1		1			
2							2	2	1	1	2			
3							3	3	1	2	2			
4							1	3	1	2	2			
5							2	3	2	2	2			

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

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 திருவள்ளூர் 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.

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	PSO3
1	1	3													
2	2	3													
3	2	3													
4	3	3													
5	3	3													

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

Formation of differential equations- Solutions of first order linear ODE: Leibnitz 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 a 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: 45+15=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 edition, 2015
5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017

**22PH202 ELECTROMAGNETISM AND MODERN
PHYSICS**

2023

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	PSO3
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 the role of catalyst in the rate of reaction
- Summarize the variation in properties and reactivity of isotopes.

Course Outcomes (COs)

1. Apply the electrochemical concepts to determine the electrode potential of a metal
2. Analyze the working of batteries for the energy storage devices
3. Understand the mechanism of corrosion and suggest a method to control the 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
1	2	1										
2	2	1										
3	2	1					1					
4	2	1										
5	2	1										

UNIT I**6 Hours****ELECTROCHEMISTRY**

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

UNIT II**6 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	4 Hours
EXPERIMENT 1	
Determination of strength of hydrochloric acid in a given solution using pH meter	
2	4 Hours
EXPERIMENT 2	
Application of calomel electrode to determine the redox potential of Fe(II) solution	
3	4 Hours
EXPERIMENT 3	
Construct an electrochemical cell exhibiting valid output and compare its potential with the given standard cell	
4	5 Hours
EXPERIMENT 4	
Determination of corrosion percentage of iron/steel by weight loss method	
5	4 Hours
EXPERIMENT 5	
Determination of percentage of corrosion inhibition in iron/mild steel using a natural inhibitor	
6	4 Hours
EXPERIMENT 6	
Electroplate copper on the given target object and estimate the amount of copper deposited at cathode	
7	5 Hours
EXPERIMENT 7	
Determination of rate constant of acid catalyzed hydrolysis of ester	
	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. Arnikaar, 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. Analyse 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. Analyse 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										
2	3	3	3	3										
3	2	2	2	3										
4	2	2	2	2										
5	2	2	2	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 & 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, Kenya. 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
1	3	2	2								2	2
2	2	2	2	3							3	2
3	2	2	1	3							2	2
4	3	2	1	2							2	2
5	2	2									2	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 Electromechanical 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

22CD206 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	PSO3
1	2	2	2												
2	2	2	2												
3	2	2	2												
4	2	2													
5	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	
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

22HS006 TAMILS AND TECHNOLOGY**1 0 0 1****Course Objectives**

1. Analyse graffiti on potteries as a form of historical and cultural documentation during the Sangam Age.
2. 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.
3. Examine ancient knowledge of oceans and its impact on Tamil society.

Course Outcomes (COs)

1. Understand the significance of the weaving industry during the Sangam Age and its cultural importance.
2. Understand the significance of dams, tanks, ponds, and sluices in the agricultural and irrigation practices of the Chola Period.
3. Explore the architectural designs and structural construction methods used in household materials during the Sangam Age.
4. Explore the art of shipbuilding in ancient Tamil culture and its role in maritime trade and transportation.
5. 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				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

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 & 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.

3 Hours

SCIENTIFIC TAMIL & TAMIL COMPUTING

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: 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

22HS006 - தமிழரும் தொழில்நுட்பமும்

1001

பாடத்திட்டத்தின் நோக்கம்

1. சங்க காலத்தில் வரலாறு மற்றும் கலாச்சார ஆவணங்களின் ஒரு வடிவமாக, மட்பாண்டங்கள் மீதான கிராஃபிட்டியை பகுப்பாய்வு செய்தல்.
2. சிலப்பதிகாரத்தில் கட்டப்பட்ட மேடை கட்டுமானங்களின் விவரங்களையும் அவற்றின் கலாச்சார முக்கியத்துவத்தையும் பகுப்பாய்வு செய்வதன் மூலம், சங்க காலத்தில் மாவீரர் கற்களின் கட்டுமானப் பொருட்கள் மற்றும் வரலாற்று சூழலை ஆராய்தல்.
3. சமுத்திரங்கள் பற்றிய பண்டைய அறிவையும், தமிழ் சமூகத்தில் அதன் தாக்கத்தையும் ஆராய்வது ஆகியவை இப்பாடத்திட்டத்தின் நோக்கம் ஆகும்.

கற்றலின் விளைவு

1. சங்க காலத்தில் நெசவுத் தொழிலின் முக்கியத்துவத்தையும் அதன் கலாச்சார முக்கியத்துவத்தையும் புரிந்து கொள்ளல்.
2. சோழர் கால விவசாய மற்றும் நீர்ப்பாசன நடைமுறைகளில் அணைகள், குளங்கள் மற்றும் மதகுகளின் முக்கியத்துவத்தைப் புரிந்து கொள்ளல்.
3. சங்க காலத்தில் வீட்டுப் பொருட்களில் பயன்படுத்தப்பட்ட கட்டடக்கலை வடிவமைப்புகள் மற்றும் கட்டமைப்பு கட்டுமான முறைகளை ஆராய்தல்.
4. பண்டைய தமிழ் கலாச்சாரத்தில், கப்பல் கட்டும் கலை, கடல் வர்த்தகம் மற்றும் போக்குவரத்தில் அதன் பங்கை ஆராய்தல்.
5. தமிழ் மொழியில் அறிவியல் சொற்களஞ்சியம் மற்றும் சொல்லகராதியின் வளர்ச்சியைக் கண்டறிதல்.

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்:

3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:

3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

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.

22CD301 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	PSO3
1	2	2													
2	1	2													
3	1	2													
4	1	2													
5	1	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 DISTRIBUTIONS

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

QUEUING THEORY

Pure Birth and Death Process -Characteristics of Queuing models- Kendall's notation- Single and multi server Markovian queuing models- M/M/1 and M/M/C (Finite and infinite capacity)- Pollaczek-Khinchine formula.

Total: 45+15=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 Queuing and Computer Science Applications, John Wiley and Sons, Second Edition, 2012.
3. Arnold O Allen, Probability Statistics and Queuing 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,

22CD302 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	PSO3
1	2	2	2	2	2						2	2	2	1	
2	2	2	2	2	2						2	2	1		
3	2	3	3	2	2						2	2	2	1	
4	3	3	3	3	2						3	3	3		
5	3	2	3	3	3						3	3	2	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. The landmark will be considered a node and the path between the two landmarks 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. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011.

22CD303 COMPUTER ORGANIZATION AND ARCHITECTURE

3 1 0 4

Course Objectives

- Understand the fundamental digital logics behind computations of computer systems.
- Impart knowledge about the operation of the arithmetic unit including the algorithms & implementation addition, subtraction, multiplication & division.
- Acquire knowledge about the modern computer architectures and their instruction execution.

Course Outcomes (COs)

1. Infer the hidden languages and inner structures of computer hardware and software through codes and combinations.
2. Design a processor architecture for implementing various pipeline mechanisms.
3. Outline the memory hierarchy architecture and the influence of Tera MTA in cache performance.
4. Analyze the performance of GPU architecture over CPU architecture and their implementation tools
5. Compare the modern computer architectures and their implementation with the traditional computing systems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2								2		1	
2	3	3	2	2								2		2	
3	2	2	2									2	2	2	
4	2	2	2	2	3							2	1	1	
5	2	2	2	2								2		2	

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+15=60 Hour

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.

22CD304 PRINCIPLES OF PROGRAMMING LANGUAGES

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	PSO3
1	2	3	1	1	3						1	2	1		
2	2	3	3	1	3						2	2	1		
3	1	2	3	1	3						2	2	2		
4	1	2	3	1	3						2	2		2	
5	1	2	3	1	3						2	2		2	

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	3 Hours
EXPERIMENT 7	
Develop a program for implementation of subprograms and nested subprograms and investigate the differences between pass-by-value and pass-by-reference parameter passing mechanisms	
8	3 Hours
EXPERIMENT 8	
Build a maze solver application that finds a path from the entrance to the exit of a maze.	
	Total: 75 Hours

Reference(s)

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

22CD305 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	PSO3
1	3	3	2	2			2		2		2	2	1		
2	3	3	2	2	3		2		2			2		2	
3	2	2	2				2		2			2	1		
4	2	2	2		3		2		2			2		2	
5	2	2	2						2				1		

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**9 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

9 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 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

22HS004 HUMAN VALUES AND ETHICS**2002****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, BarunK.Mitra, Oxford University Press, 2012
6. Business English by Ken Taylor, Orient Blackswan, 2011

22CD401 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)

- 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

Course Outcomes (COs)

- Understand and apply the concepts of Boolean algebra and characteristics in computers.
- Apply formalized arguments to classify and assess real-world arguments.
- Represent the characteristics of predicate logic in computer engineering.
- Apply different properties of injection, surjection, bijection, composition and inverse functions in software engineering.
- 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	PSO3
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: 45+15=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.

22CD402 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.

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. 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.
- d. 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.
- e. 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.
- k. Project Management and Finance: Demonstrate the 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.
- l. 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.

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

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	1	2	2	2	2						2	2		
3	2	3	3	2	2						2	2		
4	3	3	3	3	2						3	3		
5	3	2	3	3	3						3	3		

UNIT I	9 Hours
TRIE DATA STRUCTURES Trie Structure-Types-Prefix-Based Search-Space Efficiency-Time Complexity-Compact Tries-Applications-Suffix Array and Suffix Tree-Rope.	
UNIT II	9 Hours
GRAPH Graph representation-Breadth-first traversal-Depth-first traversal-Shortest Path Algorithms: Unweighted Shortest Paths-Dijkstras Algorithm-Travelling Salesman Problem-Analysis of shortest path algorithms.	
UNIT III	9 Hours
GRAPH MST Minimum Spanning Tree: Prims Algorithm-Kruskals Algorithm-Disjoint-Set Union (Union-Find)-A* algorithm-Flood filling algorithm-Analysis of MST algorithms.	
UNIT IV	9 Hours
ALGORITHM DESIGN TECHNIQUES 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	9 Hours
MODERN DATA STRUCTURES Segment Tree-Interval Tree-Fenwick Tree-K-D Tree-Quadtree and Octree-Circular Buffer (Ring Buffer)-Marshaling/Unmarshalling-JSON-benefits-Schema-limitations-Protobuf.	
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 Kruskals 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 Queens 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

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

22CD403 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.

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. 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.
- d. 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.
- e. 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.
- g. 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.
- i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- k. Project Management and Finance: Demonstrate the 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.
- l. 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.

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	3	3	2	2	3		2		2			2		
3	2	2	2				2		2			2		
4	2	2	2		3		2		2			2		
5	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**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>

22CD404 WEB TECHNOLOGY AND FRAMEWORKS**2 0 2 3****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

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. 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.
- d. 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.
- e. 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.
- k. Project Management and Finance: Demonstrate the 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.
- l. 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.

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		
3	2	3	3	2	2						2	2		
4	3	3	3	3	2						3	3		
5	3	2	3	3	3						3	3		

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

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****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-Languages-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.

1**3 Hours****EXPERIMENT 1**

Create a simple HTML page and use the browsers 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: 45+15=60 Hours

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, 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

22CD405 DATABASE MANAGEMENT SYSTEM

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.

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. 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.
- d. 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.
- e. 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.
- k. Project Management and Finance: Demonstrate the 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.
- l. 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.

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	PSO1	PSO2
1	2	2	2	2	2						2	2		
2	2	2	2	2	2						2	2		
3	2	3	3	2	2						2	2		
4	3	3	3	3	2						3	3		
5	3	2	2	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	
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

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.

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, TataMcGraw 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

22CD501 THEORY OF COMPUTATION**3 1 0 4****Course Objectives**

- Understand the mathematical models of computation and formal language
- Understand the capability of Turing machines and to design TM for a given language
- Understand the decidability and intractability of computational problems

Course Outcomes (COs)

1. Design the Finite Automata for computable problems.
2. Formulate / Design regular expression for pattern recognition.
3. Develop pushdown automata for language recognition.
4. Analyze the Turing machine for language acceptance.
5. Analyze the undecidability of languages.

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	2	3	2										2		
3	3	2	3										2		
4	3	2	3										2		
5	1	1	1										1		

UNIT I**9 Hours****FINITE AUTOMATA**

Introduction-Basic Mathematical Notation and techniques-Finite State systems-Basic Definitions-Finite Automaton-DFA & NFA- Regular Languages-Regular Expression-Equivalence of NFA and DFA-Equivalence of finite Automaton and regular expressions-Minimization of DFA-Pumping Lemma for Regular sets.

UNIT II**9 Hours****CONTEXT FREE GRAMMAR**

Grammar Introduction-Types of Grammar-Context Free Grammars(CFG) and Languages-Derivations and Languages-Ambiguity-Relationship between derivation and derivation trees -Simplification of CFG-Greibach Normal form-Chomsky normal form.

UNIT III**9 Hours****PUSHDOWN AUTOMATA**

Pushdown Automata-Definitions-Moves-Instantaneous descriptions -Deterministic pushdown automata-Equivalence of Pushdown automata and CFL-pumping lemma for CFL.

UNIT IV**9 Hours****TURING MACHINES**

Definitions of Turing machines-Models-Computable languages and functions-Techniques for Turing machine construction-Multi head and Multi tape Turing Machines-The Halting problem.

UNIT V

9 Hours

UNSOLVABLE PROBLEMS AND COMPUTABLE FUNCTIONS

Unsolvability Problems and Computable Functions-Recursive and recursively enumerable languages-Universal Turing machine. Measuring and Classifying Complexity:-P and NP completeness-Polynomial time reductions.

Total: 45+15=60 Hours

Reference(s)

1. Hopcroft J.E, Motwani R, and Ullman J D, Introduction to Automata Theory, Language and Computations, 3rd Edition, Pearson Education (ISBN 1292039051), 2014.
2. Martin J, Introduction to Languages and the Theory of Computation, 3rd Edition, TMH, 2007.
3. Kamala Krithivasan and Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson education 2009.
4. Peter Linz, An Introduction to Formal Languages and Automata, Fifth edition, 2012.
5. Harry R Lewis and Christos H Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.
6. Mishra K L P and Chandrasekaran N, Theory of Computer Science-Automata, Languages and Computation, Third Edition, Prentice Hall of India, 2004.

22CD502 VISUAL DESIGN AND COMMUNICATION**3 0 0 3****Course Objectives**

- To understand the principles of the visual language and their semantic use.
- To communicate more concisely and in a visually appropriate manner, it is necessary to use commonly understood principles, perspective and design layout standards.
- To understand the fundamentals of Typography and Photography

Course Outcomes (COs)

1. Develop the ability to create visual compositions using basic elements and by applying appropriate principles of visual composition to communicate
2. Develop the ability to perceive, visualize, and communicate visual elements as visual narratives
3. Develop the ability to apply the dynamics of visual design in Typography and Photography.
4. Develop the ability to address simple communication problems through a visualization process and construct mental imageries
5. Demonstrate the ability to plan, develop, design and execute communication products

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	1												2	
3	2	2					3							2	
4	1						3							2	
5	2						3							2	

UNIT I**9 Hours****INTRODUCTION TO VISUAL DESIGN**

Importance of understanding visual language-its relation in context to nature and environment-Exploring and understanding Dots, Lines, Forms, Space, Pattern, Texture and Colour as an elements of visual language

UNIT II**9 Hours****INTRODUCTION TO THE PRINCIPLES OF VISUAL LANGUAGE**

Visual explorations and experiments with Form, Colour, and Space, Texture, in relation to the context and environments-Concepts of harmony, balance, contrast, proportion, order, symmetry, asymmetry, rhythm, tension, juxtaposition, proximity, size, scale, proportion, orientation, alignment, variety, gradation, dominance, subordination, transition etc.

UNIT III**9 Hours****INTRODUCTION TO FUNDAMENTALS OF TYPOGRAPHY**

Introduction to Type and its History-Type as a form and means of communication in our environment-Introduction

to Indian type: Vernacular letter-forms-Classification of types: Typefaces, type families and type designers-Anatomy of the type: x-height, ascenders, descenders, counter, cap-height, baseline, etc-Typographic variables: Kerning, tracking, leading, spacing etc.-Semantics of type: Legibility & readability issues in type and meaning attributed to type. Expressive Typography-Introduction to printing techniques.

UNIT IV**9 Hours****INTRODUCTION TO PHOTOGRAPHY**

Introduction and Orientation: Art and Science of Photography. Drawing out parallels / differences between the

EYE and the CAMERA-Camera: Understanding the various controls on a Digital SLR Camera Features and Details. Shooting Modes. Aperture and Depth of Field. Shutter Speed. Critical Shutter Speeds and Effects-Exposure: Exposure as function of Quantity of Light and Time. Getting used to shooting in Manual Mode and learning to measure light using the cameras built-in exposure meter-Film Speed/Sensor Sensitivity: Understanding the role of sensitivity in Exposure. ISO/ASA and Digital Noise-Lenses: Different Types of Lenses. Classification of Lenses by Focal Lengths. Angle of View. Fixed Focal Length and Zoom Lenses. Close up and Macro Lenses-Light and Color Temperature- Digital Post-Production: Introduction to File-Formats. RAW vs.JPG.

Understanding resolution, resizing and basic image post processing using Photoshop. Exploring the software to visualize and create digital mosaics.

UNIT V**9 Hours****INTRODUCTION TO VIDEOGRAPY**

Concept development-Storyboarding-Video Shooting-Framing, Camera movement etc-Video Editing-Defining communication-Sender, Channel and Receiver-Semiotics-Study of sign process (semiosis), meaning making and meaningful communication. Sign, Signifier, Signified-Denotation and Connotation-Story, narrative and see different perspectives-Identifying problems, opportunities and improvements. Differentiating problem, need and conflict-Persona study-Scenario study

Total: 45 Hours**Reference(s)**

1. Wallschlaeger, Charles, & Busic-Synder, Cynthia, Basic Visual Concepts and Principles for Artists, Architects and Designers, McGraw-Hill, (1992).
2. Buxton, Bill, Sketching User Experience: Getting the Design Right and the Right Design (Interactive Technologies),Morgan Kaufmann, (2007).
3. Caplin, Steve; Banks, Adam,The Complete Guide to Digital Illustration, Publisher: Watson - Guptill Publications, 2003).

22CD503 DESIGN THINKING**3 0 0 3****Course Objectives**

- Understand and compare the important of design thinking
- Identify the steps in the design thinking (DT) process

Course Outcomes (COs)

1. Interpret the importance of design thinking and steps in the DT process
2. Analyze empathize phase of design thinking
3. Compare the different perspectives on personas in the define phase
4. Analyze the ideate phase of design thinking
5. Recognize the importance of the prototype and testing phase in DT

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2		3			1					2	1	2		
2	2		3			1					2	1	2		
3	2		2			1					2	1	2		
4	2		3			1					2	1	2		
5	2		1			1					2	1	2		

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

Introduction-Importance of Design Thinking (DT) -Design Thinking for business-Design Thinking for an Individual-Steps in the DT process- Empathize-Define-Ideate-Prototype-Test.

UNIT II**9 Hours****EMPATHY PHASE**

Empathy Phase:-Steps in the empathize phase of DT-Empathy-What, How, Why-Different types to developing Empathy towards People-Steps required to conduct an immersion activity-How to empathize-Introduction to Immersion Activity-Conducting an immersion activity-DT question template for Immersion activity

UNIT III**9 Hours****DEFINE PHASE**

Creating personas-Steps to create personas in the define phase of DT-Creating your own Persona-Four Different Perspectives on Personas-Goal-directed Personas, Role-Based Personas, Engaging Personas, Fictional Personas-Steps to create your Engaging Personas and Scenarios-Steps to create problem statements in the define phase of DT-Problem statements-Defining problem statements-Problem statements in define phase of DT

UNIT IV**9 Hours****IDEATE PHASE**

How to Ideate-Steps in the ideate phase of DT-Appling the steps in the ideate phase of DT-Ideation games-Six Thinking Hats and Million-dollar idea -Ideate to find solution-Characteristics Required for Successful Ideation-Doodling for expressing ideas-Importance of storytelling in presenting ideas and prototypes-Storytelling in DT

UNIT V

9 Hours

PROTOTYPE AND TESTING PHASE

Importance of the prototype phase in DT-Prototype your idea-Create a prototype-Types of Prototyping-Low-Fidelity Prototyping and High-Fidelity Prototyping-Guidelines for Prototyping-Service value proposition-Creating a value proposition statement-Testing in Design Thinking-Test the Prototype-Role of DT in your work -DT for better coding -Agile and DT complement each other to deliver customer Satisfaction-Satori

Total: 45 Hours

Reference(s)

1. Mauricio Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena and Beatriz Russo, Design Thinking: Business innovation, First Edition,MJV Press, 2014.
2. Mads Soegaard, The Basics of User Experience Design by Interaction Design Foundation, Kindle Edition,2018
3. Nir Eyal, Hooked: How to Build Habit-Forming Products, Kindle Edition, Penguin Publishers,2011
4. Judkins, The Art of Creative Thinking, Kindle Edition, Hachette Book Publishing,2015
5. Dan Senor and Saul Singer, Start Up Nation, , Kindle Edition, Twelve Publishers,2011.
6. Simon Sinek, Start with Why, Kindle Edition, Portfolio Publishers, 2011.

22CD504 ANIMATION AND GRAPHICS**3 0 2 4****Course Objectives**

- Gain knowledge about graphics hardware devices and software used.
- Understand the two and three dimensional graphics and their transformations.
- Appreciate illumination and color models.
- Be familiar with understanding animation techniques.

Course Outcomes (COs)

1. Outline the basics of graphics and graphics software.
2. Design two dimensional graphics and transformations.
3. Design three dimensional graphics and transformations.
4. Demonstrate illumination and color models.
5. Design animation sequences.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	1		2									2	
2	1	2	3		2									2	
3	1	2	3		2									2	
4	1	2	2		2									2	
5	2	2	3		2									2	

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

Survey of computer graphics, Overview of graphics systems-Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software, Output primitives-points and lines, line drawing algorithms, loading the frame buffer, line function, circle and ellipse generating algorithms, Pixel addressing and object geometry, filled area primitives.

UNIT II**9 Hours****TWO DIMENSIONAL GRAPHICS**

Two dimensional geometric transformations-Matrix representations and homogeneous coordinates, composite transformations, Two dimensional viewing-viewing pipeline, viewing coordinate reference frame, window-to-viewport coordinate transformation, Two dimensional viewing functions, clipping operations-point, line, and polygon clipping algorithms.

UNIT III**10 Hours****THREE DIMENSIONAL GRAPHICS**

Three dimensional concepts, Three dimensional object representations-Polygon surfaces-Polygon tables-Plane equations-Polygon meshes, Curved Lines and surfaces, Quadratic surfaces, Blobby objects, Spline representations- Bezier curves and surfaces-B-Spline curves and surfaces. TRANSFORMATION AND VIEWING-Three dimensional geometric and modeling transformations-Translation, Rotation, Scaling, composite transformations, Three dimensional viewing-viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

UNIT IV	7 Hours
ILLUMINATION AND COLOUR MODELS	
Light sources-basic illumination models-half-tone patterns and dithering techniques, Properties of light-Standard primaries and chromaticity diagram, Intuitive colour concepts- RGB colour model- YIQ colour model- CMY colour model- HSV colour model- HLS colour model, Colour selection.	
UNIT V	10 Hours
ANIMATIONS	
ANIMATION GRAPHICS: Design of Animation sequences-animation function-raster animation-key frame systems-motion specification-morphing-tweening-COMPUTER GRAPHICS REALISM: Tiling the plane- Recursively defined curves-Koch curves-C curves-Dragons-space filling curves-fractals-Grammar based models-fractals-turtle graphics-ray tracing.	
1	3 Hours
EXPERIMENT 1	
Study of Fundamental Graphics Functions	
2	3 Hours
EXPERIMENT 2	
Implementation of Line drawing algorithms: DDA Algorithm, Bresenham's Algorithm	
3	3 Hours
EXPERIMENT 3	
Implementation of Circle drawing algorithms: Bresenham's Algorithm, Mid-Point Algorithm	
4	3 Hours
EXPERIMENT 4	
Programs on 2D and 3D transformations	
5	6 Hours
EXPERIMENT 5	
Write a program to implement Cohen Sutherland line clipping algorithm	
6	3 Hours
EXPERIMENT 6	
Write a program to draw Bezier curve	
7	6 Hours
EXPERIMENT 7	
Using Flash/Maya perform different operations (rotation, scaling move etc..) on objects	
8	3 Hours
EXPERIMENT 8	
Create a Bouncing Ball using Key frame animation and Path animation.	
Total: 75 Hours	

Reference(s)

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,Computer Graphics: Principles and Practice, 3rd Edition, Addison-Wesley Professional,2013. (UNIT I, II, III, IV).
2. Donald Hearn and Pauline Baker M, Computer Graphics, Prentice Hall, New Delhi, 2007(UNIT V).
3. Donald Hearn and M. Pauline Baker, Warren arithers, Computer Graphics With Open GL, 4th Edition, Pearson Education, 2010.
4. Jeffrey McConnell, Computer Graphics: Theory into Practice, Jones and Bartlett Publishers,2006.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard,KelvinSung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.

22CD507 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	PSO3
1	1	2	1	1	2			2	2	2			1	1	1
2	1	2	1	1	2			2	2	2			1	1	1
3	1	2	1	1	2			2	2	2	2		1	1	1
4	1	2	1	1	2			2	2	2	2		1	1	1
5	1	2			2			2	2	2			1	1	1

Total: 2 Hours

**22CD601 ARTIFICIAL INTELLIGENCE AND
MACHINE LEARNING**

3 0 2 4

Course Objectives

- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

Course Outcomes (COs)

1. Use appropriate search algorithms for problem solving
2. Apply reasoning under uncertainty
3. Build supervised learning models
4. Build ensembling and unsupervised models
5. Build deep learning neural network models

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	2								2		
2	3	2	2	1	1								2		
3	2	3	3	2	2								2		
4	2	3	3	2	2								2		
5	2	3	3	2	2								2		

UNIT I

9 Hours

PROBLEM SOLVING

Introduction to AI-AI Applications-Problem solving agents-search algorithms-uninformed search strategies-Heuristic search strategies-Local search and optimization problems-adversarial search-constraint satisfaction problems(CSP)

UNIT II

9 Hours

PROBABILISTIC REASONING

Acting under uncertainty-Bayesian inference-naive bayes models-Probabilistic reasoning-Bayesian networks-exact inference in BN-approximate inference in BN-causal networks.

UNIT III

9 Hours

SUPERVISED LEARNING

Introduction to machine learning-Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function-Probabilistic discriminative model-Logistic regression, Probabilistic generative model-Naive Bayes, Maximum margin classifier-Support vector machine, Decision Tree, Random forests

UNIT IV	9 Hours
ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning-bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization	
UNIT V	9 Hours
NEURAL NETWORKS	
Perceptron-Multilayer perceptron, activation functions, network training-gradient descent optimization-stochastic gradient descent, error backpropagation, from shallow networks to deep networks-Unit saturation (aka the vanishing gradient problem)-ReLU, hyperparameter tuning, batch normalization, regularization, dropout.	
1	3 Hours
EXPERIMENT 1	
Implementation of Uninformed search algorithms (BFS, DFS)	
2	3 Hours
EXPERIMENT 2	
Implementation of Informed search algorithms (A*, memory-bounded A*)	
3	2 Hours
EXPERIMENT 3	
Implement naive Bayes models	
4	2 Hours
EXPERIMENT 4	
Implement Bayesian Networks	
5	2 Hours
EXPERIMENT 5	
Build Regression models	
6	2 Hours
EXPERIMENT 6	
Build decision trees and random forests	
7	3 Hours
EXPERIMENT 7	
Build Support vector machine models	
8	3 Hours
EXPERIMENT 8	
Implement ensembling techniques	
9	3 Hours

EXPERIMENT 9

Implement clustering algorithms

10

2 Hours

EXPERIMENT 10

Implement EM for Bayesian networks

11

2 Hours

EXPERIMENT 11

Build simple NN models

12

3 Hours

EXPERIMENT 12

Build deep learning NN models

Total: 75 Hours

Reference(s)

1. Stuart Russell and Peter Norvig, Artificial Intelligence-A Modern Approach, Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Fourth Edition, 2020.
3. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson Education, 2007
4. Kevin Night, Elaine Rich, and Nair B., Artificial Intelligence, McGraw Hill, 2008
5. Patrick H. Winston, Artificial Intelligence, Third Edition, Pearson Education, 2006
6. Deepak Khemani, Artificial Intelligence, Tata McGraw Hill Education, 2013(<http://nptel.ac.in/>)

22CD602 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 analyser and pattern recognition using parsers.
- Familiar with the code generation schemes and optimization methods.

Course Outcomes (COs)

1. Analyse 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 analyse the issues in code generation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		1	1										2		2
2		2	3		1								2		2
3		3	3		1								2		3
4		2	3										3		3
5		2	2										3		3

UNIT I**9 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**9 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

9 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: 45+15=60 Hours

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, 2008
3. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2003.

22CD603 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 be aware of mobile HCI.
- To learn the guidelines for user interface.

Course Outcomes (COs)

1. Understand the foundations of HCI
2. Design effective HCI for individuals and groups using the design rules.
3. Recognize the models and theories used with HCI.
4. Infer the HCI implications for designing multimedia or ecommerce or e-learning Web sites.
5. Develop and design meaningful user interfaces.

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	3										2		
3	2	2											3		
4	2		3										3		
5	2		3										3		

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**

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 (UNIT I, II & III)
2. Brain Fling,Mobile Design and Development,First Edition,OREily Media Inc 2009
3. Bill Scott and Theresa Neil,Designing Web interfaces,First Edition,OREily Media Inc,2009

22CD607 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	PSO3
1	2	2	2										2	2	2
2	2	3	3	3	3								2	2	2
3	3	3	3	3	3						2		3	3	3
4	3	3	3	3	3						2		3	3	3
5	3	3	3	3	3								3	3	3

Total: 2 Hours

22CD701 GAME DESIGN AND DEVELOPMENT**3 1 0 4****Course Objectives**

- To provide an overview of game design and development.
- To provide basics of game programming.

Course Outcomes (COs)

1. Understand the concepts of 3D graphics for Game design and development.
2. Design the processes, and use mechanics for game development.
3. Explain the Core architectures of Game Programming
4. Use Game programming platforms, frame works and engines.
5. Create and develop interactive 2D and 3D Games.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		2		2	2								1	2	2
2		2		2	2								1	2	2
3		3		3	3								1	3	3
4		2		2	2								1	3	3
5		2		2	2								1	3	3

UNIT I**9 Hours****THREE D GRAPHICS FOR GAME PROGRAMMING**

Game-Definition-Genres of games-Basics of Two D and Three D Graphics-Game Objects design-Two D and Three D Transformations-Projections-Colour Models-Illumination and Shader Models-Animation-Controller based Animation

UNIT II**9 Hours****GAME ENGINE DESIGN**

Game engine architecture-Engine support systems-Resources and File systems-Game loop and real-time-simulation-Human Interface devices-Collision and rigid body dynamics-Game profiling

UNIT III**9 Hours****GAME PROGRAMMING**

Application layer-Game logic-Game views-managing memory-controlling the main loop-loading and caching game data-User Interface management-Game event management

UNIT IV**9 Hours****GAMING PLATFORMS AND FRAMEWORKS**

Two D and Three D Game development using Flash-DirectX-Java-Python-Game engines-Unity DX Studio

UNIT V

9 Hours

GAME DEVELOPMENT

Developing TwoD and ThreeD interactive games using DirectX or Python-Isometric and Tile based Games- Puzzle games-Single player games-Multiplayer games

Total: 45+15=60 Hours

Reference(s)

1. Mike Mc Shaffrly and David Graham, Game Coding Complete, Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, Game Engine Architecture, CRC Press and A K Peters, 2009.
3. David H. Eberly, 3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics, 2nd Editions, Morgan Kaufmann, 2006.
4. Ernest Adams and Andrew Rollings, Fundamentals of Game Design, 2nd Edition Prentice Hall and New Riders, 2009.
5. Eric Lengyel, Mathematics for 3D Game Programming and Computer Graphics, 3rd Edition, Course Technology PTR, 2011.
6. Jesse Schell, The Art of Game Design: A book of lenses, 1 st Edition, CRC Press, 2008.

22CD702 MOBILE APPLICATION DESIGN AND DEVELOPMENT

3 0 2 4

Course Objectives

- To Provide an Overview of designing mobile applications.
- To be able to implement and deploy mobile applications.

Course Outcomes (COs)

1. Understand the requirements for mobile applications.
2. Design mobile applications using basic design rules.
3. Design mobile applications using advanced design rules.
4. Use Android to develop mobile applications.
5. Use IOS to develop mobile 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	2
2		2		2	2									2	2
3		3		3	3									3	3
4		2		2	2									3	3
5		2		2	2									3	3

UNIT I

9 Hours

INTRODUCTION

Introduction to mobile applications-Embedded systems-Market and business drivers for mobile applications-Publishing and delivery of mobile applications-Requirements gathering and validation for mobile applications

UNIT II

9 Hours

BASIC DESIGN

Introduction-Basics of embedded systems design-Embedded OS-Design constraints for mobile applications both hardware and software related-Architecting mobile applications-user interfaces for mobile applications-touch events and gestures-Achieving quality constraints-performance-usability-security-availability and modifiability

UNIT III

9 Hours

ADVANCED DESIGN

Designing applications with multimedia and web access capabilities-Integration with GPS and social media networking applications-Accessing applications hosted in a cloud computing environment-Design patterns for mobile applications

UNIT IV	9 Hours
MOBILE APP DEVELOPMENT USING ANDROID	
Introduction-Establishing the development environment-Android architecture-Activities-and views-Interacting with UI-Persisting data using SQLite-Packaging and deployment-Interaction with server side applications-Using Google Maps GPS and Wifi-Integration with social media applications	
UNIT V	9 Hours
MOBILE APP DEVELOPMENT USING IOS	
Introduction to Objective C-iOS features-UI implementation-Touch frameworks-Data persistence using Core Data and SQLite- Location aware applications using Core Location and Map Kit- Integrating calendar and address book with social media application-Using Wifi-iPhone marketplace	
1	6 Hours
EXPERIMENT 1	
Create an activity to display the contact picked by the user	
2	6 Hours
EXPERIMENT 2	
Implement an application that creates an alert message	
3	6 Hours
EXPERIMENT 3	
Establish the communication between activities using Intent	
4	3 Hours
EXPERIMENT 4	
Design an application with Views and ViewGroups to perform user interactions	
5	3 Hours
EXPERIMENT 5	
Implement the various menus for an application	
6	3 Hours
EXPERIMENT 6	
Display number names using Toast message	
7	3 Hours
EXPERIMENT 7	
Develop a simple calculator	
	Total: 75 Hours

Reference(s)

1. <https://developer.android.com/develop/index.html>
2. Jeff McWherter and Scott Gowell, Professional Mobile Application Development, Wrox, 2012
3. Charlie Collins, Michael Galpin and Matthias Kappler, Android in Practice, DreamTech, 2012
4. James Dovey and Ash Furrow, Beginning Objective C, Apress, 2012
5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, Beginning iOS 6 Development: Exploring the iOS SDK, Apress, 2013

22CD707 PROJECT WORK I**0 0 4 2****Course Objectives**

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Express the 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	PSO3
1	2	2	3	3	1	3	3	3	3	3		2	3	3	3
2	2	2	3	3	1	3	3	3	3	3		2	3	3	3
3	2	2	3	3	3	3	3	3	3	3	3	2	3	3	3
4	2	2	3	3	3	3	3	3	3	3	3	2	3	3	3
5	2	2			2	3		3	3	3		2	3	3	3

Total: 4 Hours

22CD801 PROJECT WORK II**0 0 20 10****Course Objectives**

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures
- To identify and learn new tools, algorithms and techniques
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Express the 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	PSO3
1	2	2	3	3	1	3	3	3	3	3		2	3	3	3
2	2	2	3	3	1	3	3	3	3	3		2	3	3	3
3	2	2	3	3	3	3	3	3	3	3	3	2	3	3	3
4	2	2	3	3	3	3	3	3	3	3	3	2	3	3	3
5	2	2	-	-	2	3	-	3	3	3		2	3	3	3

Total: 20 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 forIntermediate 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 Supervisionand 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, GoyalPublishers & Distributers Pvt. Ltd., New Delhi, 2015.
2. Langenscheidt Eurodictionary, German English / English German, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009.
3. Grundkurs, DEUTSCH Lehrbuch Hueber München, 2007.

22HSJ01 JAPANESE**1 0 2 2****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 Publishersand 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 SOUVIRIR 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

22CD001 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	PSO3
1	3	2	3	3	3								2		
2	2	2	2	3	3								2		
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. Knaflic, Cole Nussbaumer. Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons, 2015. (Unit 2)
4. Kazil, 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.

22CD002 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.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- m. PSO:1 Apply the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering problems.

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	PSO3
1	2	2	1	2	1								1		
2	1	2	1	1	1								1		
3	2	3	1	1	1								2		
4	3	2	2	2	1								2		
5	2	2	1	2	1								2		

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.

22CD003 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.

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 the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering problems.

Course Outcomes (COs)

- Understand the big data and use cases from selected business domains.
- Understand NoSQL big data management.
- Utilize map reduce analytics and related tools.
- Understand the basics of Hadoop.
- 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	PSO3
1	2	1	1		1								2		
2	2	2	3		3								2		
3	1	3	3		3								3		
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.

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.

22CD004 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.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- e. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

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	PSO3
1	2	1	1		1									2	
2	2	2	3		3									2	
3	1	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-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative 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.

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 hyperparameters.	
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

22CD005 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- e. 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.
- m. PSO:1 Apply the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering problems.

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	PSO3
1	2	1	1		1								2		
2	2	2	3		3								2		
3	1	3	3		3								2		
4	2	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 Filling.

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.

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.

22CD006 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- m. PSO:1 Apply the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering problems.

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in image processing and computer vision.
2. Implement basic and some advanced image processing techniques in OpenCV.
3. 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	PSO3
1	3	1	1	1									2		
2	3	3	3	2									2		
3	3	3	2	2									2		
4	2	3	3	2									2		
5	2	3	3	2									2		

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 **8 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 **10 Hours**

FEATURE-BASED ALIGNMENT

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 albedosos.

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.

22CD007 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.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- e. 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.
- l. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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	PSO3
1	1		2									2			2
2	2	2	2												2
3	1		2		2							2			2
4	1		2		2							2			2
5	1		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-Earl ÅCEÅ³s 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.

22CD008 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 design process and methodology.
- Learning the Importance and scope of Interaction design, User centered design

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- e. 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.
- m. PSO:1 Apply the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering problems.

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	PSO3
1	1												1		
2	1	2	2		1								2		
3		3	3		1								2		
4		2	2										1		
5		2	2										1		

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

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.
2. Wilbent. O. Galitz ,The Essential Guide To User Interface Design, John Wiley&Sons, 2001.
3. Alan Cooper,The Essential Of User Interface Design, Wiley Dream Tech Ltd.,2002.
4. Baecker, Ronald M., Jonathan Grudin, et al. Readings in Human-Computer Interaction: Toward the Year 2000.
5. Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed. Addison Wesley, 2004.

22CD009 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- e. 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.
- i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- j. 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.
- m. PSO:1 Apply the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering problems.

Course Outcomes (COs)

1. Apply modules and components and Animations for creating Forms and developing web pages
2. Create web applications by performing CRUD operations in database using web frameworks
3. Design Progressive Web Application with dynamic HTML web pages using Angular.
4. Designing single page applications with reusable UI components using React CSS and SaaS
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	PSO3
1	1		2		2				2	2			2		
2	1		1		3				2	2			3		
3	1		2		2				2	2			3		
4	1		1		3				2	2			2		
5	1		1		3				1	1			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-Ng Modules-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 EventEmitter-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, Vasam 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

22CD010 WEB APPLICATION AND SECURITY

3 0 0 3

Course Objectives

- Understand the fundamentals of web application security.
- Focus on wide aspects of secure development and deployment of web applications.
- Get an insight about Secure website design.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

Course Outcomes (COs)

1. Summarize the basic concepts of web application security and the need for it
2. Explain the process for secure development and deployment of web applications.
3. Illustrate the development of Secure Web Applications using Secure APIs.
4. Analyze the importance of web application vulnerabilities and penetration testing.
5. Compare hacking techniques and tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1			1										2
2	2	2			3										2
3	2	3			3										3
4	2	3			3										3
5	2	3			3										3

UNIT I

9 Hours

INTRODUCTION

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

9 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 **9 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 **9 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 **9 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.

Total: 45 Hours

Reference(s)

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, OReilly Media, Inc.
2. Roger S. Pressman, David Lowe, Web Engineering, Tata McGraw Hill Publication, 2007.
3. Guy W. Lecky-Thompson, Web Programming, Cengage Learning, 2008.
4. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginners Guide. McGraw Hill Professional, 2012.
5. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hackers Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011
6. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA

22CD011 SOFTWARE TESTING AND AUTOMATION

3 0 0 3

Course Objectives

- 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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	PSO3
1	3	2	1		1										1
2	2	3	2		2										1
3	2	2	2		2										1
4	2	3	2		3										2
5	3	2	1		3										2

UNIT I

9 Hours

INTRODUCTION

Basic definitions-Software Testing Principles-The Testers Role in a Software Development Organization-Origins of Defects-Cost of Defects-Defect Classes-The Defect Repository and Test Design-Defect Examples-Developer or 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

Reference(s)

1. Srinivasan Desikan and Gopaldaswamy Ramesh, Software Testing Principles and Practices, Pearson Education, 2006.
2. Ron Patton, Software Testing, Second Edition, Sams Publishing, Pearson Education,2007.
3. Ilene Burnstein, Practical Software Testing, Springer International Edition, 2003.
4. Edward Kit,Software Testing in the Real World Improving the Process, Pearson Education, 1995.
5. Boris Beizer,Software Testing Techniques 2nd Edition, Van Nostrand Reinhold, New York, 1990.
6. Aditya P. Mathur, Foundations of Software Testing Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

22CD012 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- m. PSO:1 Apply the skill of Design and Creative thinking to provide digital solutions to modern and complex engineering 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	PSO3
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

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 & 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 or 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

Reference(s)

1. Hands-On Azure DevOps: Cid 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/>

**22CD013 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.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- c. 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.
- d. 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.
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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	PSO3
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

9 Hours

UNDERSTANDING VIRTUALIZATION

Describing Virtualization-Microsoft Windows Drives Server Growth-Explaining Moores 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-CPU's 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

Understanding Configuration Options-Installing Windows on a Virtual Machine-Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions-Managing CPU's 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

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.aspx>
6. <https://www.oreilly.com/library/view/cloud-security-and/9780596806453/ch04.html>

**22CD014 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
- Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and OpenStack
- 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

Course Outcomes (COs)

1. 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	PSO3
1	3	3	1	1	1										2
2	3	1	2	3	2										2
3	1	1	3	1	3										2
4	1	1	1	2	3										2
5	1	3	3	2	2										2

UNIT I **9 Hours**

CLOUD COMPUTING REFERENCE ARCHITECTURE (CCRA)

Introduction to Cloud Computing Reference Architecture (CCRA), Benefits of CCRA, Architecture and 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, Oreilly, SPD, 2011

22CD015 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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	PSO3
1	1	2	1	3	3										2
2	3	1	2	3	3										2
3	1	1	3	2	2										2
4	3	2	1	2	2										2
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

Cloud Backup: Strategies and Architecture, Data Deduplication and Compression, Security - Cloud Archive: Strategies and Architecture, Replication for Data Redundancy: Synchronous and asynchronous replication methods - Disaster Recovery in the Cloud - Hybrid Backup and Archiving in Cloud Environments - Backup and Archive Management in Cloud Environments

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) 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 Computing, Tata Mcgraw Hill, 2013.
4. Rittinghouse, John W., and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

22CD016 CLOUD AUTOMATION TOOLS AND APPLICATIONS

3 0 0 3

Course Objectives

- Learn the options for running automation tools, and load balancers in the cloud-native applications.
- Learn the configuration management in the cloud.
- Know the importance of cloud automation.
- Learn what types of cloud automation tools can be used.
- Learn load balancing and auto scaling in the cloud.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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	PSO3
1	2		2	1	3										2
2		2			3										2
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 Cloud Formation-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 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.

22CD017 SOFTWARE DEFINED NETWORKS

2 0 2 3

Course Objectives

- Understand the need for SDN and its data plane operations
- Understand the functions of control plane
- Comprehend the migration of networking functions to SDN environment
- Explore various techniques of network function virtualization
- Comprehend the concepts behind network virtualization

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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	PSO3
1	1	2	3	1	3										2
2	2	1	2	2	3										2
3	2	2	2	3	3										2
4	2	2	2	3	1										2
5	3	3	1	1	3										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 Date 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, OpenDaylight, ONOS-Distributed Controllers.

UNIT III **6 Hours**

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:
Premises Equipment, Virtual Evolved Packet Core, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV.

1 **5 Hours**

EXPERIMENT 1

Setup your own virtual SDN lab

- i) Virtualbox/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: 59 Hours

Reference(s)

1. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design, 1 st 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 nd Edition, OReilly Media, 2017.
4. Paul Goransson, Chuck Black Timothy Culver, Software Defined Networks: A Comprehensive Approach, 2 nd Edition, Morgan Kaufmann Press, 2016.
5. Thomas D Nadeau, Ken Gray, SDN: Software Defined Networks, OReilly Media, 2013.
6. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud, Pearson Education, 1 st Edition, 2015.

22CD018 SECURITY AND PRIVACY IN CLOUD**3 0 0 3****Course Objectives**

- Introduce Cloud Computing terminology, definition & concepts
- Understand the security design and architectural considerations for Cloud
- Understand the Identity, Access control in Cloud
- Follow best practices for Cloud security using various design patterns
- Able to monitor and audit cloud applications for security

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.
- 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.
- 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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	PSO3
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.

22CD019 MULTIMEDIA AND ANIMATION

2 0 2 3

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.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

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 target multimedia 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	PSO3
1	2	2	1		2									2	
2	2	2	2	2	2									3	
3	3													2	
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 AUTHORIZING

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

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

Total: 60 Hours

Reference(s)

1. Ze-Nian Li, Mark S. Drew, Jianguan Liu, Fundamentals of Multimedia, Third Edition, Springer Texts in Computer Science, 2021.
2. Maraffi, Chris, Maya Character Creation: Modeling and Animation Controls. New Riders, 2008.
3. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
4. Rogers David, Animation: Master A Complete Guide (Graphics Series), Charles River Media, 2006.
5. Rick parent, Computer Animation: Algorithms and Techniques, Morgan Kauffman, 3rd Edition, 2012.

22CD020 AUGMENTED REALITY AND 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.

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.
- PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

- Analyze the tools and technologies related to AR/VR.
- Design various models using modeling techniques.
- Apply programming concepts and techniques specific to VR development, including 3D graphics.
- Develop AR/VR applications in different domains.
- 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	PSO3
1	2	2	2		2									2	
2	2	2	2		2									2	
3	3	3	3		3									3	
4	3	3	3		3									3	
5	3	3	3		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 walkthroughs and visualization of historic places.

9

3 Hours

EXPERIMENT 9

Develop AR enabled simple applications like human anatomy, DNA/RNA structure visualization and surgery simulation

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.

22CD021 DIGITAL AUDIO AND VIDEO DESIGN

3 0 0 3

Course Objectives

- Introduce the fundamental principles of Audio processing.
- Provide an overview of Audio enhancement and Audio compression techniques
- Review latest trends and future technologies in Audio processing.
- Introduce the fundamental concepts of Video processing and video coding.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- c. 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.
- f. 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.
- k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

1. Describe the basics of digital audio.
2. Identify the sound synthesis in music and the principles of MIDI.
3. Analyze the principles of stereo and surround sound.
4. Explain the fundamentals of video and its standards.
5. Illustrate the process of video coding and compression.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3		1			1					1	1		3	
2	2		2			3					3	3		3	
3	2		2			2					3	3		3	
4	2		2			2					3	3		3	
5	2		3			3					3	3		3	

UNIT I

9 Hours

DIGITAL AUDIO

Basics of Digital Audio - Digitization of Sound- Auditory Perception - Sampling, Normalization, Noise

Reduction and Visualization. Digital and Analog audio Recording, A/D and D/A Converter, Pitch Shifting and Time Stretching, Audio Data Reduction.

UNIT II **9 Hours**

MUSICAL SOUND SYNTHESIS AND MIDI

Acoustic Instruments, Sound Synthesis in Music, MIDI Principles - Hardware aspects, Structure of MIDI

Messages, General MIDI, MIDI-to-Wav Conversion.

UNIT III **9 Hours**

STEREO AND SURROUND SOUND

Two-Channel Stereo - Principles of Loudspeaker and Microphone, Stereo and Loudspeaker Stereo, Two-Channel Signal Formats and Microphone techniques, Binaural Recording and Dummy Head Techniques, Surround Sound - Three Channel Stereo, Four Channel Surround, 5.1 Channel Surround, and other Multichannel Configurations. Surround Sound Systems, Matrix Surround Sound Systems, Dolby Digital, DTS, Ambisonics.

UNIT IV **9 Hours**

VIDEO FUNDAMENTALS

Basic concepts and Terminology-Analog video standards-Digital video basics-Analog to Digital conversion-Color representation and chroma subsampling-Digital video formats and standards-Changing Video sampling rate and standards.

UNIT V **9 Hours**

MPEG VIDEO CODING

Basic Video coding and Audio Compression Techniques-Motion Detection-MPEG Video and audio Compression-Real-time video compression.

Total: 45 Hours

Reference(s)

1. Francis Rumsey & Tim McCormick Sound and Recording, Sixth Edition, 2009, Focal Press,Elsevier Ltd.
2. Ian Mcloughlin Applied Speech and Audio Processing with MATLAB Examples Cambridge University Press, Cambridge, New York, 2009.
3. Oges Marques, Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press, 2011.

22CD022 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.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- e. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

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	PSO3
1	3	3	3		3									3	
2	2	2	2		2									2	
3	2	2	2		2									2	
4	2	2	2		2									2	
5	2	2	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

5 **4 Hours**

EXPERIMENT 5

Production: Single camera production personnel

6 **3 Hours**

EXPERIMENT 6

Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching

7 **4 Hours**

EXPERIMENT 7

Write Documentary

8 **5 Hours**

EXPERIMENT 8

Post-production: Editing, Sound design, Finishing

Total: 60 Hours

Reference(s)

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw Hill 2003.

22CD023 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

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- e. 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.
- o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

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 digital Marketing 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	PSO3
1	2	1	1		1										2
2	2	2	3		3										2
3	1	3	3		3										3
4	2	2	2		3										3
5	2	2	1		3										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; First edition (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,first edition, Que Biz-Tech series2012.
5. Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice, Paperback - Import, 2012.

22CD024 HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS

3 0 0 3

Course Objectives

- To provide knowledge about management issues related to staffing, training, performance, compensation, human factors consideration and compliance with human resource requirements.
- To gain knowledge needed for success as a human resource professional.
- To develop the skills needed for a successful HR manager
- To implement the concepts learned in the workplace.

Programme Outcomes (POs)

k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

Course Outcomes (COs)

1. Gain knowledge on the various aspects of HRM
2. Gain knowledge needed for success as a human resources professional.
3. Develop the skills needed for a successful HR manager
4. Prepared to implement the concepts learned in the workplace.
5. Aware of the emerging concepts in the field of HRM

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
3											3				3
4											3				3
5											3				3

UNIT I

9 Hours

PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT

Evolution of human resource management-The importance of the human capital-Role of human resource manager-Challenges for human resource managers-trends in Human resource-Computer applications in human resource management-Human resource accounting

UNIT II

9 Hours

HUMAN RESOURCE PLANNING AND RECRUITMENT

Importance of Human Resource Planning-Forecasting human resource requirement-matching supply and demand-Internal and External sources-Organizational Attraction-Recruitment, Selection, Induction and Socialization- Theories, Methods and Process

UNIT III **9 Hours**

TRAINING AND DEVELOPMENT

Types of training methods-purpose-benefits-resistance. Executive development programme-Common Practices-Benefits-Self Development-Knowledge management

UNIT IV **9 Hours**

EMPLOYEE ENGAGEMENT

Compensation plan-Reward-Motivation-Application of theories of motivation -Career management-Mentoring-Development of mentor-Protege relationships- Job Satisfaction, Employee Engagement, Organizational Citizenship Behaviour-Theories, Models

UNIT V **9 Hours**

PERFORMANCE EVALUATION AND CONTROL

Method of performance evaluation-Feedback-Industry practices. Promotion, Demotion, Transfer and Separation-Implication of job change. The control process-Importance-Methods-Requirement of effective control systems grievances-causes-implications-Redressal methods

Total: 45 Hours

Reference(s)

1. Dessler Human Resource Management, Pearson Education Limited, 14th Edition, 2015.
2. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012
3. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8th edition 2012.
4. Wayne Cascio, Managing Human Resource, McGraw Hill, 2007.
5. Ivancevich, Human Resource Management, McGraw Hill 2012.

22CD025 SUPPLY CHAIN MANAGEMENT

3 0 0 3

Course Objectives

- Comprehensive understanding of the different components of a supply chain.
- Apply supply chain management principles to improve the efficiency and effectiveness of a business.
- Develop students critical thinking and problem-solving skills.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Course Outcomes (COs)

1. Understand the key concepts of supply chain management.
2. Develop a supply chain strategy to achieve strategic goals.
3. Plan the supply chain to identify key stakeholders.
4. Implement the supply chain plan.
5. Analyze supply chain performance and develop a supply chain culture.

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
3	3														3
4	3														3
5	3														3

UNIT I

9 Hours

SUPPLY CHAIN STRATEGY

Understanding Supply Chain : Objectives, Importance, Decision Phases, Process Views- Supply Chain Strategies: Competitive And Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Challenges-Supply Chain Drivers And Metrics :Financial Measures, Drivers of Supply Chain Performance, Framework For Structuring Drivers

UNIT II

9 Hours

SUPPLY CHAIN NETWORK DESIGN

Role of Distribution In Supply Chain-Factors Influencing Distribution Network Design-Design Options For Distribution Network-Role Of Network Design In The Supply Chain-Factors Influencing Network Design Decisions-Framework For Network Design Decisions-Models For Facility Location And Capacity Location-Impact Of Globalization On Supply Chain Networks

UNIT III

9 Hours

DEMAND SUPPLY PLANNING

Demand Forecasting In Supply Chain : Role Of Forecasting In Supply Chain, Characteristics of Forecasts-Forecasting Methods-Role Of IT In Forecasting-Aggregate Planning In The

Supply Chain : Role-Characteristics-Aggregate Planning-Role of IT In Aggregate Planning-Sales And Operation Planning-Coordination In Supply Chain

UNIT IV

9 Hours

INVENTORY MANAGEMENT

Role of cycle inventory-estimating cycle inventory-short term discounting-managing multi echelon cycle inventory-role of safety inventory-impacts on safety inventory-managing safety inventory in multi echelon supply chain- role of it in inventory management-estimating and managing safety inventory-Product Availability-Transportation

UNIT V

9 Hours

CROSS FUNCTIONAL SCM

Source Decisions: Role-Sourcing-Logistics Providers and Suppliers-Pricing And Revenue Management: Role-Usage-Information Technology In Management : Role-Supply chain IT Framework-Customer/Supplier Relationship management-Sustainability And The Supply Chain : Role-Keymetrics-Sustainability And Supply Chain Drivers-closed loop supply chain

Total: 45 Hours

Reference(s)

1. Supply Chain Management: Strategy, Planning, and Operation, Global Edition, 7th edition, Pearson,2020.
2. Supply Chain Management Strategy, Planning, and Operation, Global Edition Sunil Chopra,2019
3. Logistics and Supply Chain Management: Systems mechanism within the Globe and Direct Delivery for effective globalization, creatspace self publisher; 4th edition , 2018
4. Handbook of Research on Global Supply Chain Management

22CD026 SOCIAL TEXT AND MEDIA ANALYTICS

3 0 0 3

Course Objectives

- Understand the basic ideas of Text mining.
- Analyze the methods and approaches used in analytics.
- Gain knowledge on various types of analytics like web, social network, and social media.

Programme Outcomes (POs)

k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

o. PSO:3 Acquire knowledge in diverse areas of Computer Science and Design to promote skills essential for career, entrepreneurship and higher studies.

Course Outcomes (COs)

1. Demonstrate the concepts and applications of text mining
2. Explain Content analysis and Sentiment analysis
3. Illustrate web analytics with a suitable model
4. Illustrate social network analytics with suitable example.
5. Illustrate social media analytics with suitable example.

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
3											3				3
4											3				3
5											3				3

UNIT I

8 Hours

TEXT MINING

Introduction, Core text mining operations, Preprocessing techniques, Categorization, Clustering, Information extraction, Probabilistic models for information extraction, Text mining applications.

UNIT II

9 Hours

METHODS

Content Analysis-Natural Language Processing-Clustering & Topic Detection-Simple Predictive Modelling-Sentiment Analysis; Sentiment Prediction.

UNIT III

9 Hours

WEB ANALYTICS

Web analytics tools-Clickstream analysis-A/B testing, online surveys-Web search and retrieval-Search engine optimization-Web crawling and Indexing-Ranking algorithms-Web traffic models.

UNIT IV

10 Hours

SOCIAL NETWORK ANALYTICS

Social contexts: Affiliation and identity - Social network analysis - Social network and web data and methods. Graphs and Matrices - Basic measures for individuals and networks.

UNIT V

9 Hours

SOCIAL MEDIA ANALYTICS

Information visualization - Making connections: Link analysis - Random graphs and network evolution.

Total: 45 Hours

Reference(s)

1. Ronen Feldman and James Sanger, *The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data*, Cambridge University Press, 2006.
2. Hansen, Derek, Ben Shneiderman, Marc Smith. *Analyzing Social Media Networks with NodeXL: Insights from a Connected World*, Morgan Kaufmann, 2011.
3. Avinash Kaushik. *Web Analytics 2.0: The Art of Online Accountability*, 2009.
4. Hanneman, Robert and Mark Riddle. *Introduction to Social Network Method*, 2005.
5. Wasserman, S. & Faust, K. *Social network analysis: Methods and applications*. New York: Cambridge University Press, 1994.
6. Monge, P. R. & Contractor, N. S. *Theories of communication networks*. New York: Oxford University, 2003.

22CD027 FINANCIAL MANAGEMENT

3 0 0 3

Course Objectives

- Understand basics of Financial Management and Time Value of Money
- Analyze the Securities Value and its Risk & Return
- Analyze the Long-Term and Short-Term Investment Decisions

Course Outcomes (COs)

1. Able to perform the basic Financial Functions and apply the concept of Time Value of Money while taking the Financial Decisions
2. Perform the Security Valuation and construct the Portfolio for given level and risk and expected rate of return
3. Manage the risk using Operating and Financial Leverages and calculate the Cost of Capital
4. Able to apply appropriate Capital Budgeting Techniques while taking Investment Decision
5. Ensure the short-term liquidity by appropriately managing the Working Capital

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
3											3				3
4											3				3
5											3				3

UNIT I

9 Hours

INTRODUCTION

Introduction to Financial Management-Goals of the firm-Financial Environments. VALUE OF MONEY: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

UNIT II

9 Hours

VALUATION OF SECURITIES

Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. RISK AND RETURN: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, the Capital Asset Pricing Model (CAPM)

UNIT III

9 Hours

OPERATING AND FINANCIAL LEVERAGE

Operating Leverage, Financial Leverage, Total Leverage, and Indifference Analysis in leverage study. COST OF CAPITAL: Concept, Computation of Specific Cost of Capital for Equity, Preference-Debt, Weighted Average Cost of Capital, Factors affecting Cost of Capital 4L

UNIT IV

9 Hours

CAPITAL BUDGETING

The Capital Budgeting Concept & Process-An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection-Alternative Methods

UNIT V

9 Hours

WORKING CAPITAL MANAGEMENT

Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term-Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital. CASH MANAGEMENT: Motives for holding cash, speeding up Cash Receipts, slowing down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, and Factoring. ACCOUNTS RECEIVABLE MANAGEMENT: Credit and Collection Policies, Analysing the Credit Applicant, Credit References, Selecting optimum Credit period

Total: 45 Hours

Reference(s)

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill.
2. Srivastava, Misra: Financial Management, OUP
3. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.

**22CD028 MARKETING RESEARCH AND
MANAGEMENT**

3 0 0 3

Course Objectives

- To gain insight on fundamental concepts of marketing
- Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world
- Impart knowledge about the principles of marketing research

Programme Outcomes (POs)

c. 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.

d. 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.

f. 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.

g. 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.

n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the concepts and core concepts of Marketing
2. Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world
3. Leverage marketing concepts for effective decision making
4. Understand the basic concepts , principles, statistical tools of marketing research
5. Execute various strategies of Internet Marketing

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											2
4				3			2								2
5			2				2								2

UNIT I **9 Hours**

MARKETING CONCEPTS AND APPLICATIONS

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services,

Importance of marketing in service sector-Marketing Planning & Environment: Elements of Marketing

Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social- Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior- Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

UNIT II **9 Hours**

MARKETING MIX

MARKETING

MIX

Concept, elements, 7 Ps of marketing-Product Management: Product decision and strategies, Packaging,

Product Life cycle concept, New Product development & strategy, Stages in New Product development,

Branding.

UNIT III **9 Hours**

MARKETING RESEARCH

Introduction, type of Market Research, Scope, Objectives and Limitations Marketing Research Techniques, Survey Questionnaire design and drafting, Pricing Research, Media Research, qualitative Research. Data analysis- Use of various statistical tools, descriptive and inference statistics, statistical hypothesis testing, multivariate analysis, discriminant analysis, cluster analysis, segmenting and positioning, factor analysis

UNIT IV **9 Hours**

INTERNET MARKETING

Business to Business Marketing-Fundamental of business markets, Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

UNIT V **9 Hours**

INTERNET MARKETING

Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and

Planning for Internet Marketing

FOR FURTHER READING

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Business to Business marketing strategy Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management.

Total: 45 Hours

Reference(s)

1. Rajan Saxena , Marketing Management, McGraw Hill Education, 6th edition, 2019
2. S.A. Sherlekar, Marketing Management, Himalaya Publishing House, 2014
3. Research for Marketing Decisions by Paul Green, Donald, Tull

4. Business Statistics, A First Course, David M Levine et al, Pearson Publication
5. Marketing Management , Philip Kotler
6. Service Marketing , S.M. Zha

22CD029 MULTIMEDIA DATA COMPRESSION

3 0 0 3

Course Objectives

- Acquire knowledge basics of compression techniques.
- Understand the categories of compression for Data.
- Explore the modalities of image and video compression algorithms.
- Understand basics of consistency of data availability in storage devices.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- c. 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.
- e. 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.
- f. 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.
- k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

1. Describe the importance of multimedia compression and compare the various compression algorithms.
2. Illustrate the applications of various Data compressions techniques
3. Compare various compression algorithms for Image and Video compression.
4. Analyze the various audio compression techniques.
5. Design and develop multimedia application in various domains.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3		1			1					1	1		1	
2	2		3			3					2	2		2	
3	2		2			3					2	2		2	
4	2		2			3					3	3		3	
5	2		3		-	3					3	3		3	

UNIT I **9 Hours**

INTRODUCTION TO MULTIMEDIA COMPRESSION

Multimedia-Special features of multimedia-Graphics, Image and Video representations-Fundamental concepts of video, digital audio-Need for compression-Taxonomy of compression Algorithms- Error Free Compression-Lossy Compression.

UNIT II **9 Hours**

DATA COMPRESSION

Introduction-Lossless and Lossy Compression-Basics of Huffman coding-Arithmetic coding-Dictionary techniques-Context based compression-Applications

UNIT III **9 Hours**

IMAGE AND VIDEO COMPRESSION

Image Compression: Lossless Image compression-JPEG-CALIC-JPEG LS-Prediction using conditional averages-Progressive Image Transmission-Lossless Image compression formats-Applications- Facsimile encoding. Video Compression: Introduction-Motion Compensation-Video Signal Representation-H.261-MPEG-1-MPEG-2-H.263.

UNIT IV **9 Hours**

AUDIO COMPRESSION

Audio compression-DPCM-Adaptive PCM-adaptive predictive coding-linear Predictive coding code excited LPC-perpetual coding. Audio compression Techniques- $\frac{1}{4}$ Law and A Law companding-Speech compression-Frequency domain and filtering- Basic sub band coding-Application to speech coding-G.722-Application to audio coding-MPEG audio

UNIT V **9 Hours**

MULTIMEDIA COMMUNICATION

Tele Services-Implementation of Conversational Services, Messaging Services, Retrieval Services, Tele Action Services, Tele Operation Services-Media Consumption-Media Entertainment-Virtual Reality-Interactive Audio-Interactive Video-Games.

Total: 45 Hours

Reference(s)

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008.
3. David Salomon, A concise introduction to data compression, 2008.
4. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor & Francis, 2019
5. Ralf Steinmetz, Klara Nahrstedt, Multimedia computing, communications, and applications, Pearson India, 2009.
6. Ranjan Parekh, Principles of Multimedia, Second Edition, McGraw Hill Education, 2017.

22CD030 STREAMING MEDIA TOOLS AND TECHNIQUES

2023

Course Objectives

- Understand the basics of Audio and Video Streaming
- Understand the basics of Streaming media
- Familiar with Streaming Technologies and tools

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- l. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

1. Understand the basics of Audio and Video Streaming
2. Develop Streaming media Applications
3. Implement applications using streaming technologies.
4. Demonstrate the use of streaming stages and tools
5. Analyze streaming services

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	1	1							1		2	
2	3	2	1	1	1							1		2	
3	3	2	2	1	2							1		3	
4	3	2	2	1	2							1		3	
5	3	3	1	2	2							1		3	

UNIT I

6 Hours

BASICS OF AUDIO AND VIDEO STREAMING

Introduction-IP Networks-World Wide Web-Video formats-Video compression-Audio compression

UNIT II BASICS OF STREAMING MEDIA Introduction to streaming media-Video streaming-Audio Streaming-Stream serving-Live web casting-Media Players	6 Hours
UNIT III STREAMING TECHNOLOGIES AND APPLICATIONS Associated Technologies and Applications-Rights Management-Content Distribution-Applications of Streaming Media	6 Hours
UNIT IV STREAMING STAGES AND TOOLS Broadcasting Area-setting up your home studio-Preparing stage-starting your first video broadcast-Top live streaming third party apps : vMix v.2x-OBS studio-FFSplit-VidBalsterX-Xsplit-ManyCam-Wirecast v.7 studio	6 Hours
UNIT V STREAMING SERVICES Software as a Service websites-Top 7 live streaming websites: Light stream-Smiletime-BlueJeans-Belive Tv-Vidpresso Live-Zoom webinar addon-Crowdcast	6 Hours
1 EXPERIMENT 1 Use any popular open source tool like HandBrake to compress, modify format and other attributes of audio and video.	4 Hours
2 EXPERIMENT 2 Set up a DLNA service for streaming media from windows 10	4 Hours
3 EXPERIMENT 3 Implement media casting using Google Cast SDK on TV like device	4 Hours
4 EXPERIMENT 4 Setup streaming media servers using open sources tools like kodi, Stremio etc.,	4 Hours
5 EXPERIMENT 5 Use any Screen Capture software tools like OBS studio, FFSplit etc., to create live video streaming and broadcasting.	4 Hours
6 EXPERIMENT 6 Create simple live webcast	5 Hours
7 EXPERIMENT 7	5 Hours

Create an example tutorial content by combining the tutor with screen capture using any of the tools and make them available for streaming

Total: 60 Hours

Reference(s)

1. David Austerberry, The Technology of Audio and Video Streaming, Second Edition, Taylor and Francis 2013.
2. Lenald Best, Bests Guide to Live Stream Video Broadcasting, BCB Live Teaching series,2017.
3. Helen M Heneveld Audio, Video and Streaming Media Technologies, Smart Home and office technologies, 2018.
4. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor & Francis,2019
5. Tay Vaughan, Multimedia: Making it Work, McGraw Hill Education, Ninth Edition, 2017.

22CD031 METAVERSE

2023

Course Objectives

- Understand the History of Metaverse.
- Explore the role of Metaverse to connect the real world and blockchain.
- Understand the advanced development of blockchain in the future.
- Study an open ecosystem of smart properties and assets.
- Explore the integration of futuristic technologies such as blockchain, crypto currency,DAO, AR/VR

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- c. 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.
- d. 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.
- e. 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.
- l. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

1. Understand the History of Metaverse.
2. Summarize the technologies involved in metaverse.
3. Illustrate the adoption of blockchain by metaverse.
4. Implement the applications of AR,VR and MR in metaverse.
5. Analyze some use cases of metaverse.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2							1		3	
2	3	3	3	3	2							2		3	
3	3	3	3	3	2							2		3	
4	3	3	3	3	2							3		3	
5	3	3	3	3	2							3		3	

UNIT I **6 Hours**

INTRODUCTION TO METAVERSE

Introduction to metaverse and immersive experience-History of metaverse-Metaverse value chain with 7 layer.

UNIT II **6 Hours**

TECHNOLOGIES INVOLVED IN THE METAVERSE

Metaverse as a product of Extended Reality- Augmented Reality (AR)- Virtual Reality (VR)- Benefits of AR/VR-Difference between AR/ VR - Mixed Reality (MR)-Artificial Intelligence (AI)- Introduction in Metaverse-Financial and Economics of Metaverse-Benefits of Metaverse.

UNIT III **6 Hours**

BLOCKCHAIN ADOPTION IN METAVERSE

Blockchain Overview-History of Blockchain-Need of Decentralization in MV-Smart Contract Capabilities in

Blockchain - Blockchain in Metaverse -Understanding Tokens-Understanding the NFT-NFT Token Standards-
NFTs in MV-Cryptocurrency in MV.

UNIT IV **6 Hours**

AR, VR, AND MR IN METAVERSE

Everything about VR (Virtual Reality)-Everything about AR (Augmented Reality)-Everything about MR (Mixed Reality)-Block chain Identity Management in Metaverse -NFT (non-fungible token) for Metaverse-Introduction to NFTs-History of NFTs-Benefits of NFTs.

UNIT V **6 Hours**

USE-CASES

Gaming in Metaverse-Meetings in Metaverse-Virtual Learning in Metaverse-Social Interactions in Metaverse-Virtual Real-estate in Metaverse-e-commerce in Metaverse-Travel in Metaverse-Personalized Avatars-Digital Identity in Metaverse.

1 **6 Hours**

EXPERIMENT 1

Installations:

Hardware Required: Android phone, Cardboard Viewer, PC with Dedicated Graphics Card and atleast 32GB RAM.

Software required: Android Studio, Cardboard SDK, Android NDK, Google Carboard XR plugin for Unity, Unity, Nethereum library to (as needed)

2 **6 Hours**

EXPERIMENT 2

Using Google Cardboard SDK for Creating simple AR/VR (XR) applications in Unity

3 **6 Hours**

EXPERIMENT 3

Creating blockchain applications in metaverse, by creating virtual assets, smart Contracts for exchange of assets using utility tokens and NFTs.

4

6 Hours

EXPERIMENT 4

Create any Metaverse based application for an educational institution.

5

6 Hours

EXPERIMENT 5

Create any Metaverse based application for a healthcare application.

Total: 60 Hours

Reference(s)

1. The Metaverse: And How It Will Revolutionize Everything Kindle Edition by Matthew Ball , Publisher : Liveright ,2022
2. The Metaverse Handbook: Innovating for the Internets Next Tectonic Shift Kindle Edition by QuHarrison Terry (Author), Scott Keeney (Author), Paris Hilton (Foreword), Publisher: Wiley; 1st edition ,2022
3. Metaverse Made Easy: A Beginner"s Guide to the Metaverse, Dr.Liew Voon Kiong,Publisher, Liew Voon Kiong, 2022
4. Metaverse For Beginners and Advanced: A Complete Journey Into the Metaverse Virtual World (Web 3.0), Darell Freeman,Publisher Darell Freeman,2022
5. Metaverse Glossary - Your Gateway to the Future , Ravindra Dastikop, Evincepub Publishing,2022
6. The Metaverse: Prepare Now for the Next Big Thing Paperback ,Terry Winters , Winters media Publications 2021

22CD032 IMAGE AND VIDEO ANALYTICS**3 0 0 3****Course Objectives**

- Understand the basics of image processing techniques for computer vision.
- Learn the techniques used for image pre-processing.
- Discuss the various object detection techniques.
- Understand the various Object recognition mechanisms.
- Elaborate on the video analytics techniques.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- c. 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.
- f. 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.
- k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

1. Interpret the importance of multimedia compression and compare the various compression algorithms.
2. Illustrate the applications of various Data compressions techniques
3. Compare various compression algorithms for Image and Video compression.
4. Analyze the Multimedia storage on disks.
5. Examine multimedia application in various domains.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3		1			1					1	1		3	
2	2		3			3					2	2		3	
3	2		2			3					2	2		3	
4	2		2			3					3	3		3	
5	2		3			3					3	3		3	

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

Basic concepts-Image functions and types-Computer Vision-Image representation and image analysis tasks-Image representations- digitization-properties-color images-Data structures

for Image Analysis-Levels of image data representation-Traditional and Hierarchical image data structures.

UNIT II **9 Hours**

IMAGE PRE-PROCESSING

Pixel brightness transformations-Geometric transformations-Local pre-processing-Image smoothing-Edge detectors-Zero-crossings of the second derivative-Scale in image processing- Canny edge detection-Parametric edge models-Edges in multi-spectral images-Local pre-processing in the frequency domain-Line detection by local pre-processing operators-Image restoration.

UNIT III **9 Hours**

OBJECT DETECTION USING MACHINE LEARNING

Object localization-Object detection-Object detection methods-Deep Learning framework for Object detection-bounding box approach-Intersection over Union (IoU)-Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

UNIT IV **9 Hours**

FACE RECOGNITION AND GESTURE RECOGNITION

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-Deep Face solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet-Gesture Recognition.

UNIT V **9 Hours**

VIDEO ANALYTICS

Video Processing-use cases of video analytics-Vanishing Gradient and exploding gradient problem-ResNet architecture-ResNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-Implementation using ResNet and Inception v3.

Total: 45 Hours

Reference(s)

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision, 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer Verlag London Limited,2011.
4. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, Video Analytics for Business Intelligence,Springer, 2012.
5. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education, 2003.
6. E. R. Davies, (2012), Computer & Machine Vision, Fourth Edition, Academic Press.

22CD033 WEARABLE DEVICES AND APPLICATIONS

3 0 0 3

Course Objectives

- Understand the basics of Wearable Computing, Wearable Devices and Technologies.
- Explore about basics of Security Challenges.
- Understand the concepts of Applications of wearables in Health Care.
- Acquire knowledge about the advanced applications of Wearable Computing.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- c. 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.
- f. 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.
- k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

1. Understand the basics of Wearable Computing
2. Explain the various devices and technologies of Wearable computing
3. Analyze the challenges of Security issues in Wearable computing
4. Discuss the applications of Wearable computing in health sector
5. Discover the advanced trends in wearable computing

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3		1			1					1	1		3	
2	2		3			3					2	2		3	
3	2		2			3					2	2		3	
4	2		2			3					3	3		3	
5	2		3			3					3	3		3	

UNIT I

9 Hours

WEARABLE COMPUTING

Introduction to Wearable Computers-Design Considerations-Wearable Interactions-Design Guidelines and Evaluation-Future Trends in Wearable Computing-Benefits

UNIT II **9 Hours**

WEARABLE DEVICES AND TECHNOLOGIES

Health and Fitness Wearables-The Promise and Perils of Wearable Technologies-Confidential Data Storage system for wearable platforms-Management and Security issues in Wearable platforms.

UNIT III **9 Hours**

SECURITY CHALLENGES

Authenticity Challenges of Wearable Technologies-Wearable Computing: Security Challenges, BYOD,Privacy, and Legal Aspects-Security, Privacy, and Ownership Issues With the Use of Wearable Health Technologies-Wearable Devices: Ethical Challenges and Solutions.

UNIT IV **9 Hours**

HEALTH CARE APPLICATION

IoT for Ambient Assisted Living: Care4Me-A Healthcare Support System-Study of Real-Time Cardiac Monitoring System: A Comprehensive Survey-Co-Designing Wearable Technology Together with Visually Impaired Children

UNIT V **9 Hours**

ADVANCED APPLICATIONS

Securing the Human Cloud: Applying Biometrics to Wearable Technology-Context-Aware Mobile and Wearable Device Interfaces-An Overview of Telemedicine Technologies for Healthcare Applications-Internet of Things in E-Health: An Application of Wearables in Prevention and WellBeing-Wearable

ECG Monitoring and Alerting System Associated With Smartphone

Total: 45 Hours

Reference(s)

1. Vivian Genaro Motti, Wearable Interaction, Springer Nature, 2020.
2. Marc L. Resnick (Bentley University, USA) and Alina M. Chircu, Wearable Devices: Ethical Challenges and Solutions, IGI Global Publisher 2018.
3. Edward Sazonov and Michael R. Neuman (Editors), Wearable Sensors Fundamentals, Implementation and Applications, Elsevier, 2015.
4. Wearable Applications Research, devices and Interactions, Internet of Medical Things Paradigm of Wearable Devices, 1st Edition, 2021 by CRC Press.
5. Wearable Technologies: Concepts, Methodologies, Tools, and Applications (Critical Explorations) 1st Edition,2018
6. Information Resources Management Association (Author, Editor), Wearable Technologies: Concepts, Methodologies, Tools, and Applications (Critical Explorations) 1st Edition, 2018.

22CD034 3D PRINTING AND DESIGN

3 0 0 3

Course Objectives

- Learn basics of 3D printing.
- Explain the principles of 3D printing technique.
- Illustrate the inkjet technology and laser technology.
- Analyze the applications of 3D printing.

Programme Outcomes (POs)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- c. 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.
- f. 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.
- k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l. 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.
- n. PSO:2 Apply the power of computing and digital media tools to provide solutions to challenging interactive technologies.

Course Outcomes (COs)

1. Understand the basic concepts of 3D printing technology.
2. Outline the processes and materials used in 3D printing.
3. Explain the concepts and working principles of 3D printing using inkjet technique.
4. Explain the working principles of 3D printing using laser technique.
5. Analyze the various method for designing and modeling for industrial applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3		1			1					1	1		3	
2	2		3			3					2	2		3	
3	2		2			3					2	2		3	
4	2		2			3					3	3		3	
5	2		3			3					3	3		3	

UNIT I

9 Hours

INTRODUCTION

Introduction; Design considerations-Material, Size,Resolution, Process; Modelling and viewing-3D; Scanning; Model preparation-Digital; Slicing; Software; File formats

UNIT II **9 Hours**

PRINCIPLE

Processes-Extrusion, Wire, Granular, Lamination, Photo polymerisation; Materials-Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection-Processes, applications, limitations;

UNIT III **9 Hours**

INKJET TECHNOLOGY

Printer-Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head

Considerations-Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication-Continuous jet, Multijet; Powder based fabrication-Colourjet-Applications to manufacturing.

UNIT IV **9 Hours**

LASER TECHNOLOGY

Light Sources-Types, Characteristics; Optics-Deflection, Modulation; Material feeding and flow-Liquid, powder; Printing machines-Types, Working Principle, Build Platform, Print bed Movement,Support structures-Applications.

UNIT V **9 Hours**

INDUSTRIAL APPLICATIONS

Securing the Human Cloud: Applying Biometrics to Wearable Technology-Context-Aware Mobile and Product Models, manufacturing-Printed electronics, Biopolymers, Packaging, Healthcare, Food,Medical, Biotechnology, Displays; Future trends;cloud based additive manufacturing-Research-Agile tooling.

Total: 45 Hours

Reference(s)

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons,2013.
3. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
4. Joan Horvath, Mastering 3D Printing, APress, 2014

ONE CREDIT COURSE**22CD0XA STREAMING ANALYTICS WITH DEEP LEARNING****1 0 0 1****Course Objectives**

- To understand the basic configuration of video analytics
- To get exposed to the various applications of video analytics

Course Outcomes (COs)

- Develop video analytic algorithms for security applications
- Design video analytic algorithms for business intelligence

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	

Computer Vision – Image representation and image analysis tasks- Image representations - digitization – properties – color images – Data structures for Image Analysis – Levels of image data representation - Object detection- Object detection methods – Deep Learning framework for Object detection bounding box approach-Intersection over Union (IoU) -Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures- Customer behavior analysis - people counting-Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

Total: 15 Hours**Reference(s)**

- [1].Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision, 4nd edition, Thomson Learning, 2013.
- [2].Vaibhav Verdhhan, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021
- [3].Nilanjan Dey , Amira Ashour and Suvojit Acharjee, Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016
- [4].Zhihao Chen, Ye Yang, Jingyu Xue, Liping Ye, Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014

OPEN ELECTIVES

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, 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.RoyChoudhry, 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 FUNCTONS

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)

1. Conclude the static and dynamic characteristics of measuring instruments
2. Compare the characteristics and working principles of Resistance, Inductance and Capacitance type sensors
3. Construct the interfacing and signal conditioning circuit for measurement system using different types of sensor
4. Analyze and select the suitable sensor for different industrial applications
5. 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)

1. Outline the concepts of traditional instruments and virtual instruments
2. Conclude the overview of modular programming and the structuring concepts in VI programming
3. Attribute the procedure to install DAQ in various OS and its interfacing methods
4. Implement the VI toolsets for specific applications
5. 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)

1. Attribute the properties of optical fibers, their light sources and detectors.
2. Implement the fiber-optic sensor for the measurement of various physical quantities.
3. Conclude the fundamentals of laser, types of laser and its working.
4. Outline the applications of laser for industrial applications.
5. 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.

21OME01 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)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. 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.
- e. 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.
- m. Design, analyse and evaluate the performance of mechanical systems.
- n. Choose the appropriate methodology, materials, tools and machinery to manufacture quality products at economical cost.

Course Outcomes (COs)

1. Design a 3D model from the 2D data.
2. Develop a CNC program for simple components.
3. Generate stl file and manipulate parameters of AM machine
4. Select appropriate liquid or solid materials based AM process to the respective application
5. 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.Pham, 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>
6. www.grabcad.com, www.all3dp.com

21OME02 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, Gollgotia Publications Pvt. Ltd., New Delhi, 2009

210ME03 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.

21OME04 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)

- a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- e. 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.
- f. 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.
- h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- j. 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.
- l. 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.
- m. Design, analyse and evaluate the performance of mechanical systems.
- n. Choose the appropriate methodology, materials, tools and machinery to manufacture quality products at economical cost.
- o. 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
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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
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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
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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
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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
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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												
UNIT I														9
Hours														

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.

9 Hours**UNIT II****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

UNIT IV

9 Hours

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

UNIT V

9 Hours

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 (CO₂ 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.

220CH01 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.

21OGE01 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

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management Science or Art Manager Vs Entrepreneur-types of managers - Managerial roles and skills Evolution of Management Scientific, Human Relations, System and Contingency approaches Types of Business organization - Sole proprietorship, partnership, Company - public and private sector enterprises - Organization culture and Environment Current Trends and issues in Management.

UNIT II

9 Hours

PLANNING

Nature and purpose of planning - Planning process - Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III

9 Hours

ORGANISING

Nature and purpose – Formal and informal organization - Organization chart - Organization Structure Types - Line and staff authority – Departmentalization - Delegation of authority - Centralization and decentralization - Job Design - Human Resource – Management - HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career planning and management

UNIT IV

9 Hours

DIRECTING

Foundations of individual and group behaviour – Motivation - Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership - types and theories of leadership – Communication - Process of communication - Barrier in communication Effective communication - Communication and IT.

UNIT V

9 Hours

CONTROLLING

System and process of controlling - Budgetary and non - Budgetary control techniques - Use of Computers and IT in Management control - Productivity problems and management - Control and Performance-Direct and preventive control - Reporting.

Total: 45 Hours

Reference(s)

1. Robbins S, Management, (13th ed.), Pearson Education, New Delhi, 2017.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management, Pearson Education, 7th Edition, 2011.
3. Robert Kreitner and Mamata Mohapatra, Management, Biztantra, 2008.
4. L. M. Prasad, Principles and Practice of Management. 7th Edition, Sultan Chand & Sons, 2007.
5. P. C. Tripathi and P. N. Reddy, Principles of Management, Fourth Edition, Tata McGraw Hill, 2008.

210GE02 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

**210GE03 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>

21OGE02 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)

6. Analyze the role of entrepreneurship in economic development.
7. Explain the types of ideas that to be used for entrepreneurship development.
8. Examine the legal aspects of business and its association.
9. Examine the sources of business and its analysis.
10. 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

**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

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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/>