

P. A. COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai)

An ISO 9001:2015 Certified Institution - Accredited by NBA and NAAC with 'A' Grade
Pollachi – 642 002



B.TECH (INFORMATION TECHNOLOGY)

CURRICULA AND SYLLABI

REGULATION

2022



Vision and Mission of the Institute and Department

Vision of the Institute

To progress to become a center of excellence in Engineering and Technology through creative and innovative practices in teaching-learning process and promoting research and development to produce globally competitive and employable professionals who are psychologically strong and emotionally balanced with social perception and professional ethics.

Mission of the Institute

To offer academic programmes, in the emerging areas of Engineering and Technology, provide training and research facilities and opportunities to promote student and faculty research in collaboration with Industry and Government for sustainable growth.

Vision of the Department

To emerge as a Centre of Excellence with focus on Education, Research and rapid Technological advancements in the field of Information Technology for the enrichment of society.

Mission of the Department

M1: To strive for viable academic Quality in Information Technology through effective Teaching Learning practices with recent tools and methodologies.

M2: To provide framework for career with competent skill-set for nurturing graduates to be excellent Technocrats, Researchers and Entrepreneurs.

M3: To produce socially and morally responsible IT professionals with ethical values to serve society.

Program Outcomes (POs):

Engineering Graduates will be able to:

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To empower graduates with a strong mathematical foundation, scientific, engineering and concepts of Information Technology to solve problems by analyzing and designing solutions.

PEO2: To inculcate graduates with qualities like excellent communication skills, teamwork, moral values, ethical conduct and technical excellence for real world challenges.

PEO3: To empower graduates for lifelong learning through innovative activities, advanced technology and higher studies.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: To understand the concepts of theoretical working of computing-machines and their applications in the field of software technology, application and system programming, data analytics, machine learning, networking and other relevant areas.

PSO2: To have an ability to apply knowledge of automation and usage of modern hardware and software tools related to Information Technology for solving complex problems.

PSO3: To have the capability to analyze, comprehend, design and development of computing systems for multi-disciplinary engineering applications with ethical values for societal wellbeing.

SEMESTER I

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
		Induction Programme	0	0	0	0
THEORY						
1	22CAHS101	Professional English - I	3	0	0	3
2	22CABS102	Matrices and Calculus	3	1	0	4
3	22CABS103	Engineering Physics	3	0	0	3
4	22CABS104	Engineering Chemistry	3	0	0	3
5	22CAES105	C Programming	3	0	0	3
6	22CAHS109	Heritage of Tamils	1	0	0	1
PRACTICAL						
7	22CAES106	Programming in C Laboratory	0	0	3	1.5
8	22CABS107	Physics and Chemistry Laboratory	0	0	3	1.5
9	22CAHS108	Communication Skills Laboratory	0	0	2	1
Total			16	1	8	21

SEMESTER II

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22CAHS201	Professional English - II	3	0	0	3
2	22CABS202	Advanced Calculus and its Applications	3	1	0	4
3	22CAES203	Python Programming	3	0	0	3
4	22CABS204	Physics for Information Science	3	0	0	3
5	22CAES205	Basics of Electrical and Electronics Engineering	3	0	0	3
6	22CAES104	Engineering Graphics	1	0	4	3
7	22CAHS202	Tamils and Technology	1	0	0	1
PRACTICAL						
8	22CAES107	Engineering Practices Laboratory	0	0	3	1.5
9	22CAES206	Python Programming Laboratory	0	0	3	1.5
Total			17	1	10	23

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22CABS301	Transform Techniques and its Applications	3	1	0	4
2	22CAES302	Digital Principles and Computer Organization	3	0	0	3
3	22CAPC303	Data Structures and Algorithms	3	0	0	3
4	22CAPC304	Object Oriented Programming	3	0	0	3
5	22ITPC305	Foundations of Data Science	3	0	2	4
6	22CAMC306	Constitution of India	3	0	0	0
PRACTICAL						
6	22CAPC307	Data Structures Laboratory	0	0	3	1.5
7	22CAPC308	Object Oriented Programming Laboratory	0	0	3	1.5
Total			18	1	8	20

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22CABS401	Discrete Mathematics	3	1	0	4
2	22ITPC402	Operating Systems	3	0	0	3
3	22CAPC403	Database Management Systems	3	0	0	3
4	22CAPC404	Object Oriented Software Engineering	3	0	0	3
5	22ITES405	Principles of Communication	3	0	0	3
6	22CAHS406	Environmental Science and Engineering	3	0	0	3
PRACTICAL						
7	22ITPC407	Operating Systems Laboratory	0	0	3	1.5
8	22CAPC408	Database Management Systems Laboratory	0	0	3	1.5
Total			18	1	6	22

SEMESTER V

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22CAPC503	Computer Networks	3	0	0	3
2	22ITPC501	Full Stack Web Development	3	0	0	3
3	22ITPC502	Artificial Intelligence and Machine Learning	3	0	2	4
4	22ITPC503	Distributed Computing	3	0	0	3
5	PE	Professional Elective - I	3	0	0	3
6	OE	Open Elective	3	0	0	3
PRACTICAL						
7	22CAPC506	Computer Networks Laboratory	0	0	3	1.5
8	22ITPC504	Full Stack Web Development Laboratory	0	0	3	1.5
Total			18	0	8	22

SEMESTER VI

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22ITPC601	Embedded Systems and IoT	3	0	0	3
2	22CAPC504	Theory of Computation	3	0	0	3
3	22ITPC602	Software Testing and Automation	3	0	0	3
4	PE	Professional Elective - II	3	0	0	3
5	PE	Professional Elective - III	3	0	0	3
6	OE	Open Elective	3	0	0	3
7	22CAMC607	Quantitative and Reasoning Skills	3	0	0	0
PRACTICAL						
7	22ITPC603	Mobile Application Development Laboratory	0	0	3	1.5
8	22ITPC604	Software Testing and Automation Laboratory	0	0	3	1.5
Total			18	0	8	21

PROFESSIONAL ELECTIVE(PE) – I (SEMESTER V)

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	22ITPE501	Digital Marketing	3	0	0	3
2	22ITPE502	Multimedia and Animation	3	0	0	3
3	22ITPE503	DevOps	3	0	0	3
4	22ITPE504	Business Analytics	3	0	0	3
5	22ITPE505	Probability and Queueing Theory	3	0	0	3
6	22ITPE506	Knowledge Engineering	3	0	0	3

PROFESSIONAL ELECTIVE(PE) – II (SEMESTER VI)

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	22ITPE601	Digital Signal Processing	3	0	0	3
2	22ITPE602	Soft Computing	3	0	0	3
3	22ITPE603	UI and UX Design	3	0	0	3
4	22ITPE604	Web Application Security	3	0	0	3
5	22ITPE605	Graph Theory and Applications	3	0	0	3
6	22ITPE606	Principles of Programming Languages	3	0	0	3

PROFESSIONAL ELECTIVE(PE) – III (SEMESTER VI)

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	22ITPE607	Data Mining for Business Intelligence	3	0	0	3
2	22ITPE608	Service Oriented Architecture	3	0	0	3
3	22ITPE609	Numerical Methods	3	0	0	3
4	22ITPE610	Augmented Reality & Virtual Reality	3	0	0	3
5	22ITPE611	Storage Technologies	3	0	0	3
6	22ITPE612	Software Defined Networks	3	0	0	3

OPEN ELECTIVES (OE)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ADOE01	Computer Vision	3	0	0	3
2.	22ADOE02	Ethics and AI	3	0	0	3
3.	22ADOE03	Network Security and Firewalls	3	0	0	3
4.	22ADOE04	R Programming	3	0	0	3
5.	22ADOE05	Programming with ASP.Net	3	0	0	3
6	22CSOE01	Computer Graphics and Simulation	3	0	0	3
7	22CSOE02	Data Integration & Big data	3	0	0	3
8	22CSOE03	Game Programming	3	0	0	3
9	22CSOE04	Storage Technologies	3	0	0	3
10	22CSOE05	Recommender Systems	3	0	0	3
11	22ECOE01	Computational Intelligence	3	0	0	3
12	22ECOE02	Wearable Devices	3	0	0	3
13	22ECOE03	VLSI Testing and Design For Testability	3	0	0	3
14	22ECOE04	IoT Based Systems Design	3	0	0	3
15	22ECOE05	Design Thinking	3	0	0	3
16	22EEOE01	Power Plant Engineering	3	0	0	3
17	22EEOE02	Sensors and Transducers	3	0	0	3
18	22EEOE03	Hybrid Energy Technology	3	0	0	3
19	22EEOE04	Biomedical Instrumentation	3	0	0	3
20	22EEOE05	Electric and Hybrid Vehicles	3	0	0	3
21	22ITOE01	Mobile Adhoc Networks	3	0	0	3
22	22ITOE02	Blockchain Technologies	3	0	0	3

23	22ITOE03	Open Source Technologies	3	0	0	3
24	22ITOE04	Android Application Development	3	0	0	3
25	22ITOE05	Digital and Mobile Forensics	3	0	0	3
26	22MEOE01	Testing of Materials	3	0	0	3
27	22MEOE02	Welding Technology	3	0	0	3
28	22MEOE03	Industrial Safety Engineering	3	0	0	3
29	22MEOE04	Marketing Management	3	0	0	3
30	22MEOE05	Maintenance Engineering	3	0	0	3

MANDATORY / AUDIT COURSES (AC) (NO - CREDIT)

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	22CAMC306	Constitution of India	3	0	0	0
2	22CAMC607	Quantitative and Reasoning Skills	3	0	0	0

COURSE OBJECTIVES:

- To improve the communicative competence of learners.
- To help learners use language effectively in academic /work contexts.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that is relevant to authentic contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
- To use language efficiently in expressing their opinions via various media.

UNIT-I: INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 9

- Listening - For general information - Listening and filling a form
 Speaking - Self Introduction
 Reading - Brochures and social media messages relevant to technical contexts.
 Writing -Writing emails / letters (permission, accepting, declining)
 Grammar - Present Tense, Parts of Speech.
 Vocabulary - One word substitution; Abbreviations & Acronyms

UNIT-II: NARRATION AND SUMMATION 9

- Listening -Listening Comprehension –Monologues - Dialogues.
 Speaking -Narrating personal experiences /oral presentation
 Reading -Reading biographies, newspaper reports, Reading Comprehension
 Writing - Paragraph writing, Short Report on an event (field trip etc.) - discourse markers (connectives & sequence words)
 Grammar - Past tense; Subject-Verb Agreement.
 Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms

UNIT-III: DESCRIPTION OF A PROCESS / PRODUCT 9

- Listening -Listen to a product and process descriptions and advertisements about a products.
 Speaking -Picture description; giving instruction to use the product; advertising a product.
 Reading -Reading advertisements, gadget reviews; user manuals.
 Writing -Writing definitions; instructions; and Product /Process description.
 Grammar -Degrees of comparison; Future Tense
 Vocabulary -Homonyms; and Homophones.

UNIT-IV: CLASSIFICATION AND RECOMMENDATIONS 9

- Listening - Listening and transfer of information- Note-taking.
 Speaking - Small Talk; Mini presentations and making recommendations.
 Reading - Reading for specific information- interpreting visual materials (pictures, labels, signs, postcards).
 Writing - Note-making / recommendations; Transferring information from non verbal (tables, chart, graph etc,) to verbal mode.
 Grammar - wh-yes or no- tags.

Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT-V: EXPRESSION

9

- Listening - Listening to speeches (experts)..
- Speaking - Group discussion, Debate, & Role play activities
- Reading - Cloze test, speed reading.
- Writing - Essay Writing (Descriptive or narrative)- Cause & Effect Expressions
- Grammar - Simple, Compound & Complex Sentences
- Vocabulary - Idioms - Phrasal verbs.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communication" – Principles And Practices, Oxford Univ. Press, New Delhi 2022.
2. Dr.S. Mahalakshmi, "Professional English", VK Publications (India) Pvt. Ltd. (2022)
3. Meenakshi Raman & Sangeeta Sharma, "Professional English", Oxford Higher Education, 2018
4. Aysha Viswamohan, "English For Technical Communication" (With CD), Mcgraw Hill Education, ISBN: 0070264244.
5. Department of English, Anna University, "English for Engineers & Technologists" Orient Blackswan Private Ltd. (2020) edit.
6. Dr. S. Gunasekaran, "A Work Book of Technical English", Vishnu Prints Media, Chennai- (2020) edit.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Listen and comprehend complex academic texts.
- CO2:** Read and infer the denotative and connotative meanings of technical texts.
- CO3:** Write definitions, descriptions, narrations and essays on various topics.
- CO4:** Speak fluently and accurately in formal and informal communicative contexts.
- CO5:** Express their opinions effectively in both oral and written medium of communication.

COURSE OBJECTIVES:

- To obtain the knowledge of Eigen values and diagonalization of a matrix.
- To be familiarize with differentiation of single variable and its applications.
- To acquire knowledge of differentiation for more than one variable and its applications.
- To obtain the knowledge of various techniques of integration.
- To acquire the knowledge of multiple integration and related applications.

UNIT-I: MATRICES**9+3**

Eigen values and Eigenvectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigenvectors - Cayley-Hamilton theorem - Diagonalization of a matrix by orthogonal transformation - Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms.

UNIT-II: DIFFERENTIAL CALCULUS**9+3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT-III: FUNCTIONS OF SEVERAL VARIABLES**9+3**

Partial differentiation - Homogeneous functions and Euler's theorem - Total derivative - Change of variables - Jacobians - Partial differentiation of implicit functions - Taylor's series for functions of two variables - Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.

UNIT-IV: INTEGRAL CALCULUS**9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT-V: MULTIPLE INTEGRALS**9+3**

Double integrals - Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals - Volume of solids - Change of variables in double and triple integrals.

Contact Periods:**Lecture: 45 Periods****Tutorial: 15 Periods****Practical: 0 Periods****Total: 60 Periods**

REFERENCES:

1. Kreyszig E., “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Edition, 2018.
2. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 44th Edition, New Delhi, 2018.
3. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4. James Stewart, “Calculus: Early Transcendentals”, Cengage Learning, 8th Edition, New Delhi, 2015.
5. Thomas G.B., Hass J. and Weir M.D., “Thomas Calculus”, Pearson Education, 14th Edition New Delhi, 2018.
6. Anton H., Bivens I. and Davis S., “Calculus”, Wiley, 10th Edition, 2016.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Understand the matrix algebra techniques for solving practical problems.

CO2: Understand the limit definition and rules of differentiation to differentiate functions.

CO3: Apply differentiation to solve maxima and minima problems.

CO4: Apply different methods of integration in solving practical problems.

CO5: Apply multiple integrals ideas in solving areas and volumes.

COURSE OBJECTIVES:

- To make the students effectively to achieve understanding of mechanics of solids.
- To enable the students to gain knowledge of thermal conductivity of solids.
- To motivate the students towards the applications of acoustics and ultrasonics.
- To equip the students to understand the importance of quantum physics.
- To make the students to understand the basics of crystallography and its importance in studying materials properties.

UNIT-I: MECHANICS OF SOLIDS**9**

Elasticity- Hooke's law - Types of strain - Classification of Modulus of Elasticity- Poisson's Ratio - Stress-Strain diagram - Factors affecting elasticity - Moment, Couple and Torque - Derivation of Twisting Couple on a wire - Bending moment - Depression of a cantilever - Young's modulus by Uniform Bending – Non-Uniform bending - I shaped girders.

UNIT-II: THERMAL PROPERTIES**9**

Thermal Conductivity - Thermal Diffusivity - Specific Heat Capacity - Rectilinear Flow of Heat along a Uniform Bar - heat conduction in solids - flow of heat through compound media (parallel and perpendicular) - Determination of Thermal Conductivity of a Good Conductor by Forbe's Method: theory and experiment - Determination of Thermal Conductivity of a poor Conductor by Lee's Disc Method: theory and experiment.

UNIT-III: ACOUSTICS AND ULTRASONICS**9**

Classification of Sound – decibel - Weber-Fechner law – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies. Piezoelectric crystals - Production of ultrasonics – magnetostriction and piezoelectric methods – Non Destructive testing – pulse echo system through transmission and reflection modes – Medical application – Sonogram.

UNIT-IV: QUANTUM MECHANICS**9**

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation - Properties of matter waves - de Broglie wavelength in terms of voltage, energy, and temperature - Heisenberg's Uncertainty principle - verification - physical significance of wave function - Schrodinger's Time independent and Time dependent wave equations - Particle in a one-dimensional potential well.

UNIT-V: CRYSTALLOGRAPHY**9**

Crystal structures: Crystal lattice – basis - unit cell and lattice parameters – crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond and NaCl structures – crystal planes, directions and Miller indices – distance between successive planes – crystalline and non-crystalline materials – imperfections in crystals.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

1. D.Halliday, R.Resnick and J.Walker, Principles of Physics, Wiley (Indian Edition), 2015.
2. N.Garcia, A.Damask and S.Schwarz, Physics for Computer Science Students. Springer Verlag, 2012.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017.
4. R.Wolfson, Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
5. Paul A. Tipler, Physics – Volume 1 & 2, CBS, (Indian Edition), 2004.
6. K.Thyagarajan and A.Ghatak, Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Understand the importance of mechanics and their various properties.

CO2: Express their knowledge in thermal physics.

CO3: Apply acoustical and ultrasonic principles for industrial and medical applications.

CO4: Understand the importance of quantum physics.

CO5: Demonstrate a strong foundational knowledge about crystals.

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on engineering applications of polymers.
- To understand the principles of electrochemistry, electrochemical cells, emf and applications of emf measurements.
- To acquire knowledge about principles of corrosion and corrosion control techniques.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT-I: WATER AND ITS TREATMENT**9**

Water quality parameters: Significance - Alkalinity, TDS, COD and BOD (definition and significance only). Hardness- types, estimation of hardness by EDTA method - Boiler feed water troubles - Scale and sludge - Priming and foaming - Caustic embrittlement - Boiler corrosion. Softening of boiler feed water - Internal softening (colloidal, phosphate, sodium aluminate and calgon conditioning) - External softening – demineralization process - Desalination of brackish water – Electrodialysis and Reverse Osmosis. Municipal water treatment - primary treatment and disinfection (UV, Ozonation, break-point chlorination).

UNIT-II: POLYMER CHEMISTRY**9**

Introduction: Classification of polymers – Functionality – Degree of polymerization. Types of polymerization: Addition, condensation and copolymerization. Thermal Properties of polymers: Thermoplastic and Thermosetting - Glass Transition temperature (T_g) – significance - factors affecting T_g , Molecular weight – weight average, number average and polydispersity index. Preparation, properties and uses of PVC, Bakelite and Epoxy resin. Conducting polymers- mechanism – application of OLED.

UNIT-III: ELECTROCHEMISTRY**9**

Electrode potential - Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf. Emf series and its applications. Nernst equation (problems). Reference electrodes – Standard Hydrogen electrode – Calomel electrode, Ion selective electrode – glass electrode and measurement of pH. Potentiometric redox titration (Estimation of ferrous ion) – conductometric titration (Strong acid Vs Strong base).

UNIT-IV: CORROSION AND ITS CONTROL**9**

Corrosion - chemical corrosion - mechanism, nature of oxides – Pilling - Bedworth rule. Electrochemical corrosion – mechanism. Galvanic series and importance. Factors influencing corrosion. Prevention methods - design of materials, cathodic protection techniques - sacrificial anode and impressed current method. Protective coatings – electroplating - Cr, Ni and galvanizing. Anodising of aluminium.

UNIT-V: ENERGY SOURCES AND STORAGE DEVICES**9**

Nuclear energy: light water nuclear power plant - breeder reactor. Solar energy conversion - working principles of photovoltaic cell, organic and dye sensitized solar cell. Batteries - Types of batteries. Primary battery – Leclanche cell. Secondary battery - lead acid battery – nickel metal hydride and Li-ion battery. Fuel cells: proton exchange membrane and solid oxide fuel cell.

Supercapacitors: working principles.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. P. C. Jain and Monica Jain, "Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 17th Edition, 2018.
2. V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar, Polymer Science, New Age International Publishers, 6th Edition, 2019.
3. Sivasankar B. "Engineering Chemistry, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
4. S.S. Dara, "A Text book of Engineering Chemistry. S. Chand Publishing, 12th Edition, 2018.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Understand the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- CO2:** Acquire the basic knowledge of polymers and apply in engineering.
- CO3:** Understand the basic principles of electrochemistry and its applications.
- CO4:** Know the principles, various types of corrosion and corrosion control techniques.
- CO5:** Identify different forms of energy resources and apply them for suitable applications in energy sectors.

COURSE OBJECTIVES:

- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop applications in C using functions and pointers.
- To develop program in C using structures and union.
- To perform file handling operations in C and learn dynamically allocated memory techniques.

UNIT-I: BASICS OF C PROGRAMMING**11**

Generation and Organization of Computers - Number System - Binary - Decimal - Conversion - Problems. Need for logical analysis and thinking - Algorithm - Pseudo code - Flow Chart. Introduction to programming paradigms: Structure of C program - Data Types - Constants - Keywords - Operators and Expressions - Input / Output statements.

UNIT-II: ARRAYS AND STRINGS**9**

Decision making statements - Switch statement - Looping statements - Arrays - Initialization - Declaration - One dimensional and Two dimensional arrays - String: String operations - String Arrays - Simple programs: Sorting - Searching - Matrix operations.

UNIT-III: FUNCTIONS AND POINTERS**9**

Introduction to functions: Function prototype, function declaration, function definition, function call, Built-in functions (string functions, math functions) - Recursion - Pointers - Pointer operators - Pointer arithmetic - Arrays and pointers - Array of pointers - Parameter passing: Pass by value, Pass by reference.

UNIT-IV: STRUCTURES AND UNION**9**

Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.

UNIT-V: FILE PROCESSING**7**

Files: File opening modes - Types of file processing: Sequential access, Random access - Preprocessor directives - Command line arguments.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, 2nd Edition, Pearson Education, 2015.
2. ReemaTheraja “Fundamentals of Computing and Programming in C”, 2nd Edition, Oxford University Press, 2016.
3. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling

- Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2013.
4. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
 5. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 16th revised edition, 2020.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Develop simple applications in C using basic constructs.
- CO2:** Design and implement applications using arrays and strings.
- CO3:** Develop and implement applications in C using functions and pointers.
- CO4:** Develop applications in C using structures and union.
- CO5:** Design applications using sequential and random-access file processing.

UNIT-I: LANGUAGE AND LITERATURE**3**

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: HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTU**3**

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: FOLK AND MARTIAL ARTS**3**

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

UNIT-IV: THINAI CONCEPT OF TAMILS**3**

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: CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**3**

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 PERIODS**REFERENCES:**

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.

COURSE OBJECTIVES:

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

LIST OF EXPERIMENTS:

1. I/O statements, operators, expressions
2. Decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.
11. Mini project

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Develop C programs for simple applications making use of basic constructs, arrays and Strings.

CO2: Develop C programs involving functions, recursion, pointers, and structures.

CO3: Design applications using sequential and random access file processing.

LIST OF EQUIPMENT'S AND COMPONENTS

- Software Required – Turbo C Compiler / GNU C Compiler / Equivalent
- Operating System – Windows 7 / 8.1 / 10 / Linux
- Computers Required – 30 Nos.

PHYSICS LABORATORY:**COURSE OBJECTIVES:**

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

LIST OF EXPERIMENTS:

1. Cantilever bending – Determination of Young's modulus.
2. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia.
3. Non-uniform bending - Determination of Young's modulus.
4. Laser- a) Determination of the wave length of the laser using grating.
b) Determination of Numerical Aperture and acceptance angle using optical fiber.
5. Air wedge - Determination of thickness of a thin sheet/wire.
6. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.

Contact Periods:**Lecture: 0 Periods****Tutorial: 0 Periods****Practical: 24 Periods****Total: 24 Periods****COURSE OUTCOMES:**

Upon completion of this course, the students will be able to:

CO1: Understand the functioning of various physics laboratory equipment.**CO2:** Use experimental models to analyze laboratory data.**CO3:** Use mathematical models as a medium for quantitative reasoning and describing physical reality.**CO4:** Access, process and analyze scientific information.**CO5:** Solve problems individually and collaboratively.

CHEMISTRY LABORATORY:

COURSE OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis.
- To inculcate experimental skills to understanding of water quality parameters, such as hardness, alkalinity and dissolved oxygen.
- To induce the students to familiarize with electroanalytical techniques such as conductometry and potentiometry.
- To demonstrate the analysis of strong acid and strong base by conductometry.
- To equip the students for determination of hydrochloric acid by pH measurement.

LIST OF EXPERIMENTS:

1. Estimation of hardness by EDTA method.
2. Determination of types and amount of alkalinity in water sample.
3. Estimation of Dissolved Oxygen by Iodometry.
4. Determination of HCl by pH titration.
5. Conductometric titration of strong acid and strong base.
6. Estimation of iron content of the given solution using potentiometer.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 21 Periods Total: 21 Periods

REFERENCE:

1. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Qualitative Chemical Analysis, 2009.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1** Outfit with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.
- CO2:** Quantify the type and amount of alkalinity in water sample.
- CO3:** Equip with the methods and techniques involved in pH metry.
- CO4:** Apply the conductometric measurements in quantitative analysis of chemical substances.
- CO5:** Estimate the amount of ferrous ion present in solution by potentiometric titration.

COURSE OBJECTIVES:

- To enhance the Employability and Career Skills of students.
- To orient the students towards grooming as a professional.
- To make them Employability Graduates.
- To develop their confidence and help them in attending interviews successfully.
- To demonstrate an understanding of job applications and interviews for internship and placements.

LIST OF ACTIVITIES & EXERCISES

S.No.	Activity/Exercise
1.	Soft skills
2.	Giving & asking personal information
3.	Listening & Answering to a Lecture
4.	Small talk on everyday topics
5.	Strategies for presentation ; group/ pair presentation
6.	Job Application Letter with Resume
7.	Group Discussion
8.	Activities to improve GD skills
9.	Interview etiquette
10.	Career plan

Contact Periods:**Lecture: 0 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 30 Periods****Recommended Software****1. Globearena****REFERENCES:**

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2. Interact English Lab Manual for Undergraduate Students,. Orient BalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.

4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014.
5. S. Hariharan et al. Soft Skills. MJP Publishers: Chennai, 2010.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Make effective presentations.

CO2: Participate confidently in Group Discussions.

CO3: Attend job interviews and be successful in them.

CO4: Develop adequate Soft Skills required for the workplace.

CO5: Present their opinions in a planned and logical manner, and draft effective resume in context of job search.

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their LSRW skills.
- To enhance learners' awareness of general rules of writing for specific audiences.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT-I: MAKING COMPARISONS**9**

- Listening - Listening to oral presentation- Listening and Gap filling
- Speaking - Marketing a product, Mock interviews
- Reading - Reading advertisements, Reading to identify stylistic features(syntax, lexis and sentence structures)
- Writing - Compare and Contrast Essay, Review writing
- Grammar - If conditions, Direct and indirect speech
- Vocabulary - Verbal analogies

UNIT-II: EXPRESSING CASUAL RELATIONS IN SPEAKING AND WRITING**9**

- Listening - Listening to longer technical, Listening technical information from podcasts
- Speaking - Describing and discussing the reasons of accidents or disasters based on news reports
- Reading - Reading and understanding technical articles
- Writing - Writing responses to complaints
- Grammar - Active Passive Voice transformations, Infinitive and Gerund
- Vocabulary - Technical Jargons

UNIT-III: PROBLEM SOVING**9**

- Listening - Listening to video clips and answering the questions, listening to different view points on an issue
- Speaking - Picture description
- Reading - Case studies, excerpts from literary texts, news reports etc
- Writing - Letter to the Editor, Checklists
- Grammar - Error correction, Numerical adjectives
- Vocabulary - Compound Words, Sentence Completion

UNIT-IV: REPORTING OF EVENTS AND RESEARCH**9**

- Listening - Listening comprehension based on news reports and documentaries
- Speaking - Interviewing, Presenting an oral report, Mini presentations on select topics
- Reading - Newspaper articles
- Writing - Delivering welcome address, Proposing Vote of thanks, Accident Report, Survey Report
- Grammar - Phrases and its types

UNIT-V: THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY

Listening	- Listening to TED Talks, Job interviews(analysis of the interview performance)
Speaking	- Participating in a Role play, virtual interviews, Making presentations with visual aids
Reading	- Company profiles, Statement of Purpose(SOP), an excerpt of interview with professionals
Writing	- Internship application, Cover letter & Resume, Precise writing, Summarizing
Grammar	- Subject- Verb agreement, Relative clauses
Vocabulary	- Numerical Adjectives

Contact Periods:

Lecture: 45 Periods

Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

REFERENCES:

1. Department of English, Anna University, "English for Engineers & Technologists", Orient Blackswan, 2020.
2. Krishna Mohan, Meera Bannerji, "Developing Communication Skills", Macmillan India Ltd, Delhi, 2020.
3. V. N. Arora and Laxmi Chandra, "Improve Your Writing", Oxford University Press, New Delhi, 2020.
4. J. Anbazhagan Vijay, "Communicative English", Global Publishers, Chennai, 2019.
5. Raman, Meenakshi, Sharma. Sangeeta, "Professional English", Oxford University Press, New Delhi, 2019.
6. Prof. R.C. Sharma & Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hall & Co. Ltd, New Delhi, 2019.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Compare and contrast products and ideas in technical texts.
- CO2:** Identify cause and effects in events, industrial processes through technical texts
- CO3:** Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- CO4:** Report events and the processes of technical and industrial nature.
- CO5:** Present their opinions in a planned and logical manner and draft effective resume in context of job search.

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COURSE OBJECTIVES:

- To gain the knowledge of vector differentiation, integration and related applications.
- To be known about analytic functions with properties, construction of analytic function and the knowledge of conformal transformation.
- To obtain the knowledge of Cauchy's integral theorem, calculus of residues and complex integration around unit circle and semicircle.
- To gain methods to solve differential equations with constant and variable coefficients.
- To introduce the basic concepts of PDE for solving standard partial differential equations

UNIT-I: VECTOR CALCULUS**9+3**

Gradient and directional derivative - Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields - Line integral over a plane curve - Surface integral - Volume integral - Green's, Gauss divergence and Stoke's theorems (Excluding Proofs).

UNIT-II: ANALYTIC FUNCTIONS**9+3**

Analytic functions - Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties - Harmonic conjugates - Construction of analytic function - Conformal mapping - Mapping by functions $w = z + c$, cz , $1/z$, z^2 - Bilinear transformation.

UNIT-III: COMPLEX INTEGRATION**9+3**

Line integral - Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series - Singularities - Residues - Residue theorem - Application of residue theorem for evaluation of real integrals - Use of circular contour and semicircular contour.

UNIT-IV: ORDINARY DIFFERENTIAL EQUATIONS**9+3**

Higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogenous equation of Euler's and Legendre's type - System of simultaneous linear differential equations with constant coefficients.

UNIT-V: PARTIAL DIFFERENTIAL EQUATIONS**9+3**

Formation of partial differential equations - Singular integrals - Solutions of standard types of first order partial differential equations $[F(p,q) = 0 \text{ and } z = px + qy + f(p,q)]$ - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous types.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2018.
2. Kreyszig E., "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, 2018.
3. Bali N.P. and Manish Goyal, "A Text book of Engineering Mathematics", Laxmi Publications Pvt. Ltd, New Delhi, 10th Edition, 2021.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
5. Ramana B.V., "Higher Engineering Mathematics", Mc Graw Hill Education Pvt. Ltd, New Delhi, 11th Edition, 2018.
6. James G., "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 4th Edition, 2016.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Acquire knowledge in Gradient, divergence and curl of a vector point function and related identities.
- CO2:** Understand the properties and formation of analytic function, mappings of standard functions and Bilinear transformation.
- CO3:** Understand calculus of residues to evaluate contour integration.
- CO4:** Apply various techniques in solving differential equations.
- CO5:** Understand how to solve the given standard partial differential equations.

COURSE OBJECTIVES:

- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.
- To understand different Python packages and libraries.

UNIT-I: DATA, EXPRESSIONS, STATEMENTS**9**

Python interpreter and interactive mode; values and Numeric Data types, variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Object Oriented Features; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT-II: CONTROL FLOW, FUNCTIONS**9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT-III: LISTS, TUPLES, DICTIONARIES**9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, quick sort

UNIT-IV: FILES, MODULES, PACKAGES**9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

UNIT-V: DATA HANDLING AND DATA VISUALIZATION**9**

Data Handling using Pandas – Introduction to Python Libraries: Pandas, Matplotlib, Numpy – Pandas: Series and Data Frames – Descriptive Statistics – Data Frame Operations – Handling missing Values – Data Visualization – Creating Charts: Bar and Pie Charts – Customizing Plots

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, “Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data”, Third Edition, MIT Press, 2021.
4. Wes McKinney, “Python for Data Analysis”, 2nd Edition, O’Reilly Publishers, 2017.
5. Karl Beecher, “Computational Thinking: A Beginner’s Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Write simple Python programs using conditionals and loops for solving problems.

CO2: Decompose a Python program into functions.

CO3: Represent compound data using Python lists, tuples, dictionaries etc.

CO4: Read and write data from/to files in Python programs.

CO5: Explore their knowledge in Python packages and libraries.

COURSE OBJECTIVES:

- To make the students to understand the importance in studying electrical properties of materials.
- To enable the students to gain knowledge in semiconductor physics
- To instil knowledge on magnetic properties of materials.
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications.
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano materials applications.

UNIT-I: ELECTRICAL PROPERTIES OF MATERIALS**9**

Classical Free electron theory of metals – Postulates - Electrical and Thermal conductivity of metals - Derivation of Wiedemann-Franz law - Lorentz number - Drawbacks of Classical theory – Occupation probability - Effect of temperature- Density of energy states in metals (derivation) – Carrier concentration in metals - Calculation of Fermi energy at 0K - Types of electronic materials: metals, semiconductors and insulators.

UNIT-II: SEMICONDUCTOR PHYSICS**9**

Properties of semiconductors - elemental and compound semiconductor - Direct and indirect band gaps - Intrinsic and extrinsic semiconductors - Fermi level - Carrier concentration in intrinsic semiconductor - Dependence of Fermi level on temperature - Electrical conductivity - band gap determination - extrinsic semiconductors - Carrier concentration in P type and N type – Semiconductors - Dependence of Fermi level on impurity concentration and temperature for P type and N type semiconductors.

UNIT-III: MAGNETIC PROPERTIES OF MATERIALS**9**

Magnetic dipole moment – atomic magnetic moments - magnetic permeability and susceptibility - Magnetic materials classification: diamagnetism – paramagnetism – ferromagnetism – Ferromagnetism: origin and exchange interaction - saturation magnetization and Curie temperature – Domain Theory - M versus H behavior – Hard and soft magnetic materials – examples and uses – Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

UNIT-IV: OPTICAL PROPERTIES OF MATERIALS**9**

Classification of optical materials – carrier generation and recombination processes – Absorption, emission and scattering of light in metals, insulators and semiconductors (concepts only) – photo current in a PN diode – solar cell - LED – Organic LED – Laser diodes – Optical data storage techniques.

UNIT-V: ADVANCED QUANTUM MECHANICS**9**

Introduction - quantum confinement – quantum structures: quantum wells, wires and dots — band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade - single electron transistor – Nanomaterials - Properties- Methods of synthesize - Top- down & Bottom up Approach -Ball Milling - Chemical vapour deposition - Application of Nanomaterials.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. D.Halliday, R.Resnick and J.Walker, Principles of Physics, Wiley (Indian Edition), 2015.
2. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020.
3. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
4. Y.B.Band and Y.Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.
5. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009.
6. Jasprit Singh, “Semiconductor Devices: Basic Principles”, Wiley (Indian Edition), 2007.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Gain knowledge on classical and quantum electron theories and energy band structures.

CO2: Acquire knowledge on basics of semiconductor physics.

CO3: Get knowledge on magnetic properties of materials and their applications in data storage.

CO4: Have the necessary understanding on the functioning of optical materials for optoelectronics.

CO5: Understand the basics of quantum structures and their applications.

SEMESTER II

COURSE OBJECTIVES:

- To introduce the basics of electric circuits and analysis.
- To impart knowledge in the basics of working principles and application of electrical machines.
- To introduce analog devices and their characteristics.
- To educate on the fundamental concepts of digital electronics.
- To introduce the functional elements and working of measuring instruments.

UNIT I ELECTRICAL CIRCUITS 9

Introduction to AC Circuits and Parameters: Waveforms, Average value, Value, RMS
Instantaneous power, real power, reactive power and apparent power, power factor – Steady state
analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle - DC Separately and Self-excited Generators, Types – emf Equation and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT III ANALOG ELECTRONICS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: PN Junction Diodes, Zener Diode – I-V Characteristics - Rectifiers – Bipolar Junction Transistor, JFET, SCR, MOSFET, IGBT – I-V Characteristics - Applications

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions - SOP and POS forms, K-map representations – minimization using K maps (Simple Problems only).

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers – DSO - Block diagram - Data acquisition.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020.
2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.
3. Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., 2008.
4. James A .Svoboda, Richard C. Dorf, “Dorf’s Introduction to Electric Circuits”, Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2015.
6. Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Analyze the DC and AC circuits.

CO2: Explore the significance of electrical machines.

CO3: Analyze the characteristics of analog electronic devices.

CO4: Acquire the basic concepts of digital electronics.

CO5: Explain the operating principles of measuring instruments.

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COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Drawing various types of conical and special engineering curves.
- Drawing orthographic projection of points, lines and 3D objects.
- Drawing projection of plane surfaces and projection of solids.
- Drawing section of solids and development of solids.
- Drawing isometric projections of simple solids and sketching of 3D objects.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT-I: PLANE CURVES**3+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT-II: ORTHOGRAPHIC PROJECTION OF POINTS, LINES AND 3D OBJECTS**3+12**

Principal planes – First angle projection – Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces. Visualization concepts – Visualization principles – Representation of Three Dimensional objects – Layout of views – Sketching of multiple views from pictorial views of objects.

UNIT-III: PROJECTION OF PLANE SURFACES AND SOLIDS**3+12**

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method – Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method.

UNIT-IV: PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**3+12**

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids: Prisms, pyramids cylinders and cones.

UNIT – V: ISOMETRIC PROJECTIONS**3+12**

Principles of Isometric projection – Isometric scale – Isometric projections of simple solids and truncated solids: Prisms, pyramids, cylinders, cones – Conversion of orthographic views to pictorial views (Simple objects)

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 75 Periods

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019.
2. Bhatt, N.D., “Engineering Drawing”, Charotar Publishing House Pvt. Ltd., 53rd Edition, 2019.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I & II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
4. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., “Engineering Graphics with AutoCAD”, PHI Learning, 2nd Edition, 2010.

COURSE OUTCOMES:

Upon on completion of this course, the student will be able to

CO1: Construct the conic curves, involutes and cycloid.

CO2: Solve practical problems involving orthographic projection of points, lines and 3D objects.

CO3: Draw the projections of plane surfaces and simple solids.

CO4: Draw the section of solids and the development of simple solids.

CO5: Draw the isometric projections of simple solids and sketching of 3D objects

Special points applicable to End Semester Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

UNIT-I: WEAVING AND CERAMIC TECHNOLOGY**3**

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

UNIT -II: DESIGN AND CONSTRUCTION TECHNOLOGY**3**

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: MANUFACTURING TECHNOLOGY**3**

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: AGRICULTURE AND IRRIGATION TECHNOLOGY**3**

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

UNIT-V: SCIENTIFIC TAMIL & TAMIL COMPUTING**3**

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 PERIODS**REFERENCES:**

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. பொருநை - 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.

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COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

- Connecting various pipe fittings used in common household plumbing work, sawing, planning and making joints in wood materials used in common household wood work.
- Welding various joints in steel plates using arc welding work.
- Machining various simple processes like turning, drilling, and tapping in parts and making a tray out of metal sheet using sheet metal work.
- Wiring various electrical joints in common household electrical wire work
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & MECHANICAL)
PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

- a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- b) Preparing plumbing line sketches.
- c) Laying pipe connection to the pump
- d) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

- a) Sawing,
- b) Planning and
- c) Making joints like T-Joint, Cross lap Joint and Dovetail joint.

Wood Work Study:

- a) Studying joints in door panels and wooden furniture.
- b) Studying common industrial trusses using models.

PART II MECHANICAL ENGINEERING PRACTICES

WELDING WORK:

- a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
- b) Practicing gas welding.

BASIC MACHINING WORK:

- a) Simple Turning.
- b) Simple Drilling.

c) Simple Tapping.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 24 Periods Total: 24 Periods

**GROUP – B (ELECTRICAL & ELECTRONICS)
PART III ELECTRICAL ENGINEERING PRACTICES**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Measurement of voltage and current using solar panel
3. Stair case wiring
4. Assembling and Testing of Ceiling Fan
5. Study of lightning arrester

PART IV ELECTRONIC ENGINEERING PRACTICES

1. Study of Electronic components and equipments – Resistor, colour coding
2. Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
3. Verification of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Assembling of 15 watts LED circuit

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 21 Periods Total: 21 Periods

COURSE OUTCOMES:

Upon completion of this course, the student will be able to

- CO1:** Apply the knowledge of pipeline and connecting various pipe fittings used in common household plumbing work and Use tools and equipments used in Carpentry.
- CO2:** Perform the various welding joints in steel plates using arc welding work.
- CO3:** Perform operation in a lathe machine and also fabricate parts like tray in sheet metal.
- CO4:** Wire various electrical joints in common household electrical wire work.
- CO5:** Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

COURSE OBJECTIVES:

- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To develop applications using python packages and libraries.

LIST OF EXPERIMENTS:

1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
3. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Retail Store –operations of list & tuples)
4. Implementing real-time/technical applications using Sets, Dictionaries. (Student Enrolment and Mark sheet - operations of Sets & Dictionaries)
5. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
6. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
7. Implementing programs using Python Standard Libraries (pandas, numpy, Matplotlib)
8. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
9. Create a data frame based on E Commerce data and generate descriptive statistics (Mean, Median, Mode and Variance).
10. Consider Data of your interest from an Open Source (Eg. Data.gov.in) aggregate and summarize. Then plot it using different plotting functions of Matplotlib Library.
11. Mini Project.

Contact Periods:**Lecture: 0 Periods****Tutorial: 0 Periods****Practical: 45 Periods****Total: 45 Periods****COURSE OUTCOMES:**

Upon successful completion of the course, students should be able to:

CO1: Implement programs in Python using conditionals and loops for solving problems.

CO2: Deploy functions to decompose a Python program.

CO3: Utilize Python packages and libraries in developing software applications.

LIST OF EQUIPMENT'S AND COMPONENTS

- Software Required – Python 3 Interpreter
- Operating System – Windows 7 / 8.1 / 10 / Linux
- Computers Required – 30 Nos.

COURSE OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in Engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To be familiar with techniques of Laplace and Inverse Laplace transformations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT-I: FOURIER SERIES**9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.

UNIT-II: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**9+3**

Classification of PDE – Fourier Series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT-III: LAPLACE TRANSFORMS**9+3**

Existence conditions – Transforms of elementary functions – Basic properties – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT-IV: FOURIER TRANSFORMS**9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT-V: Z -TRANSFORMS AND DIFFERENCE EQUATIONS**9+3**

Z-transforms – Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

Contact Periods:**Lecture: 45 Periods****Tutorial: 15 Periods****Practical: 0 Periods****Total: 60 Periods**

REFERENCES:

1. Grewal B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
2. Kreyszig E., "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, 2018.
3. Ramana B.V., "Higher Engineering Mathematics", Mc Graw Hill Education Pvt. Ltd, New Delhi, 11th Edition, 2018.
4. Andrews L. C and Shivamoggi B, "Integral Transforms for Engineers" SPIE Press, 1999.
5. Bali N.P. and Manish Goyal, "A Text book of Engineering Mathematics", Laxmi Publications Pvt. Ltd, New Delhi, 10th Edition, 2021.
6. James G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, New Delhi, 2016.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Solve differential equations using Fourier series analysis which plays a vital role in Engineering applications.
- CO2:** Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- CO3:** Understand Laplace transform and inverse transform of simple functions, various related theorems and application to differential equations with constant coefficients.
- CO4:** Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of Engineering.
- CO5:** Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

COURSE OBJECTIVES:

- To understand and realize the Boolean postulates using basic gates.
- To acquire knowledge for the design of the combinational circuit and sequential circuit.
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

UNIT-I: BASIC CONCEPTS OF DIGITAL SYSTEMS 9

Review of Number systems - Number Representation - Boolean algebra - Boolean postulates and laws - De-Morgan's Theorem - Simplifications of Boolean functions using Karnaugh map - Realization of Boolean functions using basic gates.

UNIT-II: COMBINATIONAL & SEQUENTIAL CIRCUITS 9

Combinational circuits - Design of combinational circuits: Adder, Subtractor, Code Converters, Decoders and Encoders, Multiplexers and Demultiplexers – Sequential Circuits – Flip Flops, Registers, Counters.

UNIT-III: COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT-IV: PROCESSOR 9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

UNIT-V: MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENECS:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the VerilogHDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, TheHardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organizationand Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
4. William Stallings, "Computer Organization and Architecture – Designing for Performance",Tenth Edition, Pearson Education, 2016.
5. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Simplify Boolean function and realize the logic circuits.
- CO2:** Design various Combinational and sequential circuits using logic gates.
- CO3:** State the fundamentals of computer systems and analyze the execution of an instruction
- CO4:** Analyze different types of control design and identify hazards
- CO5:** Identify the characteristics of various memory systems and I/O communication

COURSE OBJECTIVES:

- To understand the need of data structures and algorithms
- To understand the concepts of array and list
- To design linear data structures – stacks, and queues
- To understand the concept of tree structures
- To apply Graph structures

UNIT I : INTRODUCTION 9

Need for Data Structures - Types of Data Structures - Abstract Data Type - Program Development Life Cycle - Algorithms - Characteristics of Algorithms - Recursive Algorithms - Complexity Analysis - Best case and worst-case complexities - Asymptotic notations -Master theorem.

UNIT II : ARRAYS AND LISTS 9

Array Representation and Operations - Linear Search and Binary Search - Insertion and Bubble Sort - Matrix representation using Multi-dimensional arrays - Linked List Representation - Operations on a Singly Linked List - Types of Linked List - Polynomial Addition - Sparse Matrices.

UNIT III: STACKS AND QUEUES 9

Stack ADT - Representation and Operations - Expression Handling - Role of Stack in implementing recursive algorithms - Queue ADT - Representation and Operations - Types of Queues - Circular Queue - Deque - Priority Queue.

UNIT IV: TREE STRUCTURES 9

Terminologies - Binary Tree - Traversal - Expression Trees - Threaded Binary Tree - Binary Heap – Heap Sort - Priority Queue implementation using Binary Heap - Binary Search Tree - B Tree - B+ Tree - Applications - AVL Tree – Trie Structure.

UNIT V: GRAPH STRUCTURES 9

Hash Table - Hash Functions - Resolving Collisions - Rehashing - GRAPH Terminologies - Types of Graphs - Representation - Breadth First Search - Depth First Search - Topological Sort – Shortest Paths – Minimum spanning tree.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENECS:**

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, An Indian Adaptation, John Wiley & Sons Inc., 2021
2. Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015
3. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011

4. Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
6. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Understanding the need of data structures and algorithms
- CO2:** Understanding the concepts of array and list
- CO3:** Implement Stack and Queue structures to solve problems.
- CO4:** Implement and apply trees structures to solve problems.
- CO5:** Implement and apply graph structures to solve problems.

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To know the principles of inheritance and interfaces and string handling operations.
- To define multithreading and use of exception handling.
- To Understand I/O streams and use of collection framework.
- To design and build simple Graphical User Interfaces.

UNIT-I: OOP FUNDAMENTALS AND BASICS OF JAVA PROGRAMMING 9

OOP Concepts – Classes and Objects – Abstraction – Encapsulation – Inheritance – Polymorphism – OOP fundamentals implementation – Instance variables – Methods – Access specifiers – Coding standards– Identifiers – Variables– Data types – Operators– Control structures– Java architecture– Methods – Pass by value and Pass by reference – Recursive methods – Arrays – Package – Accessing sub-package and classes.

UNIT-II: INHERITANCE AND INTERFACE 9

Constructor – Types of constructor – Static keyword and its use – Final keyword and its use – Inheritance – Types of Inheritance – Polymorphism – Static polymorphism and dynamic polymorphism – Abstract keyword – Abstract class – Interface – Extending the interface – Implementation of interface – Difference between abstract class and interface. String: String Methods – String buffer class – String builder class – String tokenizer class.

UNIT-III: MULTITHREADING AND EXCEPTION HANDLING 9

Introduction to multi – Threading – Thread life cycle – Implementation of multithreading – Thread synchronization – Inter thread communication – Introduction to exception handling – Types of exception – Try and catch – Multiple catch block and nested try block – Finally block.

UNIT-IV: FILE HANDLING AND COLLECTION FRAMEWORK 9

Input / output basics – Streams – Byte streams and character streams – Reading and writing console – Reading and writing files. Collection interfaces – Collection classes.

UNIT-V: EVENT DRIVEN PROGRAMMING 9

Graphics programming – Frame – Components –Working with 2D shapes – Using color, fonts, and images – Basics of event handling – Event handlers – Adapter classes – Actions –Mouse events – AWT event hierarchy – Introduction to Swing – Layout management – Swing Components – Text Fields, Text Areas – Buttons– Check boxes – Radio buttons – Lists– choices– Scrollbars – Windows – Menus – Dialog Boxes

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann and Gary Cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.
3. Paul Deitel and Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
4. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
5. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Develop Java programs using OOP principles.
- CO2:** Develop Java programs with the concepts of inheritance and interfaces.
- CO3:** Build Java applications using exceptions and multithreading.
- CO4:** Develop Java applications with I/O streams and collection framework.
- CO5:** Develop GUI based Java programs using swings.

COURSE OBJECTIVES:

To understand the data science fundamentals and process.

To learn to describe the data for the data science process.

To learn to describe the relationship between data.

To utilize the Python libraries for Data Wrangling.

To present and interpret data using visualization libraries in Python

UNIT I : INTRODUCTION 9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data.

UNIT II : DESCRIBING DATA 9

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores.

UNIT III: DESCRIBING RELATIONSHIPS 9

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r^2 –multiple regression equations – regression towards the mean.

UNIT IV: PYTHON LIBRARIES FOR DATA WRANGLING 9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.

UNIT V: DATA VISUALIZATION 9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

45 PERIODS**PRACTICAL EXERCISES 30 PERIODS**

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Stats models and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Apply and explore various plotting functions on UCI data sets.
 - a. Normal curves

- b. Density and contour plots
 - c. Correlation and scatter plots
 - d. Histograms
 - e. Three dimensional plotting
6. Visualizing Geographic Data with Basemap

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 75 Periods

REFERNECS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
4. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Define the data science process

CO2: Understand different types of data description for data science process

CO3: Gain knowledge on relationships between data

CO4: Use the Python Libraries for Data Wrangling

CO5: Apply visualization Libraries in Python to interpret and explore data

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COURSE OBJECTIVES:

- To know about Indian constitution.
- To know about central government functionalities in India.
- To know about state government functionalities in India.
- To know about Indian society.
- To know about election commission of India.

UNIT-I: INTRODUCTION**9**

Constitution - Definition, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental rights and duties, Directive principles of State policy.

UNIT -II: UNION GOVERNMENT AND ITS ADMINISTRATION**9**

Structure of the Indian Union: Federalism, Centre – State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

UNIT-III: STATE GOVERNMENT AND ITS ADMINISTRATION**9**

Governor: Role and position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

UNIT-IV: LOCAL ADMINISTRATION**9**

District's administration head: Role and Importance, Municipalities: Introduction, Mayor and role of elected representative, CEO of Municipal corporation, Panchayat raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational hierarchy (Different departments), Village level: Role of elected and appointed officials, Importance of grass root democracy.

UNIT-V: ELECTION COMMISSION**9**

Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and functioning, Institute and bodies for the welfare of SC/ST/OBC and women.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Sharma and Brij Kishore, "Introduction to the Consitution of India," Prentice Hall of India, New Delhi, 2018.
2. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2018.

3. Laxmikanth M., “Indian Polity”, Mcgraw Hill Education (India) Private Limited, 2016.
4. Agarwal R.C., “Indian Political System”, S. Chand and Company, New Delhi, 2004.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Understand the concepts of constitution assembly.

CO2: Develop knowledge of union government and its administration.

CO3: Develop knowledge of state government and its administration.

CO4: Develop knowledge of local administration.

CO5: Learn to use the function of election commission.

COURSE OBJECTIVES:

- To implement the linear data structures.
- To implement the Nonlinear data structures.
- To implement the sorting and hashing techniques.

LIST OF EXPERIMENTS:

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations of List
5. Implementation of Stack and Queue ADTs
6. Applications of List, Stack and Queue ADTs
7. Implementation of sorting and searching algorithms
8. Implementation of Hash tables
9. Tree representation and traversal algorithms
10. Implementation of Binary Search Trees
11. Implementation of Heaps
12. Graph representation and Traversal algorithms
13. Implementation of single source shortest path algorithm
14. Implementation of minimum spanning tree algorithms
15. Mini Project

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Implement ADTs as Python classes.
- CO2:** Design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications.
- CO3:** Design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting.
- CO4:** Model problems as graph problems and implement efficient graph algorithms to solve them.
- CO5:** Develop a mini project using concepts of Data structures

LIST OF EQUIPMENT'S AND COMPONENTS

Lab Requirements: for a batch of 30 students

Operating Systems: Linux / Windows

Front End Tools: Python IDLE / Pycharm / Jupyter Notebook

COURSE OBJECTIVES:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing.
- To develop applications using generic programming and event handling.

LIST OF EXPERIMENTS:

1. Develop a Java Application to generate Electricity Bill.
2. Develop a Java Application to implement currency convertor, distance convertor and timeconvertor.
3. Design and develop a java application for the Employee Payroll system using inheritance
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Implement a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
6. Implement a java program to accept integer or string values from the user within a specified range. (Range has to be specified with minimum and maximum by the user). If the input violates the range, appropriate exception needs to be raised.
7. Implement a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
8. Design and implement an application that executes two threads. First thread displays the alphabets A to Z at every one second. The Second thread will display the alphabets Z to A at every two seconds. Both the threads need to synchronize with each other for printing alphabets. The Second thread has to wait until the first thread finishes its execution. The application waits for all the threads to finish the execution.
9. Implement a program to design an application for banking operation (deposit and withdrawal) using files.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java.
12. Develop a mini project for any application using Java concepts.

Contact Periods:**Lecture: 0 Periods****Tutorial: 0 Periods****Practical: 45 Periods Total: 45 Periods**

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.

CO2: Implement Java programs with array list, exception handling and multithreading.

CO3: Design applications using file processing and generic programming.

CO4: Develop and implement java programs using event handling

CO5: Develop a mini projects using java concepts.

LIST OF EQUIPMENT'S AND COMPONENTS

Lab Requirements: for a batch of 30 students

Operating Systems: Linux / Windows

Front End Tools: Eclipse IDE / Netbeans IDE

COURSE OBJECTIVES:

- To extend students logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

UNIT-I: LOGIC AND PROOFS**9+3**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT-II: COMBINATORICS**9+3**

Mathematical induction – Strong induction and well ordering – The basics of counting – The Pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT-III: GRAPHS**9+3**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT-IV: ALGEBRAIC STRUCTURES**9+3**

Algebraic systems – Semi groups and monoids – Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT-V: LATTICES AND BOOLEAN ALGEBRA**9+3**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

REFERENCES:

1. Rosen K. H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2. Tremblay J. P and Manohar R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2017.
3. Grimaldi R.P., "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2013.

4. Lipschutz S and Mark Lipson , "Discrete Mathematics", Schaum's Outlines, 3rd Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2010.
5. Koshy T., "Discrete Mathematics with Applications", Elsevier Publications, 2006.
6. T Veera rajan, "Discrete Mathematics and its Applications" 7th Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, July 2017.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Have knowledge of the concepts needed to test the logic of a program.
- CO2:** Have Knowledge in identifying structures on many levels.
- CO3:** Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- CO4:** Be aware of the counting principles.
- CO5:** Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads.
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT-I: OPERATING SYSTEM OVERVIEW**7**

Computer system overview – Basic elements, Instruction execution, Interrupts, Memory hierarchy, Cache memory, Direct Memory Access, Multiprocessor and multicore organization. Operating system overview – Objectives and functions, Evolution of operating system, Computer system organization operating system structure and operations – System calls, System programs, OS generation and system boot.

UNIT-II: PROCESS MANAGEMENT**11**

Processes – Process concept, Process scheduling, Operations on Processes, Inter process Communication; CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads – Overview, Multithreading models, Threading issues; Process Synchronization – The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT-III: STORAGE MANAGEMENT**9**

Main Memory – Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture examples; Virtual memory – Background, Demand Paging, Page replacement, Allocation, Thrashing; Allocating kernel memory, OS Examples.

UNIT-IV: FILE SYSTEMS AND I/O SYSTEMS**9**

Mass storage system – Overview of mass storage structure, Disk structure, Disk scheduling and management, Swap space management; File-System interface – File concept, Access methods, Directory structure, Directory organization, File system mounting, File sharing and protection; File system implementation – File system structure, Directory implementation, Allocation methods, Free space management, Efficiency and performance, Recovery; I/O systems – I/O hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

UNIT-V: CASE STUDY**9**

Linux system – Design principles, Kernel modules, Process management, Scheduling, Memory management, Input-Output management, File system, Inter-Process communication; Mobile OS – IOS and android – Architecture and SDK framework, Media layer, Services layer, Core OS layer, File system.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

1. Abraham Silberschatz, "Peter Baer Galvin and Greg Gagne", "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2. Ramaz Elmasri, A. Gil Carrick and David Levine, Operating Systems – A Spiral Approach Tata McGraw Hill Edition, 2010.
3. Achyut S. Godbole and Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
4. Andrew S. Tanenbaum, "Modern Operating Systems", 2nd Edition, Pearson Education, 2004.
5. Gary Nutt, "Operating Systems", 3rd Edition, Pearson Education, 2004.
6. Harvey M. Deitel, "Operating Systems", 3rd Edition, Pearson Education, 2004.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Analyze various scheduling algorithms.

CO2: Understand deadlock, prevention and avoidance algorithms.

CO3: Compare and contrast various memory management schemes.

CO4: Understand the functionality of file systems.

CO5: Understand and characterize phenomenon of Linux Operating System.

COURSE OBJECTIVES:

- To expose the students to the fundamentals of Database Management Systems and SQL.
- To make clear the students with ER diagrams.
- To understand the essential concepts of transaction processing, concurrency control and recovery procedures.
- To comprehend the internal storage structures using different file and indexing techniques.
- To have an introductory knowledge about the distributed and object oriented database.

UNIT-I: INTRODUCTION TO DBMS**9**

Purpose of database system – Views of data – Data models – Database languages – Database system architecture – Introduction to relational databases – Keys – Relational algebra Operations – SQL Fundamentals – Integrity – Advanced SQL Features – Embedded SQL – Dynamic SQL

UNIT-II: DATABASE DESIGN**9**

Entity Relationship model – ER Diagrams – Enhanced ER model – ER to Relational mapping – Normalization – Functional dependencies – Decomposition – First, Second, Third Normal Forms – Boyce Codd normal form – Multivalued dependencies and Fourth normal form – Join dependencies and Fifth normal form

UNIT-III: TRANSACTION PROCESSING AND CONCURRENCY CONTROL**9**

Transaction concepts – ACID Properties – Transaction recovery – System recovery – Media recovery – Save points – Isolation levels – Serializability – Concurrency control – Need for concurrency – Locking protocols – Two phase locking – Dead Lock – SQL Facilities for concurrency and recovery

UNIT-IV: IMPLEMENTATION TECHNIQUES**9**

Overview of physical storage media – Magnetic disks – RAID – Tertiary storage – File organization – Organization of records in files – Indexing and hashing – Ordered indices – B+ Tree index files – B Tree index files – Static hashing – Dynamic hashing – Query processing Overview – Catalog information for cost estimation – Selection operation – Sorting – Join operation

UNIT-V: ADVANCED TOPICS**9**

Introduction to distributed databases – Architecture – Data storage – Transaction processing – object based databases – Object database concepts – Object relational features – ODMG object model – ODL – OQL – XML databases – XML hierarchical model – DTD – XML schema – Xquery

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth and Sudharshan S., - Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. RamezElmasri and Shamkant B. Navathe, - Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.
3. Raghu Ramakrishnan, - “Database Management Systems”, 4th Edition, McGraw-Hill College Publications, 2015.
4. Date C. J, Kannan A and Swamynathan S, - “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.
5. Gupta G.K., “Database Management Systems”, Tata Mc Graw Hill, 2011.
6. Singh S. K., “Database Systems Concepts, Design and Applications”, 1st Edition, Pearson Education, 2006.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Design Databases for applications.

CO2: Map ER model to Relational model to make database design.

CO3: Apply concurrency control and recovery mechanisms for real-world problems.

CO4: Compare the several indexing strategies in different database systems.

CO5: Learn advanced database concepts and assess how it differ from traditional databases.

22CAPC404	OBJECT ORIENTED SOFTWARE ENGINEERING	SEMESTER IV			
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COURSE OBJECTIVES:

- To understand the phases in object-oriented software development
- To gain fundamental concepts of requirements engineering and analysis.
- To know about the different approach for object oriented design and its methods
- To learn about how to perform object oriented testing and how to maintain software
- To provide various quality metrics and to ensure risk management.

UNIT I : SOFTWARE DEVELOPMENT LIFE CYCLE 9

Introduction – Object Orientation - Object Oriented Methodologies – Terminologies - Software Development Life Cycle – Conventional Software Life Cycle Models – Build and Fix Model – Waterfall Model – Prototyping Model – Iterative Enhancement Model – Spiral Model – Extreme Programming - Object Oriented Software Life Cycle Models – Selection of Software Development Life Cycle Models

UNIT II : OBJECT ORIENTED REQUIREMENTS ELICITATION & ANALYSIS 9

Software Requirement - Requirements Elicitation Techniques – Initial Requirements Document – Use Case Approach – Characteristics of a Good Requirement – SRS Document – Requirements Change Management – Object Oriented Analysis : Identification of Classes and Relationships, Identifying State and Behavior – Case Study LMS - Managing Object Oriented Software Engineering: Projection Selection and Preparation – Product Development Organization – Project Organization and Management – Project Staffing

UNIT III : OBJECT ORIENTED SOFTWARE DESIGN 9

Object Oriented Design – Interaction Diagrams – Sequence Diagram – Collaboration Diagrams – Refinement of Use Case Description – Refinement of Classes and Relationships – Construction of Detailed Class Diagram – Development of Detailed Design & Creation of Software Design Document - Object Oriented Methods : Object Oriented Analysis (OOA / Coad-Yourdon), Object Oriented Design (OOD/Booch) , Hierarchical Object Oriented Design (HOOD), Object Modeling Technique (OMT), Responsibility – Driven Design Case Studies : Warehouse Management System, Telecom

UNIT IV : OBJECT ORIENTED TESTING AND MAINTENANCE 9

Software testing: Software Verification Techniques – Object Oriented Checklist :- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Levels of Testing – Static and Dynamic Testing Tools - Software Maintenance – Categories – Challenges of Software Maintenance – Maintenance of Object Oriented Software – Regression Testing

UNIT V : SOFTWARE QUALITY & METRICS

9

Need of Object Oriented Software Estimation – Lorenz and Kidd Estimation – Use Case Points Method – Class Point Method – Object Oriented Function Point – Risk Management – Software Quality Models – Analyzing the Metric Data – Metrics for Measuring Size and Structure – Measuring Software Quality - Object Oriented Metrics.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Yogesh Singh, RuchikaMalhotra, “Object – Oriented Software Engineering”, PHI Learning Private Limited ,First edition, 2012.
2. Ivar Jacobson. Magnus Christerson, PatrikJonsson, Gunnar Overgaard, “Object Oriented Software Engineering, A Use Case Driven Approach”, Pearson Education, Seventh Impression, 2009.
3. Craig Larman, “Applying UML and Patterns, an Introduction to Object-Oriented Analysis and Design and Iterative Development”, Pearson Education, Third Edition, 2008.
4. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston, “Object Oriented Analysis & Design with Applications, Third Edition, Pearson Education,2010.
5. Roger S. Pressman, “Software Engineering: A Practitioner’s Approach, Tata McGraw-Hill Education, 8th Edition, 2015.
6. Timothy C. Lethbridge and Robert Laganriere, “Object – Oriented Software Engineering, Practical Software Development using UML and Java”, Tata McGraw Hill Publishing Company Limited, Second Edition, 2004.

COURSE OUTCOMES:

- Able to identify the appropriate process model to develop the object oriented Software
- Gain knowledge about requirement elicitation and analyzing techniques
- Able to choose and design suitable UML diagrams and methods
- Able to apply correct testing methods and maintain software systems.
- Able to estimate the object oriented application by applying metric data.

COURSE OBJECTIVES:

- To introduce Analog Modulation Schemes
- To impart knowledge in random process
- To study various Digital techniques
- To introduce the importance of sampling & quantization
- To impart knowledge in demodulation techniques

UNIT I : AMPLITUDE MODULATION**9**

Review of signals and systems, Time and Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. SSB Generation – Filter and Phase Shift Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope AM techniques, Superheterodyne Receiver.

UNIT II : RANDOM PROCESS & SAMPLING**9**

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation. Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Nyquist criterion- Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM

UNIT III: DIGITAL TECHNIQUES**9**

Pulse modulation Differential pulse code modulation. Delta modulation, Noise considerations in PCM,, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes – Cyclic codes - Convolutional codes - Viterbi Decoder

UNIT IV: DIGITAL MODULATION SCHEME**9**

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Spectrum Analysis – Occupied bandwidth – Adjacent channel power, EVM, Principle of DPSK

UNIT V: DEMODULATION TECHNIQUES**9**

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference, Optimum demodulation of digital signals over band- limited channels.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

1. Simon Haykins,” Communication Systems”, Wiley, 5th Edition, 2009.
2. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2011.
3. Wayner Tomasi, Electronic Communication System, 5th Edition, Pearson Education,2008.
4. D.Roody, J.Coolen, Electronic Communications, 4th edition PHI 2006
5. A.Papoulis, “Probability, Random variables and Stochastic Processes”, McGraw Hill, 3rd edition, 1991.
6. B.Sklar, “Digital Communications Fundamentals and Applications”, 2nd Edition Pearson Education 2007.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Gain knowledge in amplitude modulation techniques
- CO2:** Understand the concepts of Random Process to the design of communication systems
- CO3:** Gain knowledge in digital techniques
- CO4:** Gain knowledge in sampling and quantization
- CO5:** Understand the importance of demodulation techniques

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COURSE OBJECTIVES:

- To learn about natural resources, exploitation and its conservation.
- To understand the concept of ecosystem and preservation of biodiversity.
- To acquire knowledge about the role of a human being in maintaining a clean and useful environment for the future generation.
- To impart awareness of various social issues affecting the environment.
- To know about population explosion in the environment.

UNIT-I: ENVIRONMENT AND NATURAL RESOURCES**10**

Definition, scope and importance of environment – Forest resources: Use and over exploitation – Deforestation – Dams and their effects on forests and tribal people – Water resources: Use and over utilization of surface and ground water – Mineral resources: Use and over exploitation – Environmental effects of extracting and using mineral resources – Food resources : changes caused by agriculture – Effects of modern agriculture – fertilizer – pesticide problems, water logging, salinity – Energy resources: Growing energy needs, renewable and non-renewable energy sources, Use of alternate energy sources – Role of an individual in conservation of natural resources.

UNIT -II: ECOSYSTEMS AND BIODIVERSITY**10**

Concept of an ecosystem – Structure and function of an ecosystem – Energy flow in the ecosystem – Ecological succession – Food chains, food webs – Forest ecosystem – Introduction to biodiversity – Genetic, species and ecosystem diversity – Value of biodiversity – India as a mega – diversity nation – Hot-spots of biodiversity – Threats to biodiversity – Endangered and endemic species – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT-III: POLLUTION AND SOLID WASTE MANAGEMENT**10**

Definition – Causes, effects and control measures of – Air pollution, Water pollution, Soil pollution, Marine pollution and Noise pollution – Solid waste management: Causes, Effects and Control measures of municipal solid wastes – Role of an individual in prevention of pollution – Disaster management: Floods, Earthquake, Cyclone and Landslides.

UNIT-IV: SOCIAL ISSUES AND THE ENVIRONMENT**8**

From unsustainable to sustainable development – Urban problems related to energy – Water conservation – Rain water harvesting – Watershed management – Resettlement and rehabilitation of people – Climate change – Global warming – Acid rain – Ozone layer depletion, Nuclear accidents and holocaust – Consumerism and waste products – 12 principles of green chemistry – Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Forest conservation act.

UNIT-V: HUMAN POPULATION AND THE ENVIRONMENT**7**

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Environmental impact assessment (EIA) – GIS – Remote sensing – Role of information technology in environment protection and human

health.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Deswal.S and Deswal.A, “A Basic Course in Environmental Studies”, Dhanpat Rai & Co (P) Ltd, New Delhi, 2021.
2. Anubha Kaushik and C.P.Kaushik, “Perspectives in Environmental Studies”, Sixth edition, New Age International Publishers, New Delhi, 2019.
3. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill, New Delhi, 2016.
4. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press (I) Pvt. Ltd., Hyderabad, 2015
5. Tyler. G Miller and Scott E. Spoolman, Environmental Science, Cengage Learning India PVT, LTD, Delhi, 2014.
6. Gilbert M. Masters and Wendell P.Ela “Introduction to Environmental Engineering and Science”, Third Edition, Pearson Education, 2013.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- CO1:** Develop an understanding of different types of natural resources
- CO2:** Realise the importance of ecosystem and biodiversity for maintaining ecological balance.
- CO3:** Create awareness about environmental pollution and role of human being in environmental protection.
- CO4:** Gain adequate knowledge about the social issues of the environment and solutions to solve the issues.
- CO5:** Understand the population explosion and current technology to protect the environment and human health.

COURSE OBJECTIVES:

- To learn Unix commands and shell programming.
- To implement various CPU Scheduling Algorithms.
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms.
- To implement Page Replacement Algorithms.
- To implement File Organization and File Allocation Strategies.

LIST OF EXPERIMENTS:

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC
8. Bankers Algorithm for Deadlock Avoidance
9. Implementation of Deadlock Detection Algorithm
10. Write C program to implement Threading & Synchronization Applications
11. Implementation of the following Memory Allocation Methods for fixed partition
 - i. First Fit ii. Worst Fit iii. Best Fit
12. Implementation of Paging Technique of Memory Management
13. Implementation of the following Page Replacement Algorithms FIFO, LRU, LFU
14. Implementation of the various File Organization Techniques
15. Implementation of the following File Allocation Strategies
 - i. Sequential ii. Indexed iii. Linked

Contact Periods:**Lecture: 0 Periods****Tutorial: 0 Periods****Practical: 45 Periods****Total: 45 Periods****COURSE OUTCOMES:**

Upon successful completion of the course, students should be able to:

- CO1:** Compare the performance of various CPU Scheduling Algorithms.
- CO2:** Implement Deadlock avoidance and Detection Algorithms.
- CO3:** Implement Semaphores and Create processes and implement IPC.
- CO4:** Analyze the performance of the various Page Replacement Algorithms.
- CO5:** Implement File Organization and File Allocation Strategies.

LIST OF EQUIPMENT'S AND COMPONENTS

- Standalone desktops with C /C++ /Java/Equivalent compiler
(or)
Server with C /C++ /Java /Equivalent compiler supporting

COURSE OBJECTIVES:

- To learn data definition and data manipulation commands.
- To be familiar with query language.
- To comprehend function, triggers and procedures.
- To learn the use of front end tool.
- To be exposed to implementation of database applications.

LIST OF EXPERIMENTS:

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying - Simple queries, Nested queries, Sub queries and Joins
3. Creation of Views, Sequences, Synonyms
4. High level programming language extensions (Control structures, Procedures and Functions).
5. Database Programming: Implicit and Explicit Cursors
6. Creation of database triggers
7. Exception Handling
8. Forms
9. Database Connectivity with Front End Tools
10. Mini project (Any one Application Development using Oracle/ Mysql)
 - i. Inventory Control System.
 - ii. Material Requirement Processing.
 - iii. Hospital Management System.
 - iv. Railway Reservation System.
 - v. Personal Information System.
 - vi. Web Based User Identification System.
 - vii. Hotel Management System

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Use typical data definitions and manipulation commands

CO2: Design applications to test Nested and Join Queries

CO3: Create and maintain tables using PL/SQL.

CO4: Prepare reports.

CO5: Implement applications that require a Front-end Tool

LIST OF EQUIPMENT'S AND COMPONENTS

Software:

Front end: VB/VC ++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/ PostgreSQL / DB2 or Equivalent

COURSE OBJECTIVES:

- To understand the protocol layering and physical level communication.
- To analyse the performance of a network.
- To understand the various components required to build different networks.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.

UNIT-I: INTRODUCTION AND PHYSICAL LAYER**9**

Networks – Network types – Protocol layering – TCP/IP Protocol suite – OSI model – Physical layer: Performance – Transmission media – Switching – Circuit-switched networks – Packet switching.

UNIT-II: DATA-LINK LAYER & MEDIA ACCESS**9**

Introduction – Link layer addressing – DLC services – Data link layer protocols – HDLC – PPP – Media access control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting devices.

UNIT-III: NETWORK LAYER**9**

Network layer services – Packet switching – Performance – IPV4 addresses – Forwarding of IP packets – Network layer protocols: IP, ICMP v4 – Unicast routing algorithms – Protocols – Multicasting basics – IPV6 addressing – IPV6 protocol.

UNIT-IV: TRANSPORT LAYER**9**

Introduction – Transport layer protocols – Services – Port numbers – User datagram protocol – Transmission control protocol – SCTP.

UNIT-V: APPLICATION LAYER**9**

World Wide Web and hypertext transfer protocol – File transfer protocol – Email – MIME – Telnet – Secure shell – Domain name system – Simple network management protocol.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition TMH, 2013.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, “Data and Computer Communications”, 10th Edition, Pearson Education, 2013.
4. Nader F. Mir, “Computer and Communication Networks”, 2nd Edition, Prentice Hall, 2014.
5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill Publisher, 2011.
6. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, 6th Edition, Pearson Education, 2013.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Gain the knowledge of basic layers and its functions in computer networks.

CO2: Evaluate the performance of a network.

CO3: Discovered the basics of how data flows from one node to another.

CO4: Design protocols for various functions in the network.

CO5: Develop real world applications using various application layer protocols.

COURSE OBJECTIVES:

- To understand the various components of full stack development
- To learn Node.js features and applications
- To develop applications with MongoDB
- To understand the role of Angular and Express in web applications
- To develop simple web applications with React

UNIT I : BASICS OF FULL STACK 9

Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React

UNIT II : NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js

UNIT III: MONGO DB 9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications

UNIT IV: EXPRESS AND ANGULAR 9

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives

UNIT V: REACT 9

MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENECS:**

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018
2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.
3. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018
4. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018
5. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp

6. <https://www.coursera.org/specializations/full-stack-react>

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- C01:** Understand the various stacks available for web application development
- C02:** Use Node.js for application development
- C03:** Develop applications with MongoDB
- C04:** Use the features of Angular and Express
- C05:** Develop React applications

COURSE OBJECTIVES:

- To study about uninformed and Heuristic search techniques.
- To learn techniques for reasoning under uncertainty
- To introduce Machine Learning and supervised learning algorithms
- To study about ensembling and unsupervised learning algorithms
- To learn the basics of deep learning using neural networks

UNIT I : PROBLEM SOLVING**9**

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 : PROBABILISTIC REASONING**7**

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

UNIT III: SUPERVISED LEARNING**11**

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: ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**9**

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: NEURAL NETWORKS**9**

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.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 30 Periods****Total: 75 Periods****Practical Exercises:**

1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, memory-bounded A*)
3. Implement naïve Bayes models
4. Implement Bayesian Networks
5. Build Regression models
6. Build decision trees and random forests
7. Build SVM models

8. Implement ensembling techniques
9. Implement clustering algorithms
10. Implement EM for Bayesian networks
11. Build simple NN models
12. Build deep learning NN models

REFERENECS:

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. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Use appropriate search algorithms for problem solving
- CO2:** Apply reasoning under uncertainty
- CO3:** Build supervised learning models
- CO4:** Build ensembling and unsupervised models
- CO5:** Build deep learning neural network models

COURSE OBJECTIVES:

- To introduce the computation and communication models of distributed systems
- To illustrate the issues of synchronization and collection of information in distributed systems
- To describe distributed mutual exclusion and distributed deadlock detection techniques
- To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
- To explain the cloud computing models and the underlying concepts

UNIT I : INTRODUCTION 9

Introduction: Definition-Relation to Computer System Components – Motivation – Message Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

UNIT II : LOGICAL TIME AND GLOBAL STATE 9

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNIT III: DISTRIBUTED MUTEX AND DEADLOCK 9

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

UNIT IV: CONSENSUS AND RECOVERY 9

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm -- Algorithm for Asynchronous Checkpointing and Recovery

UNIT V: CLOUD COMPUTING 9

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

Arshdeep Bagga, Vijay Madisetti, “ Cloud Computing: A Hands-On Approach”, Universities Press, 2014.

- 1.
2. Kshemkalyani Ajay D, Mukesh Singhal, “Distributed Computing: Principles, Algorithms and Systems”, Cambridge Press, 2011.
3. Mukesh Singhal, Niranjana G Shivaratri, “Advanced Concepts in Operating systems”, McGraw Hill Publishers, 1994.
4. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
5. Pradeep L Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007
6. Tanenbaum A S, Van Steen M, “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Explain the foundations of distributed systems
- CO2:** Solve synchronization and state consistency problems
- CO3:** Use resource sharing techniques in distributed systems
- CO4:** Apply working model of consensus and reliability of distributed systems
- CO5:** Explain the fundamentals of cloud computing

COURSE OBJECTIVES:

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

LIST OF EXPERIMENTS:

1. Learn to use commands like Tcpdump, Netstat, Ifconfig, Nslookup and Traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine
2. Write a HTTP web client program to download a web page using TCP sockets
3. Applications using TCP sockets like:
 - i. Echo client and Echo server
 - ii. Chat
 - iii. File Transfer
4. Simulation of DNS using UDP sockets
5. Write a code simulating ARP /RARP protocols
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS3
7. Study of TCP/UDP performance using Simulation tool
8. Simulation of Distance Vector/ Link State Routing algorithm
9. Performance evaluation of Routing protocols using Simulation tool
10. Simulation of Cyclic Redundancy Code.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Implement various protocols using TCP and UDP.

CO2: Compare the performance of different transport layer protocols.

CO3: Use simulation tools to analyze the performance of various network protocols.

CO4: Analyze various routing algorithms.

CO5: Implement error correction codes.

LIST OF EQUIPMENT'S AND COMPONENTS

- Software Required – C / C++ / Java / Python / Equivalent Compiler Network simulator like NS3/OPNET IT Guru / Wireshark packet analyzer / Packet Tracer / Equivalent.
- Hardware Required – Standalone desktops 30 Nos.

COURSE OBJECTIVES:

- To develop full stack applications with clear understanding of user interface, business logic and data storage.
- To design and develop user interface screens for a given scenario
- To develop the functionalities as web components as per the requirements
- To implement the database according to the functional requirements
- To integrate the user interface with the functionalities and data storage.

LIST OF EXPERIMENTS:

1. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter.
2. Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items
3. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
4. Create a food delivery website where users can order food from a particular restaurant listed in the website.
5. Develop a classifieds web application to buy and sell used products.
6. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.
7. Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed.
8. Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Design full stack applications with clear understanding of user interface, business logic and data storage.
- CO2:** Design and develop user interface screens
- CO3:** Implement the functional requirements using appropriate tool
- CO4:** Design and develop database based on the requirements
- CO5:** Integrate all the necessary components of the application

LIST OF EQUIPMENT'S AND COMPONENTS

- Software Required – Javascript / Python IDE / Equivalent web components like React, Angular, Node.js server, Express.js, MongoDB, Visual Studio
- Hardware Required – Standalone desktops 30 Nos.

COURSE OBJECTIVES:

- To grasp the fundamental knowledge of Multimedia elements and systems.
- To get familiar with Multimedia file formats and standards.
- To learn the process of authoring multimedia presentations.
- To learn the techniques of animation in 2D and 3D and for the mobile UI.
- To explore different popular applications of multimedia

UNIT-I: INTRODUCTION TO MULTIMEDIA**9**

Definitions- Elements- Multimedia Hardware and Software- Distributed multimedia systems- challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata- Multimedia databases- Hypermedia- Multimedia Learning

UNIT-II: MULTIMEDIA FILE FORMATS AND STANDARDS**9**

File formats – Text- Image file formats- Graphic and animation file formats- Digital audio and Video file formats- Color in image and video- Color Models. Multimedia data and file formats for the web

UNIT-III: MULTIMEDIA AUTHORIZING**9**

Authoring metaphors- Tools Features and Types: Card and Page Based Tools- Icon and Object Based Tools- Time Based Tools- Cross Platform Authoring Tools- Editing Tools- Painting and Drawing Tools- 3D Modeling and Animation Tools- Image Editing Tools- audio Editing Tools- Digital Movie Tools- Creating interactive presentations- Virtual learning- simulations

UNIT-IV: ANIMATION**9**

Principles of animation: staging- squash and stretch- timing- onion skinning- secondary action- 2D- 2 ½ D and 3D animation- Animation techniques: Key frame- Morphing- Inverse Kinematics- Hand Drawn- Character rigging- vector animation- stop motion- motion graphics- Fluid Simulation- skeletal animation- skinning Virtual Reality- Augmented Reality

UNIT-V: MULTIMEDIA APPLICATIONS**9**

Multimedia Big data computing- social networks- smart phones- surveillance- Analytics- Multimedia Cloud Computing- Multimedia streaming cloud- media on demand- security and forensics- Online social networking- multimedia ontology- Content based retrieval from digital libraries

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****REFERENCES:**

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021.
2. John M Blain, "The Complete Guide to Blender Graphics: Computer Modeling & Animation", CRC press, 3rd Edition, 2016.
3. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
4. Prabhat K. Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
5. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
6. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
7. <https://opensource.com/article/18/2/open-source-audio-visual-production-tools>

8. <https://developer.android.com/training/animation/overview>

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Get the bigger picture of the context of Multimedia and its applications.

CO2: Use the different types of media elements of different formats on content pages.

CO3: Author 2D and 3D creative and interactive presentations for different target multimedia applications.

CO4: Use different standard animation techniques for 2D, 2 1/2 D, 3D applications.

CO5: Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

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.

UNIT-I: INTRODUCTION TO DEVOPS**9**

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github

UNIT-II: COMPILE AND BUILD USING MAVEN & GRADLE**9**

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- Understand build using Gradle

UNIT-III: CONTINUOUS INTEGRATION USING JENKINS**9**

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: CONFIGURATION MANAGEMENT USING ANSIBLE**9**

Ansible Introduction- Installation- Ansible master/slave configuration- YAML basics- Ansible modules- Ansible Inventory files- Ansible playbooks- Ansible Roles- adhoc commands in ansible

UNIT-V: BUILDING DEVOPS PIPELINES USING AZURE**9**

Create Github Account- Create Repository- Create Azure Organization- Create a new pipeline- Build a sample code- Modify azure-pipelines.yaml file

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods

REFERENCES:

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.
3. Hands-On Azure Devops: CICD Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: (English Edition) January 2020
4. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
5. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
6. 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.
7. <https://www.jenkins.io/user-handbook.pdf>

8. <https://maven.apache.org/guides/getting-started/>

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.

CO3: Ability to Perform Automated Continuous Deployment.

CO4: Ability to do configuration management using Ansible.

CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps.

COURSE OBJECTIVES:

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence.
- To understand various types of analytics for Business Forecasting.
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business.

UNIT-I: INTRODUCTION TO BUSINESS ANALYTICS**9**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

UNIT-II: BUSINESS INTELLIGENCE**9**

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions

UNIT-III: BUSINESS FORECASTING**9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics

UNIT-IV: HR & SUPPLY CHAIN ANALYTICS**9**

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year

UNIT-V: MARKETING & SALES ANALYTICS**9**

Marketing Strategy, Marketing Mix, Customer Behaviour- selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods

REFERENCES:

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017.
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016.
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016.
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.
6. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley, First Edition, 2017.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Explain the real world business problems and model with analytical solutions.

CO2: Identify the business processes for extracting Business Intelligence.

CO3: Apply predictive analytics for business fore-casting.

CO4: Apply analytics for supply chain and logistics management.

CO5: Use analytics for marketing and sales.

COURSE OBJECTIVES:

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT-I: REASONING UNDER UNCERTAINTY**9**

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT-II: METHODOLOGY AND MODELING**9**

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT-III: ONTOLOGIES – DESIGN AND DEVELOPMENT**9**

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT-IV: REASONING WITH ONTOLOGIES AND RULES**9**

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT-V: LEARNING AND RULE LEARNING**9**

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods

REFERENCES:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016.
2. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
3. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
4. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
5. King, Knowledge Management and Organizational Learning, Springer, 2009.

6. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition, 2001.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Understand the basics of Knowledge Engineering.

CO2: Apply methodologies and modelling for Agent Design and Development.

CO3: Design and develop ontologies.

CO4: Apply reasoning with ontologies and rules.

CO5: Understand learning and rule learning.

COURSE OBJECTIVES:

- The primary objective of this course is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT-I: INTRODUCTION TO ONLINE MARKET**9**

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT-II: SEARCH ENGINE OPTIMISATION**9**

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: E- MAIL MARKETING**9**

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: SOCIAL MEDIA MARKETING**9**

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: DIGITAL TRANSFORMATION**9**

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods

REFERENCES:

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. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- CO2:** To focus on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
- CO3:** To know the key elements of a digital marketing strategy.
- CO4:** To study how the effectiveness of a digital marketing campaign can be measured.
- CO5:** To demonstrate advanced practical.

COURSE OBJECTIVES:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I : 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II : EMBEDDED C PROGRAMMING 9

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III: IOT AND ARDUINO PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV: IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V: APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENECS:**

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, Second Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.
3. Michael J. Pont, “Embedded C”, Pearson Education, 2007.

4. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
5. Andrew N Sloss, D. Symes, C. Wright, “Arm System Developer's Guide”, Morgan Kauffman/ Elsevier, 2006.
6. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- C01:** Explain the architecture of embedded processors.
- C02:** Write embedded C programs.
- C03:** Design simple embedded applications.
- C04:** Compare the communication models in IOT
- C05:** Design IoT applications using Arduino/Raspberry Pi /open platform.

COURSE OBJECTIVES:

- To give an overview of the theoretical foundations of computer science from the perspective of formal languages
- To illustrate finite state machines to solve problems in computing
- To explain the hierarchy of problems arising in the computer sciences.
- To familiarize Regular grammars, context free grammar.

UNIT I : FINITE AUTOMATA 9

Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

UNIT II : REGULAR EXPRESSIONS AND REGULAR GRAMMARS 9

REGULAR EXPRESSIONS (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.

UNIT III: CONTEXT FREE GRAMMAR 9

Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, Minimization of CFG's, CNF, GNF, Pumping Lemma for CFL's, Enumeration of Properties of CFL (Proof's omitted).

UNIT IV: PUSHDOWN AUTOMATA AND TURING MACHINES 9

PUSHDOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA. TURING MACHINES (TM): Formal definition and behaviour, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.

UNIT V: RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES 9

Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), undecidability of PCP.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

1. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2008.
2. John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill, 2011.
3. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of India, 2015.
4. Peter Linz, "An Introduction to Formal Language and Automata", 6th Edition, Jones & Bartlett, 2016.
5. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata Languages and Computation", 3rd Edition, Prentice Hall of India, 2006.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Construct automata theory using Finite Automata
- CO2:** Write regular expressions for any pattern
- CO3:** Design context free grammar and Pushdown Automata
- CO4:** Design Turing machine for computational functions
- CO5:** Differentiate between decidable and undecidable problems

COURSE OBJECTIVES:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT I : FOUNDATIONS OF SOFTWARE TESTING 9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II : TEST PLANNING 9

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III: TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV: ADVANCED TESTING CONCEPTS 9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V: TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENECS:**

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avsarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

3. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
4. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing.
5. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor & Francis Group.
6. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
7. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
8. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Understand the basic concepts of software testing and the need for software testing
- CO2:** Design Test planning and different activities involved in test planning
- CO3:** Design effective test cases that can uncover critical defects in the application
- CO4:** Carry out advanced types of testing
- CO5:** Automate the software testing using Selenium and TestNG

22ITPC603

**MOBILE APPLICATIONS DEVELOPMENT
LABORATORY**

SEMESTER V

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COURSE OBJECTIVES:

- Use of Android Studio/Flutter/Kotlin multi-platform environment for building cross-platform mobile applications.
- Demonstrate the knowledge of different programming techniques and patterns for mobile application development.
- Identify the components and structure of mobile application development frameworks.
- Understand the capabilities and limitations of different platforms.
- Design and develop real-time mobile applications.

LIST OF EXPERIMENTS:

1. Study and installation of Flutter/Kotlin/Android Studio multi-platform environment
2. Develop an application that uses Widgets, GUI components, Fonts, and Colors.
3. Develop a native calculator application.
4. Develop a gaming application that uses 2-D animations and gestures.
5. Develop a movie rating application (similar to IMDB)
6. Develop an application to connect to a web service and to retrieve data with HTTP.
7. Develop a simple shopping application.
8. Design a web server supporting push notifications.
9. Develop an application by integrating Google maps
10. Mini Projects involving Android Studio/Flutter/Kotlin multi-platform

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Design and build simple mobile applications supporting multiple platforms.
CO2: Apply various programming techniques and patterns to build mobile applications.
CO3: Build real-time mobile applications for society/environment
CO4: Build gaming and multimedia based mobile applications
CO5: Build gaming and multimedia based mobile applications

LIST OF EQUIPMENT'S AND COMPONENTS

- Software Required – Flutter / Kotlin / Android Studio equivalent
- Hardware Required – Standalone desktops 30 Nos.

COURSE OBJECTIVES:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

LIST OF EXPERIMENTS:

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).
2. Design the test cases for testing the e-commerce application
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the test cases for an inventory control system.
5. Execute the test cases against a client server or desktop application and identify the defects.
6. Test the performance of the e-commerce application.
7. Automate the testing of e-commerce applications using Selenium.
8. Integrate TestNG with the above test automation.
9. Mini Project:
 - a) Build a data-driven framework using Selenium and TestNG
 - b) Build Page object Model using Selenium and TestNG
 - c) Build BDD framework with Selenium, TestNG and Cucumber

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Understand the basic concepts of software testing and the need for software testing
CO2: Design Test planning and different activities involved in test planning
CO3: Design effective test cases that can uncover critical defects in the application
CO4: Carry out advanced types of testing
CO5: Automate the software testing using Selenium and TestNG

LIST OF EQUIPMENT'S AND COMPONENTS

- Software Required – Selenium / TestNG / Load Runner / Cucumber / equivalent.
- Hardware Required – Standalone desktops 30 Nos.

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COURSE OBJECTIVES:

- To understand the basics of discrete time signals, systems and their classifications.
- To analyze the discrete time signals in both time and frequency domain.
- To design low pass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using Fourier method, window technique.
- To realize the concept and usage of DSP in various engineering fields.

UNIT-I: DISCRETE TIME SIGNALS AND SYSTEMS 9

Introduction to DSP – Basic elements of DSP – Sampling of continuous time signals – Representation, Operation and classification of discrete time signal – Classification of discrete time systems – Discrete convolution: Linear and circular – Correlation.

UNIT-II: ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS 9

Analysis of LTI Discrete time systems using DFT – Properties of DFT – Inverse DFT –analysis of LTI Discrete time systems using FFT algorithms – Inverse DFT using FFT algorithm.

UNIT-III: INFINITE IMPULSE RESPONSE FILTERS 9

Frequency response of Analog and Digital IIR filters – Realization of IIR filter – Design of analog low pass filter – Analog to Digital filter transformation using Bilinear transformation and Impulse Invariant method – Design of digital IIR filters (LPF, HPF, BPF, and BR) using various transformation techniques.

UNIT-IV: FINITE IMPULSE RESPONSE FILTERS 9

Linear Phase FIR filter – Phase delay– Group delay – Realization of FIR filter – Design of causal and Non-causal FIR filters (LPF, HPF, BPF and BR) using window method (Rectangular, Hamming window, Hanning window) – Frequency sampling technique.

UNIT-V: APPLICATIONS OF DSP 9

Multirate signal processing: Decimation, Interpolation, Spectrum of the sampled signal – Processing of audio and radar signal.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, 4th Edition, Pearson Education / Prentice Hall, 2007.

2. Richard G. Lyons, "Understanding Digital Signal Processing", 2nd Edition, Pearson Education.
3. Oppenheim A.V, Schafer R.W and Buck J.R., "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
4. Emmanuel C. Ifeakor, and Barrie W. Jervis, "Digital Signal Processing", 2nd Edition, Pearson Education / Prentice Hall, 2002.
5. William D. Stanley, "Digital Signal Processing", 2nd Edition, Reston Publications.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Perform mathematical operations on signals.
- CO2:** Model the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
- CO3:** Transform the time domain signal into frequency domain signal and vice-versa.
- CO4:** Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.
- CO5:** Identify the applications of DSP.

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing

UNIT I : INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNIT II : NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III: GENETIC ALGORITHMS 9

Chromosome Encoding Schemes -Population initialization and selection methods – Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

UNIT IV: NEURO FUZZY MODELING 9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

UNIT V: APPLICATIONS 9

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

1. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020
2. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India pvt Ltd, 2019.
3. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
4. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997
5. Samir Roy, Udit Chakraborty, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
6. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Understand the fundamentals of fuzzy logic operators and inference mechanisms
- CO2:** Understand neural network architecture for AI applications such as classification and clustering
- CO3:** Learn the functionality of Genetic Algorithms in Optimization problems
- CO4:** Use hybrid techniques involving Neural networks and Fuzzy logic
- CO5:** Apply soft computing techniques in real world applications

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I : FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II : FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III: FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience – Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals – Know about Business Goals

UNIT IV: WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing – Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V: RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping - Information Architecture

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020
4. Steve Schoger, Adam Wathan "Refactoring UI", 2018
5. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015
6. <https://www.interaction-design.org/literature>.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Build UI for user Applications
- CO2:** Evaluate UX design of any product or application
- CO3:** Demonstrate UX Skills in product development
- CO4:** Implement Sketching principles
- CO5:** Create Wireframe and Prototype

COURSE OBJECTIVES:

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT I : FUNDAMENTALS OF WEB APPLICATION SECURITY 9

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 : SECURE DEVELOPMENT AND DEPLOYMENT 9

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: SECURE API DEVELOPMENT 9

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: VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

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: HACKING TECHNIQUES AND TOOLS 9

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.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.
4. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
5. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
6. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
7. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Understanding the basic concepts of web application security and the need for it
- CO2:** Be acquainted with the process for secure development and deployment of web applications
- CO3:** Acquire the skill to design and develop Secure Web Applications that use Secure APIs
- CO4:** Be able to get the importance of carrying out vulnerability assessment and penetration testing
- CO5:** Acquire the skill to think like a hacker and to use hackers tool sets

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COURSE OBJECTIVES:

- To understand the graph models and basic concepts of graphs.
- To study the characterization and properties of trees and graph connectivity.
- To provide an exposure to the Eulerian and Hamiltonian graphs.
- To introduce Graph colouring and explain its significance.
- To provide an understanding of Optimization Graph Algorithms.

UNIT I : INTRODUCTION TO GRAPHS 9

Graphs and Graph Models – Connected graphs – Common classes of graphs – Multi graphs and Digraphs – Degree of a vertex – Degree Sequence – Graphs and Matrices – Isomorphism of graphs.

UNIT II : TREES AND CONNECTIVITY 9

Bridges – Trees – Characterization and properties of trees – Cut vertices – Connectivity.

UNIT III: TRAVERSABILITY 9

Eulerian graphs – Characterization of Eulerian graphs – Hamiltonian graphs – Necessary condition for Hamiltonian graphs – Sufficient condition for Hamiltonian graphs.

UNIT IV: PLANARITY AND COLOURING 9

Planar Graphs – The Euler Identity – Non planar Graphs – Vertex Colouring – Lower and Upper bounds of chromatic number.

UNIT V: OPTIMIZATION GRAPH ALGORITHMS 9

Dijkstra's shortest path algorithm – Kruskal's and Prim's minimum spanning tree algorithms – Transport Network – The Max-Flow Min-Cut Theorem – The Labeling Procedure – Maximum flow problem.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENECS:**

1. Gary Chartrand and Ping Zhang, "Introduction to Graph Theory", Tata McGraw – Hill companies Inc., New York, 2006.
2. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics, An applied introduction" Fifth edition, Pearson Education, Inc, Singapore, 2004.

3. Balakrishnan R. and Ranganathan K., “A Text Book of Graph Theory”, Springer – Verlag, New York, 2012.
4. Douglas B. West, “Introduction to Graph Theory”, Pearson, Second Edition, New York, 2018.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- C01:** Apply graph models for solving real world problem.
- C02:** Understand the importance the natural applications of trees and graph connectivity.
- C03:** Understand the characterization study of Eulerian graphs and Hamiltonian graphs.
- C04:** Apply the graph colouring concepts in partitioning problems.
- C05:** Apply the standard optimization graph algorithms in solving application problems.

COURSE OBJECTIVES:

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To develop programs in non-procedural programming paradigms

UNIT I : SYNTAX AND SEMANTICS**9**

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing

UNIT II : DATA, DATA TYPES, AND BASIC STATEMENTS**9**

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection - primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements

UNIT III: SUBPROGRAMS AND IMPLEMENTATIONS**9**

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping

UNIT IV: OBJECT-ORIENTATION, CONCURRENCY & EVENT HANDLING**9**

Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling

UNIT V: FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES**9**

Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

1. Robert W. Sebesta, "Concepts of Programming Languages", Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, "Programming Language Pragmatics", Fourth Edition, Elsevier, 2018.
3. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, Prentice Hall, 2011.
4. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Pearson, 1997.
5. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Describe syntax and semantics of programming languages
- CO2:** Explain data, data types, and basic statements of programming languages
- CO3:** Design and implement subprogram constructs
- CO4:** Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog
- CO5:** Understand and adopt new programming languages

22ITPE607	DATA MINING FOR BUSINESS INTELLIGENCE	SEMESTER V			
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COURSE OBJECTIVES:

- To know how to derive meaning from huge volume of data and information
- To understand how knowledge discovering process is used in business decision making.

UNIT I : INTRODUCTION 9

Data mining, Text mining, Web mining, Spatial mining, Process mining, Data warehouse and datamarts.

UNIT II : DATA MINING PROCESS 9

Data mining process KDD, CRISP-DM, SEMMA and Domain-Specific, Classification and Prediction performance measures -RSME, MAD, MAP, MAPE, Confusion matrix, Receiver Operating Characteristic curve & AUC; Validation Techniques - hold-out, k-fold cross-validation, LOOCV, random subsampling, and bootstrapping.

UNIT III: PREDICTION TECHNIQUES 9

Data visualization, Time series ARIMA, Winter Holts, Vector Autoregressive analysis, Multivariate regression analysis.

UNIT IV: CLASSIFICATION AND CLUSTERING TECHNIQUES 9

Classification- Decision trees, k nearest neighbour, Logistic regression, Discriminant analysis; Clustering; Market basket analysis;

UNIT V: MACHINE LEARNING AND AI 9

Genetic algorithms, Neural network, Fuzzy logic, Support Vector Machine, Optimization techniques Ant Colony, Particle Swarm, DEA

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERNECS:

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007.
4. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.

5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.
6. Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Have knowledge on data storage models
- CO2:** Analyzing the purpose of business analytics
- CO3:** Apply data mining techniques and methods to large data sets.
- CO4:** Compare and contrast the various classifiers
- CO5:** Understand different clustering techniques

22ITPE608

SERVICE ORIENTED ARCHITECTURE

SEMESTER V

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3	0	0	3

COURSE OBJECTIVES:

- To learn the concepts of distributed application development
- To differentiate XML based web services from other standard models
- To study the importance of service composition

UNIT I : SOA FUNDAMENTALS 9

SOA – Services – Loose Coupling – The Enterprise service bus – Service Classification – Business process management – SOA and the organization – SOA and the organization - SOA in context – Message exchange patterns – SOA life cycle – Versioning – Web services

UNIT II : SERVICE-ORIENTED ANALYSIS AND DESIGN 9

SOA Terminology and Concepts - REST Design Constraints and Goals - RESTful ServiceOrientation - Service Contracts with REST - Service-Oriented and REST Service-Oriented Analysis and Design with REST - Mainstream SOA Methodology - Analysis and Service Modeling with REST - Service-Oriented Design with REST HTML - Cookies - Simple PHP scripts

UNIT III: SERVICE COMPOSITION 9

Service Composition with REST - Fundamental Service Composition with REST - Advanced Service Composition with REST - Service Composition with REST Case Study - Design Patterns for SOA with REST - Service Versioning with REST - Uniform Contract Profiles

UNIT IV: RESTFUL SERVICES AND THE RESOURCE-ORIENTEDARCHITECTURE 9

Introducing the Simple Storage Service - Object-Oriented Design of S3 - URIs - Addressability - Statelessness - Representations - Links and Connectedness - The Uniform Interface - Resource Design - Turning Requirements into Read-Only Resources - Service Implementation - Web service case studies - Connect Resources to Each Other - Controller Code - Model Code

UNIT V: SOA TRANSACTION AND SECURITY 9

SOA and performance - SOA and security – Service Management - Model driven service deployment – Establishing SOA and SOA governance

Contact Periods:

Lecture: 45 Periods

Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

REFERENECS:

1. Nicolai M.Josuttis, SOA in design - The art of distributed system design, O'REILLY publication, 2007.

2. Raj Balasubramanian, Benjamin Carlyle, Thomas Erl, Cesare Pautasso, "SOA with REST - Principles, Patterns & Constraints for building Enterprise solutions with REST", Prentice Hall/PearsonPTR , 2012.
3. Leonard Richardson and Sam Ruby, RESTful Web Services, O'REILLY publication, 2007.
4. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson education,2005.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Understanding the fundamental of SOA
- CO2:** Analyze and design SOA based solutions
- CO3:** Create RESTful and SOAP based services
- CO4:** Define workflow automation and develop BPM based applications
- CO5:** Analyze various security policies

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I : SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II : INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III: NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV: INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V: BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

Contact Periods:**Lecture: 60 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 60 Periods****REFERENECS:**

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10 th Edition, New Delhi, 2015.
3. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
4. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6 th Edition, New Delhi, 2006.
5. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2 nd Edition, Prentice Hall, 1992.
6. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
7. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- CO2:** Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- CO3:** Apply the numerical techniques of differentiation and integration for engineering problems.
- CO4:** Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- CO5:** Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

22ITPE610	AUGMENTED REALITY & VIRTUAL REALITY	SEMESTER V			
		L	T	P	C
		4	0	0	3

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.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I : INTRODUCTION 9

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 – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II : VR MODELING 9

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT III: VR PROGRAMMING 9

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV: APPLICATIONS 9

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 – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V: AUGMENTED REALITY 9

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation Navigation-Wearable devices

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENECS:

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

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Understand the basic concepts of AR and VR
- CO2:** Understand the tools and technologies related to AR/VR
- CO3:** Know the working principle of AR/VR related Sensor devices
- CO4:** Design of various models using modeling techniques
- CO5:** Develop AR/VR applications in different domains

22ITPE611

STORAGE TECHNOLOGIES

SEMESTER V

L	T	P	C
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

UNIT I : STORAGE SYSTEMS

9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II : INTELLIGENT STORAGE SYSTEMS AND RAID

9

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale-out storage Architecture.

UNIT III: STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

9

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV: BACKUP, ARCHIVE AND REPLICATION

9

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT V: SECURING STORAGE INFRASTRUCTURE

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERNECS:

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
- CO2:** Illustrate the usage of advanced intelligent storage systems and RAID
- CO3:** Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
- CO4:** Examine the different role in providing disaster recovery and remote replication technologies
- CO5:** Infer the security needs and security measures to be employed in information storage management

L	T	P	C
4	0	0	3

COURSE OBJECTIVES:

- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT I : SDN: INTRODUCTION 9

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane

UNIT II : SDN DATA PLANE AND CONTROL PLANE 9

Data Plane functions and protocols - OpenFlow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III: SDN APPLICATIONS 9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT IV: NETWORK FUNCTION VIRTUALIZATION 9

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V: NFV FUNCTIONALITY 9

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENECS:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.

2. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
3. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.
4. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition, CRC Press, 2014.
5. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann Press, 2016.
6. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Describe the motivation behind SDN
- CO2:** Identify the functions of the data plane and control plane
- CO3:** Design and develop network applications using SDN
- CO4:** Orchestrate network services using NFV
- CO5:** Explain various use cases of SDN and NFV

P. A. COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai)
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CURRICULA & SYLLABI

REGULATIONS

2022



LIST OF OPEN ELECTIVES

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ADOE01	Computer Vision	3	0	0	3
2.	22ADOE02	Ethics and AI	3	0	0	3
3.	22ADOE03	Network Security and Firewalls	3	0	0	3
4.	22ADOE04	R Programming	3	0	0	3
5.	22ADOE05	Programming with ASP.Net	3	0	0	3
6	22CSOE01	Computer Graphics and Simulation	3	0	0	3
7	22CSOE02	Data Integration & Big data	3	0	0	3
8	22CSOE03	Game Programming	3	0	0	3
9	22CSOE04	Storage Technologies	3	0	0	3
10	22CSOE05	Recommender Systems	3	0	0	3
11	22ECOE01	Computational Intelligence	3	0	0	3
12	22ECOE02	Wearable Devices	3	0	0	3
13	22ECOE03	VLSI Testing and Design For Testability	3	0	0	3
14	22ECOE04	IoT Based Systems Design	3	0	0	3
15	22ECOE05	Design Thinking	3	0	0	3
16	22EEOE01	Power Plant Engineering	3	0	0	3
17	22EEOE02	Sensors and Transducers	3	0	0	3
18	22EEOE03	Hybrid Energy Technology	3	0	0	3
19	22EEOE04	Biomedical Instrumentation	3	0	0	3
20	22EEOE05	Electric and Hybrid Vehicles	3	0	0	3
21	22ITOE01	Mobile Adhoc Networks	3	0	0	3
22	22ITOE02	Blockchain Technologies	3	0	0	3

23	22ITOE03	Open Source Technologies	3	0	0	3
24	22ITOE04	Android Application Development	3	0	0	3
25	22ITOE05	Digital and Mobile Forensics	3	0	0	3
26	22MEOE01	Testing of Materials	3	0	0	3
27	22MEOE02	Welding Technology	3	0	0	3
28	22MEOE03	Industrial Safety Engineering	3	0	0	3
29	22MEOE04	Marketing Management	3	0	0	3
30	22MEOE05	Maintenance Engineering	3	0	0	3

L	T	P	C
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

UNIT-I: INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

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: FEATURE DETECTION, MATCHING AND SEGMENTATION 9

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: FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9

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: 3D RECONSTRUCTION 9

Shape from X - Active rangefinding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos.

UNIT-V: IMAGE-BASED RENDERING AND RECOGNITION 9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Videobased rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets..

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

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.
6. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, “ A Guide to Convolutional Neural Networks for Computer Vision”, Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** To understand basic knowledge, theories and methods in image processing and computer vision.
- CO2:** To implement basic and some advanced image processing techniques in OpenCV.
- CO3:** To apply 2D a feature-based based image alignment, segmentation and motion estimations.
- CO4:** To apply 3D image reconstruction techniques
- CO5:** To design and develop innovative image processing and computer vision applications.

COURSE OBJECTIVES:

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

UNIT-I: INTRODUCTION

9

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust.

UNIT-II: ETHICAL INITIATIVES IN AI

9

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization.

UNIT-III: AI STANDARDS AND REGULATION

9

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT-IV: ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS

9

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology – Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional ResponsibilityRoboethics Taxonomy.

UNIT-V: AI AND ETHICS- CHALLENGES AND OPPORTUNITIES

9

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries- National and International Strategies on AI.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,”The ethics of artificial intelligence: Issues and initiatives”, EPRS European Parliamentary Research Service Scientific Foresight Unit March 2020.
2. Patrick Lin, Keith Abney, George A Bekey,” Robot Ethics: The Ethical and Social Implications of Robotics”, The MIT Press- January 2014
3. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
4. Mark Coeckelbergh,” AI Ethics”, The MIT Press Essential Knowledge series, April 2020
5. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January

2022

6. The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Learn about morality and ethics in AI
- CO2:** Acquire the knowledge of real time application ethics, issues and its challenges.
- CO3:** Understand the ethical harms and ethical initiatives in AI
- CO4:** Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
- CO5:** Understand the concepts of Roboethics and Morality with professional responsibilities.

COURSE OBJECTIVES:

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

UNIT-I: INTRODUCTION**9**

Basics of cryptography, conventional and public-key cryptography, hash functions, authentication and digital signatures.

UNIT-II: KEY MANAGEMENT AND AUTHENTICATION**9**

Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT-III: ACCESS CONTROL AND SECURITY**9**

Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.

UNIT-IV: APPLICATION LAYER SECURITY**9**

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security

UNIT-V: FIREWALLS**9**

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.
2. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
3. Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004.
4. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141-1.

5. Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
6. The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Classify the encryption techniques
- CO2:** Illustrate the key management technique and authentication.
- CO3:** Evaluate the security techniques applied to network and transport layer
- CO4:** Discuss the application layer security standards.
- CO5:** Apply security practices for real time applications.

COURSE OBJECTIVES:

- To understand the basics in R programming in terms of constructs, control statements, string functions.
- To learn to apply R programming for Text processing.
- To expose the use of R Big Data analytics.
- To able to appreciate and apply the R programming from a statistical perspective.
- To make clear the concept for data visualization and statistics and probability.

UNIT-I: INTRODUCTION TO R**9**

Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element name.

UNIT-II: MATRICES, ARRAYS AND LISTS**9**

Matrices, Arrays and Lists Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT-III: DATA FRAMES**9**

Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions.

UNIT-IV: CONTROL STATEMENTS, FUNCTIONS, R GRAPHS**9**

Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues –Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots.

UNIT-V: INTERFACING**9**

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Andy Vickler, “R Programming: This book includes: R Basics for Beginners + R Data Analysis and Statistics + R Data Visualization”, Ladoo Publishing LLC, 2022.
2. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data & Analytics Series, 2013.
3. Mark Gardener, “ Beginning R – The Statistical Programming Language”, Wiley, 2013.
4. Robert Knell, “Introductory R: A Beginner's Guide to Data Visualisation, Statistical

- Analysis and Programming in R”, Amazon Digital South Asia Services Inc, 2013.
5. Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press, 2011.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Create artful graphs to visualize complex data sets and functions.
- CO2:** Write more efficient code using parallel R and vectorization.
- CO3:** Interface R with C / C++ and Python for increased speed or functionality.
- CO4:** Evaluate new packages for text analysis, image manipulation, and perform statistical analysis of the same.
- CO5:** Develop interfacing R to other Languages.

COURSE OBJECTIVES:

- To understand .Net as simple, modern, object- oriented computer programming language
- To understand CLR Framework
- To design web services
- To design and build interactive webpages and server side logic
- To understand the data access

UNIT-I: INTRODUCTION TO .NET FRAMEWORK AND MANAGED CODE 9

Introduction to .NET Framework: Managed Code and the CLR- Intermediate Language, Metadata and JIT Compilation - Automatic Memory Management

UNIT-II: LANGUAGE CONCEPTS, CLR, AND FRAMEWORK CLASS LIBRARY 9

Language Concepts and the CLR: Visual Studio .NET - Using the .NET Framework. The Framework Class Library: NET objects - ASP .NET - .NET web services – Windows Forms

UNIT-III: ASP.NET FEATURES AND WEB SERVICES 9

ASP.NET Features: Change the Home Directory in IIS - Add a Virtual Directory in IIS- Set a Default Document for IIS - Change Log File Properties for IIS - Stop, Start, or Pause a Web Site

UNIT-IV: WEB CONTROLS AND CREATING WEB FORMS 9

Creating Web Controls: Web Controls - HTML Controls, Using Intrinsic Controls, Using Input Validation Controls, Selecting Controls for Applications - Adding web controls to a Page. Creating Web Forms: Server Controls - Types of Server Controls - Adding ASP.NET Code to a Page.

UNIT-V: ASP.NET DATA ACCESS 9

ASP.NET Data Access: Data Binding Server Controls-Viewing Data Collections in a Grid. ASP.NET Caching Mechanism for caching Dynamic response data. Page Output Caching.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Jason N. Gaylord, Christian Wenz, Pranav Rastogi, Todd Miranda, and Scott Hanselman "Professional ASP.NET 4.5 in C# and VB"
2. Jonas Fagerberg , "ASP.NET Core 5 for Beginners"
3. Alex Homer, Dave Sussman, Professional ASP.NET 1.1, Wrox Publication
4. .NET Framework, OREILY Publication.
5. Deitel and Deitel, Visual Basic.NET How to Program, Pearson Education, 2nd edition Greg Buczek, ASP.NET Developer's Guide, Tata McGraw-Hill, 2002.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Learn fundamentals of .net framework

CO2: Enrich knowledge about Windows Forms, Controls and ASP.NET based applications.

CO3: Create Web services for web based application.

CO4: Create Web forms for web applications

CO5: Web-based applications and Reports using .net technologies

COURSE OBJECTIVES:

- To Gain knowledge about graphics hardware devices and software used.
- To Understand the two dimensional graphics and their transformations.
- To Understand the three dimensional graphics and their transformations.
- To Appreciate illumination and color models.
- To be familiar with understand clipping techniques.

UNIT-I: INTRODUCING**9**

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: TWO DIMENSIONAL GRAPHICS**9**

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

UNIT-III: THREE DIMENSIONAL GRAPHICS**9**

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: ILLUMINATION AND COLOUR MODELS**9**

Light sources - basic illumination models – halftone 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: ANIMATIONS & REALISM**9**

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.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

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, AddisonWesley 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 Carithers,“Computer Graphics With Open GL”, 4th Edition, Pearson Education, 2010.
 4. Jeffrey McConnell, “Computer Graphics: Theory into Practice”, Jones and Bartlett Publishers, 2006.
 5. Hill F S Jr., "Computer Graphics", Maxwell Macmillan” , 1990

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Identify graphics hardware devices and software used.
- CO2:** Design and apply two dimensional transformations
- CO3:** Design three dimensional graphics.
- CO4:** Apply Illumination and color models.
- CO5:** Apply clipping techniques to graphics and Design animation sequences.

COURSE OBJECTIVES:

- To understand the concepts of BI and ETL.
- To inculcate and express knowledge of Talend architecture and its various components.
- To explain the different integration process using advanced components.
- To examine Big Data, Hadoop concepts and the benefits of integrating Talend with Hadoop.
- To focus the various Hadoop Eco systems.

UNIT-I: FUNDAMENTALS OF BI AND ETL**9**

Introduction to Business Problem Analysis – Business Intelligence, Data warehousing, Data Collection and Description, Data Extraction – ETL Process, Schema Integration, Data integration, Data Quality

UNIT-II: INTRODUCTION TO TALEND**9**

Introduction – Architecture of Talend Tool, Starting a Talend Tool, Talend models, Talend Metadata, Managing Metadata, Data Integration features, Data integration Components

UNIT-III: INTRODUCTION TO BIG DATA**9**

Introduction - Historical Interpretation of Big Data - Defining Big Data From 3Vs to 3²Vs - Big Data Analytics and Machine Learning - Big Data Analytics and Cloud Computing - Real-Time Analytics: Characteristics of Real-Time Systems, Real-Time Processing for Big Data — Concepts and Platforms

UNIT-IV: BASICS OF HADOOP**9**

Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – file-based data structures

UNIT-V: HADOOP ECOSYSTEM**9**

Introduction to Sqoop components – Tables and Databases, Introduction to Pig Components – Load and Store operations, Grouping and joining, Combining and splitting, Filtering and Sorting Spark and Hbase - Basic Concepts.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

1. Domenico Talia, Paolo Trunfio, Fabrizio Marozzo, Loris Belcastro, Riccardo Cantini, Alessio Orsino, “Programming Big Data Applications: Scalable Tools And Frameworks For Your Needs Hardcover”, World Scientific Europe Ltd, 2024.
2. Wilfried Grossmann, Stefanie Rinderle-Ma, “Fundamentals of Business Intelligence”, Springer-Verlag Berlin and Heidelberg GmbH & Co. K, 2016.
3. Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, “Big Data Principles and Paradigms”, Morgan Kaufmann, 2016.
4. Marz N and Warren J, “Big Data”, Manning Publications, 2015.
5. Richard Daniel Barton, “Talend Open Studio Cookbook”, Packt Pub Ltd, 2013.
6. Chuck Lam, “Hadoop in Action”, Manning Publications, 2010.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Gain the basic concepts of BI and ETL schema and architecture.
- CO2:** Apply Talend tool architecture and suitable components for data analysis.
- CO3:** Design various integration techniques using different components.
- CO4:** Compare appropriate Hadoop concepts with integrating Talend to observe Big Data.
- CO5:** Automate the different Hadoop Eco systems.

COURSE OBJECTIVES:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT-I: 3D GRAPHICS FOR GAME DESIGN**9**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT-II: GAME DESIGN PRINCIPLES**9**

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT-III: GAME ENGINE DESIGN**9**

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT-IV: OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS**9**

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity Single player and Multi-Player games

UNIT-V: GAME DEVELOPMENT USING PYGAME**9**

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics Algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based Arcade Games – Puzzle Games.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley, 2013.
2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress, 2007.
3. Paul Craven, “Python Arcade games”, Apress Publishers, 2016

4. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press,2006.
5. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.
6. Y.Narahari, “Game Theory and Mechanism Design”, IISC Press, World Scientific.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Explain the concepts of 2D and 3D Graphics
- CO2:** Design game design documents.
- CO3:** Implementation of gaming engines.
- CO4:** Survey gaming environments and frameworks.
- CO5:** Implement a simple game in Pygame

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

UNIT I : STORAGE SYSTEMS**9**

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II : INTELLIGENT STORAGE SYSTEMS AND RAID**9**

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scaleout storage Architecture.

UNIT III: STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION**9**

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV: BACKUP, ARCHIVE AND REPLICATION**9**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT V: SECURING STORAGE INFRASTRUCTURE**9**

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods**

REFERENECS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018
2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.
3. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018
4. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018
5. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
6. <https://www.coursera.org/specializations/full-stack-react>

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- CO1:** Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
- CO2:** Illustrate the usage of advanced intelligent storage systems and RAID
- CO3:** Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
- CO4:** Examine the different role in providing disaster recovery and remote replication technologies
- CO5:** Infer the security needs and security measures to be employed in information storage management

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 attack resisted recommender system.
- To learn about evaluating recommender system

UNIT-I: INTRODUCTION**9**

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) - Applications of recommendation systems, Issues with recommender system.

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

High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, CO1, CO2 Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

UNIT-III: COLLABORATIVE FILTERING**9**

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

UNIT-IV: ATTACK-RESISTANT RECOMMENDER SYSTEMS**9**

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

UNIT-V: EVALUATING RECOMMENDER SYSTEMS**9**

Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics. Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016

2. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st edition.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011)
4. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st edition
5. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.
6. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013),1st edition

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Understand the basic concepts of recommender systems.
- CO2:** Evaluate Types of recommender systems: non-personalized, content based filtering
- CO3:** Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
- CO4:** Design and implement attack resisted recommender system.
- CO5:** Evaluate the recommender system

COURSE OBJECTIVES:

- Study about uninformed and Heuristic search techniques.
- 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.

UNIT-I: PROBLEM-SOLVING**9**

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: PROBABILISTIC REASONING**9**

Acting under uncertainty – Bayesian inference – Naïve bayes models. Probabilistic reasoning – Bayesian networks – Exact inference in BN – Approximate inference in BN – Causal networks.

UNIT-III: SUPERVISED LEARNING**9**

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: ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**9**

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: NEURAL NETWORKS**9**

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.

Contact periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

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 AI and ES”, 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.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Use appropriate search algorithms for problem solving.

CO2: Apply reasoning under uncertainty.

CO3: Build supervised learning models.

CO4: Understand ensembling and unsupervised models.

CO5: Outline the deep learning neural network models.

COURSE OBJECTIVES:

- To know the hardware requirement of wearable systems.
- To describe the energy harvesting for wearable devices.
- To know the concepts of BAN in health care.
- To understand the security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine

UNIT-I: INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS 9

Wearable Systems – Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems – Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor.

UNIT-II: SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICE 9

Wearability issues – Physical shape and placement of sensor, Technical challenges – Sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements – Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles

UNIT-III: WIRELESS HEALTH SYSTEMS 9

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges – System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.

UNIT-IV: SMART TEXTILE 9

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks. Case study-smart fabric for monitoring biological parameters – ECG, respiration.

UNIT-V: APPLICATIONS OF WEARABLE SYSTEMS 9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45Periods

REFERENCES:

1. Annalisa Bonfiglio and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011.
2. Zhang and Yuan-Ting, Wearable Medical Sensors and Systems, Springer, 2013.
3. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elsevier, 2014.

4. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications, Pan Stanford Publishing Pte. Ltd, Singapore, 2012.
5. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Describe the concepts of wearable system.

CO2: Explain the energy harvestings in wearable device.

CO3: Use the concepts of BAN in health care.

CO4: Illustrate the concept of smart textile.

CO5: Compare the various wearable devices in healthcare system.

COURSE OBJECTIVES:

- To Learn fault models and fault simulation techniques.
- To understand faults in combinational logic circuits.
- To Have Knowledge on faults in sequential logic circuits.
- To introduces the different testability methods.
- To understand fault diagnosis approaches.

UNIT-I: FAULT MODELLING AND SIMULATION**9**

Introduction to testing – Faults in digital circuits – Modeling of faults – Logical fault models – Fault detection – Fault location – Fault dominance – Single stuck fault model and multiple stuck.

UNIT-II: TESTING FOR SINGLE STUCK AT FAULTS**9**

Test generation algorithms for combinational circuits – Fault oriented ATG – D Algorithm – Examples – PODEM – Fault independent ATG – Random Test generation – ATGs for SSFs in sequential circuits – TG using iterative array models – Random test generation.

UNIT-III: DELAY TEST**9**

Delay test problem – Path delay test – Test generation for combinational circuits, Number of paths in a circuit– Transition faults – Delay test methodologies – Slow clock combinational test, Enhanced scan test, normal scan sequential test, Variable – Clock Non-scan sequential test, Rated-clock Non-scan sequential test.

UNIT-IV: DESIGN FOR TESTABILITY**9**

Testability – Controllability and observability, Ad-hoc design for testability techniques – Controllability and observability by means of scan registers – Storage cells for scan design – Level sensitive scan design (LSSD) – Partial scan using I-Paths – Boundary scan standards.

UNIT-V: FAULT DIAGNOSIS**9**

Logical level diagnosis – Diagnosis by UUT reduction – Fault diagnosis for combinational circuits – Self-checking design – System level diagnosis.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Abramovici M, Breuer A and Friedman D., "Digital Systems Testing and Testable Design", Jaico Publishing House, 2002.
2. Parag K. Lala, "Fault Tolerant and Fault Testable Hardware Design", BS Publications, 2002.
3. Michael L. Bushnell and Vishwani D. Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed Signal Circuits", Springer, Verlag2000.

4. Stanley L. Hurst, "VLSI Testing: Digital and Mixed Analogue Digital Techniques", Institute of Electrical Engineers, 1998.
5. Xiaoqing Wen, Cheng Wen Wu and LaungTerng Wang, "VLSI Test Principles and Architectures: Design for Testability", Cambridge University Press, 2000.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO1:** Discuss various fault models and fault simulation techniques.
- CO2:** Examine faults in combinational logic circuits.
- CO3:** Analyze faults in sequential logic circuits.
- CO4:** Explain different testability methods.
- CO5:** Outline fault diagnosis approaches.

COURSE OBJECTIVES:

- To understand the basics of IoT.
- To get knowledge about the various services provided by IoT.
- To familiarize themselves with various communication techniques and networking.
- To know the implementation of IoT with different tools.
- To understand the various applications in IoT.

UNIT-I: INTRODUCTION TO INTERNET OF THINGS**9**

Rise of the machines – Evolution of IoT – Web 3.0 view of IoT – Definition and characteristics of IoT – IoT Enabling Technologies – IoT Architecture – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects – IoT levels and deployment templates – A panoramic view of IoT applications.

UNIT-II: MIDDLEWARE AND PROTOCOLS OF IOT**9**

Middleware technologies for IoT system (IoT Ecosystem Overview – Horizontal Architecture Approach for IoT Systems – SOA based IoT Middleware) Middleware architecture of RFID, WSN, SCADA, M2M – Interoperability challenges of IoT-Protocols for RFID, WSN, SCADA, M2M – Zigbee, KNX, BACNet, MODBUS – Challenges Introduced by 5G in IoT Middleware.

UNIT-III: COMMUNICATION AND NETWORKING**9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks.

UNIT-IV: IOT IMPLEMENTATION TOOLS**9**

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor-based applications through embedded system platform, Implementing IoT concepts with Python, Implementation of IoT with Raspberry Pi.

UNIT-V: APPLICATIONS AND CASE STUDIES**9**

Home automations - Smart cities – Environment – Energy – Retail – Logistics – Agriculture – Industry - Health and life style – Case study.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45Periods

REFERENCES:

1. Honbo Zhou, "Internet of Things in the cloud:A middleware perspective", CRC press, 2012.
2. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2014.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017

4. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, “Internet of Things (IoT) in 5G Mobile Technologies” Springer International Publishing Switzerland 2016..
5. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things” Springer-Verlag Berlin Heidelberg, 2011.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Articulate the main concepts, key technologies, strength and limitations of IoT.

CO2: Identify the architecture, infrastructure models of IoT

CO3: Analyze the networking and how the sensors are communicated in IoT.

CO4: Analyze and design different models for IoT implementation.

CO5: Identify and design the new models for market strategic interaction

COURSE OBJECTIVES:

- Introduce tools & techniques of design thinking for innovative products.
- Development Illustrate customer-centric product innovation.
- Use cases Demonstrate development of Minimum usable Prototypes
- Outline principles of solution concepts & their evaluation
- Describe system thinking principles as applied to complex systems.

UNIT-I: DESIGN THINKING PRINCIPLES**9**

Exploring Human-centered Design – Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy – Building techniques, Mitigate validation risk with FIR [Forge Innovation rubric] – Case studies.

UNIT-II: ENDUSER-CENTRIC INNOVATION**9**

Importance of customer-centric innovation – Problem Validation and Customer Discovery – Understanding problem significance and problem incidence – Customer Validation. Target user, User persona & user stories. Activity: Customer development process – Customer interviews and field visits.

UNIT-III: APPLIED DESIGN THINKING TOOLS**9**

Concept of Minimum Usable Prototype [MUP] – MUP challenge brief – Designing & Crafting the value proposition – Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design.

UNIT-IV: CONCEPT GENERATION**9**

Solution Exploration, Concepts Generation and MUP design – Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts.

UNIT-V: SYSTEM THINKING**9**

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems.

Contact periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

1. Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.
2. Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith, Trish Papadacos, (2014), Value.
3. Proposition Design: How to Create Products and Services Customers Want, Wiley.
4. Donella H. Meadows, (2015), “Thinking in Systems -A Primer”, Sustainability Institute.
5. Tim Brown,(2012) “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Business.

COURSE OUTCOMES:

At the end of each unit, the students will be able to -

CO1: Define & test various hypotheses to mitigate the inherent risks in product innovations.

CO2: Understand customer-centric product innovation.

CO3: Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.

CO4: Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching

CO5: Apply system thinking in a real-world scenario.

COURSE OBJECTIVES:

- To providing an overview of thermal power plants and detailing the role of mechanical engineers in their operation and maintenance.
- To understand construction and operation of diesel, gas turbine and combined cycle power plants.
- To understand construction and operation of nuclear power plants.
- To learn about power from wind and solar.
- To know about the energy, economic and environmental issues of power plants.

UNIT-I: COAL BASED THERMAL POWER PLANTS**9**

Layout of modern coal power plant, super critical boilers, FBC boilers, subsystems of thermal power plants – Fuel and ash handling and draught system, feed water treatment.

UNIT-II: DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS**9**

Components of diesel and gas turbine power plants - Combined cycle power plants - Integrated gasifier based combined cycle systems.

UNIT-III: NUCLEAR POWER PLANTS**9**

Basics of nuclear engineering, layout and subsystems of nuclear power plants, working of nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU), breeder, gas cooled and liquid metal cooled reactors. safety measures for nuclear power plants.

UNIT-IV: POWER FROM RENEWABLE ENERGY**9**

Hydroelectric power plants – Classification, typical layout and associated components. Principle, construction and working of Wind, Tidal, Solar thermal and Fuel cell power systems.

UNIT-V: ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS**9**

Power tariff types, load distribution parameters, load curve, comparison of site selection criteria, relative merits & demerits, capital & operating cost of different power plants. Pollution control technologies including waste disposal options for coal and nuclear power plants.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Nag P. K., "Power Plant Engineering", 4th Edition, Tata McGraw – Hill Publishing Company Ltd., 2014.
2. El -Wakil M. M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
3. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
4. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Standard Handbook of Power Plant Engineering", 2nd Edition, McGraw – Hill Professional, 2012.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- CO1:** Understand the layout, construction and working of the components inside a thermal power plant.
- CO2:** Acquire knowledge about the layout, construction and working of the components inside a diesel, gas and combined cycle power plants.
- CO3:** Gain the basic knowledge of construction and working of the components inside nuclear power plants.
- CO4:** Explore the construction and working of the components inside renewable energy power plants.
- CO5:** Analysis and solve energy and economic related issues in power sector.

COURSE OBJECTIVES:

- To understand the concepts of measurement technology.
- To learn the various motion, proximity and ranging sensors used to measure various physical parameters.
- To understand the various force, magnetic and heading sensors used to measure various physical parameters.
- To know the various optical, pressure and temperature sensors used to measure various physical parameters.
- To understand the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT I : INTRODUCTION**9**

Basics of measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor output signal types.

UNIT II : MOTION, PROXIMITY AND RANGING SENSORS**9**

Motion sensors – Potentiometers, resolver, encoders – Optical, magnetic, inductive, capacitive, LVDT – RVDT – Synchro – Microsyn, accelerometer – GPS, bluetooth, range sensors – Ultrasonic ranging, Laser range sensor (LIDAR).

UNIT III : FORCE, MAGNETIC AND HEADING SENSORS**9**

Strain gage, Load cell, Magnetic sensors – Types, principle, requirement and advantages: Magneto resistive – Hall effect – Current sensor, heading sensors – Compass, gyroscope.

UNIT IV : OPTICAL, PRESSURE AND TEMPERATURE SENSORS**9**

Photo conductive cell, Photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, bellows, Piezoelectric – Tactile sensors, Temperature – IC, thermistor, RTD, thermocouple. Acoustic Sensors – Flow and level measurement, radiation sensors – Smart Sensors – MEMS & Nano sensors.

UNIT V : SIGNAL CONDITIONING AND DAQ SYSTEMS**9**

Amplification – Filtering – Sample and hold circuits – Data acquisition: single channel and multi channel data acquisition – Data logging – Applications – Automobile, aerospace, home appliances, manufacturing, environmental monitoring.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Ernest O. Doebelin, "Measurement Systems - Applications and Design", Tata McGraw-Hill, 2009.
2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th Edition, Dhanpat Rai & Co, New Delhi, 2013.
3. Patranabis D., "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2010.
4. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999.

5. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd Edition, CRC Press, 2015.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- CO1:** Expertise in various calibration techniques and signal types for sensors.
- CO2:** Apply the various sensors in the automotive and mechatronics applications.
- CO3:** Study the basic principles of various magnetic sensors.
- CO4:** Study the basic principles of various smart sensors.
- CO5:** Implement the DAQ systems with different sensors for real time applications.

COURSE OBJECTIVES:

- To provide knowledge about different types of hybrid energy systems.
- To analyze the various electrical Generators used for the Wind Energy Conversion Systems.
- To design the power converters used in SPV Systems.
- To analyze the various power converters used in hybrid energy systems and to understand the importance of standalone and grid-connected operation in Hybrid renewable energy systems.
- To analyze the performance of the various hybrid energy systems

UNIT-I: INTRODUCTION TO HYBRID ENERGY SYSTEMS**9**

Hybrid Energy Systems – Need for Hybrid Energy Systems – Solar-Wind-Fuel Cell-Diesel, Wind- Biomass-Diesel, Micro-Hydel-PV, Ocean and geyser energy - Classification of Hybrid Energy systems – Importance of Hybrid Energy systems – Advantages and Disadvantages - Environmental aspects of renewable energy - Impacts of renewable energy generation on the environment - Present Indian and international energy scenario of conventional and RE sources - Ocean energy, Hydel Energy - Wind Energy, Biomass energy, Hydrogen energy - Solar Photovoltaic (PV) and Fuel cells: Operating principles and characteristics.

UNIT-II: ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS (WECS)**9**

Review of reference theory fundamentals –Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG).

UNIT-III: POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS**9**

Power Converters for SPV Systems - Line commutated converters (inversion-mode) - Boost and buck- boost converters- selection of inverter, battery sizing, array sizing - Analysis of SPV Systems - Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems.

UNIT-IV: ANALYSIS OF POWER CONVERTERS FOR HYBRID ENERGY SYSTEMS**9**

Introduction to Power Converters – Stand-alone Converters -AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters - Bi-Directional Converters - Grid-Interactive Inverters - Matrix converter – Merits and Limitations.

UNIT-V: CASE STUDIES FOR HYBRID RENEWABLE ENERGY SYSTEMS**9**

Hybrid Systems- Range and type of Hybrid systems – Performance Analysis – Cost Analysis - Case studies of Diesel-PV, Wind-PV-Fuel-cell, Micro-hydel-PV, Biomass-Diesel-Fuel-cell systems.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Bahman Zohuri, “Hybrid Energy Systems”, Springer, First Edition, 2018.
2. S.M. Mueyen, “Wind Energy Conversion Systems”, Springer First Edition, 2012

3. Md. Rabiul Islam, Md. Rakibuzzaman Shah, Mohd Hasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles", CRC Press, First Edition, 2021
4. Ernst Joshua, Wind Energy Technology, PHI, India, 2018, 3rd Edition.
5. S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 7th Impression, 2005.
6. Rashid.M. H "Power electronics Hand book", Academic press, 4th Edition, 2018.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- CO1:** Analyze the impacts of hybrid energy technologies on the environment and demonstrate them to harness electrical power.
- CO2:** Select a suitable Electrical machine for wind energy conversion systems and simulate wind energy conversion system
- CO3:** Design the power converters such as AC-DC, DC-DC, and AC-AC converters for SPV systems.
- CO4:** Analyze the power converters such as AC-DC, DC-DC, and AC-AC converters for Hybrid energy systems.
- CO5:** Interpret the hybrid renewable energy systems

COURSE OBJECTIVES:

- To provide knowledge about the physical foundations of biological systems.
- To grasp the various electro physiological measurements in the human body.
- To get knowledge on the measurement of non-electrical parameters in the human body.
- To study the various medical imaging techniques and their applications.
- To provide knowledge in medical assisting and therapy equipment.

UNIT-I: PHYSIOLOGY**9**

Man instrument system – Problems encountered in measuring a living system – Transducers for biomedical applications – Cell and its structure – Resting and action potential – Propagation of action potentials – The heart and cardiovascular system – Electrophysiology of cardiovascular system – Physiology of the respiratory system – Nervous system – Central nervous system and Peripheral nervous system – Electrode theory – Bio-potential electrodes.

UNIT-II: ELECTRO PHYSIOLOGICAL MEASUREMENT**9**

ECG – Vector cardiographs – EEG – EMG – ERG – EOG – Lead system and recording methods – Typical waveforms.

UNIT-III: NON- ELECTRICAL PARAMETER MEASUREMENTS**9**

Measurement of blood pressure, blood flow and cardiac output – Plethysmography – Measurement of heart sounds – Gas analysers – Blood gas analysers – Oximeters.

UNIT-IV: MEDICAL IMAGING AND TELEMETRY**9**

X-ray machine – Echocardiography – Computer tomography – MRI – Diagnostic ultrasound – PET – SPECT – Electrical impedance tomography – Thermograph – Biotelemetry.

UNIT-V: ASSISTING AND THE RAPEUTIC DEVICE**9**

Pacemakers – Defibrillators – Ventilator – Anesthesia machine – Nerve and muscle stimulator – Heart lung machine – Kidney machine – Audiometers – Diathermy – Endoscopes – Lasers in biomedicine.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", PHI, New Delhi, 2015.
2. Khandpur R.S., "Handbook of Biomedical Instrumentation", 2nd Edition, Tata McGraw Hill 2016.
3. Geddes L. A and Baker L.E., "Principles of Applied Biomedical Instrumentation", 3rd Edition, John Wiley, New York, 2015.
4. Richard Aston, "Principles of Bio-medical Instrumentation and Measurement", Merrill Publishing Company, New York, 2016.
5. Ed. Joseph D. Bronzino, "The Biomedical Engineering Handbook" 2nd Edition, Boca Raton, CRC Press LLC, 2014.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- CO1:** Understand the physical foundations of biological systems.
- CO2:** Realize the various electro physiological measurements in the human body.
- CO3:** Acquire knowledge on the measurement of non-electrical parameters in the human body.
- CO4:** Analyze the various medical imaging techniques and their applications.
- CO5:** Apply the concepts on the working of medical assisting and therapy equipment.

COURSE OBJECTIVES:

- To understand the operation and architecture of electric and hybrid vehicles
- To identify various energy source options like battery and fuel cell
- To select suitable electric motor for applications in hybrid and electric vehicles.
- To explain the role of power electronics in hybrid and electric vehicles
- To analyze the energy and design requirement for hybrid and electric vehicles.

UNIT-I: DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES**9**

Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. - Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refuelling Systems.

UNIT-II: ENERGY SOURCES**9**

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modelling - Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT-III: MOTORS AND DRIVES**9**

Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

UNIT-IV: POWER CONVERTERS AND CONTROLLERS**9**

Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes

UNIT-V: HYBRID AND ELECTRIC VEHICLES**9**

Main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Iqbal Husain, "Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
2. Mehrdad Ehsani, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRCPress,2005.
3. James Larminie and John Lowry, "Electric Vehicle Technology Explained "John Wiley & Sons,2003
4. Lino Guzzella, "Vehicle Propulsion System" Springer Publications,2005
5. Ron Hod Kinson, "Light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- CO1:** Learn the operation and architecture of electric and hybrid vehicles
- CO2:** Classify various energy source options like battery and fuel cell
- CO3:** Select suitable electric motor for applications in hybrid and electric vehicles.
- CO4:** Explicate the role of power electronics in hybrid and electric vehicles
- CO5:** Analyze the energy and design requirement for hybrid and electric vehicles.

COURSE OBJECTIVES:

- Understanding of the current topics in MANETs and WSNs, both from an industry and research point of views.
- Understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. ·
- Understand how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.
- Know about routing protocol
- Analyze various routing algorithms

9**UNIT-I: INTRODUCTION**

Introduction to ad-hoc networks – definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoor models.

9**UNIT-II:MEDIUM ACCESS PROTOCOLS**

MAC Protocols: Design issues, goals and classification. Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

9**UNIT-III: NETWORK PROTOCOLS**

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

9**UNIT-IV: END-END DELIVERY AND SECURITY**

Transport Layer: Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols

9**UNIT-V: CROSS LAYER DESIGN**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition TMH, 2013.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, “Data and Computer Communications”, 10th Edition, Pearson Education, 2013.
4. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols, 2nd edition, Pearson Edition, 2007.
5. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000.

6. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, Mobile ad-hoc networking, Wiley-IEEE press, 2004.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Gain the knowledge of basic layers of adhoc networks.

CO2: Evaluate the performance MAC protocols and standards.

CO3: Understand the functions of routing protocols.

CO4: Know different protocols involved in network security enhancement.

CO5: Analyze the necessity of cross layer designs and Mobile IP networks.

COURSE OBJECTIVES:

- To assess blockchain applications in a structured manner.
- To impart knowledge in block chain techniques and able to present the concepts clearly and structured.
- To understand the modern concepts of blockchain technology.
- To get familiarity with future currencies and to create own crypto token.
- To analyze the market scenario of cryptocurrency.

UNIT I : BASIC CONCEPTS 9

Introduction - Decentralized society - Disturbed Database, Byzantine General problem - Fault tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete - P2P network - Private key - Public key - Cryptography - Hash Function - Digital Signature - ECDSA - Memory Hard Algorithm - Zero Knowledge Proof.

UNIT II : BLOCKCHAIN 9

Introduction - Advantage over conventional distributed database – Network and protocols - Block chain network - Mining - Mechanism - Life Cycle of Block chain - Distributed consensus - Merkle Patricia Tree - Gas Limit - Transactions and Fee - Anonymity - Reward - Chain policy- Life of Block chain applications -Soft and Hard Fork - Private and Public blockchain.

UNIT III: DISTRIBUTED CONSENSUS 9

Nakamoto consensus - Proof of work - Proof of Stake - Proof of Burn - Difficulty level - Sybil Attack - Energy Utilization and alternate – Fabric model - SDKs - Components of Fabric Model - Architecture of Hyperledger fabric.

UNIT IV: CRYPTOCURRENCY 9

History - Distributed ledger - Bitcoin protocols - Mining strategy and rewards - Ethereum - construction - Truffle - DAO - dApps - Smart Contract - Boot strapping - GHOST Vulnerability - Attacks - Sidechain - Namecoin.

UNIT V: CRYPTOCURRENCY REGULATIONS 9

Stakeholders - Roots and Bitcoin - Legal Aspects - Crypto currency exchange - Black market and Global economy. Applications : IoT - Medical Record Management system - Domain Name Service and future of Blockchain - Business applications and assessing blockchain projects.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 75 Periods

REFERENECS:

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.
2. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction” Princeton University Press, 2016
3. Antonopoulos, Mastering Bitcoin, O’Reilly Publishing, 2014. .

4. Antonopoulos and G. Wood, “Mastering Ethereum: Building Smart Contracts and Dapps”, O’Reilly Publishing, 2018.
5. D. Drescher, Blockchain Basics. Apress, 2017.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Understand the various technologies and its business use.
- CO2:** Analyse the block chain applications in a structure manner.
- CO3:** Explain the modern concepts of block chain technology systematically.
- CO4:** Handle the cryptocurrency.
- CO5:** Understand the modern currencies and its market usage

COURSE OBJECTIVES:

- To differentiate open source software and commercial software.
- To familiarize with Linux operating system.
- To examine web applications using open source web technologies like Apache, MySQL and PHP (LAMP/XAMP).
- To implement table commands and table joins.
- To learn cookies and sessions with PHP and MySQL.

UNIT-I: OPEN SOURCE**9**

Introduction to Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Basics of Linux - Linux Kernel – Linux Distributions.

UNIT-II: LINUX**9**

Introduction to Linux Essential Commands - File system Concept - Standard Files - The Linux Security Model - Vi Editor - Partitions creation - Shell Introduction - String Processing - Investigating and Managing Processes - Network Clients – Installing Application.

UNIT-III: APACHE**9**

Apache Explained - Starting, Stopping, and Restarting Apache - Modifying the Default Configuration - Securing Apache - Set User and Group - Consider Allowing Access to Local Documentation - Don't Allow public html Web sites - Apache control with .htaccess.

UNIT-IV: MYSQL**9**

Introduction to MYSQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.

UNIT-V: PHP**9**

Introduction- General Syntactic Characteristics - PHP Scripting - Commenting your code -Primitives, Operations and Expressions - PHP Variables - Operations and Expressions Control Statement - Array - Functions - Basic Form Processing - File and Folder Access - Cookies - Sessions - Database Access with PHP - MySQL - MySQL Functions - Inserting Records - Selecting Records - Deleting Records - Update Records.

Contact Periods:**Lecture: 45 Periods****Tutorial: 0 Periods****Practical: 0 Periods****Total: 45 Periods****REFERENCES:**

1. Steven Weber, "The success of Open Source", Harvard University Press October 31, First Edition, 2021.
2. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", Sixth Edition, O'Reilly Media, 2009.
3. James Lee and Brent Ware, "Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", Dorling Kindersley (India) Pvt. Ltd, 2008.
4. Eric Rosebrock, Eric Filson, "Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Compare the open source software and commercial software.

CO2: Study, install and run Linux operating system.

CO3: Identify and install open source web technology Apache and manage applications.

CO4: Manage users and privileges in MySQL and to handle SQL functions.

CO5: Design and develop complete website using PHP.

COURSE OBJECTIVES:

- To facilitate students to understand android SDK
- To gain a basic understanding of Android application development
- To inculcate working knowledge of creating mobile interface
- To learn about testing of android application
- To create basic android applications

UNIT-I: INTRODUCTION TO ANDROID**9**

The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT-II: ANDROID APPLICATION DESIGN ESSENTIALS:**9**

Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT-III: ANDROID USER INTERFACE DESIGN ESSENTIALS**9**

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation

UNIT-IV: TESTING ANDROID APPLICATION**9**

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT-V: ANDROID APPLICATION**9**

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
3. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
4. Android Application Development All in one for Dummies by Barry Burd, Edition: I

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1:** Identify various concepts of mobile programming that make it unique from programming for other platforms,
- CO2:** Critique mobile applications on their design pros and cons,

- CO3:** Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces
- CO4:** Program mobile applications for the Android operating system that use basic and advanced phone features
- CO5:** Deploy applications to the Android marketplace for distribution

COURSE OBJECTIVES:

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

UNIT I : INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II : DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT III: DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV: iOS FORENSICS 9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT V: ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENECS:

1. Andre Arnes, “Digital Forensics”, Wiley, 2018.
2. Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRC Press, 2022.
3. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- C01:** Have knowledge on digital forensics.
- C02:** Know about digital crime and investigations.
- C03:** Be forensic ready.
- C04:** Investigate, identify and extract digital evidence from iOS devices.
- C05:** Investigate, identify and extract digital evidence from Android devices.

COURSE OBJECTIVES:

- Basic fundamentals of materials and their properties.
- Various mechanical testing methods, processes, properties and applications.
- Different types of NDT testing methods, processes, properties and applications.
- The different methods of materials, their properties, classifications and applications and acquire knowledge to apply on the respective fields.
- Various tests on different materials and know about the failure mechanism.

UNIT I: INTRODUCTION TO MATERIALS TESTING**9**

Overview of materials, Classification of material testing, Purpose of testing, Selection of material, Development of testing, Testing organizations and its committee, Testing standards, Result Analysis, Advantages of testing.

UNIT II: MECHANICAL TESTING**9**

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT III: NON-DESTRUCTIVE TESTING**9**

Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT IV: MATERIAL CHARACTERIZATION TESTING**9**

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) – Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

UNIT-V: OTHER TESTING**9**

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermomechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass spectrometry.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Cullity, B. D., “Elements of X-ray diffraction”, 3rd Edition, Addison-Wesley Company Inc., New York, 2000.
3. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7th Edition, Cousens Press, 2007.
4. Brandon D.G., “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA, 1986.
5. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.
6. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA 2000.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to

- CO1:** Apply the fundamental concepts of material selection and acquire knowledge on testing.
- CO2:** Identify the suitable testing methods and process to attain the specified microstructural changes in the metal.
- CO3:** Choose the different types of methods and testing on the basis of the material and make use of them in their specific application areas.
- CO4:** Identify the different methods of materials, their properties, classifications and applications and acquire knowledge to apply on the respective fields.
- CO5:** Select the various tests on different materials and know about the failure mechanism.

COURSE OBJECTIVES:

- To study the gas and arc welding processes.
- To learn the resistance welding processes.
- To understand the solid state welding processes.
- To study the special welding processes.
- To understanding of inspection methods of welded products and also helps to know the material considerations of this operation.

UNIT-I: GAS AND ARC WELDING PROCESSES**9**

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - Advantages, Limitations and Applications.

UNIT-II: RESISTANCE WELDING PROCESSES**9**

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes –Advantages, Limitations and Applications.

UNIT-III: SOLID STATE WELDING PROCESSES**9**

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - Advantages, Limitations and Applications.

UNIT-IV: OTHER WELDING PROCESSES**9**

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, Nuclear and surface transport vehicles.

UNIT-V: DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS**9**

Various weld joint designs – Welding defects – Causes and remedies – Weldability of Aluminium, Copper, and Stainless steels. Destructive and non-destructive testing of weldments.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. O.P.Khanna, “Welding Technology”, Dhanpat Rai and sons, 2011.
2. Davis A.C., “The Science and Practice of Welding”, Cambridge University Press, Cambridge, 2010.
3. Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

4. Parmer R.S., "Welding Engineering and Technology", 1st Edition, Khanna Publishers, New Delhi, 2008.
5. Nadkarni S.V., "Modern Arc Welding Technology", South Asia Books, 2008.
6. Parmer R.S., "Welding Processes and Technology", Khanna Publishers, New Delhi, 1992

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Understand the construction and working principles of gas and arc welding process.

CO2: Understand the construction and working principles of resistance welding process.

CO3: Understand the construction and working principles of various solid state welding process.

CO4: Understand the construction and working principles of various special welding processes.

CO5: Understand the concepts on weld joint design, Weldability and testing of weldments.

COURSE OBJECTIVES:

- To study about the safety concept Technical and Managerial roles in the Industries.
- To apply knowledge on investigation and reporting in the working environment.
- To use quality of safety education and training to foresee and solve issues in the industrial situations.
- To learn about the safety management associated with the agencies.
- To familiarize with safety audit and regulation.

UNIT I: SAFETY CONCEPT 9

Evolution of modern safety concept – History of safety movement –Influence of environmental safety – Hazards – Safety policy – Safety survey, Safety inspection safety culture and Behavioural safety.

UNIT II: ACCIDENT INVESTIGATION AND REPORTING 9

Concept of an accident, Reportable and non reportable accidents – Principles of accident prevention accident investigation and analysis – Documentation of accidents – Unsafe act and unsafe condition domino sequence – Role of safety committee and cost of accident.

UNIT III: SAFETY EDUCATION AND TRAINING 9

Importance of training – Training methods –Method of promoting safe practice – Motivation – Role of government agencies and private consulting agencies in safety training – Creating awareness – Safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign.

UNIT IV: SAFETY MANAGEMENT 9

General concept of safety management – National Safety Council-OSHA, their roles in safety propagation – Evolution of modern safety concept – Planning for safety for optimization of productivity – Line and staff functions for safety – Safety sampling, fault tree analysis.

UNIT-V: SAFETY AUDIT AND SAFETY REGULATION 9

Components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist and report – Review of inspection, safety measures in factories act, pollution control act for water, air, and land. OSHAS18001, ISO14001.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Vollman TE., “Manufacturing Planning and Control Systems”, Galgotia Publications, 2002.
2. Elwood S. Buffa, and Rakesh K. Sarin, “Modern Production/Operation Management”, 8th Edition, John Wiley & Sons, 2000.
3. Krishnan N.V, “Safety management in Industry”, Jaico Publishing House, Bombay, 1997.

4. Dan Petersen, "Techniques of Safety Management", Mc Graw-Hill Company, Tokyo, 1981.
5. "Accident Prevention Manual for Industrial Operations", N.S.C Chicago, 1980.
6. Heinrich H.W, "Industrial accident Prevention", McGraw-Hill Company, New York, 1980.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to

CO1: Anticipate, identify, evaluate, and control workplace hazardous conditions and practices.

CO2: Develop effective safe operating procedures and comprehensive safety and health programs.

CO3: Address identified hazards, conditions, and practices in a cost effective manner.

CO4: Apply the general concept of safety management and planning for safety for optimization of productivity.

CO5: Measure and evaluate occupational safety and health performance.

COURSE OBJECTIVES:

- To familiarize with the basic concepts, and techniques of salesmanship.
- To learn and behave about the quality of salesman.
- To create awareness of marketing Remuneration / Compensation.
- To analyse and solve marketing problems in the complex and fast changing business environment.
- To understand the behaviour of consumers.

UNIT I: SALESMANSHIP**9**

Meaning, Definition, Characteristics, Concept, Kinds, Nature – Evolution, and psychology in selling, Scope, Limitations and importance – Sales management: meaning, definition, Characteristics, Principles, Functions and importance, Difference between sales management and marketing management.

UNIT II: SALESMAN**9**

Types, Qualities, Objectives, Duties and responsibilities of good salesman, Recruitment, selection and training of salesman: Sources of recruitment, Principles of selection, Selection procedure, Meaning, Advantages, Disadvantages, Methods, Principles and limitation, Subject matter and Types of good training programme.

UNIT III: REMUNERATION/ COMPENSATION**9**

Essentials of Good Remuneration Plan, Objectives – Methods, Factors determining Remuneration Plan, Comparative study of various plans. Motivating sales force: Meaning, Definition, Objectives, Importance and methods.

UNIT IV: SALES PLANNING**9**

Meaning, Components, Elements, Types, Importance and limitations, Sales fields or territories: Meaning, Definition, Objectives, Factors determining Size, Allocation of sales territories, Steps in setting sales territories. Sales quota: Meaning, Definition, Objectives, Factors determining sales quota, Methods of determining sales quota, Types, Principles of successful sales quota, Advantages and disadvantages of sales quota.

UNIT-V: CONSUMER BEHAVIOUR**9**

Meaning, Definition, Variables and factors affecting Consumer behaviour – Buying Motives: Meaning, Kinds, Chief buying motives – Different types of consumers – Behaviour and customer service.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Santoki, "Sales Management", Kalyani Publisher 2010.
2. Gupta S L., "Sales and Distribution Management", Excel Books, New Delhi, 2008.
3. Still R and Richard, "Sales Management", Pearson Prentice Hall, Delhi 2007.
4. Schiffman, Kanuk and Kumar, "Consumer Behaviour", Pearson, 10th Edition 2005.
5. Kotler and Keller, "Marketing Management", Pearson Publication 2004.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to

CO1: Understand the concepts for salesmanship.

CO2: Developed knowledge of salesman responsibilities.

CO3: Understand the concepts for remuneration and compensation methods.

CO4: Developed knowledge of sales planning techniques.

CO5: Understand the use of consumer behaviour concepts.

COURSE OBJECTIVES:

- To study the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To identify the different maintenance categories like Preventive maintenance and Total Productive Maintenance.
- To illustrate some of the simple instruments used for condition monitoring in industry.
- To learn the fundamental components of mechanical systems functions and predict the faulty locations.
- To study the appropriate repair methods and maintaining records.

UNIT I: PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9

Basic principles of maintenance planning – Objectives and principles of planned maintenance – Importance and benefits of sound maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II: MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, Repair cycle – Principles and methods of lubrication – TPM.

UNIT III: CONDITION MONITORING 9

Condition monitoring – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – Wear debris analysis.

UNIT IV: REPAIR METHODS FOR BASIC MACHINE ELEMENTS 9

Repair methods for beds, slide ways, Spindles, Gears, Lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT-V: REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 9

Repair methods for material handling equipment – Equipment records – Job order systems – Use of computers in maintenance.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Bhattacharya S N., “Installation, Servicing and Maintenance”, S. Chand and Co., 2013.
2. Venkataraman K., “Maintenance Engineering and Management”, PHI Learning Pvt. Ltd. 2010.
3. Srivastava S.K., “Industrial Maintenance Management”, - S. Chand and Co., 2006.
4. Higgins L R., Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 1994.
5. White E N., “Maintenance Planning”, I Documentation, Gower Press, 1979.

6. Garg M R., "Industrial Maintenance", S. Chand & Co., 1987.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to

CO1: Explain basic principle of maintenance and practices the maintenance in organization and economics.

CO2: Practice the various maintenance policies and the various preventive maintenances.

CO3: Describe various aspects of condition monitoring and able to perform estimation Analysis.

CO4: Practice various repairs and able to predict the faulty locations.

CO5: Familiarize various methods of repairing material handling equipments.