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.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULA & SYLLABI

(I-VIII Semesters)

REGULATIONS

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 enrich the students, technical knowledge and practical skills in the field of Electronics and Communication Engineering and to nurture highly emulous communication engineers with the power to facilitate the society.

Mission of the Department

To provide quality education and promote research in the field of Electronics and Communication Engineering and thereby rendering continuous service to the society by imbibing leadership skills and moral values in the students.

Program Educational Objectives (PEO)

The objectives of the programme are to provide the following to the students:

PEO 1: To nourish the students with fundamentals of engineering and technology by excelling in the field of Electronics and Communication to envisage the emerging industrial needs and professional competence.

PEO 2: To impart skill based training program to design, analyze and create innovative solutions for technical challenges.

PEO 3: To instill strong zeal and elegant personality by imbibing ethical principles and modeling the prosocial behavior to inculcate values among future generation.

Program Specific Outcomes (PSO):

The following outcomes of the programme are provided to the students:

PSO 1: Ability to exploit the acquired knowledge of basic skills, mathematical concepts and electronic principles for the design of electronic and communication systems.

PSO 2: Be acquainted with the continuous learning in the field of Embedded systems, VLSI design, Communication and Signal Processing and hold expertise in the modern tools for quenching the techno-thirsty society.

PSO 3: Incorporate the socio-responsible electronics and communication engineer with leadership, teamwork skills and exhibit a commitment to the lifelong learning.

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.

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	22CAES104	Engineering Graphics	1	0	4	3
5	22CAES105	C Programming	3	0	0	3
6	22ECES106	Electrical and Instrumentation Engineering	3	0	0	3
7	22CAHS109	Heritage of Tamils	1	0	0	1
PRACTICAL						
7	22CAES106	Programming in C Laboratory	0	0	3	1.5
8	22CAES107	Engineering Practices Laboratory	0	0	3	1.5
		Total	**17**	**1**	**10**	**23**

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	22ECPC204	Electronic Devices and Circuit Analysis	3	0	0	3
5	22CABS205	Physics for Electronics Engineering	3	0	0	3
6	22CABS104	Engineering Chemistry	3	0	0	3
7	22CAHS202	Tamils and Technology	1	0	0	1
PRACTICAL						
7	22CABS107	Physics and Chemistry Laboratory	0	0	3	1.5
8	22CAES206	Python Programming Laboratory	0	0	3	1.5
		Total	**19**	**1**	**6**	**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	22ECPC302	Communication Theory	3	0	0	3
3	22ECPC303	Analog Circuits	3	0	0	3
4	22ECPC304	Digital System Design	3	0	0	3
5	22ECPC305	Signals and Systems	3	0	0	3
6	22CAHS306	Environmental Science and Engineering	3	0	0	3
PRACTICAL						
7	22ECPC307	Analog Circuits Laboratory	0	0	3	1.5
8	22ECPC308	Digital System Design Laboratory	0	0	3	1.5
		Total	**18**	**1**	**6**	**22**

SEMESTER IV

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22CABS401	Probability and Random Processes	3	1	0	4
2	22ECPC402	Digital Communication	3	0	0	3
3	22ECPC403	Linear Integrated Circuits	3	0	0	3
4	22ECPC404	Electromagnetic Fields	3	0	0	3
5	22ECES405	Control systems	3	0	0	3
6	22ECES406	Data Structures in Java	3	0	0	3
PRACTICAL						
7	22ECPC407	Communication Systems Laboratory	0	0	3	1.5
8	22ECPC408	Linear Integrated Circuits Laboratory	0	0	3	1.5
9	22CAHS108	Communication Skills Laboratory	0	0	2	1
		Total	**18**	**1**	**8**	**23**

SEMESTER V

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22ECPC501	Digital Signal Processing	3	0	0	3
2	22ECPC502	Microcontrollers Interfacing and its applications	3	0	0	3
3	22ECPC503	Wireless Communication	3	0	0	3
4	22ECPE5XX	Professional Elective – I	3	0	0	3
5	22ECPE5XX	Professional Elective – II	3	0	0	3
6	22ECPE5XX	Professional Elective – III	3	0	0	3
PRACTICAL						
7	22ECPC504	Digital Signal Processing Laboratory	0	0	3	1.5
8	22ECPC505	Microcontrollers Interfacing and its applications Laboratory	0	0	3	1.5
		Total	**18**	**0**	**6**	**21**

SEMESTER VI

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22ECPC601	Transmission Lines and Antennas	3	0	0	3
2	22ECPC602	Networks and Security	3	0	0	3
3	22ECPC603	VLSI and Chip Design	3	0	0	3
4	22ECPE6XX	Professional Elective – IV	3	0	0	3
5	22ECPE6XX	Open Elective – I	3	0	0	3
6	22ECPE6XX	Open Elective – II	3	0	0	3
7	22CAMC306	Constitution of India	3	0	0	–
PRACTICAL						
8	22ECPC604	Networks and Security Laboratory	0	0	3	1.5
9	22ECPC605	VLSI and Chip Design Laboratory	0	0	3	1.5
		Total	**21**	**0**	**6**	**21**

SEMESTER – VII

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	22ECPC701	Optical and Microwave Engineering	3	0	0	3
2	22ECPC702	Embedded Systems	3	0	0	3
3	22ECPE7XX	Professional Elective – V	3	0	0	3
4	22ECPE7XX	Professional Elective – VI	3	0	0	3
5	22ECOEXX	Open Elective – III	3	0	0	3
6	22CAMC703	Youth Empowerment and Holistic Health	3	0	0	–
PRACTICAL						
7	22ECPC704	Embedded Systems Laboratory	0	0	3	1.5
8	22ECPC705	Optical and Microwave Engineering Laboratory	0	0	3	1.5
9	22ECEE706	Mini Project	0	0	4	2
		Total	**18**	**0**	**10**	**20**

SEMESTER – VIII

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	22ECOEXX	Open Elective – IV	3	0	0	3
2.	22CAHS604	Professional Ethics in Engineering	3	0	0	3
PRACTICAL						
3.	22ECEE801	Project Work	0	0	20	8
		Total	**6**	**0**	**20**	**14**

Total Credits : 167

Total Credits : 121(III-VIII Semesters)

PROFESSIONAL ELECTIVES (PE) – I
(SEMESTER V)
Sensor Technologies and IoT

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ECPE501	MEMS and NEMS	3	0	0	3
2.	22ECPE502	Consumer Electronics	3	0	0	3
3.	22ECPE503	Nanoelectronics	3	0	0	3
4.	22ECPE504	Opto Electronic Devices	3	0	0	3
5.	22ECPE505	Industrial IoT and Industry 4.0	3	0	0	3
6.	22ECPE506	IoT Based System protocols	3	0	0	3
7.	22ECPE507	IoT Processors	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – II
(SEMESTER V)
Space Technologies and High-Speed Communication Networks

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ECPE508	Satellite Communication	3	0	0	3
2.	22ECPE509	Remote Sensing	3	0	0	3
3.	22ECPE510	Green Communication	3	0	0	3
4.	22ECPE511	Avionics Systems	3	0	0	3
5.	22ECPE512	4G/5G Communication Networks	3	0	0	3
6.	22ECPE513	Software Defined Networks	3	0	0	3
7.	22ECPE514	Wireless Networks	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – III

(SEMESTER V)

Management Courses

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ECHS515	Principles of Management	3	0	0	3
2.	22ECHS516	Total Quality Management	3	0	0	3
3.	22ECHS517	Engineering Economics and Financial Accounting	3	0	0	3
4.	22ECHS518	Human Resource Management	3	0	0	3
5.	22ECHS519	Knowledge Management	3	0	0	3
6.	22ECHS520	Industrial Management	3	0	0	3
7.	22ECHS521	Intellectual Property Rights	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – IV

(SEMESTER VI)

Bio Medical Technologies

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ECPE601	Biomedical Instrumentation	3	0	0	3
2.	22ECPE602	Medical Imaging Systems	3	0	0	3
3.	22ECPE603	Therapeutic Equipment	3	0	0	3
4.	22ECPE604	Brain Computer Interface and Applications	3	0	0	3
5.	22ECPE605	Human Assist Devices	3	0	0	3
6.	22ECPE606	Bio– Medical Electronics	3	0	0	3
7.	22ECPE607	Compressive Sensing	3	0	0	3

SIONAL ELECTIVES (PE) – V
(SEMESTER VII)
RF Technologies and Signal Processing

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ECPE701	Digital Image Processing	3	0	0	3
2.	22ECPE702	Advanced Digital Signal Processing	3	0	0	3
3.	22ECPE703	Computer Vision	3	0	0	3
4.	22ECPE704	DSP Structures for VLSI	3	0	0	3
5.	22ECPE705	Signal Integrity	3	0	0	3
6.	22ECPE706	Software Defined Radio	3	0	0	3
7.	22ECPE707	RF Transceivers	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – VI
(SEMESTER VII)
(Semiconductor and Chip Design)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	22ECPE708	Low Power VLSI Design	3	0	0	3
2.	22ECPE709	ASIC Design	3	0	0	3
3.	22ECPE710	Mixed Signal Design	3	0	0	3
4.	22ECPE711	CAD for VLSI Circuits	3	0	0	3
5.	22ECPE712	IC Packaging and Testing	3	0	0	3
6.	22ECPE713	Verilog Programing	3	0	0	3
7.	22ECPE714	CMOS Analog circuits	3	0	0	3

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

22CAHS101	PROFESSIONAL ENGLISH - I	SEMESTER I L T P C 3 0 0 3

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.

22CABS102 **MATRICES AND CALCULUS** **SEMESTER I**

L	T	P	C
3	1	0	4

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.

22CABS103 **ENGINEERING PHYSICS** **SEMESTER I**

L	T	P	C
3	0	0	3

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.

22CAES104 ENGINEERING GRAPHICS SEMESTER I

L	T	P	C
1	0	4	3

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.

22CAES105 **C PROGRAMMING** **SEMESTER I**

L	T	P	C
3	0	0	3

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.

2ECES106 ELECTRICAL AND INSTRUMENTATION ENGINEERING SEMESTER I

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge in types, construction and working of transformers.
- To impart knowledge in types, construction and working of DC machines.
- To impart knowledge in types, construction and working of AC rotating machines.
- To introduce the functional elements and working of measuring instruments.
- To introduce the components of Electrical installations and energy conservation.

UNIT I TRANSFORMER **9**

Introduction - Ideal and Practical Transformer – Phasor diagram - Per Unit System – Equivalent circuit - Testing - Efficiency and Voltage Regulation - Three Phase Transformers - Applications- Auto Transformers, Advantages.

UNIT II DC MACHINES **9**

Introduction - Constructional Features - Motor and Generator mode - EMF and Torque equation - Methods of Excitation- Characteristics - Starting and Speed Control - UniversalMotor - Stepper Motors - Brushless DC Motors- Applications.

UNIT III AC ROTATING MACHINES **9**

Principle of operation of three-phase induction motors - Construction –Types - Equivalent circuit - Single phase Induction motors - Construction- Types–starting methods. Alternator: Working principle - Equation of induced EMF - Voltage regulation, Synchronous motors - working principle - starting methods - Torque equation.

UNIT IV 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.

UNIT-V ELECTRICAL INSTALLATIONS AND ENERGY CONSERVATION **9**

Single phase and three phase system - phase, neutral and earth, basic house wiring - basic safety measures at home and industry - Energy efficient lamps - Components of LT switchgear : Switch fuse unit, MCB, MCCB, ELCB- Types of wires and cables - Earthing - Batteries - Principle, characteristics, types and applications - safety precautions and First Aid.

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", Second Edition, Pearson Education, 2017.
3. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 2015.
4. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
5. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International pvt.ltd.,2003.

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Explain the working principle of transformers

CO2: Explain and Analyze the output characterizes of electrical machines

CO3: Choose the appropriate electrical machines for various applications

CO4: Analyze the types and operating principles of measuring instruments

CO5: Understand the basic Electrical Installation, Safety and Energy Conservation

22CAHS109 **HERITAGE OF TAMILS** **SEMESTER I**

L	T	P	C
1	0	0	1

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. 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.

.

22CAES106 PROGRAMMING IN C LABORATORY SEMESTER I

L	T	P	C
0	0	3	1.5

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.

22CAES107 ENGINEERING PRACTICES LABORATORY SEMESTER I

L	T	P	C
0	0	3	1.5

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.

22CAHS201	PROFESSIONAL ENGLISH - II	SEMESTER II L T P C 3 0 0 3

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
Vocabulary - Cliches, Redundancies

UNIT-V: THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY **9**

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.

22CABS202	ADVANCED CALCULUS AND ITS APPLICATIONS	SEMESTER II			
		L	T	P	C
		3	1	0	4

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 [$F(p,q) = 0$ 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

REFERNCES:

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.

22CAES203	PYTHON PROGRAMMING	SEMESTER II

L	T	P	C
3	0	0	3

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.

22ECPC204	ELECTRONIC DEVICES AND CIRCUIT ANALYSIS	SEMESTER II			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarize the application of diode.
- To learn the fundamentals of transistors.
- To introduce electric circuits and its analysis.
- To impart knowledge on solving circuits using network theorems.
- To study the phenomenon of resonance in coupled circuits and obtaining the transient response of circuits.

UNIT-I: BASIC DIODES AND ITS APPLICATIONS 9

Characteristics of PN junction diode and Zener diode – Rectifier circuits – Clipper and Clamper circuits – Voltage regulators.

UNIT-II: BJT and FET 9

NPN and PNP Transistors – Early effect – Input and output characteristics of CE configuration – Construction and operation of JFET and MOSFET.

UNIT-III: BASIC CIRCUITS ANALYSIS 9

Ohm's Law – Kirchhoff's laws - DC and AC Circuits - Resistors in series and parallel circuits - Mesh current and node voltage method of analysis for DC and AC circuits - Phasor diagram - Power, Power Factor and Energy.

UNIT-IV: NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 9

Network reduction: voltage and current division, source transformation - star delta conversion. Thevenins and Norton & Theorem - Superposition Theorem - Maximum power transfer theorem - Reciprocity Theorem

UNIT-V: RESONANCE / COUPLED CIRCUITS AND TRANSIENT RESPONSE FOR DC CIRCUITS 9

Series and parallel resonance - their frequency response - Quality factor and Bandwidth - Self and mutual inductance - Coefficient of coupling - Tuned circuits - Single tuned circuits. Transient response of RL, RC and RLC Circuits using Laplace transform for DC input - Characterization of two port networks in terms of Z, Y and h parameters.

Contact Periods:

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

REFERENCES:

1. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2016.
2. Robert L. Boylestad, Louis Nashelsky "Electronic Devices and Circuit Theory", Prentice Hall of India, Eighth Edition, 2002.
3. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India Private Limited, New Delhi, 2003

4. Chakrabati A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai& Sons, New Delhi, Seventh - Revised edition (2018).
5. Jacob. Millman, Christos C.Halkias, Electronic Devices and Circuits, Tata McGraw Hill Publishing Limited, New Delhi, 2003.
6. Joseph A. Edminister, MahmoodNahri, “Electric circuits”, Schaum’s series, Tata Mc Graw-Hill, New Delhi (2010).

COURSE OUTCOMES:

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

CO1: Construct electronic circuits using the PN junction diode for various applications.
CO2: Analyze BJT and JFET characteristics.
CO3: Infer the basics of electrical circuit analysis.
CO4: Choose the suitable network simplification method for DC circuits.
CO5: Inspect resonance circuits and transient response.

22CABS205 PHYSICS FOR ELECTRONICS ENGINEERING SEMESTER II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students to understand the basics of electromagnetism and its importance.
- To understand the properties of Laser including Einstein's theory, types and their applications.
- To instil knowledge on types of optical fibers and device applications.
- To establish a sound grasp of knowledge on conducting and semiconducting materials.
- To inculcate an idea of significance of magnetic and superconducting materials and their applications.

UNIT-I: ELECTROMAGNETISM 9

Physics of Divergence, Gradient and Curl, Qualitative understanding of surface and volume integral - Maxwell Equations (Qualitative) - Differential Form and Integral Form - Wave Equation – Derivation of Plane electromagnetic waves in vacuum and Homogeneous Isotropic Dielectric Medium - Electromagnetic Waves - Refractive index - Phase velocity - Group velocity, Group index, Wave guide (Qualitative) - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources.

UNIT-II: LASER 9

Properties of laser beams – monochromaticity - coherence - directionality and brightness - Einstein's theory of radiation and determination of A and B coefficients - amplification of light by population inversion - types of lasers - Gas laser: CO_2 - Solid state laser: Nd-YAG laser - dye laser - Applications of lasers in cutting, welding and materials processing.

UNIT-III: FIBER OPTICS 9

Introduction - Basic Principles involved in fiber optics - Total internal reflection - Structure of optical fiber - Propagation of light through optical fiber - Derivation for Numerical Aperture and acceptance angle - fractional index change - Classification of optical fiber based on materials, refractive index profile and Modes - Fiber optical communication links - Fiber optic sensors - Temperature and displacement.

UNIT-IV: INTRODUCTION TO SOLIDS AND SEMICONDUCTORS 9

Quantum theory - Fermi distribution function - effect of temperature - density of energy states in metals - Semiconductors - Properties - elemental and compound semiconductors - Intrinsic and extrinsic semiconductors - properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature - extrinsic semiconductors - Carrier concentration in P type and N type semiconductors - variation of Fermi level with temperature and impurity concentration.

UNIT-V: MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment - Bohr magneton - Dia, Para, and Ferro magnetic materials - Domain Theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials. Superconductivity - properties - Meissner effect, effect of magnetic field and heavy current- Types of superconductors - BCS theory of superconductivity (qualitative) - Applications of superconductors: Cryotron and Magnetic levitation.

Contact Periods:

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

REFERENCES:

1. David Griffith, “Introduction to Electrodynamics”, 4thEdition, 2013, Pearson Education.
2. S.O. Kasap, Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
3. D.Halliday, R.Resnick and J.Walker, Principles of Physics, Wiley (Indian Edition), 2015.
4. G.W.Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition), 2009.
5. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Education (Indian Edition), 2019.
6. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.

COURSE OUTCOMES:

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

CO1: Acquire knowledge in basics of Electromagnetism and its importance.

CO2: Gain knowledge on the properties, types and applications of Laser in industries.

CO3: Understand clearly of optical fibers classification and their applications.

CO4: Understand the properties of conducting and semiconducting materials and their carrier concentration.

CO5: Appreciate the importance of magnetic and superconducting materials for device applications.

22CABS104 **ENGINEERING CHEMISTRY** **SEMESTER II**

L	T	P	C
3	0	0	3

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 (Tg) – significance - factors affecting Tg, 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.

22CAHS202 TAMILS AND TECHNOLOGY SEMESTER II

L	T	P	C
1	0	0	1

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 goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - 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.

22CABS107 PHYSICS AND CHEMISTRY LABORATORY SEMESTER II

L	T	P	C
0	0	3	1.5

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.

22CAES206 PYTHON PROGRAMMING LABORATORY SEMESTER II

L	T	P	C
0	0	3	1.5

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.

22CABS301	TRANSFORM TECHNIQUES AND ITS APPLICATIONS	SEMESTER III

L	T	P	C
3	1	0	4

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.

22ECPC302 **COMMUNICATION THEORY** **SEMESTER III**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of amplitude modulation.
- To exposed to the principles of angle modulation.
- To gain knowledge in effect of noise on communication systems.
- To be familiar the basics of receivers.
- To know the principles of sampling & quantization.

UNIT-I: AMPLITUDE MODULATION **9**

Introduction to communication system, Need for modulation, Amplitude modulation, Phasor representations – Power relations in AM waves – Generation of AM: Square law modulator, Switching modulator, Detection of AM: Square law detector, Envelope detector – Generation of DSB-SC waves, Balanced Modulator, Ring Modulator, Coherent detection of DSB-SC Modulated waves – Principles of SSB modulation, Vestigial side band modulation.

UNIT-II: ANGLE MODULATION **9**

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Transmission Bandwidth – Generation of FM wave: Direct method, varactor diode, Armstrong method, Detection of FM waves, balanced frequency discriminator, Zero crossing detector, Phase locked loop, Pre-emphasis & De-Emphasis in FM.

UNIT-III: NOISE IN COMMUNICATION SYSTEMS **9**

Types of noise: Resistive noise, shot noise, white noise Input SNR, Output SNR and Figure of Merit analysis: Noise in AM system: Amplitude Modulation, Double Side band Suppressed Carrier Modulation, Single side band Modulation, Noise in FM Systems.

UNIT-IV: RADIO TRANSMITTER AND RECEIVERS **9**

Transmitter types : AM transmitter , FM transmitter- Receiver types: Tuned radio frequency receiver, Super heterodyne receiver – FM Receiver – AGC – Amplitude limiting.

UNIT-V: ANALOG PULSE MODULATION TECHNIQUES **9**

Sampling - Natural sampling, Flat top sampling – Mathematical Representation – Spectrum – Reconstruction – Aliasing, Types of Pulse Modulation: PAM, PPM, PWM – Generation and Demodulation of PAM, PWM, PPM

Contact periods:

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

REFERENCES:

1. Simon Haykins John, “Communication Systems”, Wiley and Sons, 5th Edition 2014.
2. Dennis Roddy and John Coolen, “Electronic Communications”, 4th Edition, PEA, 2008.
3. Lathi B.P., “Modern Digital and Analog Communication Systems”, 4th Edition, BS Publication, 2011.
4. Robert J. Schoenbeck, “Electronic Communication Systems – Modulation and Transmission” 2nd Edition, 2004, PHI.
5. Simon Haykin, “Analog and Digital Communications”, John Wiley, 2006.

6. Sam Shanmugam K., “Analog and Digital Communication”, Wiley and Sons, 2006.
7. Wayne Tomasi, “Electronics Communication Systems: Fundamentals through Advanced”, Prentice Hall, 2009.

COURSE OUTCOMES:

At the end of each unit, the students will be able to

CO1: Design AM communication systems.

CO2: Illustrate and analyze Angle modulated communication systems

CO3: Analyze the noise performance of AM and FM systems.

CO4: Develop and analyze AM receivers.

CO5: Gain knowledge in sampling and quantization

22ECPC303 **ANALOG CIRCUITS** **SEMESTER III**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the different biasing methods in transistors.
- To design simple amplifier circuits using BJT.
- To study the feedback concept and oscillator principles.
- To learn about tuned amplifier and power amplifier.
- To introduce wave shaping circuits.

UNIT-I: AMPLIFIERS **9**

Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model – Analysis of CS, CG and Source follower – Gain and frequency response – High frequency analysis.

UNIT -II: MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER **9**

Cascade amplifier and Cascode amplifier – Differential amplifier – Common mode and Difference mode analysis – Gain and frequency response – Neutralization methods.

UNIT-III: FEEDBACK AMPLIFIERS AND OSCILATORS **9**

Feedback concepts – Gain with feedback – Effect of feedback on gain stability – Topologies of feedback amplifiers – Analysis of Series – series, Shunt - shunt and Shunt - series feedback amplifiers. Barkhausen criterion for oscillation – Phase shift, Wien bridge – Hartley & Colpitt‘s oscillators – Crystal oscillators – Oscillator amplitude stabilization.

UNIT-IV: TUNED AMPLIFIERS AND POWER AMPLIFIERS **9**

Tuned amplifiers – Single tuned, Doublet tuned and Stagger tuned amplifiers. Classification of power amplifiers – Operation of Class A direct coupled and transformer coupled amplifier, Class B push pull and complementary symmetry amplifier, Class C amplifier, Class AB amplifiers – Efficiency – Distortion in amplifiers.

UNIT-V: WAVE SHAPING AND MULTIVIBRATOR CIRCUITS **9**

Pulse circuits – Attenuators – RC integrator and differentiator circuits – Diode clampers and clippers – Multivibrators – Astable, Monostable and Bistable multivibrators – Schmitt trigger – UJT oscillator.

Contact periods:

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

REFERENCES:

1. Adel S. Sedra and Kenneth C. Smith, “Micro Electronic Circuits”; 7th Edition, Oxford University Press, 2014.
2. Salivahanan S and Suresh Kumar N., “Electronic Devices and Circuits”, 4th Edition, TMH, 2012.
3. David A. Bell, “Electronic Devices and Circuits”, 4th Edition, PHI, 2016.
4. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson Education / PHI, 2008.

5. Milman Jacob, “Integrated Electronics”, Tata McGraw-Hill, 2nd edition, 2017.
6. D. Schilling and C. Belove, "Electronic Circuits", McGraw Hill, 3 rd Edition, 2002.
7. Donald A. Neamen, “Electronic Circuit Analysis and Design”, 2nd Edition, TMH 2009.

COURSE OUTCOMES:

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

CO1: Design different types of BJT and FET amplifiers.

CO2: Analyze frequency response of BJT and FET amplifiers.

CO3: Implement different feedback amplifiers and oscillators.

CO4: Illustrate different types of tuned amplifiers and power amplifiers.

CO5: Describe wave shaping circuits and multivibrators.

22ECPC304 DIGITAL SYSTEM DESIGN SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To apply different minimization techniques for designing various combinational logic circuits.
- To analyze and design the various combinational digital circuits using logic gates.
- To design and verify synchronous sequential logic circuits using flip-flops.
- To apply state machine models to design asynchronous sequential logic circuits.
- To design combinational circuits using programmable logic devices.

UNIT-I: BASIC CONCEPTS OF DIGITAL SYSTEMS 9

Review of Number systems, Number Representation, Binary Arithmetic and Logic gates, Boolean algebra, Boolean postulates and laws – De-Morgan's Theorem – Principle of Duality, Simplification using Boolean algebra, Canonical forms – Sum of product and Product of sum – Minimization using Karnaugh map and Tabulation method.

UNIT -II: COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder / Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer – Function realization using Multiplexer, Decoder – Code converters.

UNIT-III: SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip-flops - SR, JK, D and T– Master-Slave – Triggering – Analysis of clocked sequential circuits – Moore/Mealy models – State reduction and assignment – Excitation table – Design procedure – Shift registers – Universal shift registers – Ripple counters – Synchronous counters – Ring counter – Johnson Counter.

UNIT-IV: ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Pulse mode and fundamental mode sequential circuits, Stable and Unstable states, cycles and races, state reduction, race free state assignments, Hazards, Essential Hazards, Design of Hazard free circuits

UNIT-V: LOGIC FAMILIES AND PROGRAMMABLE DEVICES 9

Introduction to Logic families – TTL & CMOS – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Ar1ray Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.

Contact periods:

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

REFERENCES:

1. Morris Mano M., "Digital Design", 5th Edition, Prentice Hall of India Pvt. Ltd., 2008 Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2015.
2. Donald. D. Givone "Digital Principles and Design" 2nd Edition, Tata McGraw Hill Higher Education (Pvt). Ltd, 2017.
3. Charles H. Roth, "Fundamentals of Logic Design", 7th Edition, Thomson Learning, 2013.

4. Salivahanan S and Arivazhagan S., “Digital Electronics”, 5th Edition, Vikas Publishing House pvt Ltd, 2018.
5. Thomas L. Floyd, “Digital Fundamentals”, 11th Edition, Pearson Education, New Delhi, 2019.
6. Soumitra Kumar Mandal, “Digital Electronics”, McGraw Hill Education Pvt Ltd, 2016.
7. Anand Kumar A., “Fundamentals of Digital Circuits”, 4th Edition, PHI Learning Private Limited, 2016.

COURSE OUTCOMES:

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

CO1: Apply the Boolean algebra, Karnaugh map and Tabulation method to design combinational logic circuits.

CO2: Design various Combinational digital circuits using logic gates.

CO3: Design and analyze sequential logic circuits using flip-flops.

CO4: Design and analyze asynchronous sequential circuit.

CO5: Implement combinational circuits using programmable logic devices.

22ECPC305 SIGNALS AND SYSTEMS SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic properties of signal & systems.
- To analyze the signal using Fourier and Laplace transforms.
- To analyze and synthesize continuous Time systems.
- To study the sampling process and analyze the signals using z– transforms.
- To analyze and synthesize discrete time systems.

UNIT-I: CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids –Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals – Classification of systems – CT systems and DT systems – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Static & dynamic, Stable & Unstable systems.

UNIT -II: ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series for periodic signals – Fourier Transform – properties – Laplace Transforms and Properties.

UNIT-III: LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response – Convolution integral – Differential Equation- Fourier and Laplace transforms in Analysis of CT systems – Block diagram representation.

UNIT-IV: ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT – Z Transform & Properties.

UNIT-V: LINEAR TIME INVARIANT – DISCRETE TIME SYSTEMS 9

Impulse response – Difference equations – Convolution sum – Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems – Block diagram representation.

Contact periods:

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

REFERENCES:

1. Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, 2015.
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2007.
3. B. P. Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford, 2009.
4. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018.
5. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.
6. Robert A. Gabel and Richard A. Roberts, "Signals & Linear Systems", John Wiley, 3rd edition, 2015.

7. Rodger E. Ziemer, William H. Tranter and Ronald Fannin D., “Signals & systems”, Fourth Edition, Pearson Education, 2002

COURSE OUTCOMES:

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

CO1: Categorize the different types of signals and systems.

CO2: Determine the analysis of continuous time signals.

CO3: Analyze the LTI continuous time systems.

CO4: Determine the analysis of continuous time signals.

CO5: Analyze the discrete time systems using DTFT and Z Transform.

22CAHS306 **ENVIRONMENTAL SCIENCE AND ENGINEERING**
(Common to all Branches) **SEMESTER III**

L	T	P	C
3	0	0	3

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.

22ECPC307 ANALOG CIRCUITS LABORATORY SEMESTER III

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To study the characteristics of PN junction diode and Zener diodes.
- To gain the knowledge of CB, and CC transistor characteristics.
- To obtain the Drain and Transfer characteristics.
- To Study the Frequency response of Amplifiers.
- To Learn the fundamental principles of oscillator circuits.

LIST OF EXPERIMENTS

1. Characteristics of PN junction diode and Zener diode
2. Half– wave & Full– wave rectifiers.
3. CE and CB transistor characteristics and parameters
4. JFET Characteristics and parameters
5. Frequency Response of CE and CC amplifiers
6. Frequency Response of Cascade amplifiers
7. CMRR measurement of Differential amplifiers
8. Design and analysis of feedback amplifiers
9. Design and testing of RC Phase shift oscillator and Wien Bridge Oscillator
10. Design and testing of Hartley Oscillator and Colpitts Oscillator
11. Design and testing of Astable and Monostable multivibrator circuit using transistors
12. Design of Schmitt trigger circuit

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

COURSE OUTCOMES:

Upon completion of this course, the students will be able to
CO1: Draw the characteristics of PN junction diode, Zener diode and rectifiers.
CO2: Verify the CB and CC transistor characteristics.
CO3: Draw the Drain and Transfer characteristics
CO4: Analyze the frequency response of different amplifier circuits.
CO5: Design oscillator circuits.

22ECPC308 DIGITAL SYSTEM DESIGN LABORATORY SEMESTER III

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand the various combinational circuits.
- To design and implement the various combinational circuits using MSI devices.
- To design and implement ripple counters.
- To design and implement shift registers.
- To design and implement ring counter.

LIST OF EXPERIMENTS

1. Implementation of Adder and Subtractor using basic gates
2. Design and implementation of code converters using logic gates.
3. Implementation of Adder and Subtractor using MSI Devices.
4. Design and implementation of Multiplexer, De– multiplexer, Decoder and Encoder using logic gates
5. Design and implementation of 2 bit Magnitude Comparator using logic gates and 8 Bit Magnitude Comparator using IC 7485
6. Realization of one flips flop using other flip flops
7. Construction and verification of 4 bit ripple counter, Mod–N Ripple counters
8. Design and implementation of synchronous counter to count any desired sequence.
9. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip– flops.
10. Design and Implementation of Johnson Counter and Ring Counter

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

COURSE OUTCOMES:

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

CO1: Implement various combinational circuits using basic gates.
CO2: Implement combinational using MSI devices.
CO3: Design and implement the various types of ripple counters.
CO4: Design and implement the various types of shift registers.
CO5: Implement ring counter.

22CABS401 PROBABILITY AND RANDOM PROCESSES SEMESTER IV

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To understand the concepts of probability and random variables.
- To know about some standard distributions and their properties.
- To understand the basic concepts of two dimensional random variables applicable to engineering which can describe real life phenomenon.
- To be familiar with the basic concepts of random processes.
- To understand the concept of correlation and spectral densities.

UNIT –I: PROBABILITY AND RANDOM VARIABLES 9+3

Probability – Axioms of probability – Conditional probability – Baye's theorem – Random Variables–Properties- Discrete random variables –Continuous random variables.

UNIT –II: STANDARD PROBABILITY DISTRIBUTIONS 9+3

Moments – Moment generating functions – Discrete distributions: Binomial distribution- Poisson distribution –Continuous distributions: Exponential distribution- Normal distribution.

UNIT-III: TWO – DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables

UNIT-IV: RANDOM PROCESSES 9+3

Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT-V: CORRELATION AND SPECTRAL DENSITIES 9+3

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

Contact periods:

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

REFERENCES:

1. Ibe O.C., "Fundamentals of Applied Probability and Random Processes ", 1st Indian Reprint, Elsevier, 2007.
2. Peebles P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2002.
3. Cooper G. R and Mc Gillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
4. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2015.
5. Stark H and Woods J.W., "Probability and Random Processes with Applications to Signal Processing", Pearson Education, Asia, 4th Edition, 2012.
6. Yates R.D and Goodman. D. J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

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

CO1: Acquire the fundamental knowledge of the concepts of probability and random variables
CO2: Understand the basic knowledge of standard distributions which can describe real life phenomenon.
CO3: Understand the basic concepts of two dimensional random variables and apply in Engineering applications.
CO4: Apply the concept of random processes in engineering disciplines.
CO5: Understand and apply the concept of correlation and spectral densities.

22ECPC402 **DIGITAL COMMUNICATION** **SEMESTER IV**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the principles of channel coding schemes.
- To study the various waveform coding schemes.
- To learn the various baseband transmission schemes.
- To understand the various Band pass signaling schemes.
- To know the fundamentals of error detection techniques.

UNIT-I: INFORMATION THEORY **9**

Discrete Memoryless source, Information, Entropy, Mutual Information – Channel Capacity – Hartley – Shannon law – Source coding theorem – Shannon – Fano & Huffman codes

UNIT-II: WAVEFORM CODING AND REPRESENTATION **9**

Elements of digital communication system – PCM – DPCM –ADPCM – Delta modulation – ADM – Linear predictive coding – Principles of line coding schemes.

UNIT-III: BASEBAND TRANSMISSION AND RECEPTION **9**

ISI – Nyquist criterion for distortionless transmission – Pulse shaping – Correlative coding – M-ary schemes – Eye pattern, Receiving Filters – Matched filter

UNIT-IV: DIGITAL MODULATION SCHEME **9**

Geometric Representation of signals – Generation, detection, PSD and BER of Coherent BPSK, BFSK and QPSK – QAM – Carrier synchronization – Structure of non-coherent receivers.

UNIT-V: ERROR CONTROL CODING **9**

Channel coding theorem – Linear block codes – Hamming codes – Cyclic codes –Convolutional codes – Viterbi decoder.

Contact periods:

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

REFERENCES:

1. Haykin S., "Digital Communications", John Wiley, 2006.
2. Sklar V., "Digital Communication Fundamentals and Applications", 2nd Edition, Pearson Education, 2008.
3. Lathi B.P., "Modern Digital and Analog Communication Systems" 3rd Edition, Oxford University Press 2007.
4. Hwei P. Hsu , Schaum Outline Series, "Analog and Digital Communications", McGraw Hill Education, 3rd Edition, 2017.
5. Proakis J.G., "Digital Communication", 5th Edition, Tata Mc Graw Hill Company, 2014.

COURSE OUTCOMES:

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

CO1: Explain the concept of channel coding schemes.

CO2: Summarize various waveform coding concepts.

CO3: Design and implement band pass signaling schemes.

CO4: Illustrate different digital modulation and demodulation techniques.
CO5: Apply error control coding schemes.

22ECPC403 LINEAR INTEGRATED CIRCUITS SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To learn the linear and non– linear applications of operational amplifiers.
- To study about filters and phase locked loop.
- To learn the theory of types of data converters.
- To understand the concepts of Voltage regulators.

UNIT-I: INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER 9

Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

UNIT-II: APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier-Integrator and differentiator, Sample and Hold circuit, Log and Antilog amplifier, Comparators, Schmitt trigger- Multivibrators, Triangular and Square waveform generators, Oscillators.

UNIT-III: ACTIVE FILTERS AND SPECIAL IC'S 9

Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, PLL – Introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566) and applications of PLL..

UNIT-IV: D to A AND A to D CONVERTERS 9

Introduction, basic DAC techniques – Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters – Parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

UNIT-V: VOLTAGE REGULATOR AND CONVERTERS 9

Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general-purpose regulators, Switching Regulator. Voltage to frequency converter – Frequency to voltage converter.

Contact periods:

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

REFERENCES:

1. Roy Choudhry D. and Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd.,5th Edition, 2018.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", fourth Edition, Tata Mc Graw– Hill, 2016.
3. Ramakant A.Gayakwad, "OP– AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.
4. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 5th Edition, 2009.

5. Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, 6th Edition, 2001.
6. Salivahanan S. &Kanchana Bhaskaran V.S., “Linear Integrated Circuits”, TMH, 2nd Edition, 4th Reprint, 2016.
7. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education, 4th Edition, 2001.

COURSE OUTCOMES:

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

CO1: Analyze the Characteristics of OP-AMP. Analyze the Characteristics of OP-AMP.

CO2: Develop and analyze operational amplifier application circuits.

CO3: Design filters using Op-amp and PLL.

CO4: Design ADC and DAC using OP-AMPS.

CO5: Design of Voltage regulators using OP-AMP.

22ECPC404 ELECTROMAGNETIC FIELDS SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts in vector algebra applied in the field of electromagnetics.
- To study the concepts and ideas in the field of static electric and magnetic fields.
- To learn the concepts of electric potential and capacitance in electrostatics.
- To analyze about inductance and applications of laws governing the magneto statics.
- To learn Maxwell's equations and solve problems based on the above concepts.

UNIT-I: VECTOR CALCULUS AND COORDINATE SYSTEMS 9

Review of vector algebra, vector multiplication – Cross product, Dot product, rectangular, cylindrical and spherical coordinate systems, , types of integrals in electromagnetic theory, Gradient of a scalar, Divergence of a vector field, Divergence theorem, Curl of a vector, Stoke's theorem, Laplacian of a scalar.

UNIT-II: ELECTROSTATICS 9

Electric field, Coulomb's law and its vector form, applications of Coulomb's law, Electric flux density, Gauss's law and applications, Work done and electric potential, potential due to point charge, Potential gradient, Energy density, Electric dipole, Maxwell's first equation.

UNIT-III: : ELECTRIC FIELD IN MATERIAL SPACE 9

Conductors, Current and current density, Continuity equation, Dielectrics in static electric field Polarization, Properties, Dielectric strength, Boundary conditions – Conductor and free space, Perfect dielectrics, Capacitance – Parallel, Cylindrical and Spherical capacitors, Poisson's and Laplace's equations, Capacitance using Laplace's equation.

UNIT-IV: : MAGNETOSTATICS 9

Magnetic fields intensity, Magnetic flux density, Properties, Biot-Savart law and its applications, Ampere's circuit law and its applications, Magnetic torque and Magnetic dipole Moment, Nature of magnetic materials, Magnetic boundary conditions, Inductance, Electric and magnetic circuits.

UNIT-V: TIME-VARYING FIELDS 9

Faraday's law, Displacement current, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, General wave equations, Uniform plane waves – Free space, Good conductor, Lossless and Lossy dielectric, Pointing vector and theorem.

Contact periods:

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

REFERENCES:

1. Cheng D.K., "Field and wave electromagnetics", 2nd Edition, Pearson (India), 2002.
2. Hayt W. H and Buck J. A., "Engineering electromagnetics", 8th Edition, McGraw-Hill (India), 2017.
3. Griffiths D.J., "Introduction to electrodynamics", 4th Edition, Pearson (India), 2013.
4. Notaros B. M., "Electromagnetics", Pearson: New Jersey, 2011.
5. Sadiku M.N.O and Kulkarni S.V., "Principles of electromagnetics", 6th Edition, Oxford (Asian Edition), 2015.

6. Salivahanan S and Karthie S., “Electromagnetic Field Theory”, McGraw Hill Education, 2nd Edition, 2018.

COURSE OUTCOMES:

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

CO1: Analyze the electromagnetic field theory with vector algebra.

CO2: Display an understanding of fundamentals in electromagnetic laws and concepts.

CO3: Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning.

CO4: Explain electromagnetic wave propagation in lossy and in lossless media.

CO5: Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws the electromagnetic field theory with vector algebra.

22ECES405	CONTROL SYSTEMS	SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the components and their representation of control systems.
- To learn various methods for analyzing the time response.
- To introduce various methods for analyzing the frequency response.
- To study the concept of stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT-I: SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure – Feed forward and feedback control theory, Electrical and Mechanical Transfer Function models – Block diagram models – Signal flow graphs models.

UNIT-II: TIME RESPONSE ANALYSIS 9

Transient response – Steady state response – Measures of performance of the standard first order and second order system – Effect on an additional zero and an additional pole – Steady error constant and system – Type number – PID control – Analytical design for PD, PI,PID control systems.

UNIT-III: FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response – Performance specification in frequency domain – Frequency response of standard second order system – Bode Plot – Polar Plot– Nyquist plots – Design of compensators using Bode plots – Cascade lead compensation – Cascade lag compensation – Cascade lag-lead compensation.

UNIT-IV: CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability – Bounded – Input bounded – Output stability – Routh stability criterion – Relative stability – Root locus concept – Guidelines for sketching root locus – Nyquist stability criterion.

UNIT-V: CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation – Conversion of state variable models to transfer functions – Conversion of transfer functions to state variable models – Solution of state equations – Concepts of Controllability and Observability – Stability of linear systems – Equivalence between transfer function and state variable representations.

Contact Periods:

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

REFERENCES:

1. Gopal M., “Control System - Principles and Design”, Tata McGraw Hill, 4th Edition, 2012.
2. Nagrath J and Gopal M., “Control System Engineering”, New Age International Publishers, 7th Edition, 2021.
3. Ogata K., "Modern Control Engineering”, 5th Edition, PHI, 2012.
4. Bhattacharya S.K., “Control System Engineering”, 3rd Edition, Pearson, 2013.
5. Benjamin C.Kuo, “Automatic control systems”, Prentice Hall of India, 7th Edition, 1995.
6. Richard C. Dorf and Bishop R. H., “Modern Control Systems”, Pearson Education, 2009.

COURSE OUTCOMES:

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

CO1: Compute the transfer function of different physical systems..

CO2: Analyse the time domain specification and calculate the steady state error.

CO3: Illustrate the frequency response characteristics of open loop and closed loop system response.

CO4: Analyse the stability using Routh and root locus techniques.

CO5: Illustrate the state space model of a physical system and discuss the concepts of sampled data control system.

22ECES406 DATA STRUCTURES IN JAVA SEMESTER IV

L	T	P	C
3	0	0	3

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 concepts of Linear Data Structures
- To understand concepts of Non-Linear Data Structures

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 Multithreading – 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: LINEAR DATA STRUCTURES 9

Introduction to Abstract Data Types (ADT) – List ADT – Array-based implementation – Linked list implementation – Applications of lists. Stack ADT: Stack model, Implementation of stacks, Applications of Stack – Queue ADT: Queue Model, Implementation of Queues, Applications.

UNIT-V: NON LINEAR DATA STRUCTURES 9

Tree ADT – Tree traversals – Binary Tree ADT – Expression trees – Applications of trees – Binary search tree ADT – Threaded Binary Trees. AVL trees – Splay trees – B-Tree – Heap, Definitions – Representation of Graphs – Traversal – Topological sort – Shortest path algorithms: Dijkstra's algorithm – Minimum Spanning Tree: Prim's and Kruskal's algorithm.

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. Mark Allen Weiss, "Data Structures and Algorithm Analysis in JAVA" 3rd Edition, Pearson Education Limited, 2012.
5. Gilberg R. F and Forouzan B. A., "Data Structures", Second Edition, Thomson India.

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: Define and use list, stack and queue Abstract Data Types.
CO5: Define and use Tree ADT and Graph.

22ECPC407 COMMUNICATION SYSTEMS LABORATORY SEMESTER IV

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To Implement Analog modulation and demodulation Schemes
- To visualize the effects of sampling and TDM
- To implement the effect of Digital Modulation Schemes
- To simulate Analog and Digital Modulation schemes
- To gain the knowledge to implement Communication system.

LIST OF EXPERIMENTS

1. Amplitude Modulation and Demodulation
2. Frequency Modulation and Demodulation
3. Signal Sampling and reconstruction
4. Time Division Multiplexing
5. Delta Modulation and Adaptive Delta Modulation.
6. ASK and FSK Modulation
7. Pulse Modulation–PPM, PCM
8. Simulation of Analog modulation schemes-AM and FM
9. Simulation of Digital Modulation schemes – ASK, FSK
10. Experiments using MATLAB Communication Tool Box
    - Analysis of Analog Modulation Schemes
    - Analysis of Digital Modulation Schemes

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

COURSE OUTCOMES:

Upon completion of this course, the students will be able to
CO1: Demonstrate analog modulation techniques.
CO2: Understand sampling effect on signal.
CO3: Implement analog modulation techniques
CO4: Demonstrate digital modulation techniques.
CO5: Simulate the various functional modules of a communication system

22ECPC408 LINEAR INTEGRATED CIRCUITS LABORATORY SEMESTER IV

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To implement various types of feedback amplifiers.
- To design oscillators and wave-shaping circuits
- To apply operational amplifiers in various circuit designs.
- To learn the concept of D-A converters using operational amplifiers.
- To acquire knowledge and practical skills in designing multivibrator circuits.

LIST OF EXPERIMENTS

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator using Op-amp
3. Hartley Oscillator and Colpitts Oscillator using Op-amp
4. RC Integrator and Differentiator circuits using Op-Amp
5. Clippers and Clampers
6. Instrumentation amplifier
7. R-2R ladder type D-A converter using Op-Amp
8. Adder,Inverting and Noninverting amplifiers using Op-amp
9. Astable and Monostable Multivibrator using IC741
10. Magnitude Comparator and Schmitt Trigger using opamp

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

COURSE OUTCOMES:

Upon completion of this course, the students will be able to
CO1: Analyze various types of feedback amplifiers.
CO2: Design oscillators, wave-shaping circuits and multivibrators.
CO3: Design Op-amp application circuits.
CO4: Design D-A converters using operational amplifiers.
CO5: Design Amplifier using op-amp.

22CAHS108 **Communication Skills Laboratory** **SEMESTER IV**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employability Graduates
- Develop their confidence and help them attend interviews successfully.
- 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

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,. OrientBalckSwan: 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. Hariharanetal. 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.

22ECPC501 DIGITAL SIGNAL PROCESSING SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand convolution, discrete Fourier transform and its properties.
- To design, realize and understand the characteristics of IIR.
- To design and realize FIR Filters.
- To understand Finite word length effects and Multi rate DSP.
- To study and understand the DSP processors.

UNIT-I: DISCRETE FOURIER TRANSFORM 9

Review of Discrete signals and system, Convolution – Linear, Circular, sectioned. Introduction to DFT – Properties of DFT – Circular convolution – Filtering methods based on DFT – FFT algorithms – Decimation in time algorithms, Decimation in frequency algorithms – Use of FFT in linear filtering.

UNIT-II: IIR FILTER DESIGN 9

Structure of IIR– Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

UNIT-III: FIR FILTER DESIGN 9

Linear phase FIR filter – Fourier series, Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques, Realization of FIR filter.

UNIT-IV: FINITE WORD LENGTH EFFECTS 9

Fixed point and floating-point number representations, Quantization – Truncation and rounding errors – Steady state output, Noise power – Coefficient quantization error – Product quantization error, Limit cycle in recursive systems – Zero input, Overflow limit cycle and scaling.

UNIT-V: DIGITAL SIGNAL PROCESSORS 9

Introduction, Features, Architecture of TMS320C5x processor, Pin diagram, Addressing modes, Applications of DSP – Speech processing, Sound processing, Biomedical signal processing.

Contact periods:

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

REFERENCES:

1. John G. Proakisand Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms and Applications", 4th Edition, Pearson Education / Prentice Hall, 2007.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. Emmanuel C. Ifeachor and Barrie. W. Jervis, "Digital Signal Processing", 2nd Edition, Pearson Education / Prentice Hall, 2002.
4. Oppenheim A.V, Schafer R. W and Buck J. R., "Discrete – Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
5. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

6. Schaums, “Outline of Digital Signal Processing", Monson H. Hayes, Tata Mc Graw Hill.
7. Nagoorkani A., “Digital Signal Processing”, McGraw Hill Education; 2nd Edition.

COURSE OUTCOMES:

At the end of each unit, the students will be able to

CO1: Apply DFT and FFT for the analysis of digital signals and systems.

CO2: Design and analyze IIR and FIR filters.

CO3: Illustrate finite Word length effect on filters.

CO4: Work with Digital signal processors.

CO5: Know the applications of DSP.

22ECPC502 MICROCONTROLLERS INTERFACING AND ITS APPLICATIONS **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the architecture and develop an ALP for 8086.
- To understand the microcontroller architecture and develop an ALP for 8051 controllers.
- To interpret the knowledge about PIC Microcontroller.
- To learn the working of peripherals and its interface with Microcontrollers.
- To interpret the real time applications based on Microcontrollers.

UNIT-I: 8086 MICROPROCESSOR **9**

Architecture – Minimum and Maximum mode configurations – Interrupts – Addressing modes – Assembler directives – Instruction set and programming.

UNIT-II: 8051 MICROCONTROLLER **9**

8051 Architecture – Memory Organization – Special Function Registers (SFRs) – Port operation – Timers/counters – Serial communication – Interrupts – Addressing modes – Instruction set – Assembly language programming.

UNIT-III: PIC MICROCONTROLLER **9**

Introduction to PIC Microcontroller – PIC 16C6x and PIC16C7x Architecture – IC16cxx – Pipelining – Program Memory considerations – Register File Structure – Instruction Set – Addressing modes – Simple Operations.

UNIT-IV: PERIPHERALS INTERFACING **9**

Programmable Peripheral Interface (8255) – Serial Communication Interface (8251) – Keyboard display controller (8279) – Programmable Interval Timer (8253) – Programmable interrupt controller (8259) – DMA Controller (8257) – ADC and DAC Interface.

UNIT-V: APLLICATIONS **9**

Interfacing 8051 with Keyboard – LED – 7-Segment – Applications: Wave form Generation – Traffic Light control – Stepper motor control.

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

REFERENCES:

1. Soumitra Kumar Mandal, "Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086 and 8051", McGraw Hill Education, ISBN- 13 978-0071329200, 2017.
2. Manish K. Patel, “The 8051 Microcontroller based Embedded systems”, Tata McGraw Hill Education (India) Pvt. Limited, 2017.
3. Krishna Kant, “Microprocessor and Microcontrollers”, PHI Learning, 2nd Edition, 2014.
4. Muhammad Ali Mazidi, Janice Gillispie Mazidi & Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Pearson Education, New Delhi, 2013.
5. A.K. Ray, K. M. Bhurchandi, “Advanced Microprocessors and Peripherals Architecture, Programming and Interface”, Tata McGraw Hill, 2006.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Infer the basics of 8086 Microprocessor.
CO2: Summarize the basic concepts of 8051 microcontroller.
CO3: Outline the PIC Microcontroller concepts.
CO4: Interface peripheral devices with 8051 microcontroller.
CO5: Model the microcontroller-based case study applications.

22ECPC503 WIRELESS COMMUNICATION SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the design of a cellular system.
- To understand the mobile radio propagation
- To study the various Digital Modulation techniques.
- To learn the various multiple access techniques.
- To understand the concepts of multiple antenna techniques.

UNIT-I: CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS 9

Introduction – Frequency Reuse – Channel Assignment Strategies – Hand-off Strategies: Prioritizing Handoffs, Practical Handoff Considerations – Interference and System Capacity: Co-Channel Interference and System Capacity – Channel Planning for Wireless Systems – Adjacent Channel Interference – Power Control for Reducing Interference – Trunking and Grade of Service – Improving Coverage and Capacity in Cellular Systems: Cell Splitting, Sectoring.

UNIT-II: II MOBILE RADIO PROPAGATION 9

Large Scale Path Loss: Introduction to Radio Wave Propagation – Free Space Propagation Model – Three Basic Propagation Mechanism: Reflection – Brewster Angle – Diffraction – Scattering – Small Scale Fading and Multipath: Small Scale Multipath Propagation – Factors Influencing Small-Scale Fading – Doppler Shift – Coherence Bandwidth – Doppler Spread and Coherence Time – Types of Small-Scale Fading – Fading effects due to Multipath Time Delay Spread – Fading effects due to Doppler Spread

UNIT-III: MODULATION TECHNIQUES AND EQUALIZATION 9

Digital Modulation – An Overview: Factors that influence the Choice Of Digital Modulation – Linear Modulation Techniques: Minimum Shift Keying (MSK) – Gaussian Minimum Shift Keying(GMSK) – Spread Spectrum Modulation Techniques: Pseudo-Noise (PN) Sequences – Direct Sequence Spread Spectrum (DS-SS) – Modulation Performance in Fading and Multipath Channels – Equalization – Diversity and Channel Coding – Introduction – Fundamentals of Equalization – Diversity Techniques: Practical Space Diversity Considerations – Polarization Diversity – Frequency Diversity – Time Diversity.

UNIT-IV: MULTIPLE ACCESS TECHNIQUES 9

Introduction to Multiple Access – Frequency Division Multiple Access (FDMA) – Time Division Multiple Access(TDMA) – Spread Spectrum Multiple Access – Code Division Multiple Access(CDMA) – Space Division Multiple Access(SDMA) – Capacity of Cellular Systems: Capacity of Cellular CDMA – Capacity of CDMA with Multiple Cells

UNIT-V: MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – Spatial multiplexing – System model – Pre-coding – Beam forming – Transmitter diversity, receiver diversity – Channel state information – Capacity in fading and non-fading channels.

Contact periods:

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

REFERENCES:

1. Rappaport T. S., “Wireless communications”, Pearson Education, Second Edition, 2010.
2. Andrea Goldsmith, “Wireless Communication”, Cambridge University Press, 2011.
3. Andreas F. Molisch, “Wireless Communications”, John Wiley, India, 2006.
4. Van Nee R and Ramji Prasad, “OFDM for Wireless Multimedia Communications”, Artech House, 2000.
5. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
6. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009

COURSE OUTCOMES:

At the end of each unit, the students will be able to

CO1: Characterize a wireless channel and evolve the system design specifications.

CO2: Understand Mobile Radio Propagation.

CO3: Recall various Digital modulation techniques.

CO4: Relate the Concepts of Multiple Access Technique.

CO5: In depth knowledge of multiple antenna techniques.

22ECPC504 DIGITAL SIGNAL PROCESSING LABORATORY SEMESTER V

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To implement generation of sequences.
- To realize Linear and Circular Convolution.
- To design and realize FIR and IIR filters.
- To implement signal processing algorithms using digital signal processor.
- To design and realize FIR and IIR filters using digital signal processor.

LIST OF EXPERIMENTS

EXPERIMENTS USING MATLAB/ ZiLab:

1. Generation of various discrete time signals
2. Linear and circular convolution of two sequences
3. Auto correlation and Cross Correlation
4. Implementation of FFT algorithm.
5. Design of FIR filters using windowing techniques
6. Design of Butterworth and Chebyshev IIR filters
7. Implement an Up– sampling and Down– sampling operation

EXPERIMENTS USING DSP PROCESSOR:

8. Architecture of Digital Signal Processor - A study
9. MAC operation using various addressing modes
10. Implementation of Linear and Circular Convolution
11. Waveform generation
12. Implementation of FIR and IIR filter

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

COURSE OUTCOMES:

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

CO1: Write code to visualize signal processing operations.

CO2: Demonstrate their abilities towards MATLAB based implementation of various DSP systems.

CO3: Design and realize FIR and IIR filters using MATLAB.

CO4: Design and implement the various DSP algorithms in processor.

CO5: Implement a DSP system for various digital filters.

22ECPC505 MICROCONTROLLERS INTERFACING AND ITS APPLICATIONS LABORATORY **SEMESTER V**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand assembly level programs for 8086.
- To learn assembly level programs for 8051.
- To interpret the peripherals devices and develop interface with microprocessors and microcontrollers.
- To experiment with the display interface with microprocessors and microcontroller.
- To build a project using 8086/8051/PIC development boards.

LIST OF EXPERIMENTS

1. Arithmetic and logic operations using 8086 microprocessor kit
2. Floating point and string Manipulation operations using 8086 microprocessor
3. Arithmetic and logical operations using 8051 microcontroller
4. 8051 microcontroller square, cube and 2's complement programs
5. Interfacing 8255 (PPI).
6. Interfacing of keypad matrix.
7. ADC and DAC interfacing.
8. Interfacing of seven segments LED with 8051 Microcontroller
9. Interfacing of Stepper Motor with 8051 Microcontroller system.
10. Arithmetic and logic operations using PIC Microcontroller kit

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

COURSE OUTCOMES:

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

CO1: Develop the assembly level programs in 8086.
CO2: Model the assembly level programs for 8051.
CO3: Outline the peripherals devices and develop interface with microprocessors and microcontrollers.
CO4: Display interface with microprocessors and microcontroller
CO5: Design project using 8086/8051/PIC development boards.

22ECPC601 TRANSMISSION LINES AND ANTENNAS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the various types of transmission lines and its characteristics
- To understand high frequency line, power and impedance measurements.
- To impart technical knowledge in impedance matching using Smith Chart.
- To understand the basic principle of antenna
- To enhance knowledge in various antenna designs.

UNIT-I: TRANSMISSION LINE THEORY AND LINE AT RADIO FREQUENCY 9

General theory of Transmission lines – General solution – Wavelength, Velocity of propagation – Waveform distortion – The distortion-less line – Loading and different methods of loading – Reflection coefficient – Reflection factor and reflection loss – Input and transfer impedance – Open and short circuited lines – Transmission line equations at radio frequencies – Line of Zero dissipation – Voltage and current on the dissipation-less line, Standing waves, Nodes, Standing wave ratio.

UNIT-II: IMPEDANCE MATCHING IN HIGH FREQUENCY LINES 9

Impedance matching: Quarter wave transformer – Impedance matching by stubs – Single stub matching – Smith chart – Solutions of problems using Smith chart – Single stub matching using Smith chart.

UNIT-III: WAVEGUIDES 9

General wave behavior along uniform guiding structures – Transverse electromagnetic waves, Transverse magnetic waves, Transverse electric waves – Field equations in rectangular waveguides, TM and TE waves in rectangular waveguides.

UNIT-IV: RADIATION PROPERTIES OF AN ANTENNA 9

Radiating fields of current element – Radiation from half wave dipole and Quarter wave monopole, folded dipole, Reciprocity principle. Broadside and End fire array – N-element linear array – Pattern multiplication – Binomial array – Concept of Phased arrays, Adaptive arrays and Microstrip antenna arrays – Antenna radiation hazards.

UNIT-V: ANTENNA TYPES AND ITS MEASUREMENTS 9

Antenna types: Loop antenna – Helical antenna – Spiral antenna – Slot antennas – Horn antenna – Parabolic reflector antenna. Modern Antennas – Embedded antennas – UWB – Plasma antenna – Smart antennas for Bluetooth applications – Antenna measurements: Antenna measurement range, Radiation pattern, Gain, Impedance, Directivity measurement, Polarization and efficiency measurements.

Contact periods:

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

REFERENCES:

1. John D. Ryder, "Networks, Lines and Fields", 2nd Edition, Prentice Hall of India, 2007.
2. John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and wave propagation", 4th Edition, McGraw–Hill Book Company, 2010.

3. Constantine A. Balanis, "Antenna Theory Analysis and Design", 4th Edition, John Wiley, 2016.
4. Rajeswari Chatterjee, "Antennas for Information Super Skyways", PHI Leaning Private Limited, 2008.
5. Raju G.S.N., "Electromagnetic Field Theory and Transmission Lines", Pearson Education, 2006.
6. J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
7. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2nd ed., 2000.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Compute the electrical parameters of transmission lines.
CO2: Solve the impedance matching by stub using smith chart.
CO3: Analyze the characteristics of TE and TM waves in waveguides.
CO4: Understand basic principle and design of antennas.
CO5: Enhance the knowledge on various antenna and parameters measurement.

22ECPC602 NETWORKS AND SECURITY SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the Basic elements of a network, Issues in building a network, protocols, standards and models.
- To be exposed the functions of Data Link Layer, Wired and Wireless networks.
- To understand the function of Network Layer and to analyze routing algorithms in unicast and Multicast domain.
- To realize the transport layer protocols and understanding congestion control and avoidance mechanisms.
- To be familiar with application layer services and importance of security in data transfer.

UNIT-I: FUNDAMENTALS OF NETWORKING AND PHYSICAL LAYER 9

Introduction to networks – Topologies – Protocols and standards – Network models: ISO/OSI model – TCP/IP – Comparison of OSI model and TCP/IP – Physical layer: Transmission media – Connecting devices – Hubs, Switches, Routers, Gateways.

UNIT-II: DATA LINK LAYER 9

Functions of DLL: Framing – Flow control – Error control – Media Access Control (MAC): Random access – Controlled access – Channelization – Working and standards of Ethernet protocol – Wireless technologies: Challenges – IEEE 802.11 – Bluetooth.

UNIT-III: NETWORK LAYER AND INTERNETWORKING 9

Purpose of Network Layer: Packet switching – Logical addressing (IPV4 and IPV6) – Routing: unicast (DVR and LSP) – Multicast (DVMRP and PIM) – Internetworking concepts: ARP, DHCP, ICMP, IGMP – Border Gateway Protocol.

UNIT-IV: TRANSPORT & APPLICATION LAYER 9

Features of Transport Layer – UDP – An overview of TCP – TCP Connection Management – Congestion control mechanisms – WWW–HTTP – E-mail (MIME, SMTP, IMAP and POP3) – DNS.

UNIT-V: NETWORKS AND SECURITY 9

Basics of Network security and cryptography; Firewalls- IP Security- VPN- Intrusion Detection- Web Security- SSL- TLS

Contact periods:

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

REFERENCES:

1. Behrouz A. Forouzan, “Data Communication and Networking”, Tata McGraw– Hill, New Delhi, 2013.
2. Kurose James F and Keith W. Ross, “Computer Networking: A Top – Down Approach”, Pearson Education, New Delhi, 2013.
3. Andrew S. Tanenbaum, “Computer networks”, Prentice Hall of India, New Delhi, 2011.
4. Comer D. E., “Internetworking with TCP/IP”, Prentice Hall of India, New Delhi, 2013.
5. William Stallings, “Data and Computer Communication”, Prentice Hall of India, New Delhi, 2014.

6. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kauffmann Publishers Inc., 2012.
7. William Stallings, “Cryptography and Network Security Principles and Practice”, Pearson Education, Fourth Edition, 2005.

COURSE OUTCOMES:

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

CO1: Identify the networking devices and differentiate the network architectures used in networking with their functions.

CO2: Illustrate the different protocols used in DLL and able to recognize the working of wireless network devices.

CO3: Analyze the routing algorithms and understanding the concept of World Wide Web and IoT.

CO4: Recognize the functions of TCP in controlling congestion and understanding the necessity of providing QoS.

CO5: Describe various application services and applying cryptography techniques on the data to be transferred.

22ECPC603 **VLSI AND CHIP DESIGN** **SEMESTER VI**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of IC technology components and their characteristics.
- To relate combinational logic circuits and design principles.
- To understand sequential logic circuits and clocking strategies.
- To demonstrate memory architecture and building blocks.
- To understand ASIC design functioning and testing.

UNIT-I: MOS TRANSISTOR PRINCIPLES **9**

MOS logic families (NMOS and CMOS) – Ideal and Non Ideal IV Characteristics – CMOS devices – MOS(FET) Transistor Characteristic under Static and Dynamic Conditions – Technology Scaling.

UNIT-II: COMBINATIONAL LOGIC CIRCUITS **9**

Propagation Delays – Stick diagram – Layout diagrams – Examples of combinational logic design – Elmore's constant – Static Logic Gates – Dynamic Logic Gates – Pass Transistor Logic – Power Dissipation – Low Power Design principles.

UNIT-III: SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES **9**

Static Latches and Registers – Dynamic Latches and Registers – Pipelines – Nonbistable Sequential Circuits – Timing classification of Digital Systems – Synchronous Design – Self-Timed Circuit Design.

UNIT-IV: INTERCONNECT, MEMORY ARCHITECTURE AND ARITHMETIC CIRCUITS **9**

Interconnect Parameters – Capacitance, Resistance and Inductance, Electrical Wire Models – Digital circuits: adders, multipliers, comparators, shift registers – Memory Architecture and Building Blocks – Memory Core and Memory Peripherals Circuitry.

UNIT-V: ASIC DESIGN AND TESTING **9**

Introduction to wafer to chip fabrication process flow – Microchip design process & issues in test and verification of complex chips – Embedded cores and SOCs – Fault models – Test coding. ASIC Design Flow – Introduction to ASICs, Introduction to test benches.

Contact periods:

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

REFERENCES:

1. Jan D Rabaey and Anantha Chandrakasan, "Digital Integrated Circuits: A Design Perspective", PHI, 2016.
2. Neil H E Weste, Kamran Eshranghian, "Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009.
3. Michael J Smith, "Application Specific Integrated Circuits", Addison Wesley,
4. Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", Second Edition, Pearson Education, 2003

5. Parag K. Lala, “Digital Circuit Testing and Testability”, Academic Press, 1997

COURSE OUTCOMES:

At the end of each unit, the students will be able to -

CO1: In depth knowledge of MOS technology.
CO2: Understand Combinational Logic Circuits and Design Principles.
CO3: Relate Sequential Logic Circuits and Clocking Strategies.
CO4: Understand Memory architecture and building blocks
CO5: Outline the ASIC Design Process and Testing.

22CAMC306	CONSTITUTION OF INDIA	SEMESTER VI

L	T	P	C
3	0	0	0

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.

22ECPC604 NETWORKS AND SECURITY LABORATORY SEMESTER VI

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To transfer data between two computers.
- To implement the coding schemes, Flow control and MAC protocols.
- To familiar with IP Configuration.
- To know to implement various routing algorithms.
- To apply programming skills for securing data.

LIST OF EXPERIMENTS

1. Study of Network simulator (NS) and creation of two nodes to analyze the data transfer between them
2. Network Topology – Bus, Star and Ring
3. Coding schemes (NRZ, Manchester and 4B/5B)
4. Error Detection (Checksum and CRC) and Error Correction Techniques (Hamming)
5. Implementation of High-Level Data Link Control
6. Visualization of Stop and Wait Protocol and sliding window using NS
7. Go back– N and selective repeat protocols using NS
8. IP address configuration and transfer of files through IP
9. Simulation of CSMA / CD and CSMA/CA protocol
10. Routing algorithms (DVR and LSP)
11. Simulation of Congestion Control Algorithms using NS
12. Implementation of DES and RSA or given data using any programming language

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

COURSE OUTCOMES:

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

CO1: Connect and transfer data between two computers.
CO2: Implement different coding schemes and protocols.
CO3: Configure IP for internetworking.
CO4: Construct and analyze a network using simulation tool.
CO5: Implement different cryptography algorithms.

22ECPC605 VLSI AND CHIP DESIGN LABORATORY SEMESTER VI

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To implement various types of feedback amplifiers.
- To design oscillators and wave-shaping circuits
- To apply operational amplifiers in various circuit designs.
- To learn the concept of D-A converters using operational amplifiers.
- To acquire knowledge and practical skills in designing multivibrator circuits.

LIST OF EXPERIMENTS

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
7. Design and simulate a CMOS inverter using digital flow.
8. Design and simulate a CMOS Basic Gates & Flip-flops.
9. Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
10. Design 4-bit Asynchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers. Analyze the input impedance, output impedance.
12. Design and simulate simple 5 transistor differential amplifier.

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

COURSE OUTCOMES:

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

CO1: Write HDL code for basic as well as advanced digital integrated circuits.
CO2: Import the logic modules into FPGA Board.
CO3: Synthesize Place and Route the digital IPs.
CO4: Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools.
CO5: Able to perform power analysis of the circuits.

22ECPC701 OPTICAL AND MICROWAVE ENGINEERING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals working of optical sources and detectors
- To inculcate understanding of the basics required for circuit representation of RF networks.
- To instill knowledge on the properties of various microwave components.
- To deal with the microwave generation.
- To understand the microwave measurement techniques.

UNIT-I: OPTICAL COMMUNICATION 9

Optical Communication Systems – Types of fibers – Step Index Fiber – Graded Index Fiber - Losses – Light Sources - LEDs and LASERs – Light Detectors – PIN and Photodiode.

UNIT-II: TWO PORT NETWORK THEORY 9

Review of low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnection of Two port networks, High frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors.

UNIT-III: PASSIVE AND ACTIVE MICROWAVE DEVICES 9

Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers Crystal and Schottky diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode, Introduction to MIC.

UNIT-IV: MICROWAVE GENERATION 9

Review of conventional vacuum Triodes, Tetrodes and Pentodes, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons, Backward wave Crossed field amplifier and oscillator.

UNIT-V: MICROWAVE MEASUREMENTS 9

Measuring Instruments: Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.

Contact Periods:

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

REFERENCES:

1. Taub D., Schilling L., Saha G. , “Principles of Communication”, Third Edition, McGraw Hill, 2008.
2. Reinhold Ludwig and Gene Bogdanov, “RF Circuit Design: Theory and Applications”,

Pearson Education Inc., 2011.
3. David M. Pozar, “Microwave Engineering”, Wiley India (P) Ltd, New Delhi, 2008.
4. Robert E. Colin, “Foundations for Microwave Engineering”, John Wiley & Sons Inc, 2005.
5. Thomas H. Lee, “Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits”, Cambridge University Press, 2004.
6. Mathew M. Radmanesh, “RF and Microwave Electronics”, Prentice Hall, 2000.

COURSE OUTCOMES:

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

CO1: Classify the optical components.
CO2: Analyze the multi- port RF networks.
CO3: Explain the active & passive microwave devices.
CO4: Acquire knowledge on components used in Microwave communication systems.
CO5: Measure and analyze Microwave signal and parameters.

22ECPC702 **EMBEDDED SYSTEMS** **SEMESTER VII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of Embedded systems.
- To learn the system design techniques and networks for embedded systems.
- To develop understanding of embedded firmware development environments and life cycle models.
- To be exposed to the basic concepts of Real time operating system.
- To observe the different case studies.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS **9**

Introduction to Embedded Systems – Structural units in Embedded processor, selection of processor & memory devices – DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING **9**

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 – CAN Bus – Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – Need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT **9**

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN **9**

Introduction to basic concepts of RTOS – Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – Synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT **9**

Case Study of Washing Machine – Automotive Application – Smart card System Application – ATM machine – Digital camera

Contact Periods:

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

REFERENCES:

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

2. Jonathan W. Valvano, "Embedded Microcomputer Systems Real Time Interfacing", 3rd Edition, Cengage Learning, 2012.

3. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.

4. Raymond J.A. Buhr and Donald L. Bailey, "An Introduction to Real-Time Systems – From Design to Networking with C / C++", Prentice Hall, 1999.

5. Krishna C. M. and Kang G. Shin, "Real-Time Systems", International Editions, McGraw Hill 1997.

6. Prasad K.V. K. K., "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.

COURSE OUTCOMES:

At the end of each unit, the students will be able to

CO1: Describe the architecture and functional units of embedded systems and select appropriate processors and memory.

CO2: Design and interface communication protocols like RS232, RS485, CAN, SPI, and I2C in embedded systems.

CO3: Use the embedded firmware development environments and life cycle models.

CO4: Develop real-time embedded applications using RTOS principles such as multitasking and inter-process communication.

CO5: Model real-time applications using embedded-system concepts.

22CAMC703 YOUTH EMPOWERMENT AND HOLISTIC HEALTH **SEMESTER VII**

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

- To study the fundamental concepts of life's purpose.
- To learn the human and social values.
- To understand and relate mental prosperity concepts.
- To understanding about yogic concepts of health and healing.
- To study the Yogic principle and practices for healthy living.

UNIT-I: PHILOSOPHY OF LIFE SCIENCE **9**

Life – Purpose of Life – Philosophy of life – Law of nature – Kindness towards living beings preserving natural resources.

UNIT-II: HUMAN VALUES AND SOCIAL VALUES **9**

Culture – Analysis of thought – Moralization of desire – Neutralization of anger – Eradication of worry – Blessings and benefits – Harmonious friendship – Love and compassion – Individual Peace. Family – Family peace – Society – Life style – World brotherhood – Greatness of women – Five duties – Economics – Hygiene and health care – Education – Politics – Responsibilities of people.

UNIT-III: DEVELOPMENT OF MENTAL PROSPERITY **9**

Prosperity of Mind – Life force – Bio-Magnetism and Mind – Functions of Mind – Mental frequency – Ten stages of Mind – Genetic Centre – Meditation –Value of spirituality –Universal magnetism and Bio-Magnetism.

UNIT-IV: YOGIC PRINCIPLES AND PRACTICES OF HEALTHY LIVING - I **9**

Dietary regulation according to Hatha yoga and Bhagavad-Gita; kshatriyas and tattva Shuddhi; Asana for mind body and spirit; Practice for pranayama kosha – pranayama; Definition of Mental Health & Mental Hygiene & Total Health: Indian approach to personality and personality integration Psycho-Social Implications of yoga: Adjustment Personal and interpersonal adjustment through yogic methods Niyama's & Yamas.

UNIT-V: YOGIC PRINCIPLES AND PRACTICES OF HEALTHY LIVING- II **9**

Attitude change towards yoga through individualized counselling, Psychological & yogic method Tackling ill effects of conflict and Frustration; Yogic methods Yoga Psychology for Adjustment: Psychological, philosophical and yogic counselling; the remedial measures; Action in relaxation-the secret of Karma Yoga; Unattached action, not to the fruits of action, equanimity in success and failure.

Contact periods:

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

REFERENCES:

1. Vethathiri Maharishi, 2011, "Journey of Consciousness", Vethathiri Publications.
2. Iyankar B.K.S., "The path to Holistic Health", Dorling Kindusly Pvt. Ltd, London, 2014.
3. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.

4. JAF Stoner, Freeman R.E and Daniel R. Gilbert, “Management”, Pearson Education, 6th Edition, 2004.
5. Dr. Nagarathna R. and Dr. Nagendra H. R., “Yoga and Health”, Swami Vivekananda Yoga Prakashan, 2002.
6. Dr Nagendra H. R., “The Secret of Action-Karma Yoga”, Published by SVYP, Bangalore,2003.

COURSE OUTCOMES:

At the end of each unit, the students will be able to

CO1: Enable the student to about purpose of life.

CO2: Possess emotional stability and cultural values.

CO3: Practice mental hygiene.

CO4: Acquire knowledge of yogic concepts of health and healing.

CO5: Aware of yogic principle and practices for healthy living.

22ECPC704 EMBEDDED SYSTEMS LABORATORY SEMESTER VII

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Learn the working of ARM processor & understand the building blocks of Embedded systems.
- Learn the concept of memory map and memory interface
- Know the characteristics of peripheral devices.
- Write programs to interface memory, I/Os with processor.
- Study the interrupt performance.

LIST OF EXPERIMENTS

1. Study of ARM evaluation system
2. Interfacing ADC and DAC
3. Interfacing LED and PWM
4. Interfacing real time clock and 7 segment display
5. Interfacing keyboard and LCD
6. Interfacing EPROM and interrupt
7. Interrupt performance characteristics of ARM and FPGA
8. Flashing of LEDS
9. Interfacing stepper motor and temperature sensor
10. Implementing ZigBee protocol with ARM

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

COURSE OUTCOMES:

Upon completion of the course, the students will be able to
CO1: Write programs in ARM for a specific application.
CO2: Interface memory and write programs related to memory operations.
CO3: A/D and D/ convertors with ARM system.
CO4: Analyze the performance of interrupt.
CO5: Write programs for interfacing keyboard, display, motor and sensor.

22ECPC705 OPTICAL AND MICROWAVE ENGINEERING LABORATORY SEMESTER VII

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand the working principle of optical sources, detector, fibers and microwave components.
- To develop the understanding of simple optical communication link.
- To learn about the characteristics and measurements in optical fiber.
- To know about the behavior of microwave components.
- To practice the microwave measurement procedures.

LIST OF EXPERIMENTS

OPTICAL EXPERIMENTS

1. DC characteristics of LED and PIN Photo diode
2. Mode characteristics of Fibers
3. Measurement of connector and bending losses
4. Numerical aperture determination for Fibers
5. Attenuation measurement in Fibers
6. Wireless channel simulation including fading and Doppler effects
7. OFDM Signal transmission and reception using SDR

MICROWAVE EXPERIMENTS

8. Reflex klystron and Gunn diode characteristics
9. Basic microwave parameter measurement such as VSWR, frequency, wavelength, Attenuation and power measurement
10. Radiation pattern of Horn Antenna
11. S - Parameter Measurements for Isolator, Circulator, E plane Tee, H Plane Tee, Magic Tee and Directional Coupler

Contact periods:

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

COURSE OUTCOMES:

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

CO1: Analyze the performance of simple optical link.
CO2: Test microwave and optical components.
CO3: Analyze the mode characteristics of fiber.
CO4: Analyze the radiation pattern of antenna.
CO5: Analyze S parameters of microwave components.

22ECEE706	MINI PROJECT	SEMESTER VII

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

- To develop their own innovative prototype of ideas.
- To train the students in preparing mini project reports and examination.

The students in a group of 3 to 4 works on a topic approved by the Head of the Department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

Contact periods:

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

COURSE OUTCOMES:

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

CO1: On completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

22ECEE801	PROJECT WORK	SEMESTER VIII

L	T	P	C
0	0	20	8

COURSE OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 240 Periods Total: 240 Periods

COURSE OUTCOMES:

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

CO1: On completion of the project work students will be in a position to take up their project work to formulating proper model.

22CAHS604 PROFESSIONAL ETHICS IN ENGINEERING SEMESTER VIII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of Values and Ethics in their professional careers.
- To know the different ideas of engineering ethics.
- To Infer moral judgment concerning the profession
- To inculcate the sense of social responsibility.
- To know the global issues of ethics.

UNIT-I: HUMAN VALUES 9

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment– Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT-II: ENGINEERING ETHICS 9

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical theories.

UNIT-III: ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation – Engineers as responsible experimenters – Codes of Ethics – A balanced outlook on law.

UNIT-IV: SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual property rights (IPR) – Discrimination.

UNIT-V: GLOBAL ISSUES 9

Multinational corporations – Environmental ethics – Computer ethics – Weapons development – Engineers as managers – Consulting Engineers – Engineers as expert witnesses and advisors – Moral leadership – Code of conduct – Corporate social responsibility.

Contact periods:

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

REFERENCES:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M., Natarajan S. and Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.

5. John R. Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
6. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility,” Mc Graw Hill education, India Pvt..
7. Edmund G. and Robert L. Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.

COURSE OUTCOMES:

At the end of each unit, the students will be able to

CO1: Identify the core values that shape the ethical behavior of an engineer.

CO2: Utilize opportunities to explore one’s own values in ethical issues.

CO3: Apply codes of ethics and standards in the engineering field.

CO4: Explore various safety issues and ethical responsibilities of an engineer.

CO5: Recognize and resolve global issues.

22ECPE501	MEMS AND NEMS	SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of micro electromechanical devices.
- To know the fabrication process of Microsystems.
- To familiarize the design concepts of micro sensors and micro actuators.
- To be made aware of the MEMS design procedures and RF MEMS.
- To investigate various applications of MEMS.

UNIT-I: INTRODUCTION TO MEMS AND NEMS **9**

New trends in Engineering and Science: Micro and nanoscale systems, MEMS and Microsystems, Introduction to design of MEMS and NEMS, Overview of nano and micro-electromechanical systems, Micro sensors, Micro actuators, Materials for MEMS: Silicon, Silicon compounds Polymers and Metals.

UNIT-II: MEMS FABRICATION TECHNOLOGIES **9**

Microsystems fabrication processes: Photolithography, Ion implantation, Diffusion and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, Electrochemical etching; Micromachining: Bulk micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) technology.

UNIT-III : MICRO SENSORS **9**

MEMS Sensors: Design of acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo resistive pressure sensors – Engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor.

UNIT-IV: MICRO ACTUATORS **9**

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical motors and pumps. Case study: Comb drive actuators.

UNIT-V: MICRO SYSTEM DESIGN, PACKAGING AND APPLICATIONS **9**

Micro system Design – Design consideration, process design, Mechanical design, Mechanical design using MEMS.

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues.

Applications of micro system in Automotive – Aero space – Telecommunications – RF MEMS.

Contact periods:

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

REFERENCES:

1. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures”, CRC Press, 2002.
2. Stephen D. Senturia, “Micro system Design”, Kluwer Academic Publishers, 2001.

3. Tai Ran Hsu, “MEMS and Microsystems Design and Manufacture”, Tata Mcraw Hill, 2002.
4. Chang Liu, “Foundations of MEMS”, Pearson Education India limited, 2006.
5. Marc J. Madou, “Fundamentals of Microfabrication”, CRC press 1997.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the basics of MEMS technology and microsystems
CO2: Acquire knowledge on the fabrication process of Microsystems.
CO3: Understand the design concepts of micro sensors
CO4: Understand the design concepts of micro actuators
CO5: Analyze various MEMS design and investigate various applications of MEMS

22ECPE502	CONSUMER ELECTRONICS	SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the working principles of loudspeakers and microphones.
- To impart knowledge on television standards and systems.
- To introduce the basic principle of optical recording and reproduction.
- To explore the various telecommunication systems.
- To give an integrated approach to home appliances.

UNIT-I: LOUDSPEAKERS AND MICROPHONES **9**

Dynamic loudspeaker, Electrostatic loudspeaker, Permanent magnet loudspeaker, Woofers and tweeters – Microphone characteristics, Carbon microphones, Dynamic microphones and wireless microphones.

UNIT-II: TELEVISION STANDARDS AND SYSTEMS **9**

Components of a TV system – Interlacing – Composite video signal. Color TV – Luminance and Chrominance signal; Monochrome and color picture tubes – Color TV systems – NTSC, PAL, SECAM – Components of a remote control.

UNIT-III: OPTICAL RECORDING AND REPRODUCTION **9**

Audio Disc – Processing of the Audio signal – Read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats – Recording systems – Playback systems.

UNIT-IV: TELECOMMUNICATION SYSTEMS **9**

Telephone services – Telephone networks – Switching system principles – PAPX switching – Circuit, Packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless local loop. VHF/UHF Radio systems, Limited range cordless phones; Cellular modems

UNIT-V: HOME APPLIANCES **9**

Basic principle and block diagram of microwave oven; Washing machine hardware and software; Components of air conditioning and refrigeration systems.

Contact periods:

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

REFERENCES:

1. Bali S.P., “Consumer Electronics”, Pearson Education, 2009.
2. Gupta R.G., “Audio and video systems”, Tata Mc Gram Hill, 2013.
3. Chitode J.S., “Consumer Electronics”, Technical Publications, Pune, 2007.
4. Dhake A.M., “Television and video Engineering”, Tata Mc Gram Hill, 2017.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Demonstrate the working principles of loudspeakers and microphones

CO2: Develop various Standards for television system.

CO3: Explain the basic principle of optical recording and reproduction.

CO4: Acquire knowledge about the various telecommunication systems.
CO5: Solve engineering problems using modern electronics.

22ECPE503	NANOELECTRONICS	SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of nano electronics.
- To interpret the ideas of quantum electronics.
- To understand the concepts of nano electronic devices, transistors, tunneling devices and superconducting devices.
- To understand the basics of nanotube devices.
- To learn the concepts of super conducting devices.

UNIT-I: INTRODUCTION TO NANO ELECTRONICS 9

Scaling to nano – Light as a wave and particle- Electrons as waves and particles – Origin of quantum mechanics – General postulates of quantum mechanics – Time independent Schrodinger wave equation – Electron confinement – Quantum dots, wires and well-Spin and angular momentum.

UNIT-II: QUANTUM ELECTRONICS 9

Quantum electronic devices – Short channel MOS transistor – Split gate transistor – Electron wave transistor – Electron wave transistor – Electron spin transistor – Quantum cellular automata – Quantum dot array, Quantum memory.

UNIT-III: NANO ELECTRONIC TRANSISTORS 9

Coulomb blockade – Coulomb blockade in Nano capacitors – Coulomb blockade in tunnel junctions – Single electron transistors, Semiconductor nano wire FETs and SETs, Molecular SETs and molecular electronics – Memory cell.

UNIT-IV: NANO ELECTRONIC TUNNELING AND SUPER CONDUCTING DEVICES 9

Tunnel effect –Tunneling element – Tunneling diode – Resonant tunneling diode – Three terminal resonant tunneling devices – Superconducting switching devices – Cryotron – Josephson tunneling device.

UNIT-V: NANOTUBES AND NANOSTRUCTURE DEVICES 9

Carbon Nanotube – Fullerenes – Types of nanotubes – Formation of nanotubes – Assemblies – Purification of carbon nanotubes – Electronic properties – Synthesis of carbon nanotubes – Carbon nanotube interconnects – Carbon nanotube FETs and SETs – Nanotube for memory applications – Nano structures and nano structured devices.

Contact periods:

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

REFERENCES:

1. Brajesh Kumar Kaushik, "Nanoelectronics: Devices, Circuits and Systems", Elsevier science, 2018.
2. Robert Puers, Livio Baldi, Marcel Van de Voorde and Sebastiaan E. Van Nooten, "Nanoelectronics: Materials, Devices, Applications", Wiley, 2017.
3. Hanson, "Fundamentals of Nanoelectronics", Pearson education, 2009.
4. Mircea Dragoman and Daniela Dragoman, "Nanoelectronics: Principles and Devices", Artech House, 2009.

5. Jan Dienstuhl, Karl Goser, and Peter Glösekötter, “Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices”, Springer-Verlag, 2004.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the basics of nano electronics including quantum wires, dots and wells.
CO2: Use the mechanism behind quantum electronic devices.
CO3: Analyze the key performance aspects of tunneling and superconducting nano electronic devices.
CO4: Apply the knowledge in the development of nanotubes and nanostructure devices.
CO5: To design the nano electronic devices.

22ECPE504 OPTO ELECTRONIC DEVICES SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To review basic semiconductor theory.
- To introduce the concepts of LED.
- To teach the principle of stimulated emission and devices based on it.
- To equip the student with the knowledge of Photovoltaics and display devices.
- To introduce the knowledge of optolectronic modulators.

UNIT-I: SEMICONDUCTOR THEORY 9

Basic quantum mechanics, semiconductor statistics, carrier transport, optical processes, and junction theory, Properties of simple and compound semiconductors, Optical absorption, Optical recombination, Recombination and carrier lifetime.

UNIT-II: LIGHT EMITTING DIODES 9

Energy Bands. Direct and Indirect Bandgap Semiconductors: E-k Diagrams. pn Junction Principles. The pn Junction Band Diagram. Light Emitting Diodes. LED Materials. Heterojunction High Intensity LEDs. LED Characteristics. LEDs for Optical Fiber Communications, White LED for display and lighting applications.

UNIT-III: STIMULATED EMISSION DEVICES 9

Stimulated Emission and Photon Amplification. Stimulated Emission Rate and Einstein Coefficients. Optical Fiber Amplifiers. LASER Oscillation Conditions. Principle of the Laser Diode. Heterostructure Laser Diodes. Rate Equation- Characteristics. Light Emitters for Optical Fiber Communications. Quantum Well and Quantum dot Devices. Vertical Cavity Surface Emitting Lasers (VCSELs). Optical Laser Amplifiers.

UNIT-IV: PHOTOVOLTAICS AND DISPLAY DEVICES 9

Photovoltaic Device Principles. p-n Junction Photovoltaic I-V Characteristics. Solar Cells Materials, Devices and Efficiencies. Liquid crystal displays, Reflective and Trans reflective types, TFT displays, Plasma displays, LED TV.

UNIT-V: POLARIZATION AND MODULATION OF LIGHT 9

Polarization. Light Propagation in an Anisotropic Medium: Birefringence. Electro-Optic Effects. Acousto-Optic Modulator. Magneto-Optic Effects. Integrated Optical Modulators Electro-absorption modulators. Non-Linear Optics and Second Harmonic Generation.

Contact periods:

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

REFERENCES:

1.S. O. Kasap, "Optoelectronics and Photonics: Principles and Practices", Pearson, 2013.
2.Michael Parker, "Physics of optoelectronics", CRC press, 2018.
3.P. N. Prasad, "Nanophotonics", John Wiley & Sons, 2004.

4.Deng-Ke Yang , Shin Tson Wu, "Fundamentals of Liquid Crystal Devices", Revised edition, John Wiley and sons, 2015.
5.Saleh and Teich, "Fundamentals of Photonics", Wiley Interscience, 2nd Edition, 2013.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand various kinds of semiconductor materials used in optoelectronics.
CO2: Understand the mechanisms of light absorption in p-n junctions.
CO3: Understand the mechanisms of light emission in p-n junctions.
CO4: To design optoelectronic integrated circuits.
CO5: Use photodiodes, LEDs, and laser diodes for various applications.

22ECPE505 INDUSTRIAL IoT and INDUSTRY 4.0 SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of IoT and development platform.
- To gain the knowledge on communication protocols in IoT platforms.
- To manage the industrial data for process optimization.
- To study the cloud services to enhance IoT development platforms.
- To apply IoT for industrial applications.

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

IoT Definition – Importance of IoT – Applications of IoT – IoT architecture – Understanding working of Sensors – Actuators – Sensor calibration – Study of Different sensors and their characteristics.

UNIT-II: IoT COMMUNICATION PROTOCOLS **9**

UART Communication Protocol – I2C Protocol device interfacing and decoding of signal – SPI Protocol device interfacing and decoding of signal – WIFI and Router interfacing – Ethernet Configuration – Bluetooth study and analysis of data flow – Zigbee Interfacing and study of signal flow.

UNIT-III: IoT ANALYTICS **9**

Big Data and Advanced Analytics – Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Handloop.

UNIT-IV: IoT CLOUD SERVICES **9**

Configuration of the cloud platform – Sending data from the IoT nodes to the gateways using different communication options – Transferring data from gateway to the cloud – Tracking of cloud data as per the requirement using cloud Services.

UNIT-V: INDUSTRIAL IoT APPLICATIONS **9**

Antenna design and placement – Chip-package system development – Power electronics – electromagnetic interference/compatibility (EMI/EMC) – IoT Solutions for Healthcare and Utilities.

Contact periods:

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

REFERENCES:

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things – A Hands-on Approach”, Universities Press, 2015.
2. N. Ida, “Sensors, Actuators and Their Interfaces”, SciTech Publishers, 2014.
3. Peter Waher, “Learning Internet of Things”, Packt Publishing, 2015.
4. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, A press, 2016.
5. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, “Industrial Internet of Things: Cyber manufacturing Systems”, Springer, 2017.
6. Giacomo Veneri, Antonio Capasso, “Hands-On Industrial Internet of Things: Create a powerful Industrial IoT”, Packt, 2018.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Define the building blocks of IoT technology.

CO2: Explain the communication standards for IoT devices and systems.

CO3: Infer the data from IoT devices to gain valuable insights, improve decision making, and optimize processes.

CO4: Illustrate the IoT devices to connect and share information using the internet.

CO5: Demonstrate the IoT for industrial applications.

22ECPE506 IOT BASED SYSTEM PROTOCOLS SEMESTER V

L	T	P	C
3	0	0	3

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.

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(Technological Requirements of 5G Systems – Perspectives and a Middleware Approach Toward 5G (COMPaaS Middleware) – Resource management in IoT.

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 – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT-IV: IOT IMPLEMENTATION TOOLS 9

Introduction to Python, Introduction to different IoT tools, developing applications through IoT tools, developing sensor-based application 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: 45 Periods

REFERENCES:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.

2. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, “Internet of Things (IoT) in 5G Mobile Technologies” Springer International Publishing Switzerland 2016.
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things” Springer-Verlag Berlin Heidelberg, 2011.
4. Honbo Zhou, “Internet of Things in the cloud:A middleware perspective”, CRC press, 2012.
5. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, VPT, 1st Edition, 2014.
6. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017
7. Arshdeep Bahga and Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.

COURSE OUTCOMES:

Upon completion of the course, 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.

22ECPE507 **IOT PROCESSORS** **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Learn the architecture and features of ARM.
- Study the exception handling and interrupts in CORTEX M3.
- Program the CORTEX M3.
- Learn the architecture of STM 32L15XXX ARM CORTEX M3/M4 microcontroller.
- Understand the concepts of System-On-Chip (SoC).

UNIT-I: OVERVIEW OF ARM AND CORTEX-M3 **9**

ARM Architecture – Versions, Instruction Set Development, Thumb 2 and Instruction Set Architecture, Cortex M3 Basics: Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence, CORTEX M3 Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions, CORTEX M3 – Implementation Overview: Pipeline, Block Diagram. Bus Interfaces, I – Code Bus, D – Code Bus, System Bus- External PPB and DAP Bus.

UNIT-II: CORTEX EXCEPTION HANDLING AND INTERRUPTS **9**

Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor Call and Pendable Service Call, NVIC: Nested Vector Interrupt Controller, Overview, Basic Interrupts, SYSTICK Time, Interrupt Behaviourm Interrupt/Exception Sequences, Exception Exits, Nested Interrupts, Tail – Chaining Interrupts, Late Arrivals and Interrupt Latency.

UNIT-III: CORTEX M3/M4 PROGRAMMING **9**

Cortex M3/M4 Programming: Overview, Typical Development Flow, Using C, CMSIS Using Assembly, Excepiton Programming Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation, Memory Protection Unit and other CORTEX M3 Features, MPU Registers, Setting up the MPU, Power Management, Multiprocessor Configuration.

UNIT-IV: STM32L15XXX ARM CORTEX M3/M4 MICROCONTROLLER **9**

AND DEBUGGING TOOLS STM32L15XXX ARM CORTEX M3/M4 Microcontroller: Memory and Bus Architecture, Power Control, Reset and Clock Control, STM32L15XXX Peripherals: GPIOs, System Configuration Controller, NVIC, ADC, Comparators, GP Timers, USART Development and Debugging Tools: Software and Hardware tools like Cross Assembler Compiler, Debugger, Simulator, In – Circuit Emulator(ICE), Logic Analyser.

UNIT-V: INTRODUCTION TO SYSTEM – ON – CHIP **9**

System Architecture: An Overview, Components of the System Processors, Memories and Interconnects, Processor Architectures, Memory and Addressing, System Level Interconnection – An Approach for SOC Design – Chip basics – Cycle Time – Die Area – Power and Cost – Area, Power and Time Trade – Offs in Processor Design – Reliability and Configurability – SOC Design Approach – Application Studies – AES, 3D Graphics Processor. Image Compression and Video Compression.

Contact periods:

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

REFERENCES:

1. Joseph Yiu, "The Definitive Guide to the ARM CORTEX M3/M4", Second Edition, Elsevier, 2010.(Unit – I, II)
2. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developers Guide Designing and Optimizing System Software", Elsevier, 2006 (Unit – III, IV)
3. Michael J Flynn and Wayne Luk, "Computer System Design, System on Chip", Wiley India 2011.(Unit – V)
4. Steve Furber, "ARM System – on – Chip Architecture", 2nd Edition, Pearson, 2015.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Explain the architecture and features of ARM.
CO2: List the concepts of exception handling.
CO3: Write a program using ARM CORTEX M3/M4.
CO4: Learn the architecture of STM32L15XXX ARM CORTEX M3/M4.
CO5: Design an SoC for any application.

22ECPE508 SATELLITE COMMUNICATION SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn current state and advantages of Satellite Communication.
- To understand satellite orbits and trajectories.
- To have Knowledge on different satellite subsystems and multiple access methods.
- To understand different aspects of communication link design.
- To understand different types of Satellite Services.

UNIT I: SATELLITE ORBITS 9

Orbital Mechanics – Orbit Equations – Kepler's Laws – Orbital Period – Orbits and their types – Orbital Spacing – look angle calculation – Satellite Launch – Propagation Delay – System Performance.

UNIT II: SATELLITE SUBSYSTEM 9

AOCS – TTC&M – Power – Transponders – Antennas – Earth control – Effects of earth Perturbation suntransit – Moontransit – Satellite power design – MTBF – Basic Equations – System Noise and G/T ratio – Uplink – Downlink and Design for a specified C/N ratio – GEO and LEO examples – Atmospheric and Rain effects on link performance.

UNIT III: SATELLITE LINK DESIGN 9

Link design equation – Noise temperature – Atmospheric effects on link design – Interference effects – Earth station parameters – Earth space propagation effects – Frequency window – Free space loss – Ionospheric scintillation – Telemetry – Tracking and command of satellites – Digital Modulation for satellite systems – Error control requirements for satellite.

UNIT IV: SATELLITE MULTIPLE ACCESS SYSTEM 9

FDMA techniques – SCPC and CSSB systems – TDMA frame structure – Burst structure – Frame efficiency – Super-frame – Frame acquisition and synchronization – TDMA vs FDMA – Burst time plan – Beam hopping – Satellite switched – Erlang call congestion formula – DA-FDMA – DA-TDMA

UNIT V: SATELLITE SERVICE 9

MSAT service, BSAT service, RADARSAT service, SAR SAT service, INTELSAT service, INMART SAT service, VSAT service, Satellite Navigation and the Global positioning system

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Contact periods:

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

REFERENCES:

1. T.Pratt, C. Bostian and J.Allnutt, "Satellite Communications", John Wiley and Sons, Second Edition, 2003.
2. D.Rody, "Satellite Communications", McGraw-Hill Professional, Fourth Edition, 2006.
3. W.L.Pritchard,H G Suyderhoud and R A Nelson, "Satellite Communication System Engineering", Second edition, Prentice Hall, 1993.
4. Tri T Ha, "Digital Satellite Communications", Tata McGraw Hill, New Delhi, 2009.

5. Timothy Pratt, Charles W Bostian, and Jeremy Allnutt, "Satellite Communications", John Wiley and Sons, New Delhi, 2008.
6. Wilbur L Pritchard and Joseph A Scuilli, "Satellite Communication Systems Engineering", Prentice Hall Inc, Eagle Wood Cliffs, New Jersey, 2008.
7. Coolen M., "Satellite Communication", IEEE Publication, 1999

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO 1: Ability to understand satellite orbits and trajectories.
CO 2: Have Knowledge on different satellite subsystems.
CO 3: Ability to understand different aspects of communication link design.
CO 4: Knowledge on multiple access methods.
CO 5: Knowledge on important applications of satellites

22ECPE509 **REMOTE SENSING** **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors.
- To enhance knowledge about satellite orbits and different types of satellites.
- To unleash the concepts of sensing techniques.
- To introduce the elements of data interpretation.

UNIT-I: REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

Definition – Components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods – Electromagnetic Spectrum – Radiation principles – Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchhoff's law – Radiation sources: active & passive – Radiation Quantities

UNIT-II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Standard atmospheric profile – Main atmospheric regions and its characteristics – Interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows – Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – Solid surface scattering in microwave region

UNIT-III: ORBITS AND PLATFORMS 9

Motions of planets and satellites – Newton's law of gravitation – Gravitational field and potential – Escape velocity – Kepler's law of planetary motion – Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms – Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit.

UNIT-IV: SENSING TECHNIQUES 9

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions – Scanners – Along and across track scanners – Optical-infrared sensors – Thermal sensors – Microwave sensors – Calibration of sensors – High Resolution Sensors – LIDAR, UAV – Orbital and sensor characteristics of live Indian earth observation satellites

UNIT-V: DATA PRODUCTS AND INTERPRETATION 9

Photographic and digital products – Types, levels and open source satellite data products – Selection and procurement of data – Visual interpretation: basic elements and interpretation keys – Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

Contact periods:

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

REFERENCES:

1. Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, "Remote Sensing and Image interpretation", John Wiley and Sons, Inc, New York, 2015.

2. George Joseph and C Jeganathan, “Fundamentals of Remote Sensing”, Third Edition Universities Press (India) Private limited, Hyderabad, 2018.
3. Janza F.Z., Blue H.M. and Johnson, J.E. “Manual of Remote Sensing”, Vol. I, American Society of Photogrametry, Virginia, USA, 2002.
4. Verbyla, David, “Satellite Remote Sensing of Natural Resources”, CRC Press, 1995.
5. Paul Curran P.J., “Principles of Remote Sensing”, Longman, RLBS, 1988.
6. Charles Elachi and JacobVan Zyl , “Introduction to Physics and Techniques of Remote Sensing”, Edition II, Wiley Publication, 2006.
7. Basudeb Bhatta, “Remote Sensing and GIS”, Oxford University Press, 2011.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the concepts and laws related to remote sensing.
CO2: Understand the interaction of electromagnetic radiation with atmosphere and earth material.
CO3: Acquire knowledge about satellite orbits and different types of satellites.
CO4: Understand the different types of remote sensors.
CO5: Gain knowledge about the concepts of interpretation of satellite imagery.

22ECPE510 GREEN COMMUNICATION SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the principles of green communications and the trade-offs exist in it while satisfying the user demands in the network.
- To design the green networks by optimizing its different layers to solve the coexistence problems due to huge power dissipation.
- To design the self-sustainable cooperative networks by energy harvesting the ambient sources and optimal power management over the operating devices.
- To study the challenges in simultaneous wireless information and power transfer (SWIPT) along with the optimization of resource allocations.
- To understand the Wireless Access Techniques for Green Radio Networks.

UNIT-I: Fundamental Tradeoffs on the Design of Green Radio Networks 9

Insight from Shannon's capacity formula, impact of practical constraints and latest research and directions, algorithms for energy harvesting wireless networks, energy harvesting technologies – PHY and MAC layer optimization for energy harvesting wireless networks.

UNIT-II: Modulation 9

Green modulation and coding schemes in energy constrained wireless networks, energy consumption of uncoded scheme, energy consumption analysis of LT coded modulation

UNIT-III: Cooperative Techniques for Energy Efficient Wireless Communications 9

Energy efficiency metrics for wireless networks, cooperative networks, optimizing the energy efficiency performance of cooperative networks, energy efficiency in cooperative base stations

UNIT-IV: Base Station Power Management Techniques for Green Radio Networks 9

Opportunistic spectrum and load management for green radio networks, energy saving techniques in cellular wireless base stations, power management for base stations in a smart grid environment.

UNIT-V: Wireless Access Techniques for Green Radio Networks 9

Cross Layer Design: Adaptive packet scheduling for green radio networks - energy efficient relaying for cooperative cellular wireless networks - energy performance in TDD CDMA multihop cellular networks - resource allocation for green communication in relay based cellular networks.

Contact periods:

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

REFERENCES:

1. Ekram Hossain, Vijay K. Bhargava and Gerhard P. Fettweis, "Green Radio Communication Networks", Cambridge University Press, 2012.
2. F. Richard Yu, Yu, Zhang and Victor C. M. Leung "Green Communications and Networking", CRC press, 2012.

3. Mazin Al Noor, “Green Radio Communication Networks Applying Radio-Over-Fibre Technology for Wireless Access”, GRIN Verlag, 2012.
4. Mohammad S. Obaidat, Alagan Anpalagan and Isaac Woungang, “Handbook of Green Information and Communication Systems”, Academic Press, 2012.
5. Jinsong Wu, Sundeep Rangan and Honggang Zhang, “Green Communications: Theoretical Fundamentals, Algorithms and Applications”, CRC Press, 2012.
6. Mazin Al Noor, “WiMAX Improvements in Green Radio Communications Utilizing Radio-Over- Fiber”, GRIN Verlag, 2012.
7. Ramjee Prasad and Shingo Ohmori, Dina Simunic, “Towards Green ICT”, River Publishers, 2010.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the principles of green communications and the trade-offs exist in it while satisfying the user demands in the network.

CO2: Design the green networks by optimizing its different layers to solve the coexistence problems due to huge power dissipation.

CO3: Design the self-sustainable cooperative networks by energy harvesting the ambient sources and optimal power management over the operating devices.

CO4: Study the challenges in simultaneous wireless information and power transfer (SWIPT) along with the optimization of resource allocations.

CO5: Understand the Wireless Access Techniques for Green Radio Networks.

22ECPE511	AVIONICS SYSTEMS	SEMESTER V

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To provide exposure to basic concepts of Aircraft product system engineering and design.
- To provide exposure to different fault and failure analysis methods in avionic systems.
- To provide exposure on systems engineering process, System Architecture and integration.
- To provide exposure on the importance of Maintainability, reliability and availability of the product.
- To provide exposure importance of formal planning and documentation in systems engineering.

UNIT-I: INTRODUCTION TO SYSTEMS ENGINEERING 9

Overview of Systems Engineering – Systems Engineering Concept Map – Systems Definition – The seven steps Systems Engineering – Conceptual System Design – System Engineering Process Requirements and Management – Trade Studies – Integrated Product and Process Development.

UNIT-II: THE AIRCRAFT SYSTEMS AND DESIGN 9

Introduction-Everyday Examples of Systems-Aircraft Systems – Generic System – Product Life Cycle-Different Phases – Whole Life Cycle Tasks – Systems Analysis – Design Drivers in the Project, Product, Operating Environment – Interfaces with the Subsystems – Mission analysis.

UNIT-III: SYSTEM ARCHITECTURES AND INTEGRATION 9

Introduction-Systems Architectures – Modeling and Trade-Offs – Evolution of Avionics Architectures Systems Integration Definition – Examples of Systems Integration-Integration Skills – Management of Systems Integration.

UNIT-IV: PRACTICAL CONSIDERATIONS **AND CONFIGURATION CONTROL 9**

Stake holders – Communications-Criticism – Configuration Control Process – Portrayal of a System – Varying Systems Configurations – Compatibility – Factors Affecting Compatibility – Systems Evolution. Considerations and Integration of Aircraft Systems – Risk Management.

UNIT-V:SYSTEMS RELIABILITY AND MAINTAINABILITY 9

Systems and Components – Analysis-Influence, Economics, Reliability – Design for Reliability – Redundancy Management – Fault and Failure Analysis – System Life Cycle cost – Case Study – Maintenance Types – Program-Planning and Design.

Contact periods:

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

REFERENCES:

1. Andrew P. Sage and James E. Armstrong, “Introduction to Systems Engineering”, Wiley Interscience; 1st edition, 2000.
2. Blake Lock, J.H., “Automatic control of Aircraft and missiles”, John Wiley Sons, New York, 1990.
3. Cary R. Spitzer, “The Avionics Handbook”, CRC Press, 2000.
4. Erik Aslaksen and Rod Belcher, “Systems Engineering”, Prentice Hall, 1992.
5. Ian Moir and Allan Seabridge, “Design and Development of an Aircraft Systems”, 2nd Edition, John Wiley & Sons Ltd, 2013.

6. Ian Moir and Allan Seabridge, “Aircraft Systems Mechanical, electrical, and avionics subsystems integration”, John Wiley & Sons Ltd, 2009.
7. Peter. Sydenham, “Systems Approach to Engineering Design”, Artech house, Inc, London, 2003.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Describe the importance of systems engineering process in product development.
CO2: Categorize different aircraft systems and will be able to differentiate the avionics architectures.
CO3: Analyze the different stages of product development and factors influencing in each stage.
CO4: Design the different alternatives during design process.
CO5: Plan, organize and document the task related to product design, development and testing.

22ECPE512 4G / 5G COMMUNICATION NETWORKS SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the evolution of wireless networks.
- To get acquainted with the fundamentals of 5G networks.
- To study the processes associated with 5G architecture.
- To study spectrum sharing and spectrum trading.
- To learn the security features in 5G networks.

UNIT-I: EVOLUTION OF WIRELESS NETWORKS 9

Networks evolution: 2G, 3G, 4G, evolution of radio access networks, need for 5G. 4G versus 5G, Next Generation core (NG-core), visualized Evolved Packet core (vEPC).

UNIT-II: 5G CONCEPTS AND CHALLENGES 9

Fundamentals of 5G technologies, overview of 5G core network architecture,5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNIT-III: NETWORK ARCHITECTURE AND THE PROCESSES 9

5G architecture and core, network slicing, multi access edge computing (MEC) visualization of 5G components, end-to-end system architecture, service continuity, relation to EPC, and edge computing. 5Gprotocols: 5G NAS, NGAP, GTP-U, IPsec and GRE.

UNIT-IV: DYNAMIC SPECTRUM MANAGEMENT AND MM-WAVES 9

Mobility management, Command and control, spectrum sharing and spectrum trading, cognitive radio based on 5G, millimeter waves.

UNIT-V: SECURITY IN 5G NETWORKS 9

Security features in 5G networks, network domain security, user domain security, flow based QoS framework, mitigating the threats in 5G.

Contact periods:

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

REFERENCES:

1. Stephen Rommer, "5G Core networks: Powering Digitalization", Academic Press, 2019.
2. Saro Velrajan, "An Introduction to 5G Wireless Networks: Technology, Concepts and Use cases", first Edition, 2020.
3. Jyrki.T.J. Penttinen, "5G Simplified: ABCs of Advanced Mobile Communications", copyrighted Material.
4. Wan Lee Anthony, "5G system Design: An end-to-end Perspective", Springer Publications, 2019.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: To understand the evolution of wireless networks.
CO2: To learn the concepts of 5G networks.
CO3: To comprehend the 5G architecture and protocols.

CO4: To understand the dynamic spectrum management.
CO5: To learn the security aspects in 5G networks.

22ECPE513	SOFTWARE DEFINED NETWORKS	SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT-I: SDN: BACKGROUND AND DATA **9**

Evolving Network Requirements – The SDN Approach – SDN and NFV – Related Standards – SDN Data Plane – OpenFlow Logical Network Device – OpenFlow Protocol.

UNIT-II: SDN CONTROL PLANE **9**

SDN Control Plane Architecture: Southbound Interface, Northbound Interface – Control Plane Functions – ITU-T Model – Open Daylight – REST – Cooperation and Coordination among Controllers.

UNIT-III: SDN APPLICATIONS **9**

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking – Mobility and Wireless – Information-centric Networking.

UNIT-IV: NETWORK FUNCTION VIRTUALIZATION **9**

NFV Concepts – Benefits and Requirements – Reference Architecture – NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV.

UNIT-V: NETWORK VIRTUALIZATION **9**

Virtual LANs – OpenFlow VLAN Support – Virtual Private Networks – Network Virtualization – OpenDaylight's Virtual Tenant Network – CoSoftware-Defined Infrastructure

Contact periods:

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

REFERENCES:

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud", Pearson Education, 1st Edition, 2015.
2. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017.
3. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann Press, 2016.
4. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition, CRC Press, 2014.
5. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Explain the motivation behind SDN and its data plane
CO2: Identify the functions of control plane
CO3: Apply SDN to networking applications
CO4: Organize various operations of network function virtualization
CO5: Model various use cases of SDN

22ECPE514	WIRELESS NETWORKS	SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To familiarize with Wireless networks, protocol stack and standards.
- To introduce the network layer solutions for Adhoc wireless networks.
- To learn about fundamentals of 3G Services, its protocols and applications.
- To study the design consideration of wireless wide area networks.
- To study about evolution of 4G Networks, its architecture and applications

UNIT-I: OVERVIEW OF WIRELESS LAN **9**

Introduction to WLAN: Infrared, Radio wave, Spread spectrum, UHF Narrowband – IEEE802.11: Architecture, Physical layer, MAC layer, MAC management – HiperLAN – WATM – Bluetooth: Architecture – Zigbee – IEEE802.16: WIMAX – A Case Study on Wireless Personal Area Networks.

UNIT-II: MOBILE AD HOC NETWORKS **9**

Introduction to Mobile IP: IP Packet delivery, Agent discovery, Tunneling and Encapsulation, IPV6 – Mobile ad-hoc network: Routing, Destination Sequence Distance Vector (DSDV), Ad - hoc on Demand Distance Vector Routing (AODV).

UNIT-III: MOBILE TRANSPORT LAYER **9**

TCP enhancements for wireless protocols – Traditional TCP: Congestion control, Implications of mobility – Classical TCP improvements: Snooping TCP, Mobile TCP – TCP over 3G wireless networks.

UNIT-IV: WIRELESS WIDE AREA NETWORK **9**

Overview of UMTS Terrestrial Radio access network – UMTS Core network Architecture - Firewall, DNS/DHCP – QoS – High speed Downlink packet access (HSDPA) – LTE network architecture and protocol.

UNIT-V: 4G NETWORKS & BEYOND **9**

4G Vision – 4G features and challenges – Applications of 4G – 4G Technologies: Smart antenna techniques, Multi carrier modulation, OFDM – MIMO systems, Adaptive Modulation, Cognitive Radio – Introduction to Wireless Sensor Networks and its Applications.

Contact periods:

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

REFERENCES:

1. Vijay Garg, "Wireless Communications and networking", 1st Edition, Elsevier, 2007.
2. C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Network – Architectures and protocols", Pearson Education, 2012.
3. Jochen Schiller, "Mobile Communications", 2nd Edition, Pearson Education, 2012.
4. William Stallings, "Wireless Communications and Networks", Pearson, Second Edition 2007.
5. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", 2nd Edition, Academic Press, 2008.

6. Anurag Kumar, Manjunath Dand Joy Kuri, “Wireless Networking”, 1st Edition, Elsevier 2011.
7. Simon Haykin, Michael Moher and David Koilpillai, “Modern Wireless Communications”, First Edition, Pearson Education 2013.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the basic concepts of wireless LAN technologies and its standards.
CO2: Analyze the network layer solutions for Adhoc wireless networks.
CO3: Analyze the operation of transport layer protocols over 3G wireless networks.
CO4: Understand the architecture and protocols for wireless wide area networks.
CO5: Understand the concepts of 4G Wireless standards and its technologies.

22ECHS515 PRINCIPLES OF MANAGEMENT SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students to understand the basic concepts of management.
- To prepare the students to know about the significance of the management in Business.
- To enable the students to get knowledge about the various techniques of Management Principles.
- To make the students to get practical skill in solving management problems.
- To introduce the students to the basic concept of management in order to provide an in-depth understanding of various organizational functions, including the wide variety of company issues that managers face in today's business firms.

UNIT-I: INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur – Types of managers – Managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management.

UNIT-II: PLANNING 9

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

UNIT-III: ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT-IV: DIRECTING 9

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

UNIT-V: CONTROLLING 9

System and process of controlling – Budgetary and non-budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

Contact periods:

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

REFERENCES:

1. Stephen P. Robbins & Mary Coulter, "Management", 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.

3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamental contingency approaches – Types of Business organization - Sole proprietorship, partnerships of Management” 7th Edition, Pearson Education, 2011.
4. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
5. Harold Koontz & Heinz Weihrich “Essentials of management” Tata Mc Graw Hill, 1998.
6. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.
7. Dr. G. K. Vijayaraghavan and Dr. M. Sivakumar, Edition 2018, “Principles of management”, Lakshmi Publications, January 2018.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the basic concepts and significance of management in business.
CO2: Develop and apply budget for planning and controlling purpose.
CO3: Enhance the primary purpose of management accounting namely financial statement analysis and budgetary control.
CO4: Take right decision applying scientific methods rather than heuristic or thumb rule.
CO5: Become employable in statistical and survey related jobs.

22ECHS516 TOTAL QUALITY MANAGEMENT SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To facilitate the understanding of Quality Management principles and process.
- To study principles and philosophies of quality management.
- To understand the different quality systems.
- T o learn the tools and techniques for management.
- To examine Quality Auditing in all service sectors.

UNIT-I: INTRODUCTION 9

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM – Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints and Customer retention – Costs of quality.

UNIT-II: TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT-III: TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT-IV: TQM TOOLS AND TECHNIQUES II 9

Control Charts – Process Capability – Concepts of Six Sigma – Quality Function Development (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures.

UNIT-V: QUALITY SYSTEMS 9

Need for ISO 9000 – ISO 9001-2008 Quality System – Elements, Documentation, Quality Auditing – QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – TQM Implementation in manufacturing and service sectors.

Contact periods:

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

REFERENCES:

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
5. ISO 9001-2015 standards.

6. Total Quality Management, Author Dr. K.C. Jain, Mukesh Pandey and Nitin Shrivastava. ISBN: 978-81-7409-239-7.

7.Total Quality Management – An Integrated Approach, DR. Kiran, BS Publications / BSP Books. ISBN: 9789352300921.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the quality concepts and philosophies of TQM.
CO2: Apply TQM principles and concepts of continuous improvement.
CO3: Explain quality tools, management tools and statistical fundamentals to improve quality.
CO4: Clarify the TQM tools as a means to improve quality.
CO5: Remember the quality systems and procedures adopted.

22ECHS517 ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understanding the concept of Engineering Economics.
- Implement various micro economics concept in real life.
- Gaining knowledge in the field of macroeconomics to enable the students to have better.
- Understanding of various components of macroeconomics and the different procedures of pricing.
- Learn the various cost related concepts in micro economics.

UNIT-I: DEMAND & SUPPLY ANALYSIS **9**

Managerial Economics – Relationship with other disciplines – Firms: Types, objectives and goals – Managerial decisions – Decision analysis. Demand – Types of demand – Determinants of demand – Demand function – Demand elasticity – Demand forecasting – Supply – Determinants of supply – Supply function – Supply elasticity

UNIT-II: PRODUCTION AND COST ANALYSIS **9**

Production function – Returns to scale – Production optimization – Least cost input – Isoquants – Managerial uses of production function. Cost Concepts – Cost function – Determinants of cost – Short run and Long run cost curves – Cost Output Decision - Estimation of Cost

UNIT-III: PRICING **9**

Determinants of Price – Pricing under different objectives and different market structures – Price discrimination – Pricing methods in practice.

UNIT-IV: FINANCIAL ACCOUNTING **9**

Balance sheet and related concepts – Profit & Loss Statement and related concepts – Financial Ratio Analysis – Cash flow analysis – Funds flow analysis – Comparative financial statements – Analysis & Interpretation of financial statements

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UNIT-V: CAPITAL BUDGETING **9**

Investments – Risks and return evaluation of investment decision – Average rate of return – Payback Period – Net Present Value – Internal rate of return.

Contact periods:

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

REFERENCES:

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi,2001.
2. P. L. Mehta, “Managerial Economics: Analysis, Problems and Cases”, Edition 13, Sultan Chand publication, 2007.
3. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.
4. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
5. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011.
6. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012.

7. Dr. S. N. Maheswari and Dr. S.K. Maheshwari, “Financial Accounting”, Vikas, 2009.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

CO2: Evaluate the economic theories, cost concepts and pricing policies.

CO3: Understand the market structures and integration concepts.

CO4: Understand the measures of national income, the functions of banks and concepts of globalization.

CO5: Apply the concepts of financial management for project appraisal.

22ECHS518 HUMAN RESOURCE MANAGEMENT SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge about management issues related to staffing.
- To provide knowledge about management issues related to training.
- To provide knowledge about management issues related to performance.
- To provide knowledge about management issues related to compensation
- To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.

UNIT-I: INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 9

The importance of human resources – Objective of Human Resource Management – Human resource policies – Role of human resource manager.

UNIT-II: HUMAN RESOURCE PLANNING 9

Importance of Human Resource Planning – Internal and External sources of Human Resources – Recruitment – Selection – Socialization.

UNIT-III: TRAINING AND EXECUTIVE DEVELOPMENT 9

Types of training and Executive development methods – Purpose – Benefits.

UNIT-IV: EMPLOYEE COMPENSATION 9

Compensation plan – Reward – Motivation – Career Development - Mentor – Protege relationships.

UNIT-V: PERFORMANCE EVALUATION AND CONTROL 9

Performance evaluation – Feedback - The control process – Importance – Methods – Grievances – Causes – Redressal methods.

Contact periods:

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

REFERENCES:

1. Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007.
2. John Bernardin. H., "Human Resource Management – An Experimental Approach", 5th Edition, Tata McGraw Hill, 2013, New Delhi.
3. Luis R,. Gomez-Mejia, DavidB. Balkin and Robert L. Cardy, “Managing Human Resources", 7 th Edition, PHI, 2012.
4. Dessler, "Human Resource Management", Pearson Education Limited, 2007.
5. TrevisCerto, “Modern Management Concepts and Skills”, Pearson Education, 2018.
6. Govindarajan and S. Natarajan, “Principles of Management”, Prentice Hall of India, New Delhi, 2009.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.

CO2: Discuss the planning; organizing and staffing functions of management in professional organization.

CO3: Apply the leading; controlling and decision-making functions of management in professional organization.

CO4: Discuss the organizational theory in professional organization.

CO5: Apply principles of productivity and modern concepts in management in professional organization.

22ECHS519 KNOWLEDGE MANAGEMENT SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To Learn the Evolution of Knowledge management.
- To be familiar with tools.
- To be exposed to Applications.
- To be familiar with some case studies.
- To develop enterprise applications.

UNIT-I: INTRODUCTION TO KNOWLEDGE 9

An Introduction to Knowledge Management – The foundations of knowledge management including cultural issues – Technology applications organizational concepts and processes – Management aspects and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management – Key Challenges Facing the Evolution of Knowledge Management – Ethics for Knowledge Management.

UNIT-II: CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 9

Organization and Knowledge Management – Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT-III: KNOWLEDGE MANAGEMENT-THE TOOLS 9

Telecommunications and Networks in Knowledge Management – Internet Search Engines and Knowledge Management – Information Technology in Support of Knowledge Management – Knowledge Management and Vocabulary Control – Information Mapping in Information Retrieval – Information Coding in the Internet Environment – Repackaging Information.

UNIT-IV: KNOWLEDGE MANAGEMENT APPLICATION 9

Components of a Knowledge Strategy – Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).

UNIT-V: FUTURE TRENDS AND CASE STUDIES 9

Adaptive Neuro-Fuzzy inference systems – Coactive Neuro-Fuzzy modeling – Classification and regression trees – Data clustering algorithms – Rule base structure identification – Neuro-Fuzzy control – Case studies.

Contact periods:

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

REFERENCES:

1. Srikantaiah, T.K., Koenig, M., “Knowledge Management for the Information Professional” Information Today, Inc., 2000.
2. Nonaka, I., Takeuchi, H., “The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation”, Oxford University Press, 1995.
3. Awad, E.M, “Knowledge Management”, Pearson India, Delhi, 2007.

4. Fernandez I. B. and Sabherwal R., “Knowledge Management: System and Resources”, 2010.
5. Kimiz Dalkir, “Knowledge Management in Theory and Practice”, Elsevier, 2005.
6. iwana Amrit, “The Knowledge Management Toolkit”, Prentice Hall PTR, 1999.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the process of acquire knowledge from experts.
CO2: Understand the learning organization.
CO3: Use the knowledge management tools.
CO4: Develop knowledge management Applications.
CO5: Design and develop enterprise applications.

22ECHS520 INDUSTRIAL MANAGEMENT SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce fundamental concepts of industrial management.
- To understand the approaches to the study of Management.
- To learn about Decision Making, Organizing and leadership.
- To analyze the Managerial Role and functions.
- To know about the Supply Chain Management.

UNIT-I: INTRODUCTION 9

Technology Management – Definition – Functions – Evolution of Modern Management – Approaches to the study of Management, Forms of Organization – Individual Ownership – Partnership – Joint Stock Companies – Co-operative Enterprises – Public Sector Undertakings, Corporate Frame Work- Share Holders – Board of Directors – Committees – Chief Executive Line and Functional Managers.

UNIT-II: FUNCTIONS OF MANAGEMENT 9

Planning – Nature and Purpose – Objectives – Strategies – Policies and Planning Premises – Decision Making – Organizing – Line and staff – Decentralization – Organizational culture, Staffing – selection and training. Placement – Performance appraisal – Career Strategy – Organizational Development. Communication, Controlling – Process of Controlling - Controlling techniques, productivity and operations management – Preventive control, Industrial Safety.

UNIT-III: ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and functions – Organizational approaches, Individual behaviour – Causes – Environmental Effect – Behaviour and Performance, Perception – Organizational Implications. Personality – Contributing factors – Dimension – Need Theories – Process Theories – Job Satisfaction, Learning and Behaviour – Learning Curves, Work Design and approaches.

UNIT-IV: GROUP DYNAMICS 9

Group Behaviour – Groups – Contributing factors – Group Norms, Communication – Process – Barriers to communication – Effective communication, leadership – formal and informal characteristics – Managerial Grid – Leadership styles – Group Decision Making – Leadership Role in Group Decision, Group Conflicts – Types – Causes – Conflict Resolution – Inter group relations and conflict, Organization centralization and decentralization – Formal and informal – Organizational Structures Organizational Change and Development – Change Process – Resistance to Change – Culture and Ethics.

UNIT-V: MODERN CONCEPTS 9

Management by Objectives (MBO) – Management by Exception (MBE), Strategic Management – Planning for Future direction – SWOT Analysis – Evolving development strategies, information technology in management Decisions support system–Management Games Business Process Reengineering(BPR) – Enterprises Resource Planning (ERP)

Contact periods:

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

REFERENCES:

1. Maynard H.B, “Industrial Engineering Hand book”, McGraw-Hill, sixth 2008.
2. O P Khanna, “Industrial Engineering and Management”, Dhanpat Rai Publications, New Delhi, 2014
3. R Paneerselvam, “Production and operations management”, PHI Learning private ltd, New Delhi, 2012.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the basic concepts of industrial management.
CO2: Identify the group conflicts and its causes.
CO3: Perform swot analysis.
CO4: Analyze the learning curves.
CO5: Understand the placement and performance appraisal.

22ECHS521 INTELLECTUAL PROPERTY RIGHTS SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To give an idea about IPR.
- To understand registration of IPRs.
- To have knowledge on patents Act.
- To introduces the different aspects IP laws.
- To understand enforcement of IPRs.

UNIT-I: INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – The way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, Technological Research, Inventions and Innovations – Important examples of IPR.

UNIT-II: REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT-III: AGREEMENTS AND LEGISLATIONS 9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT-IV: DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT-V: ENFORCEMENT OF IPRs 9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

Contact periods:

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

REFERENCES:

1. Scople Vinod V., “Managing Intellectual Property”, Prentice Hall of India pvt Ltd, 2012.
2. Satakar S. V., “Intellectual Property Rights and Copy Rights”, Ess Publications, New Delhi, 2002
3. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
4. Prabuddha Ganguli, “Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
5. Derek Bosworth and Elizabeth Webster, “The Management of Intellectual Property”, Edward Elgar Publishing Ltd., 2013.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Ability to manage Intellectual Property portfolio to enhance the value of the firm.
CO2: Have Knowledge on different registration of IPRs.
CO3: Ability to recognize on patents Act.
CO4: Knowledge on different aspects IP laws.
CO5: Knowledge on enforcement of IPRs.

22ECPE601 BIOMEDICAL INSTRUMENTATION SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To Illustrate the origin of biopotentials and its propagations.
- To understand the different types of electrodes and its placement for various recordings.
- To design a bio amplifier for various physiological recordings.
- To learn the different measurement techniques for non-physiological parameters.
- To Summarize different biochemical measurements.

UNIT-I: BIOPOTENTIAL ELECTRODES 9

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode – Skin interface, half-cell potential, Contact impedance, polarization effects of electrode – Non polarizable electrodes. Types of electrodes – Surface, needle and micro electrodes and their equivalent circuits. Recording problems – Motion artifacts, measurement with two electrodes.

UNIT-II: BIOPOTENTIAL MEASUREMENTS 9

Bio signals characteristics – Frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system, Principles of vector cardiography.EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG – Unipolar and bipolar mode. Recording of ERG, EOG and EGG

UNIT-III: SIGNAL CONDITIONING CIRCUITS 9

Need for bio-amplifier – single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers – Transformer and optical isolation – Isolated DC amplifier and AC carrier amplifier. Power line interference, Right leg driven ECG amplifier, Bandpass filtering

UNIT-IV: MEASUREMENT OF NON-ELECTRICAL PARAMETERS 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods – Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT-V: BIOCHEMICAL MEASUREMENT AND BIOSENSORS 9

Biochemical sensors –PH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors, Blood gas analyzers – Colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description) – Bio Sensors – Principles – Amperometric and voltometric techniques

Contact periods:

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

REFERENCES:

1. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.

2. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2004.
3. Myer Kutz, “Standard Handbook of Biomedical Engineering and Design”, McGraw Hill Publisher, 2003.
4. Khandpur R.S, “Handbook of Biomedical Instrumentation”, 3rd edition, Tata McGraw-Hill New Delhi, 2014.
5. Leslie Cromwell, “Biomedical Instrumentation and measurement”, 2nd edition, Prentice hall of India, New Delhi, 2015.

COURSE OUTCOMES:

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

CO1: Differentiate different bio potentials and its propagations.
CO2: Illustrate different electrode placement for various physiological recordings.
CO3: Design bio amplifier for various physiological recordings.
CO4: Explain various techniques for non-electrical physiological measurements.
CO5: Demonstrate different biochemical measurement techniques.

22ECPE602 MEDICAL IMAGING SYSTEMS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the generation of X-ray and its uses in Medical imaging.
- To describe the principle of Computed Tomography.
- To know the techniques used for visualizing various sections of the body.
- To learn the principles of different radio diagnostic equipment in Imaging.
- To discuss the radiation therapy techniques and radiation safety.

UNIT-I: X RAY **9**

Nature of X-rays – X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography – Discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography

UNIT-II: COMPUTED TOMOGRAPHY **9**

Principles of tomography, CT Generations, X- Ray sources-collimation – X- Ray detectors – Viewing systems – spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques – back projection and iterative method.

UNIT-III: MAGNETIC RESONANCE IMAGING **9**

Fundamentals of magnetic resonance – Properties of electromagnetic waves : speed, amplitude, phase, orientation and waves in matter – Interaction of Nuclei with static magnetic field and Radio frequency wave – Rotation and prec–ession – Induction of magnetic resonance signals – Bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system – system magnet (Permanent, Electromagnet and Superconductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT-IV: NUCLEAR IMAGING **9**

Radioisotopes – Alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors – Gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gamma camera – Principle of operation, collimator, photomultiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET.

UNIT-V: RADIATION THERAPY AND RADIATION SAFETY 9

Radiation therapy – linear accelerator, Telegamma Machine. SRS – SRT – Recent Techniques in radiation therapy – 3D CRT – IMRT – IGRT and Cyber knife – radiation measuring instruments Dosimeter, film badges, Thermo Luminescent dosimeters – electronic dosimeter – Radiation protection in medicine – radiation protection principles

Contact periods:

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

REFERENCES:

1. Isaac Bankman, I. N. Bankman , Handbook Of Medical Imaging: Processing and Analysis(Biomedical Engineering),Academic Press, 2000.

2. Jacob Beutel (Editor), M. Sonka (Editor), Handbook of Medical Imaging, Volume 2, Medical Image Processing and Analysis , SPIE Press 2000.
3. Khin Wee Lai, Dyah Ekashanti Octorina Dewi "Medical Imaging Technology", Springer Singapore, 2015
4. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw – Hill, New Delhi, 2003.
5. Dougherty, Geoff (Ed.), "Medical Image Processing-Techniques and Applications ",Springer-Verlag New York, 2011.

COURSE OUTCOMES:

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

CO1: Describe the working principle of the X-ray machine and its application.

CO2: Illustrate the principle computed tomography.

CO3: Interpret the technique used for visualizing various sections of the body using Magnetic Resonance Imaging.

CO4: Demonstrate the applications of radionuclide imaging.

CO5: Analyze different imaging techniques and choose appropriate imaging equipment for better diagnosis and outline the methods of radiation safety.

22ECPE603 THERAPEUTIC EQUIPMENT SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the therapeutic devices for ailments related to cardiology.
- To describe the principle of bodycare equipment.
- To know the operation of dental care equipment.
- To learn the different types of therapies for suitable applications.
- To discuss the application of lasers in biomedical.

UNIT-I: CARDIAC AND RESPIRATORY THERAPY EQUIPMENT 9

Cardiac Pacemaker: Internal and External Pacemaker – Programmable pacemakers. Cardiac Defibrillators: AC and DC Defibrillator- Internal and External Defibrillators – Protection Circuits, Defibrillator analyzers. Cardiac ablation catheter. Types of Ventilators – Pressure, Volume, and Time controlled. Basic principles of electromechanical, pneumatic and electronic ventilators, Patient Cycle Ventilators, and Ventilator testing. Humidifiers, Nebulizers, Inhalators.

UNIT-II: BIOMECHANICAL THERAPEUTIC EQUIPMENT 9

Electrodiagnosis, Therapeutic radiation, Electrotherapy, Electrodes, Stimulators for Nerve and Muscle, Functional Electrical Stimulation. peripheral nerve stimulator, ultrasonic stimulators, Stimulators for pain and relief – Inferential Therapy Unit, TENS. GAIT Assessment and Therapy. Continuous Passive Motion unit, Cervical / Lumber Traction Machine – Traction Table.

UNIT-III: BODY CARE EQUIPMENT 9

Skin Treatment: Ultrasonic spot remove, vacuum therapy unit, Skin tightening, Wrinkle Reduction, Facial and Rejuvenation. Laser hair therapy machine. Body Slimmer/Shaper – Deep Heat Therapy, Massager, Fitness – Treadmill, Bike.

UNIT-IV: DENTAL CARE EQUIPMENT 9

Dental Chair – Dental Hand pieces and Accessories: Evolution of rotary equipment, Low-speed handpiece, High-speed handpiece, Hand piece maintenance. Vacuum and Pneumatic techniques: Vacuum tecniques, Oral evacuation systems, Vacuum pump, Pneumatic techniques, Dental compressor. Decontamination Unit and constant fumigation unit. Dental Radiography: Dental X-ray Machine.

UNIT-V: HEAT & PHOTON THERAPY EQUIPMENT 9

High frequency heat therapy, Principle, Short wave diathermy, Microwave diathermy, Ultrasonic therapy, Lithotripsy. Therapeutic UV and IR Lamps. Basic principles of Biomedical LASERS: Applications of lasers in medicine, CO2laser, He-Ne laser, Nd-YAG and Ruby laser.

Contact periods:

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

REFERENCES:

1. Khandpur. R.S.,"Handbook of Biomedical Instrumentation". Second Edition. Tata McGrawHill Pub. Co., Ltd. 2003.

2. John.G.Webster. “Medical Instrumentation, Application and Design”. Fourth Edition.Wiley &s ons, Inc., NewYork. 2009.
3. Leslie Cromwell, Fred. J. Weibell & Erich. A.Pfeiffer. “Biomedical Instrumentation and Measurements”. Second Edition. Prentice Hall Inc.2000.
4. John Low & Ann Reed. “Electrotherapy Explained, Principles and Practice”. Second Edition. Butterworth Heinemann Ltd. 2000.
5. Joseph. J. Carr, John Michael Brown, “Introduction to Biomedical Equipment Technology”, Prentice Hall and Technology, 2008.

COURSE OUTCOMES:

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

CO1: Suggest suitable therapeutic devices for ailments related to cardiology, pulmonology, neurology, etc.

CO2: Comprehend the principles of bodycare equipment.

CO3: Understand the operation of dental care equipment.

CO4: Analyze the different types of therapies for suitable applications.

CO5: Appreciate the application of lasers in biomedical applications.

22ECPE604 BRAIN COMPUTER INTERFACE AND APPLICATIONS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the BCI system and its potential applications.
- To describe the principle of event related potentials and sensory motor rhythms.
- To know the features suitable for BCI.
- To learn the different classifier for a BCI system.
- To discuss the application of BCI.

UNIT-I: INTRODUCTION TO BCI 9

Fundamentals of BCI – Structure of BCI system – Classification of BCI – Invasive, Non-invasive and Partially invasive BCI – EEG signal acquisition - Signal Preprocessing – Artifacts removal.

UNIT-II: ELECTROPHYSIOLOGICAL SOURCES 9

Sensorimotor activity – Mu rhythm, Movement Related Potentials – Slow Cortical Potentials-P300 - Visual Evoked Potential - Activity of Neural Cells - Multiple Neuromechanisms.

UNIT-III: FEATURE EXTRACTION METHODS 9

Time/Space Methods – Fourier Transform, PSD – Wavelets – Parametric Methods – AR,MA,ARMA models – PCA – Linear and Non-Linear Features.

UNIT-IV: FEATURE TRANSLATION METHODS 9

Linear Discriminant Analysis – Support Vector Machines – Regression – Vector Quantization– Gaussian Mixture Modeling – Hidden Markov Modeling – Neural Networks.

UNIT-V: APPLICATIONS OF BCI 9

Functional restoration using Neuroprosthesis – Functional Electrical Stimulation, Visual Feedback and control – External device control, Case study: Brain actuated control of mobile Robot.

Contact periods:

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

REFERENCES:

1. Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, “Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction”, Springer, 2010.
2. R. Spehlmann, “EEG Primer”, Elsevier Biomedical Press, 1981.
3. Arnon Kohen, “Biomedical Signal Processing”, Vol I and II, CRC Press Inc, Boca Rato, Florida, 1986.
4. Bishop C.M., “Neural Networks for Pattern Recognition”, Oxford, Clarendon Press, 1995.
5. Joseph. J. Carr, John Michael Brown, “Introduction to Biomedical Technology”, Prentice Hall and Technology, 2008.

COURSE OUTCOMES:

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

CO1: Describe BCI system and its potential applications.
CO2: Analyze event related potentials and sensory motor rhythms.
CO3: Compute features suitable for BCI.
CO4: Design classifier for a BCI system.
CO5: Implement BCI for various applications.

22ECPE605	HUMAN ASSIST DEVICES	SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the role and importance of machines that takes over the functions of the heart and lungs.
- To study various mechanical techniques that help a non-functioning heart.
- To learn the functioning of the unit which does the clearance of urea from the blood.
- To understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
- To study about recent techniques used in modern clinical applications.

UNIT-I: HEART LUNG MACHINE AND ARTIFICIAL HEART 9

Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for Cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Schematic for temporary bypass of left ventricle.

UNIT-II: CARDIAC ASSIST DEVICES 9

Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle, Open Chest and Closed Chest type, Intra Aortic Balloon Pumping, Prosthetic Cardiac valves, Principle of External Counter pulsation techniques.

UNIT-III: ARTIFICIAL KIDNEY 9

Indication and Principle of Haemodialysis, Membrane, Dialysate, types of filter and membranes, Different types of hemodialyzers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.

UNIT-IV: RESPIRATORY AND HEARING AIDS 9

Ventilator and its types – Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, SISI, masking techniques, wearable devices for hearing correction.

UNIT-V: RECENT TRENDS 9

Transcutaneous electrical nerve stimulator, bio-feedback, Diagnostic and point-of-care platforms.

Contact periods:

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

REFERENCES:

1. Gray E Wnek, Gray L Browlin – Encyclopedia of Biomaterials and Biomedical Engineering –Marcel Dekker Inc New York 2004.
2. John. G . Webster – Bioinstrumentation - John Wiley & Sons (Asia) Pvt Ltd – 2004.
3. Joseph D.Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006.
4. Andreas.F. Von racum, “Hand book of bio material evaluation”, Mc-Millan publishers, 1980.

5. Gray E Wnek, Gray L Browlin, “Encyclopedia of Biomaterials and Biomedical Engineering” Marcel Dekker Inc New York 2004.

COURSE OUTCOMES:

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

CO1: Explain the principles and construction of artificial heart.

CO2: Understand various mechanical techniques that improve therapeutic technology.

CO3: Explain the functioning of the membrane or filter that cleanses the blood.

CO4: Describe the tests to assess the hearing loss and development of wearable devices for the same.

CO5: Analyze and research on electrical stimulation and biofeedback techniques in rehabilitation and physiotherapy.

22ECPE606	BIO-MEDICAL ELECTRONICS	SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To gain knowledge about the physiological parameters.
- To understand about cardiac assist devices.
- To study about various assist devices.
- To gain knowledge about various equipment used in diagnosis and treatment.
- To study about the state of art technologies in medical field.

UNIT-I: ELECTRO-PHYSIOLGOGY AND BIO POTENTIAL RECORDING 9

Origin of Bio Potentials – Bio-Potential Electrodes – Biological amplifiers – ECG and PCG, EEG, EMG: Lead systems, recording methods, typical waveforms and signal characteristics.

UNIT-II: CARDIAC ASSIST DEVICES 9

Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle, Open Chest and Closed Chest type, Intra Aortic Balloon Pumping, Prosthetic Cardiac valves, Principle of External Counter pulsation techniques.

UNIT-III: ASSIST DEVICE 9

Cardiac Pacemakers: External and internal – Defibrillators: AC, DC and DC synchronized – Dialyzer: Hemo dialyzer and peritoneal dialyzer – Heart lung machine – Ventilators.

UNIT-IV: PHYSICAL MEDICINE AND BIO TELEMETRY 9

Diathermy: Shortwave, Microwave, Ultrasonic and Surgical types – Bio telemetry: Principles, Types, Applications, MRI, CT and CAT.

UNIT-V: RECENT TRENDS IN MEDICAL APPLICATIONS 9

Endoscopy: Principle and recording setup, Radio pill and pill cam, Computer axial Tomography – Virtual surgery

Contact periods:

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

REFERENCES:

1. Khandpur. R.S., "Biomedical Instrumentation: Technology and Applications", McGraw–Hill Education (India), 3rd Edition, 2014.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall (India), 2007.
3. Arumugam. M., "Biomedical Instrumentation", Anuradha Publications, 2017.
4. Andreas.F. Von racum, "Hand book of bio material evaluation", Mc-Millan publishers, 1980.
5. John G. Webster, "Medical Instrumentation Application and Design", 3rd Edition Wiley India, 2007.

COURSE OUTCOMES:

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

CO1: Know the knowledge about the physiological parameters.

CO2: Understand the concept of cardiac assist device.

CO3: Explode about various assist devices.

CO4: Interpret the knowledge about various equipment used in diagnosis and treatment.

CO5: Comprehend study about the state of art technologies in the medical field.

22ECPE607 COMPRESSIVE SENSING SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic theory.
- To enable the student to learn the reconstruct sparse or nearly sparse signals from undersampled data.
- To expose students to recent ideas in modern convex optimization allowing rapid signal recovery.
- To familiarize sensor elements in WSN.
- To give students a sense of real-time applications that might benefit from compressive sensing ideas.

UNIT-I: INTRODUCTION TO COMPRESSED SENSING 9

Introduction, Motivation, Mathematical Background, Traditional Sampling, Traditional Compression, Conventional Data Acquisition System, Drawbacks of Transform coding, Compressed Sensing (CS).

UNIT-II: SPARSITY AND SIGNAL RECOVERY 9

Signal Representation, Basis vectors; Sensing matrices, Restricted Isometric Property, Coherence, Stable recovery, Number of measurements.

UNIT-III: RECOVERY ALGORITHMS 9

Basis Pursuit algorithm: L1 minimization, Matching pursuit, Orthogonal Matching Pursuit(OMP), Stage wise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP), Iterative Thresholding algorithm: Hard thresholding, Soft thresholding, Model based: Model based CoSaMP, Model based HIT.

UNIT-IV: COMPRESSIVE SENSING FOR WSN 9

Basics of WSN, Wireless Sensor without Compressive Sensing, Wireless Sensor with Compressive Sensing, Compressive Wireless Sensing, Spatial compression in WSNs, Projections in WSNs, Compressed Sensing in WSNs.

UNIT-V: APPLICATIONS OF COMPRESSIVE SENSING 9

Compressed Sensing for Real-Time Energy-Efficient Compression on Wireless Body Sensor Nodes, Compressive sensing in video surveillance, An Application of Compressive Sensing for Image Fusion, Single-Pixel Imaging via Compressive Sampling.

Contact periods:

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

REFERENCES:

1. Radha S., Hemalatha R. and Aasha Nandhini S., “Compressive Sensing for Wireless Communication: Challenges and Opportunities”, River publication, 2016.

2. Mark A. Davenport, Marco F. Duarte, Yonina C. Eldar and Gitta Kutyniok, “Introduction to Compressed Sensing, in Compressed Sensing: Theory and Applications”, Cambridge University Press, 2011.
3. Duarte M.F., Davenport M.A., Takhar D., Laska, J.N., Ting Sun, Kelly K.F. and Baraniuk, R.G., “Single-Pixel Imaging via Compressive Sampling”, Signal Processing Magazine, IEEE, vol.25, no.2, pp.83-91, March 2008.
4. Tao Wan., Zengchang Qin, “An application of compressive sensing for image fusion”, CIVR '10 Proceedings of the ACM International Conference on Image and Video Retrieval, Pages 3-9.
5. Mamaghanian H., Khaled N., Atienza D. and Vandergheynst P. “Compressed sensing for real-time energy-efficient ECG compression on wireless body sensor nodes”, IEEE Trans. Biomed. Eng., vol. 58, no. 9, pp.2456 -2466 2011.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Appreciate the motivation and the necessity for compressed sensing technology.
CO2: Analyze the sparse signals from undersampled data.
CO3: Compare the design of the data plane, control plane and routing.
CO4: Apply sensor elements in WSN.
CO5: Use compressive sensing in real-time applications.

22ECPE701 DIGITAL IMAGE PROCESSING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn digital image fundamentals and be exposed to simple image processing techniques.
- To summarize the mathematical foundations of different image transformation concepts.
- To familiarize with image restoration and segmentation techniques.
- To explain the various compressions standards and interpret on image applications.
- To apply image processing techniques practically using MATLAB and dealing with 3D data sets.

UNIT-I: DIGITAL IMAGE FUNDAMENTALS 9

Introduction – Origin – Steps in digital image processing – Components – Elements of visual perception – Image sensing and acquisition – Image sampling and quantization – Relationships between pixels – Color models.

UNIT-II: IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of spatial filtering – Smoothing and sharpening spatial filtering – **Frequency Domain:** Introduction to Fourier transform – Smoothing and sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

UNIT-III: IMAGE RESTORATION AND SEGMENTATION 9

Noise models – Mean filters – Order statistics – Adaptive filters – Band reject filters – Band pass filters – Notch filters – Optimum notch filtering – Inverse filtering – Wiener filtering **Segmentation:** Detection of discontinuities – Edge linking and Boundary detection – Region based segmentation – Morphological processing – Erosion and dilation.

UNIT-IV: WAVELETS AND IMAGE COMPRESSION 9

Wavelets – Sub band coding – Multi-resolution expansions – **Compression:** Fundamentals – Image compression models – Error free compression – Variable length coding – Bit-Plane coding – Lossless predictive coding – Lossy compression – Lossy predictive coding – Compression standards.

UNIT-V: DIGITAL IMAGE PROCESSING SIMULATION AND 3D IMAGE VISUALIZATION 9

Histograms equalization, Detection and recognition, Enhancement techniques, Image compression, Sources of 3D Data sets, Image processing in 3D, Measurements on 3D images.

Contact periods:

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

REFERENCES:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", 1st Edition, PHI Learning, 2010.
3. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing Using MATLAB", 2nd Edition, McGraw Hill Education, 2010.

4. Jayaraman S, Veerakumar T. and Esakkirajan S., "Digital Image Processing", 1st Edition, McGraw Hill Education, 2009.
5. William K. Pratt, "Digital Image Processing", 4th Edition, John Wiley, New York, 2007.
6. Ardeshir Goshtasby, " 2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications",John Wiley and Sons,2005.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the digital image fundamentals and be exposed to simple image processing techniques.

CO2: Analyze the basic concept of different image transformation.

CO3: Summarize image restoration and segmentation techniques.

CO4: Explain the various compressions standards and interpret on image applications.

CO5: To analyze the constraints in image processing when dealing with 3D data sets and to apply image processing techniques practically using MATLAB.

22ECPE702 ADVANCED DIGITAL SIGNAL PROCESSING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To bring out the concepts related to stationary and non– stationary random signals.
- To emphasize the importance of true estimation of power spectral density.
- To introduce the design of linear and adaptive systems for filtering and linear prediction.
- To introduce signal processing concepts in the systems having more than one sampling frequency.
- To study the wavelet transforms.

UNIT-I: DISCRETE– TIME RANDOM SIGNALS 9

Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Auto-covariance properties and matrices, White noise, Power spectral density, Spectral factorization, Filtering random processes, ARMA, AR and MA processes.

UNIT-II: POWER SPECTRUM ESTIMATION 9

Introduction to power spectrum estimation – Parameter estimation – Bias and consistency – Non parametric methods – Periodogram – Modified periodogram – Bartlett method – Welch method – Blackman Tukey method – Performance comparison – Parametric methods for spectral estimation.

UNIT-III: ADAPTIVE FILTERS 9

Forward and backward linear prediction – FIR Wiener Filter – Principles of adaptive filter – FIR adaptive filter – Newton‘s Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT-IV: MULTIRATE SIGNAL PROCESSING 9

Introduction to multirate signal processing – Decimation – Interpolation – Polyphase Decomposition of FIR filter – Multistage implementation of sampling rate conversion – Applications of multirate signal processing.

UNIT-V: WAVELET TRANSFORMS 9

Multiresolution analysis – Continuous and discrete wavelet transform – Short Time Fourier Transform – Application of wavelet transform – Cepstrum and Homomorphic filtering.

Contact periods:

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

REFERENCES:

1. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., New York, Indian Reprint, 2008.
2. John G.Proakis and Dimitris G. Manolakis, “Digital Signal Processing”, Pearson, 4th Edition, 2007.
3. Dwight F. Mix, “Random Signal Processing”, Prentice Hall, 1995.
4. Dimitris G. Manolakis, Vinay K. Ingle and Stephen M. Kogon, “Statistical and Adaptive Signal Processing”, Artech House, 2005.
5. Widrow B and Stearns S D., “Adaptive Signal Processing”, Prentice Hall Inc., 2011.
6. Fliege N J., “Multirate Digital Signal Processing”, John Wiley and Sons, 2010.

7. Soman K.P, Ramachandran K.I and Resmi N.G., “Insight into Wavelets from Theory to Practice”, 3rd Edition, PHI Learning Private limited, 2010.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Analyze statistical characteristics of random signals.
CO2: Identify various power spectrum estimation methods.
CO3: Illustrate the concepts of linear prediction and adaptive filtering.
CO4: Analyze and design multi– rate systems.
CO5: Employ the concepts of wavelets in signal processing applications.

22ECPE703 **COMPUTER VISION** **SEMESTER VII**

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 albedosos.

UNIT-V: IMAGE-BASED RENDERING AND RECOGNITION **9**

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

Contact periods:

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

REFERENCES:

1. Richard Hartley and Andrew Zisserman, “Multiple View Geometry in Computer Vision”, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
3. Davies E. R., “Computer and Machine Vision”, Fourth Edition, Academic Press, 2012.
4. Nalini M., Somasundaram K. and Vijendra Babu D., “Computer Vision Programming”, Notion Press, 2021.
5. Widrow B and Stearns S D., “Adaptive Signal Processing”, Prentice Hall Inc., 2011.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: To understand basic knowledge, theories and methods in image processing and computer vision.

CO2: Illustrate the concepts of feature detection, matching and detection.

CO3: To apply 2D a feature-based based image alignment, segmentation and motion estimations.

CO4: Employ the concepts of 3D image reconstruction techniques.

CO5: To understand image-based rendering and recognition.

22ECPE704 DSP STRUCTURES FOR VLSI SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of DSP.
- To learn various DSP structures and their implementation.
- To know designing constraints of various filters.
- To design and optimize VLSI architectures for basic DSP algorithms.
- To enable students to design VLSI system with high speed and low power.

UNIT-I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING 9

Linear system theory – Convolution – Correlation – DFT – FFT – Basic concepts in FIR filters and IIR filters – Filter realizations. Representations of DSP algorithms – Block diagram – SFG – DFG.

UNIT-II: ITERATION BOUND, PIPELINING AND PARALLEL PROCESSING OF FIR FILTER 9

Data-flow graph representations – Loop bound and Iteration bound algorithms for computing iteration bound – LPM algorithm. Pipelining and parallel processing: pipelining of FIR digital filters parallel processing, pipelining and parallel processing for low power.

UNIT-III: RETIMING, UNFOLDING AND FOLDING 9

Retiming: definitions, properties and problems solving – Systems of inequalities. Properties of Unfolding, critical path, Unfolding and Retiming, applications of Unfolding, Folding transformation register minimization techniques, register minimization in folded architecture – Folding of multirate system.

UNIT-IV: FAST CONVOLUTION 9

Cook-toom algorithm – Modified cook – Toom algorithm. Design of fast convolution algorithm by inspection – Winograd algorithm – Modified Winograd algorithm.

UNIT-V: ARITHMETIC STRENGTH REDUCTION IN FILTERS 9

Parallel FIR filters – Fast FIR algorithms-two parallel and three parallel. Parallel architectures for rank order filters – Odd-even, merge-sort architecture-rank order filter architecture-parallel rank order filters – Running order merge order sorter, low power rank order filter.

Contact periods:

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

REFERENCES:

1. Parhi K.K., "VLSI Digital Signal Processing", John-Wiley, 2nd Edition Reprint, 2008.
2. John G.Proakis, Dimitris G.Manolakis, "Digital Signal Processing", Prentice Hall of India, 1st Edition, 2009.
3. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and Implementation", Wiley, Interscience, 2007.
4. Meyer U., Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, 2nd Edition, 2004.
5. Johnson H. W. and Graham M., "High-Speed Digital Design: A Handbook of Black Magic", Prentice Hall, 1993.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: To understand basic knowledge, theories and methods in image processing and computer vision.

CO2: Illustrate the concepts of feature detection, matching and detection.

CO3: To apply 2D a feature-based based image alignment, segmentation and motion estimations

CO4: Employ the concepts of 3D image reconstruction techniques

CO5: To understand image-based rendering and recognition.

22ECPE705 **SIGNAL INTEGRITY** **SEMESTER VII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand characteristic impedance of transmission line and impedance matching techniques.
- Understand plain signal reflection and cross talk noise in the transmission line, and also explain the mathematical analysis method.
- Understand Eye diagram and related measurement to test quality of Signal.
- Learn Jitter analysis and jitter decomposition.
- Work with high frequency differential signal and its applications.

UNIT-I: SIGNAL REFLECTION AND IMPEDANCE MATCHING TECHNIQUE 9

Phenomenon of signal reflection. Signal reflection at transmitting end. Signal reflection at branch point. Multiple reflection in transmission line. Prevention of signal reflection by using impedance matching technique.

UNIT-II: CROSSTALK NOISE 9

Crosstalk definition and classification. Crosstalk mechanism. Analysis of crosstalk noise in transmission line. Main factor of causing crosstalk noise.

UNIT-III: DIFFERENTIAL SIGNAL TRANSMISSION CIRCUIT 9

Pros and cons of using differential signaling compared with that of single-ended signaling. High-speed differential interfaces. Theory of differential signaling. Differential signal termination techniques.

UNIT-IV: FREQUENCY RESPONSE OF A CIRCUIT 9

Frequency response of transmission line and circuit. Inter-symbol interference (ISI) and eye-pattern. Deterioration of a signal waveform due to ISI. Circuit techniques to prevent the deterioration. Linear time-invariant systems. Frequency response of pulse.

UNIT-V: EYE DIAGRAM AND JITTER 9

Jitter Definition and Types of Jitters; Jitter decomposition; Eye diagram analysis and related measurement.

Contact periods:

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

REFERENCES:

1. Signal and Power integrity Simplified -Eric Bogatin, Pearson, 3rd Edition.
2. High Speed Digital Design by Howard Johnson and Martin Graham, Prentice Hall,1st Edition.
3. High Speed Signal Propagation and Howard Johnson,Prentice Hall,1st Edition.
4. Meyer U., – Baese, “Digital Signal Processing with Field Programmable Gate Arrays”, Springer, 2nd Edition, 2004.
5. Ludwig R, and Bretchko P., “RF Circuit Design Theory and Applications”, Prentice Hall, 2000.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Familiarity with High speed design and related issues.
CO2: Understanding on critical design aspect.
CO3: Know about Jitter and related measurements which is critical for design.
CO4: Practical application of high speed differential signals.
CO5: Measurement expertise up to industry expectations.

22ECPE706 SOFTWARE DEFINED RADIO SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of software radios.
- To know about RF implementation challenges for software defined radios.
- To understand the digital generation of signals.
- To know about the concept of smart antenna.
- To learn the software and hardware requirements for software defined radios.

UNIT-I: INTRODUCTION TO SOFTWARE RADIO 9

The Need for Software Radios. Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio.

UNIT-II: RF IMPLEMENTATION 9

Purpose of RF front-end, Dynamic range, RF receiver front-end topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and distortion in the RF chain, Hybrid DDS – PLL systems, Applications of Direct Digital Synthesis.

UNIT-III: DIGITAL GENERATION OF SIGNALS 9

Comparison of direct digital synthesis with analog signal synthesis, Approaches to direct digital synthesis, Analysis of spurious signals, Performance of direct digital synthesis systems, Applications of direct digital synthesis.

UNIT-IV: SMART ANTENNAS 9

Benefits of smart antennas, Structures for beamforming systems, Smart antenna algorithms, Hardware implementation of smart antennas, Digital Hardware Choices – Key hardware elements.

UNIT-V: HARDWARE AND SOFTWARE FOR SDR & CASE STUDIES 9

DSP Processors, FPGA, ASICs. Trade-offs, Object oriented programming, Object Brokers, GNU Radio-USRP. Case Studies: SPEAK easy, JRTS, SDR-3000

Contact periods:

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

REFERENCES:

1. Jeffrey Hugh Reed, “Software Radio: A Modern Approach to Radio Engineering,” Prentice Hall Professional, 2002.
2. Tony J Rouphael, “RF and DSP for SDR,” Elsevier Newnes Press, 2008.
3. Kenington P., “RF and Baseband Techniques for Software Defined Radio,” Artech House, 2005.
4. Paul Burns, “Software Defined Radio for 3G,” Artech House, 2002.
5. Behrouz. F. Bourjney, “Signal Processing for Software defined Radios”, Lulu 2008.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Demonstrate an understanding in the evolving paradigm of Software defined radio and technologies for its implementation.
CO2: Analyse Radio frequency implementation issues.
CO3: Know about Smart antenna techniques for software defined radio.
CO4: Compare various digital synthesis procedures.
CO5: Comprehend various hardware and software requirements for software defined radios.

22ECPE707 **RF TRANSCEIVERS** **SEMESTER VII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of RF system design.
- To acquaint with the various components of RF system for wireless communications.
- To know the basic techniques needed for analysis of RF systems.
- To enable the students to verify the basic principles and design aspects involved in RF systems components.
- To conduct experiments to analyze and interpret data to produce meaningful conclusion and match with theoretical concepts.

UNIT-I: CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURE **9**

CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise – Transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR – Phase noise – Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low-IF Architectures – Transmitter: Direct-up conversion, Two-step up conversion schemes.

UNIT-II: IMPEDANCE MATCHING NETWORKS AND AMPLIFIERS **9**

Review of S-parameters and Smith chart – Passive IC components – Impedance matching networks – Amplifiers: Common Gate, Common Source Amplifiers – OC Time constants in bandwidth estimation and enhancement – High frequency amplifier design – Low Noise Amplifiers: Power match and Noise match, single-ended and differential LNAs.

UNIT-III: FEEDBACK SYSTEMS AND POWER AMPLIFIERS **9**

Feedback Systems: Stability of feedback systems, Gain and phase margin, Root-locus techniques, Time and Frequency domain considerations, Compensation – Power Amplifiers: General model – Class A, AB, B, C, D, E and F amplifiers – Linearization Techniques – Efficiency boosting techniques – ACPR metric.

UNIT-IV: FILTERS, OSCILLATORS AND MIXERS **9**

Overview – Basic resonator and filter configuration, special filter realizations, filter implementation – Basic oscillator model, high-frequency oscillator configuration, Colpitt's oscillator – Basic characteristics of mixers, single and double-balanced mixers.

UNIT-V: PLL AND FREQUENCY SYNTHESIZERS **9**

PLL: Linearized Model, Noise properties, Phase detectors, Loop filters and Charge pumps Frequency Synthesizers: Integer-N frequency synthesizers – Direct Digital Frequency Synthesizers

Contact periods:

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

REFERENCES:

1. Lee T., "Design of CMOS RF Integrated Circuits", Cambridge, Second Edition, 2004.
2. Razavi B., "RF Microelectronics", Pearson Education, Second Edition, 2012.
3. Ludwig R., and Bretchko P., "RF Circuit Design Theory and Applications", Prentice Hall, 2000.

4. Razavi B., “Design of Analog CMOS Integrated Circuits”, McGraw Hill, Second Edition, 2017.
5. Kyung-WhanYeom, “Microwave Circuit Design - A Practical Approach using ADS”, Pearson Education, 2015.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Interpret the nonlinear effects in RF circuits.
CO2: Design RF circuits.
CO3: Analyze the performance of RF circuits.
CO4: Apply knowledge to identify a suitable architecture and systematically design an RF System.
CO5: Comprehensively record and report the measured data, and would be capable analyzing, interpreting the experimentally measured data and produce the conclusions.

22ECPE708	LOW POWER VLSI DESIGN	SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To identify sources of power in an IC.
- To identify the power reduction techniques based on technology independent and technology dependent methods.
- To identify suitable techniques to reduce the power dissipation.
- To estimate power dissipation of various MOS logic circuits.
- To develop algorithms for low power dissipation.

UNIT-I: POWER DISSIPATION IN CMOS **9**

Hierarchy of Limits of Power – Sources of Power Consumption – Physics of Power Dissipation in CMOS FET Devices – Basic Principle of Low Power Design.

UNIT-II: POWER OPTIMIZATION **9**

Logic Level Power Optimization – Circuit Level Low Power Design – Gate Level Low Power Design –Architecture Level Low Power Design – VLSI Subsystem Design of Adders, Multipliers, PLL, Low Power Design.

UNIT-III: DESIGN OF LOW POWER CMOS CIRCUITS **9**

Computer Arithmetic Techniques for Low Power System – Reducing Power Consumption in Combinational Logic, Sequential Logic, Memories – Low Power Clock – Advanced Techniques – Special Techniques, Adiabatic Techniques – Physical Design, Floor Planning, Placement and Routing.

UNIT-IV: POWER ESTIMATION **9**

Power Estimation Techniques, Circuit Level, Gate Level, Architecture Level, Behavioral Level, – Logic Power Estimation – Simulation Power Analysis –Probabilistic Power Analysis.

UNIT-V: SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER CMOS CIRCUITS **9**

Synthesis for Low Power – Behavioral Level Transform –Algorithms for Low Power – Software Design for Low Power.

Contact Periods:

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

REFERENCES:

1. Kaushik Roy and Prasad S.C., “Low Power CMOS VLSI Circuit Design”, Wiley, 2000.
2. Kulo J.B. and Lou J.H., “Low Voltage CMOS VLSI Circuits”, Wiley 1999.
3. James B.Kulo, Shih-Chia Lin, “Low Voltage SOI CMOS VLSI Devices and Circuits”, John Wiley and Sons, Inc. 2001.

4. Rabaey J., “Low Power Design Essentials (Integrated Circuits and Systems)”, Springer, 2009.
5. Sung-Mo Kang & Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, Mcgraw-Hill, 1998.

COURSE OUTCOMES:

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

CO1: Find the power dissipation of MOS circuits.
CO2: Design and analyze various MOS logic circuits.
CO3: Apply low power techniques for low power dissipation.
CO4: Estimate the power dissipation of ICs.
CO5: Develop algorithms to reduce power dissipation by software.

22ECPE709	ASIC DESIGN	SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the design flow of different types of ASIC.
- To familiarize the different types of programming technologies and logic devices.
- To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC.
- To analyze the synthesis, Simulation and testing of systems.
- To know about different high-performance algorithms and its applications in ASIC.

UNIT-I: OVERVIEW OF ASIC AND PLD **9**

Types of ASICs – Design flow – CAD tools used in ASIC design – Programming technologies: Antifuse – Static RAM – EPROM and EEPROM technology, Programmable logic devices: ROMs and EPROMs – PLA – PAL. Gate arrays – CPLDs and FPGAs.

UNIT-II: PROGRAMMABLE ASIC **9**

Programmable ASIC logic cells for ACTEL and XILINX – DC & AC inputs and outputs – Clock and power inputs – ACTEL and XILINX I/O blocks – Programmable ASIC architecture: Xilinx XC 4000 – FLEX 8000/10000, ACTEL's ACT – 1,2,3 and their speed performance, Altera MAX 5000 and 7000 – Altera MAX 9000 – Spartan II and Virtex II FPGAs – Apex and cyclone FPGAs.

UNIT-III: ASIC PHYSICAL DESIGN **9**

System partition partitioning – Partitioning methods – Interconnect delay models and measurement of delay – Floor planning – Placement – Routing: Global routing – Detailed routing – Special routing.

UNIT-IV: LOGIC SYNTHESIS, SIMULATION AND TESTING **9**

Design systems – Logic synthesis – Verilog and VHDL synthesis – Types of simulation – Boundary scan test – Fault simulation – Automatic test pattern generation.

UNIT-V: HIGH PERFORMANCE ALGORITHMS FOR ASICS/ SOCS **9**

Canonic signed digit arithmetic, KCM, Distributed arithmetic, High performance filters using delta – Sigma modulators. Case studies: Digital camera, SDRAM, High speed data standards.

Contact periods:

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

REFERENCES:

1. Smith M.J.S., "Application – Specific Integrated Circuits", Pearson, 2003.
2. Steve Kilts, "Advanced FPGA Design," Wiley Inter– Science.
3. Roger Woods, John McAllister, Dr. Ying Yi and Gary Lightbody, "FPGA– based Implementation of Signal Processing Systems", Wiley, 2008.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw Hill, 1994.
5. Douglas J. Smith, "HDL Chip Design", Madison, AL, USA: Doone Publications, 1996.
6. Jose E. France, Yannis Tsividis, "Design of Analog – Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.
7. Hodges D. A., "Analysis and Design of Digital Integrated Circuits", 3rd Edition, MGH 2004.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Demonstrate VLSI tool– flow and appreciate FPGA architecture.
CO2: Analyze about programmable ASIC design.
CO3: Gain Knowledge of ASIC physical design.
CO4: Determine the logical synthesis, simulation and testing aspects of ASIC.
CO5: Understand the high-performance algorithms for ASICs/ SOCs.

22ECPE710	MIXED SIGNAL DESIGN	SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To analyze power dissipation mechanisms in CMOS integrated circuits.
- To describe the architecture and design considerations of continuous-time filters.
- To identify and analyze non-idealities in Digital-to-Analog Converters (DACs).
- To describe the principles of oversampling converters.
- To explain the theory of differential algebraic equations for mixed-signal modeling.

UNIT-I: Power Dissipation in CMOS **9**

Introduction to Active Filters & Switched capacitor filters: Switched capacitor filters: Switched capacitor resistors – Amplifiers – Comparators – Sample & hold circuits – Integrator – Biquad.

UNIT-II: Continuous Time Filters **9**

Introduction to Gm – C filters – Bipolar transconductors – CMOS Transconductors using Triode transistors, active transistors – BiCMOS transconductors – MOSFET C Filters – Tuning Circuitry – Dynamic range performance – Elementary transconductor building block – First and Second order filters.

UNIT-III: Digital to Analog & Analog to Digital Converters **9**

Non-idealities in the DAC – Types of DAC's: Current switched, Resistive, Charge redistribution (capacitive), Hybrid, segmented DAC's -Techniques for improving linearity – Analog to Digital Converters: quantization errors – non-idealities – Types of ADC's: Flash, two step, pipelined, successive approximation, folding ADC's.

UNIT-IV: Sigma Delta Converters **9**

Over sampled converters – Over sampling without noise & with noise – Implementation imperfections – First order modulator – Decimation filters – Second order modulator – Sigma delta DAC & ADC's

UNIT-V: Analog and Mixed Signal Extensions To HDL **9**

Introduction – Language design objectives – Theory of differential algebraic equations – Conservative systems – Time and the simulation cycle – A/D and D/A Interaction – Quiescent Point – Frequency domain modeling and examples – Analog extensions to Verilog: Introduction – Data types – Expressions – Signals- Analog behavior – Hierarchical Structures – Mixed signal Interaction.

Contact Periods:

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

REFERENCES:

1. Gordon W.Roberts, Friedrich Taenzler, Mark Burns, "An Introduction to Mixed-signal IC Test and Measurement" Oxford University Press, Inc.2012.

2. M. L.Bushnell and V.D.Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Kluwer Academic Publishers, 2002.
3. Jacob Baker R., “CMOS mixed-signal circuit design”, Wiley India, IEEE press, reprint 2008
4. Rudy V. DePlassche, “CMOS Integrated ADCs and DACs”, Springer, Indian edition, 2005.
5. Phillip Allen and Douglas Holberg “CMOS Analog Circuit Design”, Oxford University Press, 2012.
6. David A Johns and Ken Martin, “Analog Integrated Circuit Design”, John Wiley and Sons, 2008.

COURSE OUTCOMES:

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

CO1: Comprehend the concepts of active filters and switched capacitor filters.
CO2: Infer the concepts of continuous time filters and its performance.
CO3: Analyze Digital to Analog & Analog to Digital Converters.
CO4: Examine sigma delta converters.
CO5: Design Analog and mixed signal circuits using HDL.

22ECPE711 CAD FOR VLSI CIRCUITS SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study various physical design methods in VLSI.
- To understand the concepts behind the VLSI design rules and placement techniques.
- To study various algorithms used for routing techniques.
- To use the simulation techniques at various levels in VLSI design flow.
- To understand the concepts of various algorithms used for high level synthesis.

UNIT-I: INTRODUCTION TO VLSI DESIGN FLOW 9

Introduction to VLSI Design methodologies – Review of data structures and algorithms – Review of VLSI design automation tools – Algorithmic graph theory and computational complexity – Tractable and intractable problems – General purpose methods for combinatorial optimization.

UNIT-II: LAYOUT, PLACEMENT AND PARTITIONING 9

Layout compaction – Design rules – Problem formulation – Algorithms for constraint graph compaction – Placement and partitioning – Circuit representation – Placement algorithms – Partitioning.

UNIT-III: FLOOR PLANNING AND ROUTING 9

Floor planning concepts – Shape functions and floor plan sizing – Types of local routing problems – Area routing – Channel routing – Global routing – Algorithms for global routing.

UNIT-IV: SIMULATION AND LOGIC SYNTHESIS 9

Simulation – Gate – level modeling and simulation – Switch – level modeling and simulation Combinational logic synthesis – Binary decision diagrams – Two level logic synthesis.

UNIT-V: HIGH LEVEL SYNTHESIS 9

High level synthesis – Hardware models – Internal representation – Allocation – Assignment and scheduling – Simple scheduling algorithm – Assignment problem – High level transformations.

Contact periods:

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

REFERENCES:

1. Gerez S.H., “Algorithms for VLSI Design Automation”, John Wiley & Sons, 2002.
2. Sherwani N.A., “Algorithms for VLSI Physical Design Automation”, Kluwer Academic Publishers, 2002.
3. Sadiq M. Sait and Habib Youssef, “VLSI Physical Design automation: Theory and Practice”, World scientific 1999.
4. Steven M. Rubin, “Computer Aids for VLSI Design”, Addison Wesley Publishing 1987.
5. Dressler R., “Evolutionary Algorithms for VLSI CAD”, Kluwer Academic Publishers, Boston, 1998.
6. Hill D., Shugard D., Fishburn J. and Keutzer K., “Algorithms and Techniques for VLSI Layout Synthesis”, Kluwer Academic Publishers, Boston, 1989.
7. Gaynor E. Taylor and Russell G., “Algorithmic and Knowledge Based CAD for VLSI”, Peter peregrinus ltd. London.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Comprehend and analyze the VLSI design methodologies.
CO2: Analyze and illustrate layout design rules, placement and partitioning.
CO3: Design and analyze floor planning and routing concept.
CO4: Examine and verify the various modeling of simulation.
CO5: Analyze and illustrate synthesis and scheduling.

22ECPE712 IC PACKAGING AND TESTING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the fundamentals of electronic packaging.
- Analyze electrical issues in system packaging.
- Gain expertise in chip package technologies.
- Develop skills in PCB design and surface mount technology.
- Apply knowledge in testing and reliability analysis.

UNIT-I: OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates.

UNIT-II: ELECTRICAL ISSUES IN PACKAGING 9

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps – Hybrid circuits – Resistive, Capacitive and Inductive parasitics.

UNIT-III: CHIP PACKAGES 9

IC Assembly – Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn-in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends.

Multichip packaging: types, design, comparison, trends. System-in-package (SIP); Passives: discrete, integrated and embedded.

UNIT-IV: PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 9

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements.

UNIT-V: TESTING of IC 9

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – Failures –Thermo mechanically induced –electrically induced – chemically induced.

Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

Contact periods:

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

REFERENCES:

1. Blackwell (Ed), “The electronic packaging handbook”, CRC Press, 2000.

2. Tummala, Rao R., “Microelectronics packaging handbook”, McGraw Hill, 2008.
3. Bosshart, “Printed Circuit Boards Design and Technology”, Tata McGraw Hill, 1988.
4. Kaduskar R.G. and Baru V. B., “Electronic Product design”, Wiley India, 2011.
5. Michael L. Bushnell &Vishwani D. Agrawal, “Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits”, Kluwer Academic Publishers.2000.
6. Abramovici M., Breuer M. A., and Friedman A.D., “Digital System Testing and Testable Design”, Computer Science Press,1990.
7. Tummala, Rao R., “Fundamentals of Microsystems Packaging”, McGraw Hill, 2001.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Introduction to the various packaging types used along with the associated thermal, speed, signal and integrity power issues.

CO2: Discuss about the electrical issues in packaging and design process of IC.

CO3: Enable design of packages which can withstand higher temperature, vibrations and shock.

CO4: Design of PCBs which minimize the EMI and operate at higher frequency.

CO5: Analyze the concepts of Testing and testing methods.

22ECPE713 **VERILOG PROGRAMING** **SEMESTER VII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart the skill in various modeling in Verilog.
- To understand the basics of Verilog HDL.
- To learn the features in Verilog HDL.
- To understand the branching in Verilog,
- To study the basic concept of system Verilog.

UNIT-I: OVERVIEW OF DIGITAL DESIGN WITH VERILOG HDL **9**

Overview of Digital Design with Verilog HDL, Evolution of CAD, emergence of HDLs, typical HDL-flow, Trends in HDLs. Hierarchical Modeling Concepts
Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.

UNIT-II: BASIC CONCEPTS **9**

Basic Concepts, Lexical conventions, data types, system tasks, compiler directives. Modules and Ports, Module definition, port declaration, connecting ports, hierarchical name referencing.

UNIT-III: GATE-LEVEL MODELING **9**

Gate-Level Modeling - Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. Dataflow Modeling, Continuous assignments, delay specification, expressions, operators, operands, operator types.

UNIT-IV: BEHAVIORAL MODELING **9**

Behavioral Modeling, Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks – Switch level modeling – Test benches.

UNIT-V: SYSTEM VERILOG CONCEPTS **9**

System Verilog variables – Structures – Union – Arrays – Tasks and Functions – Design Hierarchy – Module prototype, net aliasing – Interfaces.

Contact periods:

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

REFERENCES:

1. Bhasker J., “Verilog HDL”, Prentice Hall, 2000.
2. Stephen Brown, “Fundamental of Digital logic with Verilog Design”, Tata McGraw Hill, 2008.
3. Samir Palnitkar, “Verilog HDL”, Pearson, 2nd Edition, 2003.
4. Zainalabedin Navabi, “Verilog digital systems design”, McGraw Hill, 2nd Edition, 1999.
5. Stuart Sutherland, Simon Davidmann and Peter Flake, "System Verilog for Design: A Guide to Using System Verilog for Hardware Design and Modeling", 2nd edition, Springer, 2006.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the fundamentals of Verilog HDL.
CO2: Gain the knowledge about various modeling in Verilog HDL.
CO3: Be familiar with features in Verilog HDL.
CO4: Understand the fundamentals branching Verilog HDL.
CO5: Explain the basic concepts of system Verilog.

22ECPE714	CMOS ANALOG CIRCUITS	SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide in-depth understanding of different types of MOS devices and modeling techniques
- To understand and design the operation of current mirror circuits
- To demonstrate the analysis and design of amplifiers using CMOS
- To design a various stages of Operational amplifiers using CMOS devices.
- To learn the concepts of capacitor switches and PLLs

UNIT-I: MOS DEVICES AND MODELING **9**

The MOS Transistor, Passive Components – Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling – Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT-II: Analog CMOS Sub-Circuits **9**

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT-III: CMOS Amplifiers **9**

Inverters, Differential Amplifiers, Cascade Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT-IV: CMOS Operational Amplifiers **9**

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascade Op Amps, Measurement Techniques of OPAmp.

UNIT-V: SWITCHED CAPACITOR CIRCUITS AND PLLS **9**

General Considerations – Sampling switches – Switched Capacitor Amplifiers – Switched Capacitor Integrator – Switched Capacitor Common mode feedback. Phase Locked Loops – Simple PLL Charge pump PLLs – Non ideal Effects in PLLs – Delay locked loops-its Applications.

Contact Periods:

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

REFERENCES:

1. Philip E. Allen and Douglas R. Holberg, “CMOS Analog Circuit Design”, Oxford University Press, International Second Edition/Indian Edition, 2010.

2. Philip E. Allen and Douglas R. Holberg, “CMOS Analog Circuit Design”, Oxford University Press, International Second Edition/Indian Edition, 2010.
3. Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley India, Fifth Edition, 2010.
4. David A. Johns, Ken Martin, “Analog Integrated Circuit Design” , Wiley Student Edition, 2013.
5. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, TMH Edition.
6. Baker, Li, “CMOS: Circuit Design, Layout and Simulation”.

COURSE OUTCOMES:

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

CO1: Model various components in CMOS process to estimate their performance in circuits.

CO2: Analyze and design of MOS and different current mirror circuits including Wilson, cascade current mirror

CO3: Design of CMOS Amplifiers including Differential, Cascode and high gain amplifier architectures

CO4: Design of CMOS Operational amplifiers and to measure the characteristics of cascode operational-amplifier.

CO5: Construct switched capacitor circuits and PLLs

22ADOE01 **COMPUTER VISION**

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 albedosos.

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.

22ADOE02 **ETHICS AND AI**

L	T	P	C
3	0	0	3

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.

22ADOE03 NETWORK SECURITY AND FIREWALLS

L	T	P	C
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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.

22ADOE04 **R PROGRAMMING**

L	T	P	C
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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 Mat off, "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.

22ADOE05 PROGRAMMING WITH ASP.NET

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand .Net as simple, modem, 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

22CSOE01 COMPUTER GRAPHICS AND SIMULATION

L	T	P	C
3	0	0	3

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.

22CSOE02 DATA INTEGRATION AND BIG DATA

L	T	P	C
3	0	0	3

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 3^2Vs - 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.

22CSOE03 GAME PROGRAMMING

L	T	P	C
3	0	0	3

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

22CSOE04 STORAGE TECHNOLOGIES

L	T	P	C
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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

22CSOE05 RECOMMENDER SYSTEMS

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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

22ECOE01 COMPUTATIONAL INTELLIGENCE

L	T	P	C
3	0	0	3

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.

22ECOE02 **WEARABLE DEVICES**

L	T	P	C
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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 Bonfiglo and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011.
2. Zhang and Yuan-Ting, Wearable Medical Sensors and Systems, Springer, 2013.
3. 00Edward 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.

22ECOE03 VLSI TESTING AND DESIGN FOR TESTABILITY

L	T	P	C
3	0	0	3

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, Brever 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.

22ECOE04 IOT BASED SYSTEMS DESIGN

L	T	P	C
3	0	0	3

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 Madisetti 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

22ECOE05 **DESIGN THINKING**

L	T	P	C
3	0	0	3

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 Papadakos, (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.

22EEOE01 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

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, das and combined cycle power plants.

CO3: Gain the basic knowledgeof construction and working of the components inside nuclear power plants.

CO4: Explore the construction and working of the components inside renewableenergy power plants.

CO5: Analysis and solve energy and economic related issues in power sector.

22EEOE02	SENSORS AND TRANSDUCERS	L	T	P	C
		3	0	0	3

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 SciencePublications, 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.

22EEOE03 HYBRID ENERGY TECHNOLOGY

L	T	P	C
3	0	0	3

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. Muyeen, “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 Edison, 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

22EEOE04 BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

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", Merril 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.

22EEOE05 ELECTRIC AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

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.

22ITOE01 MOBILE ADHOC NETWORKS

L	T	P	C
3	0	0	3

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.

22ITOE02 BLOCKCHAIN TECHNOLOGIES

L	T	P	C
3	0	0	3

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

22ITOE03 OPEN SOURCE TECHNOLOGIES

L	T	P	C
3	0	0	3

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, My SQL 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, OReilly 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.

22ITOE04 ANDROID APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

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 you 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

22ITOE05	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

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:

CO1: Have knowledge on digital forensics.

CO2: Know about digital crime and investigations.

CO3: Be forensic ready.

CO4: Investigate, identify and extract digital evidence from iOS devices.

CO5: Investigate, identify and extract digital evidence from Android devices.

22MEOE01	TESTING OF MATERIALS	L	T	P	C
		3	0	0	3

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", 3rdEdition, Addison-Wesley CompanyInc., NewYork, 2000.
3. P. Field Foster, "The Mechanical Testing of Metals and Alloys" 7thEdition, CousensPress, 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, 9thEdition, 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.

22MEOE02	WELDING TECHNOLOGY	L	T	P	C
		3	0	0	3

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**.**

22MEOE03	INDUSTRIAL SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

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 COPNCEPT **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 foroptimization of productivity.

CO5: Measure and evaluate occupational safety and health performance.

22MEOE04	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

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.

22MEOE05	MAINTENANCE ENGINEERING	L	T	P	C
		3	0	0	3

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 estimationAnalysis.

CO4: Practice various repairs and able to predict the faulty locations.

CO5: Familiarize various methods of repairing material handling equipments.