KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 052
(Autonomous)

VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Providing value based quality education for the development of students as competent and responsible citizens.
- Contributing to the nation and beyond through research and development
- Continuously improving our services

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To be a centre of excellence for development and dissemination of knowledge in Electronics and Communication Engineering for the Nation and beyond.

MISSION

Department of Electronics and Communication Engineering is committed

MS1: To impart industry and research based quality education for developing value based electronics and communication engineers

MS2: To enrich the academic activities by continual improvement in the teaching learning process

MS3: To infuse confidence in the minds of students to develop as entrepreneurs

MS4: To develop expertise for consultancy activities by providing thrust for Industry Institute Interaction

MS5: To endeavour for constant upgradation of technical expertise for producing competent professionals to cater to the needs of the society and to meet the global challenges

2014 REGULATIONS

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Electronics and Communication Engineering will

PEO1: Succeed in industry and higher education by applying knowledge of mathematics, science and engineering principles

PEO2: Analyze, design and implement electronics based solutions to meet the real world problems, with constant update of domain knowledge

PEO3: Demonstrate Soft skills, Professional and Ethical values and an aptitude for lifelong learning needed for a successful professional career

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	3	3	3
MS2	3	3	2
MS3	3	3	3
MS4	3	3	2
MS5	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **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.

PO3: **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.

PO4: **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.

PO5: **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.

PO6: **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.

PO7: **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.

PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **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.

PO11: **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.

PO12: **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Products Development :** Apply intradisciplinary knowledge and skills to develop products for providing solutions for the real world problems in Industry, Agriculture, Healthcare, Communication etc.

2. **Development of Entrepreneurship:** An aptitude to take up applied research and to become Entrepreneurs in Electronics and Communication Engineering by combining the skills of project management and finance.

MAPPING OF PEOs WITH POs AND PSOs

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	3	3	3	1	-	2	2	2	1	2	3	1
PEO2	3	3	3	3	3	3	3	3	1	2	3	3	3	3
PEO3	-	1	2	-	-	3	3	3	3	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

CURRICULUM BREAKDOWN STRUCTURE UNDER REGULATION 2014

Curriculum Breakdown Structure(CBS)	**Curriculum Content (% of total number of credits of the program)**	**Total number of contact hours**	**Total number of credits**
Basic Sciences(BS)	16.5	510	30
Engineering Sciences(ES)	14.28	540	26
Humanities and Social Sciences(HS)	9.34	255	17
Program Core(PC)	38.5	1380	70
Program Electives(PE)	9.89	270	18
Open Electives(OE)	4.94	135	9
Project(s)/Internships(PR)	6.59	180	12
		Total	**182**

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
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B.E. DEGREE IN ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14EGT11	Communicative English I	3	0	0	3	40	60	100	HS
14MAT11	Mathematics I	3	1	0	4	40	60	100	BS
14PHT11	Applied Physics	3	0	0	3	40	60	100	BS
14CYT11	Applied Chemistry	3	0	0	3	40	60	100	BS
14CSC11	Problem Solving and Programming	3	0	3	4	40	60	100	ES
14EET11	Basics of Electrical and Electronics Engineering	3	0	0	3	40	60	100	ES
	PRACTICAL								
14PHL11	Physical Sciences Laboratory I	0	0	3	1	100	0	100	BS
14EEL11	Basics of Electrical and Electronics Engineering	0	0	3	1	100	0	100	ES
				Total	**22**				

CA - Continuous Assessment, ESE – End Semester Examination

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B.E. DEGREE IN ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14EGT21	Communicative English II	3	0	0	3	40	60	100	HS
14MAT21	Mathematics II	3	1	0	4	40	60	100	BS
14PHT21	Materials Science	3	0	0	3	40	60	100	BS
14CYT21	Environmental Science	3	0	0	3	40	60	100	BS
14MET11	Basics of Civil and Mechanical Engineering	3	0	0	3	40	60	100	ES
14MEC11	Engineering Drawing	2	0	3	3	40	60	100	ES
14VEC11	Value Education	0	2	1	1	100	0	100	HS
	PRACTICAL								
14PHL21	Physical Sciences Laboratory II	0	0	3	1	100	0	100	BS
14MEL11	Basics of Civil and Mechanical Engineering Laboratory	0	0	3	1	100	0	100	ES
				Total	**22**				

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CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – III

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14MAT31	Mathematics – III	3	1	0	4	40	60	100	BS
14CST35	Object Oriented Programming	3	0	0	3	40	60	100	ES
14ECT31	Digital Electronics	3	1	0	4	40	60	100	PC
14ECT32	Solid State Devices	3	0	0	3	40	60	100	PC
14EET32	Circuits and Networks	3	1	0	4	40	60	100	PC
	PRACTICAL								
14ECL31	Digital Electronics Laboratory	0	0	3	1	100	0	100	PC
14ECL32	Solid State Devices and Circuit Theory Laboratory	0	0	3	1	100	0	100	PC
14CSL34	Object Oriented Programming Laboratory	0	0	3	1	100	0	100	ES
				Total	**21**				

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CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – IV

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14MAT44	Probability Theory and Random Process	3	1	0	4	40	60	100	BS
14ECT41	Analog Electronics	3	1	0	4	40	60	100	PC
14ECT42	Signals and Systems	3	1	0	4	40	60	100	PC
14ECT43	Microprocessor, Microcontroller and Interfacing	3	0	0	3	40	60	100	PC
14ECT44	Electromagnetics and Waveguides	3	1	0	4	40	60	100	PC
14EET44	Electrical Machines	3	0	0	3	40	60	100	ES
	PRACTICAL								
14ECL41	Analog Electronics Laboratory	0	0	3	1	100	0	100	PC
14ECL42	Microprocessor Microcontroller and Interfacing Laboratory	0	0	3	1	100	0	100	PC
14EGL41	Communication Skills Laboratory	0	0	3	1	100	0	100	HS
				Total	**25**				

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CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – V

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14EET53	Control Systems	3	1	0	4	40	60	100	PC
14ECT51	Digital Signal Processing	3	1	0	4	40	60	100	PC
14ECT52	Linear Integrated Circuits	3	1	0	4	40	60	100	PC
14ECT53	Data Communication and Internetworking	3	0	0	3	40	60	100	ES
14ECT54	Microcontroller: Architecture and Applications	3	0	0	3	40	60	100	PC
	Elective – I (Professional)	3	0	0	3	40	60	100	PE
	PRACTICAL								
14ECL51	Linear Integrated Circuits Laboratory	0	0	3	1	100	0	100	PC
14ECL52	Digital Signal Processing Laboratory	0	0	3	1	100	0	100	PC
14ECL53	Microcontroller and Its Applications Laboratory	0	0	3	1	100	0	100	PC
				Total	**24**				

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B.E. DEGREE IN ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – VI

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET61	Economics and Management for Engineers	3	0	0	3	40	60	100	HS
14ECT61	VLSI Design	3	0	0	3	40	60	100	PC
14ECT62	Analog and Digital Communication Systems	3	1	0	4	40	60	100	PC
14ECT63	Antennas and Wave Propagation	3	1	0	4	40	60	100	PC
	Elective - II (Professional)	3	0	0	3	40	60	100	PE
	Elective - III (Open)	3	0	0	3	40	60	100	OE
	PRACTICAL								
14ECL61	Analog and Digital Communication Systems Laboratory	0	0	3	1	100	0	100	PC
14ECL62	VLSI Laboratory	0	0	3	1	100	0	100	PC
14ECL63	Networks Laboratory	0	0	3	1	100	0	100	ES
				Total	**23**				

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CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – VII

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET71	Total Quality Management	3	0	0	3	40	60	100	HS
14ECT71	Cellular and Mobile Communication	3	1	0	4	40	60	100	PC
14ECT72	Microwave and Optical Engineering	3	1	0	4	40	60	100	PC
	Elective – IV (Professional)	3	0	0	3	40	60	100	PE
	Elective – V (Open)	3	0	0	3	40	60	100	PE
	Elective – VI (Open)	3	0	0	3	40	60	100	PE
	PRACTICAL								
14ECL71	Optical and Microwave Laboratory	0	0	3	1	100	0	100	PC
14ECP71	Mini Project	0	0	6	3	50	50	100	PC
				Total	**24**				

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B.E. DEGREE IN ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER –VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET81	Professional Ethics and Human Values	3	0	0	3	40	60	100	HS
	Elective – VII (Professional)	3	0	0	3	40	60	100	PE
	Elective – VIII (Professional)	3	0	0	3	40	60	100	PE
	Elective – IX (Professional)	3	0	0	3	40	60	100	PE
	PRACTICAL								
14ECP81	Project Work	0	0	18	9	100	100	200	PW
				Total	**21**				

CA - Continuous Assessment, ESE – End Semester Examination

Total Credits: 182

LIST OF PROFESSIONAL ELECTIVES						
Course Code	**Course Title**	**Hours/Week**			**Credit**	**CBS**
		L	**T**	**P**		
SEMESTER V						
14ECE01	Transmission Lines and Networks	3	0	0	3	PE
14ECE02	Modern Electronic Instrumentation	3	0	0	3	PE
14ECE03	Computer Architecture and Interfacing	3	0	0	3	PE
14ECE04	Medical Electronics	3	0	0	3	PE
SEMESTER VI						
14MAT41	Numerical Methods	3	1	0	4	PE
14EIE04	Soft Computing Techniques	3	0	0	3	PE
14ECE05	Wireless Networks	3	0	0	3	PE
14ECE06	Satellite Communication	3	0	0	3	PE
14ECE07	Embedded Systems Design	3	0	0	3	PE
14ECE08	Digital Image Processing	3	0	0	3	PE
14ECE09	DSP Processors	3	0	0	3	PE
SEMESTER VII						
14ITE13	Java Technologies	3	0	0	3	PE
14ECE10	High Speed Networks	3	0	0	3	PE
14ECE11	RF Communications	3	0	0	3	PE
14ECE12	Broadband Communication	3	0	0	3	PE
14ECE13	VLSI for ASIC Design	3	0	0	3	PE
14ECE14	Real Time Operating Systems	3	0	0	3	PE
14ECE15	Pattern Recognition	3	0	0	3	PE
14ECE16	Statistical Theory of Signal Processing	3	0	0	3	PE
SEMESTER VIII						
14MTE07	Automotive Electronics	3	0	0	3	PE
14CSE20	.Net Technologies	3	0	0	3	PE
14GEE81	Entrepreneurship Development	3	0	0	3	PE
14ECE17	Cyber Physical System	3	0	0	3	PE

14ECE18	Network Information Security	3	0	0	3	PE
14ECE19	Testing and Fault Diagnosis of VLSI Circuits	3	0	0	3	PE
14ECE20	Low Power VLSI Design	3	0	0	3	PE
14ECE21	RISC: Programming and Applications	3	0	0	3	PE
14ECE22	Embedded Internet of Things	3	0	0	3	PE
14ECE23	Optimization Techniques	3	0	0	3	PE
14ECE24	Radar Engineering	3	0	0	3	PE
14ECE25	Next Generation Wireless Communication	3	0	0	3	PE
14ECE26	Remote Sensing	3	0	0	3	PE

LIST OF OPEN ELECTIVES						
Course Code	**Course Title**	**Hours/Week**			**Credit**	**CBS**
		L	**T**	**P**		
Semester VI						
14ECO01	Embedded Systems	3	0	0	3	OE
14ECO02	Wireless Internetworking Technologies	3	0	0	3	OE
Semester VII						
14ECO03	Bio-medical Signal and Image Processing	3	0	0	3	OE
14ECO04	Opto Electronics	3	0	0	3	OE
14ECO05	Nano Electronics	3	0	0	3	OE
14ECO06	Speech Signal Processing	3	0	0	3	OE

14EGT11 COMMUNICATIVE ENGLISH I

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Functional Grammar: Basics of Vocabulary - Parts of speech or Word Classes including Determiners - Prefixes and Suffixes - Homonyms and Homophones - Connectives - Compound Nouns. **Listening:** Introduction to Listening / Types of Listening – Extensive / Intensive Listening - Listening Activities. **Speaking:** Verbal and non verbal communication – An introduction to speech sounds, syllables & word stress – Speaking Activities. **Reading:** Introduction to Skimming and scanning as reading techniques - understanding discourse coherence – sequencing of sentences – Reading activities. **Writing:** Introduction to aspects of technical writing – writing definitions and descriptions- Letter Writing – Informal letters-Punctuation in Letter Writing

UNIT – II **9**

Functional Grammar: Concord - Tenses - Voice - Use of Articles and prepositions. **Listening:** Listening Comprehension – Cloze Test - Extensive listening – listening for general information. **Speaking:** Role Play – Situational Conversations. **Reading:** Reading newspaper articles – global understanding skills and ability to infer, extract gist and understand main ideas. **Writing:** Letter Writing - Formal letters, Writing a Profile about an organization—Punctuation (General).

UNIT – III **9**

Functional Grammar: Phrasal verbs - Clauses - Simple, Compound and Complex Sentences - Synonyms and Antonyms. **Listening:** Listening Comprehension – Cloze Text - Intensive listening – listening for specific information. **Speaking:** Describing Places, People, Technical Processes. **Reading:** Reading different types of texts – Understanding general and specific information. **Writing:** Paragraph Writing – Writing reviews on short films and videos - Offering suggestions and recommendations

UNIT – IV **9**

Functional Grammar: Conditional clauses (If clause) - Adjectives, Compound Adjectives and Degrees of Comparison. **Listening:** Listening to different accents, listening to speeches / presentations. **Speaking:** Describing Technical Processes and Machines and Gadgets - Telephone Skills. **Reading:** Reading Texts with focus on use of verbs and verb phrases. **Writing:** Writing e-mails –Transcoding - Using Charts, pictures and tables for interpretations.

UNIT – V **9**

Functional Grammar: Modals – Types of Sentences – Idioms and Phrases and proverbs - identifying odd words. **Listening:** Retrieval of factual information – listening to identify topic, context, function, speaker's opinion, attitude, etc. **Speaking:** Interviews - Personal and Telephonic - Giving impromptu talks, making presentations on given topics. **Reading:** Reading for structure and detail – finding key information in a given text and finding topic sentences. **Writing:** Designing and Making Posters – Writing Advertisements-Free writing on any given topic (Technical and topics on current affairs)

TOTAL : 45

TEXT BOOKS :

1. "Learn English – A Fun Book of Functional Language, Grammar and Vocabulary", McGraw Hill Education [India] Pvt. Ltd., Santanu Sinha Chaudhuri, 2013.

REFERENCE BOOKS :

1. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: Principles and Practice", Oxford University Press, New Delhi, 2011.
2. Regional Institute of English, "English for Engineers", Cambridge University Press, New Delhi, 2006.
3. Rizvi, Ashraf M., "Effective Technical Communication", Tata McGrawHill, New Delhi. 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: speak clearly, confidently, comprehensibly, and communicate with others using appropriate communicative strategies

CO2: write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide range of vocabulary, organizing their ideas logically on a topic

CO3: read different genres of texts adopting various reading strategies

CO4: listen/view and comprehend different spoken discourses / excerpts in different accents

CO5: use language effectively and accurately acquiring vocabulary from real-life context

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT11 MATHEMATICS I

(Common to all Engineering and Technology branches)

3 1 0 4

Pre-requisites: Basics concepts of matrices, Basic idea of differentiation, Knowledge of differential equations

UNIT – I **9**

Matrices: Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors (without proof) – Cayley-Hamilton Theorem (Statement and Applications) - Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of quadratic forms – Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT – II **9**

Functions of Several Variables: Functions of two variables – Partial derivatives – Total differential – Taylor's Series expansion –Maxima and Minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians – Properties.

UNIT – III **9**

Ordinary Differential Equations of First Order: Solutions of equations in separable form – Exact differential equations – Integrating factors – Linear first order differential equations – Bernoulli's equation – Clairaut's equation.

UNIT – IV **9**

Ordinary Differential Equations of Higher Order: Linear differential equations of second and higher order with constant coefficients – Particular Integrals for the types: e^{ax} – cos(ax) / sin(ax) – x^n – $e^{ax}x^n$, e^{ax}sin(bx) and e^{ax}cos(bx) – x^nsin(ax) and x^ncos(ax) – Linear differential equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation.

UNIT – V **9**

Applications of Ordinary Differential Equations: Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Simple harmonic motion – Deflection of beams – Electric circuits (Differential equations and associated conditions need to be given).

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi.
2. Veerarajan T., "Engineering Mathematics, (for first year)", Reprint Edition 2013, Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, New Delhi, 2011.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House, New Delhi, Reprint 2014.
3. Bali N.P. and Manish Goyal, "Text Book of Engineering Mathematics", 8th Edition, Laxmi Publications, New Delhi, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2011.
5. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: solve engineering problems which needs matrix computations

CO2: solve extremal problems which arise in function of several variables

CO3: identify the appropriate method for solving first order ordinary differential equations

CO4: classify and find the solution of ordinary differential equations of higher order

CO5: apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHT11 APPLIED PHYSICS

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Properties of Matter: Elasticity – Hooke's law – Modulus of elasticity (qualitative) – Stress-strain diagram – Poisson's ratio – Bending moment – Depression of a cantilever (theory) – Derivation of Young's modulus of the material of the beam – Uniform and non-uniform bending – I-shaped girders. **Thermal Physics:** Modes of heat transfer – Thermal conductivity – Derivation of rectilinear flow of heat along a bar – Radial and cylindrical heat flow – Conduction through compound media (series and parallel).

UNIT – II **9**

Acoustics: Classification of sound – Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. **Ultrasonics:** Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitation – Industrial applications – Drilling, welding, soldering and cleaning – Non destructive testing – Ultrasonic pulse echo system.

UNIT – III **9**

Laser and Applications: Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO_2 laser, Semiconductor lasers: homojunction and heterojunction – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.

UNIT – IV **9**

Fiber Optics and Applications: Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication links – Losses in optical fibers – Fiber optic sensors – Temperature and displacement sensors.

UNIT – V **9**

Quantum Physics and Applications: Black body radiation – Planck's theory (derivation) – Compton effect (theory) – Matter waves – Uncertainty principle (qualitative) – Schroedinger's wave equations – Time independent and time dependent wave equations – Physical significance of wave function – Particle in a box (One dimensional) – Electron microscopes – Scanning electron microscope – Transmission electron microscope.

TOTAL : 45

TEXT BOOKS:

1. Tamilarasan K and Prabu K, "Engineering Physics-I", Tata McGraw Hill Education Private Limited, New Delhi, 2014.

REFERENCE BOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai and Sons, New Delhi, 2009.
2. Uma Mukherji, "Engineering Physics", Narosa Publishing House, New Delhi, 2011.
3. Laud B.B., "Lasers and non- linear optics", New Age International (P) Limited Publishers, New Delhi, 1996.
4. Ajoy Ghatak and Thyagarajan K., "Introduction to Fiber Optics", Cambridge University Press, New York, USA, 2000
5. Mehta and Neeraj, "Applied Physics for Engineers", Prentice-Hall of India Private Limited, New Delhi, 2011.
6. Douglas Brandt and Douglas C. Giancoli, "Physics for Scientists and Engineers", Prentice-Hall of India Private Limited, New Delhi, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Infer the extensive properties of matter and heat conduction in metal.
CO2: Demonstrate acoustically good buildings and non-destructive testing using ultrasonic waves.
CO3: Employ the laser in engineering and technology.
CO4: Sketch the principle of fiber optics and fiber optic communication link.
CO5: Interpret the concepts of quantum physics to optical phenomena and electrons in a metal.

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CYT11 APPLIED CHEMISTRY

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Water: Introduction - Sources of water - Impurities in water - Types of water - Water quality standards - Water quality parameters (Brief discussion only) - Hardness of water- Expression of hardness - Units of hardness –Estimation of Hardness of water by EDTA method – Determination of alkalinity - Disadvantages of using hard water - Boiler troubles due to hard water - scale and sludge formation – boiler corrosion – caustic embrittlement- priming and foaming- Softening of water- External treatment methods - zeolite and demineralization process (principle, process, advantages and disadvantages only) - Internal treatment process - colloidal, carbonate, calgon and phosphate conditioning (brief discussion only) - desalination by reverse osmosis method

UNIT – II **9**

Electrochemistry: Introduction – Electrolytic and Electrochemical Cells – Representation of a galvanic cell - Reversible and Irreversible cells - EMF and its determinations – Electrode potential - Nernst Equation – Reference electrodes (hydrogen and calomel electrodes) – Electrochemical series and its applications – Conductometric titrations (strong acid vs strong base only) - Batteries (Lead Acid battery, NICAD, Lithium battery, Lithium Sulphur battery) – Proton exchange membrane cells.

UNIT – III **9**

Corrosion and Its Control: Introduction – Mechanism of chemical and electrochemical corrosion – galvanic corrosion - concentration cell corrosion – Galvanic series - Factors influencing rate of corrosion – corrosion control methods - Sacrificial anode and impressed current cathodic protection methods – Corrosion inhibitors - Protective coatings - classifications - Pretreatment of metal surface - Metallic coating -electroplating and electrolessplating (General discussion) - Hot dipping (Tinning and galvanising) - Non-metallic coating - surface conversion coating (phosphate coating and anodized coating) - Organic coating - paints – constituents and their function – Special paints (Fire retardant, temperature indicating, water repellant and luminescent paints)

UNIT – IV **9**

Fuels: Coal and its varieties – proximate and ultimate analysis – their significance – metallurgical coke - Otto-Hoffman byproduct method - Liquid fuel - refining of petroleum – Manufacture of synthetic petrol – Cracking - Polymerization - Hydrogenation of coal (Fisher Tropsch and Bergius methods) - knocking - octane number – improving octane number by additives – Diesel – cetane number – Gaseous fuels (Water gas and LPG).

Combustion: Introduction – Calorific Values – Gross and Net Calorific Values – Dulong's formula (simple problems)- Flue gas analysis by Orsat's method - Explosive range and Spontaneous Ignition Temperature

UNIT – V **9**

Polymers: Introduction – Nomenclature of polymers – functionality – polymerization - types – addition, condensation and co-polymerization with examples – Effect of polymer structure on properties (strength, plastic deformation, glass transition temperature and melting point of polymers (Tg and Tm), crystallinity and chemical resistance) - plastics – types (thermo and thermosetting plastics) - individual polymers - Polyethylene, Polypropylene, PVC, Teflon and Bakelite (preparation, properties and uses only) - Compounding of plastics- Fabrication of plastics (compression, injection and extrusion moulding methods) – conducting polymers

TOTAL : 45

TEXT BOOKS:

1. Palanisamy P.N, Geetha A, Manjula Rani K, "Applied Chemistry", 2nd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2013.
2. Jain P C and Monica Jain, "Engineering Chemistry", 15th Edition, Dhanpat Rai Publication Co., New Delhi, 2008.

REFERENCE BOOKS:

1. Sharma B.K., "Engineering Chemistry", Krishna Prakasan Media (P) Ltd., Meerut, 2001.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill, New Delhi, 2008.
3. Krishnamurthy N., "Engineering Chemistry", 2nd Edition, PHI Learning Private Limited, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: get the basic knowledge of water quality parameters and treatment methods
CO2: obtain the principles of electrochemical cells, EMF series and energy storing devices
CO3: acquire the knowledge of the types and prevention methods of corrosion
CO4: know the concepts and developments in combustion and various types of fuels
CO5: understand the knowledge about the types of polymers, plastics and moulding methods

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CSC11 PROBLEM SOLVING AND PROGRAMMING

(Common to all Engineering and Technology branches)

3 0 3 4

UNIT – I **9**

Introduction to Computer and Problem Solving: Overview of computers – Applications of computers-Characteristics of computer - Basic computer Organization – Number System - Problem solving: Planning the computer program – Algorithms - Flowcharts – Pseudo codes – Structuring the logic - Top-Down design.

UNIT – II **9**

Case Study on Problem Solving: Algorithm, Flowchart and Pseudo code for the problems: Exchanging the values of two variables – Finding the biggest number - Counting – Summation of numbers – Factorial computation – Generation of Fibonacci Sequence - Summation of series – Base Conversion - Reversing the digits of an Integer.

UNIT – III **9**

Introduction to C and Control Statements: Overview of C – Basic structure of a C Program – Executing a C Program – C Character set – Tokens – Keywords and Identifiers – Constants – Variables – Data types - Storage classes - Managing Input and Output operations – Operators and Expressions - Decision making and Branching - Looping – break and continue statements.

UNIT – IV **9**

Arrays, Strings and Functions: Arrays – One dimensional and Two dimensional arrays - Handling of character strings: Declaring and initializing string variables – String handling functions - Library functions – User defined functions: Elements of User defined Functions – nesting of functions – passing arrays to function – passing strings to functions - recursion.

UNIT – V **9**

Structures, Unions and Pointers: Structure definition – Structure declaration – Accessing a structure member- Structure initialization – Array of Structures - Arrays within structures –Structures within Structures – Structures and Functions , Unions. Understanding pointers – Accessing address of a variable – Declaring pointer variables – Initialization of pointer variables – accessing a variable through its pointer – Pass by value vs. Pass by pointers.

Lecture: 45, Practical: 45, TOTAL: 90

REFERENCE BOOKS:

1. Dromey R.G., "How to Solve it by Computer", Pearson Education, 2009.
2. Balagurusamy E., "Fundamentals of Computing and Programming", Tata McGraw-Hill Education Pvt. Ltd, 2010.
3. Stephen G. Kochan, "Programming in C", 3rd Edition, Pearson Education, 2005.
4. Yashavant P. Kanetkar, " Let Us C", BPB Publications, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply fundamental principles of problem solving techniques
CO2: develop algorithm, flowchart and pseudo code to provide solutions to problems
CO3: develop programs using basic programming principles of C language
CO4: implement modular programming concepts using functions
CO5: design simple applications using arrays, structures and pointers

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT- I **9**

Introduction to Power Systems: Introduction: Electric Potential, Current, Power and Energy. Generation of Electrical Energy: Sources of Energy - Renewable and Non Renewable - Power Generation: Thermal, Hydro and Nuclear Power plants - Solar and Wind (schematic arrangement and operation) Power plants - Structure of Electric Power System - Transmission and Distribution Voltages. Electrical Safety Aspects - Phase-Neutral - Earthing: Need for Earthing and Types - Domestic Wiring (Simple and staircase) - Energy Conservation and Sustainability.

UNIT - II **9**

DC Circuits and AC Circuits: Resistance: Resistors in Series and Parallel - Network Reduction - Voltage and Current Division Rule - Ohm's Law- Kirchhoff's Laws - Mesh Analysis of Simple Resistive Networks.

Single phase systems: Alternating (Sinusoidal) Voltage and Current, R.M.S and Average Value, Power Factor, Form Factor and Peak Factor - AC Series Circuits (RL, RC & RLC). Three phase Systems (Qualitative only): Star and Delta Connected Systems - Line and Phase Voltage/Current - Three Phase Power Measurement by Two Wattmeter Method.

UNIT - III **9**

Electrical Machines: DC Machines: Construction, Principle of Operation of DC Motor-Torque Equation, Types and Applications. AC Machines: Construction and Working Principle of AC Generator , Single Phase Transformer, Three Phase Induction Motor and Single Phase Induction Motor (Split Phase and Capacitor Start Induction Motor) - Applications.

UNIT - IV **9**

Basic Electronics: PN Junction Diode - Operation of Rectifiers (Half wave, Full wave - Bridge Rectifiers with waveforms) and Filters - Zener Diodes - Zener Diode as Voltage Regulator - IC Voltage Regulators (78XX & 79XX) - Transistors: Types - Operation of NPN Transistor - Transistor as an Amplifier - Operation and Characteristics of SCR - UPS and SMPS (Block Diagram approach).

UNIT - V **9**

Digital Electronics: Introduction – Binary Number Systems and Conversions - Binary Addition and Subtraction - Logic Gates and Truth tables - Boolean Algebra - Basic Laws and Demorgan's theorem - Simplification of Boolean Functions - Full Adder and Full Subtractor - Flip Flops - Counters: Asynchronous Binary Ripple Counter .

TOTAL: 45

TEXT BOOKS:

1. Prasad P.V., Sivanagaraju S. and Prasad R., "Basics of Electrical and Electronics Engineering", 1st Edition, Cengage Learning, 2013.
2. Muthusubramanian R. and Salivahanan S., "Basics of Electrical and Electronics Engineering", 1st Edition ,Tata McGraw Hill, 2009.

REFERENCE BOOKS:

1. Jegathesan V., Vinoth Kumar K. and Saravanakumar R., "Basic Electrical and Electronics Engineering", 1st Edition, Wiley India, 2011.
2. Sukhija M.S. and Nagsarkar T.K., "Basics of Electrical and Electronics Engineering", 1st Edition ,Oxford University Press, 2012.
3. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, PHI Learning, 2007.
4. Edward Hughes, Ian McKenzie Smith, Dr. John Hiley and Keith Brown, "Electrical and Electronics Technology", 8th Edition, Pearson Education, 2012.
5. http://www.nptelvideos.in/2012/11/basic-electrical-technology.html
6. http://nptel.kongu.edu/Basic%20Courses%20I%20&%20II/Others/BEL/index.html

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: develop a basic understanding of the concept of electrical systems
CO2: analyze the DC and AC circuits
CO3: interpret the construction and working of different types of electric machines
CO4: discuss the basic electronic components
CO5: distinguish analog and digital electronics

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHL11 PHYSICAL SCIENCES LABORATORY I

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: APPLIED PHYSICS LABORATORY
(Any five experiments)

LIST OF EXPERIMENTS:

1. Determination of Young's modulus of a given material using uniform bending.
2. Determination of thermal conductivity of bad conductor using Lee's disc arrangement.
3. Determination of velocity of ultrasonic waves in liquid and compressibility of liquid using ultrasonic interferometer.
4. (a) Particle size determination using diode laser.
   (b) Determination of wavelength of laser
5. Determination of specific resistance of a given coil of wire using Carey Foster bridge.
6. Determination of wavelength of Hg spectrum using spectrometer and grating.

Demonstration

1. Measurement of efficiency of a solar cell
2. Non destructive testing
3. Tyndall effect

PART-B: APPLIED CHEMISTRY LABORATORY
(Any five experiments)

LIST OF EXPERIMENTS:

1. Estimation of Total, Temporary and Permanent hardness of water by EDTA method.
2. Estimation of Ca^{2+} and Mg^{2+} hardness separately by EDTA method.
3. Estimation of Alkalinity of the given water sample.
4. Conductometric titration - Mixture of acids.
5. Estimation of Hydrochloric acid using pH meter.
6. Estimation of Ferrous ion by potentiometric titration.

Demonstration

1. Distillation system
2. RO water treatment system
3. UV Spectrophotometer

REFERENCES / MANUALS / SOFTWARE:

1. Physics Laboratory Manual –Dr.K.Tamilarasan and Dr.K.Prabu
2. Chemistry Laboratory Manual- Dr.P.N.Palanisamy, P.Manikandan, A.Geetha and K.Manjularani

TOTAL : 45

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: describe the basics of modulus of elasticity, thermal conductivity, ultrasonics and compressibility of water, laser parameters, specific resistance of electrical conductors, and interference and diffraction of light waves.

CO2: operate thebasic measuring devices, travelling microscope, Lee's disc arrangement, ultrasonic interferometer, Carrey Foster bridge and spectrometer, and to measure the related physical parameters.

CO3: analyze the hardness, amount of Ca^{2+} and Mg^{2+} ions, and presence of alkalinity in water.

CO4: employ the instruments like pH meter, conductivity meter and potentiometer for the estimation of unknown concentration of acids and ferrous ion.

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

1. Control of incandescent and fluorescent lamp by simple and stair-case wiring
2. Resistor color coding and verification of Ohm's Law and Kirchhoff's Laws
3. Measurement of real power, reactive power, power factor and impedance of RC, RL and RLC circuits.
4. Measurement of Earth's resistance
5. Load test on DC shunt motor
6. Performance characteristics of single phase Transformer
7. Load test on single phase induction motor.
8. Verification of basic logic gates and their truth tables.
9. Implementation of Half wave and Full wave Rectifier with simple Capacitor Filter
10. Study of Mixie, Ceiling Fan and Vacuum Cleaner

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

- Lab Manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: create a basic electrical connections for domestic applications
CO2: test basic electrical machines like transformer and DC motors
CO3: construct and analyze basic electronic circuits
CO4: measure the various electrical parameters of the circuit
CO5: explain the working of various domestic appliances

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EGT21 COMMUNICATIVE ENGLISH II

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Functional Grammar: Sentences – Affirmative / Negative – Asking questions in the simple present – Using reference words - Cause and Effect expressions. **Listening:** Listening practice - listening to different types of conversation and answering questions - listening to Audio texts and completing cloze exercises. **Speaking:** Opening a conversation and getting acquainted with people. **Reading:** Reading excerpts from a novel, itinerary, magazine and news paper articles. **Writing:** Formal Letter writing – Job Application Letter – CV and Resume – Writing Instructions

UNIT – II **9**

Functional Grammar: Sentences – Interrogative & WH questions - SI units – Numerical Adjectives

Listening: Listening to situation based dialogues – listening to short and long conversations in different domains of activity. **Speaking** : Conversation practice in real life situations, describing places, narration, introducing ideas. **Reading:** Reading historic writing – biographical writing – Non fictional book extracts and news feeds. **Writing:** Filling Forms – Academic Writing - Basics of Business Writing – Calling for Quotation, Placing Orders, Letter of Complaint

UNIT – III **9**

Functional Grammar: Sentences – Imperative – Gerunds & Infinitives - Commonly confused words. **Listening:** Understanding the structure of conversations - Listening to academic lectures and live speech – advertisements and announcements. **Speaking:** Giving and Justifying opinions – apologizing – extempore. **Reading:** Reading Blogs - Website articles – e-mails. **Writing:** e-mails – Tweets – Texting and SMS language

UNIT – IV **9**

Functional Grammar: Transformation of Sentences – Simple, Compound and Complex - Vocabulary (single word substitute) – conjunctions - reporting verbs – Direct and Indirect speech. **Listening:** Listening to a telephone conversation, viewing of model interviews (face–to–face, telephonic and video conferencing). **Speaking:** Giving instructions – Role play – Interviews. **Reading:** Reading job advertisements and profile of the company concerned **Writing:** Writing Reports - Preparing a Check list

UNIT – V **9**

Grammar: Analyzing sentence structures in a given short passage - Identifying parts of speech in a given short passage. **Listening:** Viewing a model group discussion and reviewing the performance of each participant – identifying the characteristics of a good listener – casual conversation. **Speaking:** Group discussion skills – initiating, turn taking and concluding the discussion. **Reading:** Making notes from long passages or any form of written materials – providing a suitable title – identifying main points, supporting points. **Writing:** Email writing – Effective use of email.

TOTAL: 45

TEXT BOOKS :

1. Dr. Elango et al. "Resonance: English for Engineers and Technologists", Foundation, Chennai, 2013.

REFERENCE BOOKS:

1. Anderson, Paul V., " Technical Communication **:** A Reader–Centered Approach", Cengage.
2. Muralikrishna and Sunita Mishra, "Communication Skills for Engineers", Pearson, New Delhi, 2011.
3. Sharma, Sangeetha and Binod Mishra, "Communication Skills for Engineers and Scientists", PHI Learning, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: speak effectively, express their opinions clearly, initiate and sustain a discussion and also negotiate using appropriate communicative strategies

CO2: write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing

CO3: read different genres of texts, infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation

CO4: listen and comprehend different spoken excerpts critically and infer unspoken and implied meanings

CO5: use functional grammar for improving employment oriented skills

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT21 MATHEMATICS II

(Common to all Engineering and Technology branches)

3 1 0 4

Pre-requisites: Basic ideas of integration, Basic ideas of vectors and complex numbers

UNIT – I **9**

Multiple Integrals: Double integration in Cartesian coordinates – Change of order of integration – Area between two curves – Triple integration in Cartesian coordinates –Volume as Triple integrals (Simple problems only).

UNIT – II **9**

Vector Calculus: Gradient of a scalar point function – Directional derivative – Divergence of a vector point function – Curl of a vector – Irrotational and Solenoidal vectors – Line Integral, Surface integral and Volume integral (Concept only) – Green's, Stoke's and Gauss divergence theorems (Statement only) – Verification of the above theorems and evaluation of integrals using them (Simple problems only).

UNIT – III **9**

Analytic Functions: Functions of a complex variable – Analytic functions – Necessary conditions and Sufficient conditions (excluding proofs) – Cauchy– Riemann equations (Statement only) – Properties of analytic function (Statement only) – Harmonic functions – Construction of Analytic functions – Conformal mapping: $w = z + a$, az, $1/z$ – Bilinear transformation.

UNIT – IV **9**

Complex Integration: Cauchy's theorem and Cauchy's integral formula (Statement and applications) – Taylor's and Laurent series – Singularities – Classification – Cauchy's Residue theorem (Statement only) – Contour integration – circular and semi-circular contours (excluding poles on real axis).

UNIT – V **9**

Laplace Transform: Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms – Transforms of derivatives and integrals – Initial and final value theorems – Transform of unit step function – Transform of periodic functions - Inverse Laplace transform of elementary functions – Partial fraction method – Convolution theorem (Statement only) – Solution of linear ODE of second order with constant coefficients.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi.
2. Veerarajan T., "Engineering Mathematics", (for first year), Reprint Edition 2013, Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, New Delhi, 2011.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House, New Delhi, Reprint 2014.
3. Bali N.P. and Manish Goyal, "Text Book of Engineering Mathematics", 8th Edition, Laxmi Publications, New Delhi, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2011.
5. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Solve problems involving double and triple integrals.
CO2: Apply the concept of vectors in engineering problems.
CO3: Have a clear idea about functions of complex variables and analytic function which are widely used in study of fluid and heat flow problems.
CO4: Evaluate complex integrals which is extensively applied in engineering.
CO5: Handle Laplace transforms to solve practical problems.

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHT21 MATERIALS SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Crystal Physics: Crystalline and amorphous solids – Lattice – Unit cell – Crystal systems – Bravais lattice – Lattice planes – Miller indices – Derivation of '*d*' spacing in cubic lattice – Atomic radius – Coordination number– Packing factor for SC, BCC, FCC and HCP structures – Crystal imperfections: Point and line imperfections.

UNIT – II **9**

Conducting Materials: Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.

UNIT – III **9**

Semiconducting Materials: Intrinsic semiconductor – Carrier concentration derivation – Electrical conductivity and band gap (theory) – Extrinsic semiconductors – Carrier concentration derivation in n-type and p-type semiconductors – Hall effect – Determination of Hall coefficient – Applications –Solar cell – LDR.

UNIT – IV **9**

Magnetic and Superconducting Materials: Magnetic materials - Types of magnetic materials (qualitative) – Domain theory – Hysteresis – Soft and hard magnetic materials – Applications - Transformer core – Magneto optical recording – Superconductors – Properties – Types of superconductors – BCS theory of superconductivity (qualitative) – Josephson effect - Applications of superconductors – SQUID – Cryotron – Magnetic levitation. **Dielectric Materials:** Dielectric constant – Qualitative study of polarization – Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – Uses of dielectric materials (capacitor) – Ferro electric materials (qualitative).

UNIT – V **9**

Smart Materials: Metallic glasses: Preparation (Melt spinning method only), properties and applications – Shape memory alloys (SMA): Characteristics and applications. **Nano Materials:** Low dimensional structures (quantum dot, wire and well) – Features of nano materials – Synthesis: top down and bottom up approaches – Ball milling and lithographic methods – Physical and chemical vapor phase depositions – Sol gel method – Carbon nanotubes: Structures – Properties – Fabrication by laser ablation – Applications.

TOTAL : 45

TEXT BOOKS:

1. Tamilarasan K. and Prabu K., "Engineering Physics-II", Tata McGraw Hill Education Private Limited, New Delhi, 2014.

REFERENCE BOOKS:

1. Mehta and Neeraj, "Applied Physics for Engineers", Prentice-Hall of India Private Limited, New Delhi, 2011.
2. Raghavan V., "Materials Science and Engineering: A first course", 5th Edition, Prentice-Hall of India, New Delhi, 2009.
3. Poole Charles P. and Ownen Frank J., "Introduction to Nanotechnology", Wiley India, 2007.
4. William Fortune Smith and Javad Hashemi, "Foundations of Materials Science and Engineering", McGraw-Hill Education, 2006, New Delhi.
5. Pillai S.O., "Solid State Physics", 5th Edition, New Age International, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Explain the various crystal systems and crystal defects.
CO2: Comprehend the theory of conducting materials.
CO3: Classify the types of semiconducting materials and to illustrate the device applications.
CO4: Summarize the theory and applications of magnetic, superconducting and dielectric materials.
CO5: Outline the properties and applications of smart materials and nano materials.

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CYT21 ENVIRONMENTAL SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Introduction to Environmental Studies and Natural Resources: Introduction to Environmental Science – Forest resources: Use and over-exploitation, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams - benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture - effects of modern agriculture, fertilizer and pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies – Land resources: Land as a resource – Conservation Practices - Role of an individual in conservation of natural resources.

UNIT – II **9**

Ecosystems: Concept of an ecosystem – Components of an ecosystem - Structural and functional features – Functional attributes (Food chain and Food web only) –Ecological Succession- Introduction, types, characteristic features, structure and functions of the (a) Forest ecosystem (b) Aquatic ecosystems (ponds, rivers and oceans). **Biodiversity:** Introduction – Classification: genetic, species and ecosystem diversity – Bio geographical classification of India- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic, option values and ecosystem service value – Biodiversity at global, national and local level- Hotspots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – In-situ and Ex-situ conservation of biodiversity.

UNIT – III **9**

Environmental Pollution: Definition – Causes, effects and control measures of: (a) Air pollution - Climate change, global warming, acid rain, ozone layer depletion (b)Water pollution (c) Soil pollution - Solid waste Management - Disaster management: floods, earthquake, cyclones and landslides - Role of an individual in prevention of pollution - Case studies. **Water Treatment methods:** Treatment of Water for Domestic Supply (Screening, Aeration, Sedimentation with Coagulation, Filtration and Disinfection methods) - Break point chlorination- Estimation of dissolved oxygen, BOD and COD - Sewage treatment (Primary, Secondary & Tertiary methods) – Introduction to industrial wastewater treatment using Reverse Osmosis Technology- Membrane Technology for wastewater treatment - Activated carbon in pollution abatement of wastewater.

UNIT – IV **9**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation– Environmental ethics - Wasteland reclamation – Environment Production Act – Air (Prevention and control of pollution) Act – Water (Prevention and control of pollution) Act – Wildlife protection Act – Forest conservation Act – Issues involved in enforcement of environmental legislation – Public awareness. **Human Population and the Environment:** Introduction - Population growth - Variation of population based on age structure - Variation among nations – Population explosion – Family welfare programme – Value Education – HIV / AIDS – Women and Child welfare – Role of Information Technology in Environment and human health – Case studies.

UNIT – V **9**

Green Chemistry for Sustainable Future: Water the greenest solvent – Role of catalyst – Biopolymers – Biofertilizers – Principle and applications of green chemistry. **Food and Human Health:** Introduction – Classification and applications of carbohydrates, amino acids, proteins, lipids and vitamins – Food additives – Balanced food – Minerals rich, carbohydrates rich and proteins rich – Chemistry of soft drinks – Oils and fats – Simple tests for identification of adulterants in food stuffs – Impacts of fluoride and arsenic on human health – Fluoride and arsenic removal methods – Significance of iodine, iron and calcium content in human health.

TOTAL : 45

TEXT BOOKS:

1. Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., "Environmental Science", Pearson Education, New Delhi, Revised Edition 2014.
2. Anubha Kaushik, and Kaushik C.P., "Environmental Science and Engineering", 4th multicolour Edition, New Age International (P) Ltd., New Delhi, 2014.

REFERENCE BOOKS:

1. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad.
2. Uppal M.M. revised by Bhatia S.C., "Environmental Chemistry", 6th Edition, Khanna Publishers, New Delhi, 2002.
3. Bahl B.S. and Arun Bahl, "Advanced Organic Chemistry", 3rd Edition, S. Chand & Co., New Delhi, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: know the types of natural resources and the individual role in conserving the resources
CO2: understand the ecological balance and the preservation of biodiversity
CO3: gain the knowledge of the various types of pollution and the waste water treatment methods
CO4: attain the knowledge of various social issues and impact of population explosion on environment
CO5: know about the green chemistry for sustainable future, food and human health

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MET11 BASICS OF CIVIL AND MECHANICAL ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

PART-A: CIVIL ENGINEERING

UNIT – I **5**

Introduction: History of civil engineering - Role and Functions of civil engineer - Fields of civil engineering

UNIT– II **5**

Building Materials: Introduction – Properties and applications of Construction Materials – bricks – stones – sand – cement – mortar- concrete – steel – glass-wood –plastics- ceramics -rubber- FRP – Non ferrous materials - Geosynthetics – Smart materials.

UNIT – III **4**

Sub Structure: Soil **–** classification- bearing capacity- foundation -function- requirements- types-failures -remedial measures- machine foundation

UNIT – IV **4**

Super Structures: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing- weathering course

UNIT – V **4**

Interior design and Landscaping: History of Interior design-Importance of Interior design- Basic elements of Interior design. Landscape Architecture-Elements of Landscaping- Green Engineering

PART-B: MECHANICAL ENGINEERING

UNIT – I **5**

Thermal Science: Laws of thermodynamics and their applications – Principle of operation of Steam, Diesel, Hydro-electric and Nuclear power plants - Classification of internal combustion engines and their working principles – Components of basic Vapour Compression Refrigeration system.

UNIT – II **4**

Fluid Science: Properties of fluids – Classification of hydraulic turbines, working principle of Pelton turbine – Applications of steam and gas turbines. Classification of pumps, working principle of centrifugal and reciprocating pump

UNIT – III **4**

Mechanics and Materials: Classification of engineering materials - Mechanical properties of engineering materials- Definition and importance of stress and strain - Definition and importance of centre of gravity and moment of inertia.

UNIT – IV **5**

Mechanical Components And Their Applications: Basic principles and applications of power transmission systems such as belt, rope, chain and gear drives – Function and principles of coupling, clutch, brake, flywheel and governor

UNIT – V **5**

Manufacturing Technology: Principle and applications of Metal forming process – Foundry, Forging. Principle and applications of Metal Joining process – Welding, Soldering and Brazing, Basics of CAD/CAM/CIM.

TOTAL : 45

TEXT BOOKS:

1. Palanichamy M.S., “Basic Civil Engineering”, Tata McGraw-Hill, New Delhi, 2006.
2. Pravin Kumar, “Basic Mechanical Engineering”, Pearson Publishers, New Delhi, 2013.

REFERENCE BOOKS:

1. Rangawala S.C., “Engineering Materials” Charotor Publishing House(P) Ltd., Anand, 2013.
2. Punmia B.C., Ashok Kumar Jain, Arun Kumar Jain, “Building Construction,” Laximi Publications (P) Ltd., NewDelhi, 2005.
3. Shanmugam G., “Basic Mechanical Engineering”, Tata McGraw-Hill, New Delhi, 2005.
4. Venugopal K. and Prabhu Raja V., “Basic Mechanical Engineering”, 6th Edition, Anuradha Publishers, Kumbakonam, 2005.
5. https://www.youtube.com/watch?v=WH2vSp_p56k
6. https://www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/principles/12-principles-of-green-engineering-html
7. https://www.youtube.com/watch?v=on-_oUajNso

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: know the various functions of Civil Engineer and to identify the suitable construction materials

CO2: demonstrate the various elements of sub-structure and super-structure

CO3: apply the elements of interior design and landscaping in Civil Engineering

CO4: demonstrate an understanding of basic concepts in thermal engineering, fluid mechanics and material properties

CO5: demonstrate an understanding of principles and applications of mechanical power transmission components and basic manufacturing process

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MEC11 ENGINEERING DRAWING

(Common to all Engineering and Technology branches)

2 0 3 3

Pre-requisites: Basic knowledge in practical geometry construction and mathematics

UNIT – I **9**

General Principles of Orthographic Projection: Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Projections of Points, Lines and Planes. General principles of orthographic projection – First angle projection – Layout of views – Projection of points, located in all quadrant and straight lines located in the first quadrant – Determination of true lengths and true inclinations and location of traces – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT – II **9**

Projections of Solid: Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT – III **9**

Sectioning of Solids: Sectioning of solids- prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

UNIT – IV **9**

Development of Surfaces: Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cone with cutout, perpendicular and inclined to the horizontal axis.

UNIT – V **9**

Isometric and Perspective Projection: Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones Conversion of isometric projection into orthographic projection. Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL : 45

TEXT BOOKS:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw-Hill, New Delhi, 2008.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, New Delhi, 2008.

REFERENCE BOOKS:

1. Bhatt N.D., "Engineering Drawing", 46th Edition, Charotar Publishing House, Anand, 2003.
2. Gopalakrishnana K.R., "Engineering Drawing", Volume. I & II, Subhas Publications, Bangaluru, 2006.
3. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD", Tata McGraw Hill, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: gain knowledge on international standards of drawings and to draw the different types of projections for points, lines and planes
CO2: draw the different projections of 3D primitive objects like cube, cone, cylinder, etc.
CO3: draw sections of solids including prisms, pyramids, cylinders and cones
CO4: understand the concepts of development of surfaces of simple and truncated solids
CO5: draw the isometric and perspective projections for the given object

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14VEC11 VALUE EDUCATION

(Common to all Engineering and Technology branches)

0 2 1 1

UNIT – I **6**

Philosophy of Life Science: Life – Purpose of life (four stages of life) – Philosophy of life (who am 'I') – Law of nature (cause of the life and body) – Content of the Life (five sheaths) – Goal of life. Five duties in life.

Methodology: Life and messages of spiritual and national leaders– The forgotten hero, etc.

Project report: Complementing with happiness - Every soul is potentially divine

UNIT – II **6**

Human Values-Moral foundation: Truth, forgiveness, compassion, endurance, humility, non violence, moderate diet, non stealing, self purification, self discipline, self study, content, cleanliness, honesty, and totality in faith– Good habits – Attitude forming for Individual peace.

Practical Methods: Personal experience with above characters, Puranic Stories - Self resolve diary maintenance

UNIT – III **6**

Social Values: Family – Family System - Greatness of women – World brotherhood (vasudeiva kudumbagam) – Glorious Bharath - Bharathian systems - Past –Present – Future - Team spirit - Goal setting – Economics – Education – Politics – Responsibilities of people – Preserving natural resources.

Methodology: Preparing an album on glorious Bharath Past, Present and Future Plans. Goal setting - Management Games. Team Spirit - Yogic Games.

UNIT – IV **6**

Development of Mental Prosperity: Prosperity of mind – Functions of mind - Obstacles of mind - Practical method to perfect mind is yoga – Types – Uses – Precaution – Contradiction – Kriyas - Asanas – Pranayamas – Meditative techniques.

Methodology: Asana - Pranayama – Cyclic meditation – Nada anu sandhana – Meditation – Yogic games for memory. Album on asanas , pranayama and mantra.

UNIT – V **6**

Maintenance of Physical Health: Human body – Structure - Ten Systems of the body as per modern science. Five elements - Harmonious relationship – Life force – Conserving vitality & health through natural life – Pranic food and its importance – Uses of herbs - Right way of cooking to preserve nutrients - Cause of the disease – Acute and chronic - Disease - Life and death.

Methodology: Natural food making, traditional millet dishes. Asanas, pranayamas, cleansing procedures, Quiz on healthy living, Uses of herbs or kitchen garden.

TOTAL : 30

TEXT BOOK:

1. "Value Education", compiled by Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, Pollachi, for Kongu Engineering College.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the purpose and value of life
CO2: exhibit positive human values
CO3: understand social values
CO4: take steps to develop mental and physical health

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3				3		
CO2						3		3				3		
CO3						3		3				3		
CO4						3		3				3		

1 – Slight, 2 – Moderate, 3 – Substantial

14PHL21 PHYSICAL SCIENCES LABORATORY II

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: APPLIED PHYSICS LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

1. Determination of band gap of a semiconductor material using post office box.
2. Determination of dispersive power of a prism using spectrometer.
3. Determination of viscosity of liquid - Poiseuille's method.
4. Determination of thickness of a thin wire – air wedge method.
5. Determination of AC frequency using Melde's string experiment.
6. Determination of hysteresis loss in a ferromagnetic material.

Demonstration

1. Thin film deposition using RF magnetron sputtering technique
2. Synthesis of nano-particles
3. Phase change memory materials - RW CD / DVD

PART - B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

1. Estimation of Chloride in the given water sample.
2. Determination of Dissolved Oxygen in the given wastewater sample.
3. Estimation of Ferrous ion in the given solution.
4. Estimation of Copper in the given solution by Iodometric method.
5. Estimation of Chromium (Cr^{6+}) in the wastewater.
6. Estimation of copper content of the given solution by EDTA method.

Demonstration

1. Turbidity measurement using Nephelometer
2. COD analyzer
3. Dissolved Oxygen measurement using DO analyzer

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Physics Laboratory Manual –Dr.K.Tamilarasan and Dr.K.Prabu
2. Chemistry Laboratory Manual- Dr.P.N.Palanisamy, P.Manikandan, A.Geetha and K.Manjularani

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: describe **t**he basics of band gap of semiconductors, dispersive power of a prism, viscosity of liquids, interference of light, AC frequency and hysteresis of ferromagnetic materials.

CO2: operate the instruments like post office box, air wedge arrangement, Melde's string apparatus and hysteresis arrangement, and to measure the related parameters

CO3: estimate the amount of DO and chloride in a given water sample

CO4: determine the amount of chromium, ferrous ion and copper in waste water

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MEL11 BASICS OF CIVIL AND MECHANICAL ENGINEERING LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

1. To prepare a square or rectangular shaped two identical MS plates by cutting and filing operations
2. To prepare a square/rectangular/circular/trapezoidal/Vshaped projection and its counterpart formating from the given square or rectangular MS plates.
3. To carryout drilling, tapping and assembly on the given MS plates.
4. To carryout thread forming on a GI and PVC pipes and cut to the required length.
5. To use various pipe fitting accessories and prepare water leak proof water line from overhead tank.
6. To prepare a T/L/Lap joint from the given wooden work pieces.
7. To prepare a plywood box/tray to the given dimensions.
8. To prepare a leak proof sheet metal tray/box/funnel to the given dimensions.
9. Cutting of MS plates by gas cutting method and arc weld joining by Lap/Butt/T joint method
10. Preparing a simple PVC window/door frame assembly.
11. Preparing a simple memento or similar articles using wood/sheet metal
12. Preparing innovative articles involving waste metals.

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Introduction to basic manufacturing processes and workshop technology by Rajender Singh, New Age International (P) Limited, 2006.
2. Elements of Workshop Technology by S.K.Hajra Choudhury, Media Promoters, 2009.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: demonstrate knowledge on safety and adhere to safety features

CO2: mark the given dimensions accurately and execute cutting and joining operations

CO3: select methods and tools and execute the given experiments

CO4: finish the job to the requirements and quantify the accuracy

CO5: plan and complete simple and innovative articles

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT31 MATHEMATICS III

(Common to all Engineering and Technology Branches)

3 1 0 4

UNIT – I **9**

Fourier Series: Dirichlet's conditions – General Fourier series – Change of interval - Odd and even functions – Half range Sine series – Half range Cosine series – Complex form of Fourier series – Harmonic analysis.

UNIT – II **9**

Partial Differential Equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Homogeneous Linear partial differential equations of higher order with constant coefficients.

UNIT – III **9**

Applications of Partial Differential Equations: Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded).

UNIT – IV **9**

Fourier Transform: Fourier Integral theorem (without proof) – Fourier transform pair – Properties – Transforms of simple functions – Fourier Sine and Cosine transforms – Convolution theorem and Parseval's identity (Statement and applications only).

UNIT – V **9**

Z - Transform: Definition – Elementary properties – Z-transform of some basic functions – Inverse Z – transform – Partial Fraction Method – Residue method – Convolution theorem – Solution of difference equations.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi.
2. Veerarajan T., "Engineering Mathematics, (for first year)", Reprint Edition 2013, Tata McGraw-Hill, New Delhi.

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, New Delhi, 2011.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House, New Delhi, Reprint 2014.
3. Bali N.P. and Manish Goyal, "Text Book of Engineering Mathematics", 8th Edition, Laxmi Publications, New Delhi, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2011.
5. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010.
6. http://nptel.ac.in/courses/111103021/
7. http://nptelvideos.com/video.php?id=119

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: expand a function in terms of Fourier series and apply it for solving engineering problems

CO2: model and solve higher order partial differential equations

CO3: apply the methods of solving PDE in practical problems

CO4: gain knowledge on Fourier transforms

CO5: handle problems in Z –transforms and apply it to solve difference equations

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CST35 OBJECT ORIENTED PROGRAMMING
(Common to Mechanical, EEE, EIE & ECE branches)

3 0 0 3

Pre-requisites: Problem solving and programming

UNIT-I **9**

Principles of Object Oriented Programming: Object Oriented Programming Paradigm - Basic concepts and benefits of OOP - Object Oriented Languages - Applications of OOP - Structure of C++ - Tokens - Expressions and Control Structures - Operators in C++. Function Prototyping - Call by Reference - Return by Reference - Inline Functions – Default and Const Arguments - Function Overloading.

UNIT-II **9**

Classes and Objects: Specifying a Class -Member Functions - Nesting of Member Functions - Private Member Functions - Memory Allocation for Objects - Static Data Members - Static Member Functions - Array of Objects - Objects as Function Arguments - Friendly Functions - Returning Objects - Const Member Functions - Pointers to Members.

UNIT-III **9**

Constructors and Destructors: Constructors - Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initialization of Objects - Copy and Dynamic Constructors – Destructors.

Overloading: Defining Operator Overloading - Overloading Unary and Binary Operators – Overloading Binary Operators using Friend Functions

UNIT-IV **9**

Inheritance: Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance - Multiple Inheritance – Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes – Abstract Classes.

Pointers, Virtual functions and Polymorphism: Pointers to Objects - this pointer - Pointers to Derived Classes - Virtual Functions - Pure Virtual Functions.

UNIT-V **9**

Managing Console I/O Operations: Introduction – C++ Streams – C++ Stream Classes – Unformatted I/O Operations- Formatted Console I/O Operations- Managing Output with Manipulators.

Working with files: Introduction- Classes for File Stream Operations- Opening and Closing a File- Detecting end-of-file - File Modes- File Pointers and Manipulations- Sequential File- Random Access File- Command line Arguments.

TOTAL:45

TEXT BOOKS:

1. Balagurusamy- E- “Object Oriented Programming with C++”- Sixth Edition- Tata McGraw-Hill- New Delhi- 2013.

REFERENCE BOOKS:

1. Hubbard- John. R.- “Schaum’s Outline Programming with C++”- Tata McGraw-Hill- New Delhi- 2003.
2. Venugopal.K.R. Raj Buyya- “Mastering C++ ”- Tata Mgraw Hill- Oxford- 2009.
3. https://www.youtube.com/watch?v=LZFoktwiars&list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: use the C++ object oriented programming language and associated class libraries to develop object oriented programs
CO2: use constructor and destructor functions to initialize and destroy class objects
CO3: apply operator overloading to overload operators for user defined types
CO4: identify the differences between private, public and protected members of a class and use inheritance and virtual functions to build class hierarchies
CO5: develop simple application using files

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT31 DIGITAL ELECTRONICS

3 1 0 4

UNIT-I **9**

Number System: Binary number system- Complements-Signed binary numbers- Binary arithmetic. Binary codes: Weighted and non-weighted codes: BCD – 2421 - Gray code – ASCII.

Logic Gates: Basic logic gates - Implementations of logic functions using basic gates and universal gates Comparison of TTL and CMOS characteristics.

UNIT-II **9**

Minimization Techniques: Boolean postulates and laws – De-Morgan's theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map minimization- Quine Mc Cluskey method of minimization.

UNIT-III **9**

Combinational Circuits: Design procedure – Half adder and subtractor – Full adder and subtractor – Parallel binary adder and subtractor – Carry look ahead adder – BCD adder - Multiplexer/ Demultiplexer – Decoder - Encoder – Parity checker & generator – Code converters - Magnitude comparator.

UNIT-IV **9**

Sequential Circuits: Introduction, Flip flops –SR, JK, D and T –Level and Edge triggering - Realization of one flip flop using other flip flops- Design and analysis of synchronous sequential circuits: Characteristic and excitation tables and equations – State diagram, State table, State minimization and State assignment - Design of synchronous counters, ring counters and sequence detector – Registers: Shift registers- Universal shift register

UNIT-V **9**

Asynchronous Sequential Circuits: Analysis of asynchronous sequential circuits – Primitive state table / flow table – Minimization of primitive state table –State assignment – Excitation table - Cycles – Races –Hazards: Static –Dynamic –Essential –Hazards elimination.

Implementation of combinational logic circuits using PLDs: PROM, PLA and PAL.

Lecture:45,Tutorial:15, TOTAL:60

TEXT BOOKS:

1. Morris Mano .M, "Digital Design", 4th Edition, Pearson Education (Singapore) Pvt. Ltd., New Delhi.2008, ISBN : 9788131794654

REFERENCE BOOKS:

1. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006, ISBN : 9788131500583
2. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006. ISBN: 0070601755
3. Anand Kumar A., "Fundamental of Digital Circuits", Prentice Hall of India Pvt. Ltd., 3rd Edition, 2013, ISBN: 9788120336797
4. Arivazhagan S Salivahanan, " Digital Circuits And Design" Vikas Publishing House Pvt Ltd, 3rd Edition, 2009, ISBN: 9788125920632
5. http://www.asic-world.com/digital/tutorial.html
6. http://nptel.ac.in/courses/117106086/1

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CO1: simplify boolean expressions

CO2: design and implement combinational and sequential circuits

CO3: design and implement synchronous and asynchronous sequential circuits

CO4: implement Boolean functions using PLDs

CO5: design various circuits for real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT32 - SOLID STATE DEVICES

3 0 0 3

UNIT-I **9**

Semiconductor Theory: Review of intrinsic and extrinsic semiconductors – Conductivity and mobility – Carrier concentration in intrinsic semiconductor – Mass Action Law - Fermi level – Charge densities in semiconductor -Drift and diffusion current

UNIT-II **9**

PN Junction Diode : Construction of PN junction diodes – VI characteristics – Quantitative theory of PN diode – Transition and diffusion capacitances – Applications: Clipping and clamping circuits, Voltage multipliers - Zener diode – Characteristics of Zener diode

UNIT-III **9**

BJT: Construction and principle of operation - I/O characteristics of BJT in CE, CB and CC configurations.

FET & MOSFET : JFET: Construction – Characteristics - MOSFET : Construction - Depletion and enhancement mode – Characteristics of MOSFET

UNIT-IV **9**

Special Diodes : UJT -Tunnel diode –PIN diode – IGBT - SCR – TRIAC – DIAC – Photodiodes - LED, LCD - Photo transistors - Photo voltaic cell - Photo conductive cell

UNIT-V **9**

Rectifiers and Power Supplies: Full-wave: Centre tapped and bridge rectifiers with resistive load - Analysis for V_{dc} and ripple voltage with C, C-L, L-C and C-L-C filters. Zener diode regulator – Transistor voltage regulators: Series and shunt regulators – Line regulation - Output resistance - Temperature coefficient- Protection circuits - Switched mode power supplyImplementation of combinational logic circuits using PLDs: PROM, PLA and PAL.

TOTAL:45

TEXT BOOKS:

1. Salivahanan .S and Sureshkumar .N, “Electronic Devices & Circuits”, 3rd Edition, Tata McGraw- Hill, New Delhi, 2011, ISBN : 9781259006418.

REFERENCE BOOKS:

1. Jacob Millman, Christos C. Halkias “Electronic Devices and Circuits”, 3rd Edition, McGraw Hill Education (India) Private Limited, 2010, ISBN : 9780070700215.
2. Allen Mottershead, “Electronic Devices and Circuits- An Introduction”, 1st Edition, PHI, New Delhi, 1990, ISBN : 9788120301245.
3. https://www.youtube.com/watch?v=Kp-jS6NHsB8&list=PLF178600D851B098F
4. https://www.youtube.com/watch?v=oqOG6XErAl8

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: apply the concepts of semiconductor theory
CO2: comprehend the construction and characteristics of various electronic devices
CO3: understand various special diodes
CO4: design and analyze various power supply circuits
CO5: design simple application circuits using various electronic circuits

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET31 - CIRCUITS AND NETWORKS

3 1 0 4

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT-I **9**

Introduction to Single Phase and Three Phase Circuits: Voltage, Current, Power and Powerfactor. Dependent and Independent Sources-Source Transformation. **Three phase circuits**: Review of Star and Delta Systems: Line, Phase Quantities- Three Phase Power - Star Delta Transformation. Three Phase Balanced and Unbalanced Circuit- Three Wire and Four Wire Systems.

UNIT-II **9**

Circuit Analysis (DC and AC): Mesh Analysis and Nodal Analysis-Super Position Theorem-Thevenin's Theorem-Norton's Theorem- Maximum Power Transfer Theorem

UNIT-III **9**

DC Response Analysis: Steady State Analysis of R-L and R-C circuits, Transient Analysis of RL RC and RLC circuits. **Resonance Circuits:** Resonance Frequency, Current and Voltage Variations, Bandwidth, Q factor for Series and Parallel Resonance Circuits.

UNIT-IV **9**

Network Topology: Introduction - Tree and Co-tree - Twigs and Links - Incidence Matrix (A) - Properties of Incidence Matrix A- Link Currents - Cut-set and Tree Branch voltages – Tie-set Matrix.

UNIT-V **9**

Coupled Circuits: Mutual inductance -Dot Convention -Coefficient of Coupling – Analysis of Simple Coupled Circuits. **Two-Port networks:** Open Circuit Impedance (Z) Parameter - Short Circuit Admittance (Y) Parameter- Transmission (ABCD) Parameters - T and Π Representation.

Lecture:45,Tutorial:15, TOTAL:60

TEXT BOOKS:

1. Sudhakar A and Shyammohan S Palli, "Circuits and Networks Analysis and Synthesis", 4th Edition Tata McGraw-Hill, New Delhi, 2010.
2. Chakrabarti A., "Circuit Theory: Analysis and Synthesis", 6th Edition, Dhanpath Rai & Sons, New Delhi, Re-print-2012.

REFERENCE BOOKS:

1. Domkundwar and Arora, "Circuit Theory:Analysis and Synthesis", 6th Edition, Dhanpat Rai & Co, 2014.
2. Edminister Joseph A. and Nahvi Mahmood., "Schaum's Outline of Electrical Circuits", 6th Edition, Tata McGraw-Hill, New Delhi, 2013.
3. Gupta B R, "Network Analysis and Synthesis", 3rd Edition, S.Chand, 2013.

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: explain the basics of DC and AC circuits

CO2: apply various theorems for the analysis of DC and AC circuits

CO3: analyze the basics of DC transient response and resonating circuits

CO4: elaborate the concepts of different network topologies

CO5: interpret the concepts of two port networks and coupled circuits

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL31 - DIGITAL ELECTRONICS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Truth table verification of logic gates
2. Verification of Boolean theorems using digital logic gates.
3. Design and implementation of combinational circuits using basic gates
4. Design and implementation of combinational circuits using universal gates.
5. Design and implementation of code converters.
6. Design and implementation of 4 bit binary adder/subtractor using MSI devices.
7. Design and implementation of parity generator/checker using basic gates and MSI devices
8. Design and implementation of magnitude comparator using basic gates and MSI devices
9. Design and implementation of multiplexers and demultiplexers using basic gates and MSI devices
10. Design of BCD to seven-segment display using 7447 IC
11. Design and implementation of decoders and encoders
12. Truth table verification of flip flops.
13. Design and implementation of shift registers in SISO,SIPO, PISO, PIPO modes using suitable ICs.
14. Design and implementation of synchronous counters and asynchronous counters

TOTAL : 45

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CO1: verify the function of logic gates and flipflops

CO2: design, construct and test combinational and sequential circuits

CO3: implement digital circuits for real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL32 - SOLID STATE DEVICES AND CIRCUIT THEORY LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode and Zener diode
2. Characteristics of BJT (common emitter configuration) and determination of h parameters
3. Characteristics of JFET and MOSFET
4. Characteristics of SCR and UJT
5. Characteristics of TRIAC
6. Verification of Ohm's Law and Kirchoff's Laws.
7. Verification of Thevenin's and Norton's Theorem.
8. Verification of Superposition Theorem, Maximum Power Transfer Theorem
9. Simulation of Transient Response of RL and RC circuits using PSPICE
10. Simulation of Experiments 1 - 4 using PSPICE

REFERENCES/MANUALS/SOFTWARE: **TOTAL : 45**

https://www.vidyarthiplus.com/vp/thread-17349.html#.WY1091FLfIU

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: interpret the characteristics of various electronic devices

CO2: analyze electric circuits using various theorems

CO3: perform simulation using PSPICE

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CSL34 - OBJECT ORIENTED PROGRAMMING LABORATORY

(Common to EEE, EIE & ECE branches**)**

0 0 3 1

Pre requisites : Object Oriented Programming

LIST OF EXPERIMENTS

1. Develop C++ Functions with default arguments.
2. Implement Call by Value- Call by Reference and Call by Address.
3. Develop a C++ program to demonstrate the use of Function Overloading.
4. Design C++ classes with data members and member functions.
5. Develop a C++ program to demonstrate the use of Friend function.
6. Implement Matrix class with dynamic memory allocation and necessary methods.
7. Develop a C++ program using Array of objects.
8. Design Classes with Constructors and destructor.
9. Overload Unary and Binary Operators.
10. Implement Multiple and Multilevel Inheritance.
11. Implement Virtual functions.
12. Develop a program to manipulate Text file.

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

- Linux - Operating System
- C ++ - Compiler

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: declare member functions inside and outside the class definition
CO2: demonstrate the use of friend function, constructor and destructor
CO3: design a simple C++ program with function and operator overloading
CO4: build class hierarchies with virtual functions and inheritance
CO5: develop simple applications using files

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT44 PROBABILITY THEORY AND RANDOM PROCESS

3 1 0 4

UNIT – I **9**

Random Variables: Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating functions – Functions of a random variable.

UNIT – II **9**

Standard Probability Distributions: Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous Distributions**:** Uniform distribution – Exponential distribution - Gamma distribution – Normal distribution.

UNIT – III **9**

Two Dimensional Random Variables: Joint probability distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables.

UNIT – IV **9**

Random processes: Classification – Stationary process – Poisson process – Markov chains – Transition probabilities – Limiting distributions.

UNIT – V **9**

Spectral Densities: Auto Correlation- Cross Correlation – Properties – Power spectral density – Cross spectral density – Properties – Wiener- Khintchine relation – Relationship between cross power spectrum and cross correlation function.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Veerarajan, T, "Probability, Statistics and Random Process", 2nd Edition, Tata McGraw-Hill, New Delhi, 2012.
2. Kandasamy, P, Thilagavathy, K and Gunavathy, K, "Probability, Random Variables and Random Processes", S. Chand & Co, New Delhi, 2013.

REFERENCE BOOKS

1. Ross, S, "A First Course In Probability", 5th Edition, Pearson Education, New Delhi, 2002.
2. Peebles, P.Z, "Probability Random Variables and Random Signal Principles", 4th Edition, Tata McGraw-Hill, New Delhi, 2002.
3. Stark, Henry and Woods, John W, "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, New Delhi, 2002.
4. Roy.D.Yates and David.J.Goodman, "Probability and Stochastic Processes - A friendly Introduction for Electrical and Computer Engineers", John Wiley & Sons, 2005.
5. http://www.nptel.ac.in/courses/117103067
6. http://www.nptel.ac.in/courses/117105085

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyse and interpret practical situations and fit a suitable probability distribution
CO2: apply effectively the concepts of two dimensional random variables
CO3: correlate the data which appear in engineering problems
CO4: handle communication problems which use random process as a base
CO5: apply concept and properties of Spectral Density Function and Cross Correlation function

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT41 - ANALOG ELECTRONICS

3 1 0 4

UNIT – I **9**

Biasing of BJT: Need for biasing - Load line and quiescent point - Variation of quiescent point - Stability factors - Different types of biasing circuits - Method of stabilizing the Q point to the extent possible - Bias compensation techniques
Midband Analysis of BJT: CE, CB and CC amplifiers - Midband analysis of various types of single stage amplifiers using small-signal equivalent circuit- Miller's theorem- Methods of increasing input impedance using Darlington connection-Bootstrap emitter follower-Multistage amplifiers (CE-CB only).

UNIT – II **9**

Frequency response of amplifiers: Low frequency analysis of amplifiers to obtain lower cutoff frequency -Hybrid – Pi equivalent circuit of BJTs - High frequency analysis of BJT amplifiers to obtain upper cutoff frequency- General expression for frequency response of multistage amplifiers - Calculation of overall upper and lower cutoff frequencies of multistage amplifiers - Amplifier rise time, sag and their relation to cutoff frequencies.

UNIT – III **9**

Feedback Amplifiers: Feedback amplifiers - Block diagram - Loop gain - Gain with feedback – Effect of negative feedback - Feedback topologies and the type of gain stabilized by each type of feedback - Input and output resistances with feedback - Method of identifying feedback topology - Analysis of feedback amplifiers.

UNIT – IV **9**

Tuned Amplifiers: Coil losses- Unloaded and loaded Q of tank circuits-Analysis of single tuned and double tuned amplifiers-Instability of tuned amplifiers- Stabilization techniques-Narrow band neutralization using coil- Hazeltine neutralization- Class C tuned amplifiers and their applications- Efficiency of Class C tuned amplifier.

UNIT – V **9**

Large Signal Amplifiers: Classification of amplifiers (Class A, B, AB, C and D) - Class A: RC coupled and transformer coupled power amplifiers - Class B: complementary-symmetry, push-pull power amplifiers - Crossover distortion and methods of elimination - Efficiency of class A and class B amplifiers.
Oscillators: Condition for oscillation - LC oscillators: Hartely and Colpitts oscillator, Quartz crystal: Construction - Electrical equivalent circuit of crystal - Crystal oscillator circuit- Miller and Pierce oscillators.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK

1. Mithal G K, "Electronic Devices and Circuits", 23rd Edition, Khanna publishers, New Delhi, 2012, ISBN : 9788174091777.

REFERENCE BOOKS:

1 Millman, J and Taub, H., "Pulse Digital And Switching Waveform", 2nd Edition, McGraw-Hill, New York, 2007, ISBN : 9780070634633.
2 Bell, David A., "Solid State Pulse Circuits", 4th Edition, Prentice Hall of India, New Delhi, 1992, ISBN : 97801382977893.
3 Allen Mottershead, "Electronic Devices and Circuits- An Introduction", 1st Edition, PHI, New Delhi, 1990, ISBN : 9788120301245.
4 http://nptel.ac.in/courses/117103063/
5 http://nptel.ac.in/courses/122106025/

COURSE OUTCOMES:

On successful completion of the course, the student will be able to
CO1: design various biasing circuits of BJT
CO2: determine various parameters of transistor amplifier circuits using small signal analysis
CO3: analyze the frequency response of amplifiers using hybrid π model
CO4: analyze the performance of large signal, feedback and tuned amplifiers
CO5: design oscillators for various frequencies for practical applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT42 - SIGNALS AND SYSTEMS

3 1 0 4

UNIT - I **9**

Classification of Signals and Systems: Signals : Types of continuous and discrete time signals - Classification of CT and DT signals – Basic operations on signals. **Systems**: CT and DT systems- Classification and properties of systems.

UNIT - II **9**

Analysis of CT and DT Signals: Differential and difference equations-- Representation of CT and DT signals- Impulse response-Step response-Convolution integral and convolution sum - Graphical procedure for convolution - Properties- Interconnection of systems.

UNIT–III **9**

Frequency Domain Analysis (Fourier Series And Fourier Transform) : Complex exponential Fourier series analysis - Properties- Spectrum of signals.

Fourier Transform –CTFT and DTFT - Properties- Response of LTI CT and DT systems. Inverse Fourier Transform-Convolution using FT.

UNIT – IV **9**

Frequency Domain Analysis (Laplace and Z Transform) : Laplace Transform of CT signals- Properties-Analysis in S-domain-Inverse Laplace Transform – Response of LTI-CT systems.

Z- Transform - Inverse Z Transform –Properties of Z-transform – Response of LTI-DT systems.

UNIT – V **9**

Sampling and Realization of Systems: Realization of DT systems: Direct form I - Direct form II - Cascade-Parallel - Transpose structure. Sampling: Theorem - Aliasing - Reconstruction - Sampling of band pass signals.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Nagoor Kani. A, “Signals and Systems”, Tata McGraw-Hill Education, New Delhi, 2010, ISBN:1259081729

REFERENCE BOOKS

1. Roberts, M.J, “Signals And Systems Analysis Using Transform Method and Matlab”, 2nd Edition, Tata McGraw-Hill, New Delhi, ,2011, ISBN :9780073380681
2. Oppenheim, Alanv., Willsky, Alan S, and Hamid Nawab S, “Signals & Systems”, 2nd Edition, Pearson Education, New Delhi, 2007, ISBN :9781292025902
3. Haykin, Simon and Barry Van Veen, “Signals and Systems”, John Wiley & Sons, 2nd Edition, NewYork, 2007, ISBN: 9788126512652
4. www.nptel.ac.in/courses/117104074

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: represent and analyze the continuous time signals and systems using mathematical models
CO2: represent and analyze the discrete time signals and systems using mathematical models
CO3: analyze various parameters of signals in time domain
CO4: analyze various parameters of signals in frequency domain
CO5: identify, formulate and realize linear time invariant systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT43 - MICROPROCESSOR, MICROCONTROLLER AND INTERFACING

3 0 0 3

UNIT – I **9**

8086 Microprocessor : Register organization of 8086 – Architecture - Physical memory organization - I/O addressing capability - Addressing modes of 8086 - Instruction set of 8086: Data transfer instructions - String instructions- Logical instructions - Arithmetic instructions - Transfer and control instructions - Processor control instructions.

UNIT – II **9**

8086 Microprocessor Programming and Stack: Simple Assembly Language Programming - Introduction to stack - Interrupt and interrupt service routines-Time delays using counter.

UNIT – III **9**

89c51 Microcontroller: Introduction to RISC and CISC machines – 89c51 Microcontroller hardware block diagram - Data and program memory mapping - Register organization - I/O pins - Ports and circuits - Interfacing to external memory- Instruction sets - Addressing modes

UNIT – IV **9**

89c51 Programming: Assembly language programming -Timer and counter programming – Serial Data Communication using MAX232 converter – Interrupt programming.

UNIT – V **9**

89c51 Interfacing with Peripherals: LED - Seven segment display – Switch interfacing – LCD-ADC0809 with LM35 sensor - Stepper motor - Speed control of DC motor - Matrix keypad – **Case study:** Voice Operated Home Appliances for Physically challenged.

TOTAL : 45

TEXT BOOKS:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, Lyla B Das, "Microprocessors and Microcontrollers", Pearson Education Asia, New Delhi, 2013, ISBN: 9788131789568

REFERENCE BOOKS:

1. Ray K., and Bhurchandi K. M., "Advanced Microprocessors and Peripherals: Architecture, Programming and Interface", 3rd Edition, Tata McGraw Hill, New Delhi, 2012, ISBN: 9780070140622
2. Patel, "The 8051 Microcontroller Based Embedded Systems", 1st Edition, McGraw Hill Education, New Delhi, 2014, ISBN : 9789332901254
3. http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers /New_index1.html
4. http://nptel.ac.in/courses/106108100/

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: comprehend the concepts of 16-bit microprocessor
CO2: differentiate microprocessor and microcontroller
CO3: write assembly language programs for 8051 microcontroller
CO4: interface peripheral devices with microcontroller
CO5: design microcontroller based projects

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT44 - ELECTROMAGNETICS AND WAVEGUIDES

3 1 0 4

UNIT – I **9**

Electrostatics: Introduction to Coordinate system - Rectangular, cylindrical and spherical coordinate system - Coulomb's law - Electric field intensity - Electric field intensity of line charge, sheet charge - Electric flux density - Gauss law - Applications of Gauss law - Electric potential - Potential due to dipole - Poisson's and Laplace equation - Boundary conditions for electric field.

UNIT – II **9**

Magnetostatics : Biot-Savart Law – Applications - Ampere's circuital law – Applications - Magnetic vector potential - Magnetic flux and Magnetic flux density - Nature of magnetic materials - Boundary conditions for Magnetic field.

UNIT – III **9**

Maxwell's Equations and Electromagnetic Waves: Faraday's law - Displacement current - Maxwell's equation in point form and integral form for steady and time varying fields - Poynting vector and Poynting theorem -Wave Equation - Uniform Plane Waves - Reflection and Refraction - Wave Polarization.

UNIT – IV **9**

Guided Waves: Waves between parallel planes of perfect conductors - Field Equations – TE waves - TM waves – Characteristics of TE and TM waves – TEM Waves – Velocities of propagation – Attenuation of TE and TM waves in parallel plane guides – Wave impedances.

UNIT – V **9**

Rectangular Waveguides and Resonators: Rectangular waveguides: Field equations – TM waves – TE waves – Characteristic of TE and TM Waves : Cutoff wavelength and phase velocity – Impossibility of TEM waves– Dominant mode– Wave impedances – Characteristic impedance – Excitation of mode – Microwave cavity resonator - Rectangular cavity resonators - Q factor of a cavity resonator for TE_{101} mode.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOKS:

1. William H.Hayt,Jr and John A.Buck., "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill Publishing Ltd, 2011, ISBN : 9780070612235, 0070612234
2. Nannapaneni Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson Education, First Impression 2009, ISBN : 9788131724156

REFERENCE BOOKS:

1. Raju, G.S.N, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, First Indian print, 2006, ISBN 10: 8131701719, 9788131701713
2. Jordan . E. C & Balmain K. G, "Electromagnetic Waves and Radiating Systems", 4th Edition, Pearson Education/PHI 2006, ISBN : 8129702983
3. Ramo, Whinnery and Van Duzer, "Fields and Waves in Communications Electronics", 3rd Edition, John Wiley & Sons , 2003, ISBN : 8129702606
4. Matthew N.O.Sadiku: "Elements of Engineering Electromagnetics", 4th Edition, Oxford University Press, 2007, ISBN : 9780195315196
5. www.nptel.ac.in/courses/108106073

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: comprehend the effect of electric and magnetic fields on materials
CO2: analyze the relation between the fields under time varying situations
CO3: interpret the principles of propagation of uniform plane waves
CO4: examine the characteristics and performance parameters of guided waves and waveguides
CO5: analyze and utilize suitable waveguides for real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET44-ELECTRICAL MACHINES
(Common to ECE, EIE and MTS)

3 0 0 3

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I D.C. MACHINES **9**

Construction of D.C. Machines - Principle and Theory of Operation of D.C. Generator - EMF Equation- Characteristics of D.C. Generators - Principle and Operation of D.C. Motor – Back E.M.F - Torque Equation - Types of D.C. Motors and their Characteristics – Swinburne's Test -Starters - Speed Control of D.C. Motors - Applications.

UNIT – II TRANSFORMER **9**

Principle - Construction Details of Shell and Core Type Transformers - EMF Equation - Regulation and Efficiency of a Transformer - OC and SC Test of Transformers –Load Test - Equivalent Circuit – All day Efficiency - Auto Transformer - Introduction to Three Phase Transformer.

UNIT – III THREE PHASE INDUCTION MACHINE **9**

Three Phase Induction Motor: Construction and Principle of Operation - Classification of Induction Motor –Torque Equation-Torque-Slip Characteristics-Starters: Need and its Types –Star -Delta Starter – Speed Control-Applications-Principle of Operation of Induction Generator.

UNIT – IV SYNCHRONOUS MACHINE **9**

Synchronous Machine: Construction and Principle of Operation as Alternator - EMF Equation - Voltage Regulation by EMF Method. **Synchronous Motor**: Principle of Operation - Starting Methods - V and Inverted V Curves - Synchronous Condenser - Applications.

UNIT – V SINGLE PHASE INDUCTION MOTOR AND SPECIAL MACHINES **9**

Single Phase Induction Motor: Principle of Operation - Double Field Revolving Theory - Types: Split Phase Type, Capacitor Type and Shaded Pole Type – Applications. **Special Machines**: Construction, Principle of Operation and Applications: Stepper Motor – Universal Motor-Servo Motor-Brushless DC Motor.

TOTAL : 45

TEXT BOOKS:

1. Theraja.B.L.,"A Textbook of Electrical Technology",Volume II,S.Chand&Co.Ltd,2012.
2. Rajput R. K.," Electrical Machines", Laxmi Publications, New Delhi, Fifth Edition, 2008.

REFERENCE BOOKS:

1. Gupta J B, "Theory & Performance of Electrical Machines*"* S K Kataria & Sons-New Delhi, 2013
2. Fitzgerald A.E, Kingsley C., and Stephen Umans "Electric Machinery", Tata McGraw - Hill, 2010
3. Bhattacharya, S.K., "Electrical Machines", Second Edition, Tata McGraw Hill, New Delhi 2014
4. Cotton, H., "Advanced Electrical Technology", Reem Publications, 2011.
5. Nagrath, I.J., and Kothari, D.P., "Electrical Machines", Tata McGraw - Hill, 2010.
6. http://nptel.ac.in/courses/108105017/

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: develop knowledge on construction and working of DC and AC machines

CO2: examine the construction and working of Transformers

CO3: determine the performance characteristics of the electrical machine

CO4: select electrical machines for various applications

CO5: explain the various tests, starting and speed control techniques

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL41 – ANALOG ELECTRONICS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Voltage Divider Bias circuit – BJT
2. Frequency response of Darlington amplifier circuit
3. Frequency response of multistage amplifiers
4. Frequency response of current series feedback amplifier
5. Frequency response of Class C tuned amplifier
6. Class - B Complementary symmetry Power amplifier- with and without crossover distortion
7. Hartley Oscillator
8. Colpitts oscillator
9. Simulation of the following experiments using PSPICE
    - Voltage Divider Bias circuit – BJT
    - Frequency response of Darlington Pair
    - Frequency response of voltage series feedback amplifier
10. Simulation of the following oscillators using PSPICE
    - Hartley oscillator
    - Colpitts oscillator

TOTAL: 45

REFERENCES/MANUALS/SOFTWARE:

http://nptel.ac.in/courses/122106025/14

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: design biasing circuits and determine the frequency response of transistor amplifiers

CO2: design large signal amplifiers

CO3: design oscillators for various frequencies

CO4: perform simulation of amplifiers and oscillators using PSPICE for real time application

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL42 - MICROPROCESSOR, MICROCONTROLLER AND INTERFACING LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Arithmetic operations using 8086.
2. Sorting, searching and string manipulation using 8086.
3. Hex./ASCII/BCD code conversion using 8086 microprocessor
4. Matrix multiplication using 8086 microprocessor
5. Addition / Subtraction / Multiplication / Division using 89c51 microcontroller
6. Interfacing of switch and LED with 89c51 microcontroller
7. Interfacing of ADC with 89c51 microcontroller.
8. Interfacing of DAC with 89c51 microcontroller. .
9. Stepper Motor/DC Motor interfacing with 89c51 microcontroller
10. UART /LCD interfacing with 89c51 microcontroller

TOTAL: 45

REFERENCES/MANUALS/SOFTWARE:

http://nptel.ac.in/courses/106108100/2

http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/TOC.htm

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CO1: write program for various applications using 16 bit processor
CO2: write assembly language programs for 8051 microcontroller
CO3: interface various peripherals with 8 bit microcontroller
CO4: design microcontroller based projects

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EGL41-COMMUNICATION SKILLS LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS

1. Listening skills :
   Listening activity using software package in the communication laboratory, listening to native speakers', developing oral communication by imitating the model dialogues. Listening for specific information – listening to improve pronunciation – Listening and typing – Filling the blanks – TV programmes and News.

Audio Visual Lab : Activity based learning

2. Activity based Reading Skills:
   Reading for getting information and understanding; scanning, skimming and identifying topic sentences – reading for gaining knowledge- Group activity
3. Activity based Writing Skills:
   Preparing a draft – using Word Editing features, editing and proof reading; Writing a short essay using the draft prepared -- Group activity
4. Speaking Skills:
   Verbal and Non-Verbal Communication; Introducing oneself - Describing a place, Expressing views and opinions; Giving a presentation on a Topic- eye contact, speaking audibly, clearly and with confidence; Group discussion.
   Conversations – Face-to-Face conversation – Simulated Telephonic Conversation
5. **Career Lab**
   Interview Skills: Introducing oneself – Answering other FAQ's. Presentation Skills: Elements and structure of effective presentation – Presentation Tools – Voice modulation – Body language –Video samples. Group Discussion: Structure of Group Discussion – Strategies in group discussion - Team work – Video Samples. Soft Skills: Fundamentals of Soft Skills – Work Place Culture and Inter-Personal Relationships.

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Orell Digital Language Lab Software

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: communicate efficiently in real life and career related situations

CO2: demonstrate good Presentation skills and team skills

CO3: familiarize in using modern communication software packages to enhance their soft skills

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET53 CONTROL SYSTEMS

(Common to EEE, EIE, ECE & Mechatronics branches)

3 1 0 4

UNIT – I **9**

Mathematical Modeling: History of control systems - Classification of control Systems - Basic Structure: Open Loop and closed loop Systems - Transfer Function and state space models (Physical and phase variable model): Electrical Systems, Mechanical Systems, Electromechanical systems: Gear Trains and DC Motor - Electrical analogy of Mechanical Systems - Reduction of multiple subsystems: Block diagram reduction, Signal flow graphs.

UNIT – II **9**

Time Response of Systems: Poles, Zeros and System Response -Type and order of System - Significance of test signals - First order system - Second order system: Classification and nature of response - Step response of second order underdamped System - Time domain specifications - Steady state error and error constant - Generalized error series.

UNIT – III **9**

Stability Analysis: Concepts of Stability - Pole location and stability - Routh Hurwitz Criterion - Root locus Technique - Effect of addition of poles and zeros on stability.

UNIT – IV **9**

Frequency Response of Systems: Concept of frequency Response - Frequency response analysis: Bode plot and polar plot - Stability analysis in frequency domain: Nyquist stability criterion - Frequency domain specifications.

UNIT – V **9**

Compensators: Need for compensator - Types of compensation - Cascade compensators: Types, Transfer function and Physical realization - Effect of ideal compensation on time response: P, PI, PD and PID - Design of lag and lead compensator via root locus.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1. Nagrath I.J. and Gopal M., "Control Systems Engineering", 5th Edition, New Age International Publishers, New Delhi, 2011.
2. Norman S. Nise, "Control Systems Engineering", 6thEdition, Wiley Publishers, 2011

REFERENCE BOOKS:

1. Nagrath I.J. and Gopal.M,"Control Systems Engineering ", 5thEdition, New Age International Publishers, New Delhi, 2008
2. Kuo,B.C, "Automatic Control Systems", 8thEdition, John Wiley and Sons, New York, 2003
3. Ogata K.,"Modern Control Engineering", 4thEdition, Pearson Education/ PHI Learning, New Delhi, 2007
4. www.nptel.ac.in/courses/108101037

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: identify various components of the control system
CO2: analyze various steady state errors for the continuous systems
CO3: estimate the time and frequency response of the systems
CO4: examine the stability of the systems
CO5: design the compensator and controllers for real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT51 DIGITAL SIGNAL PROCESSING
(Common to ECE & IT branches)

3 1 0 4

UNIT – I **9**

DFT and FFT: Review of DFT - Properties of DFT– FFT algorithms – Radix-2 FFT algorithms – Decimation in time – Decimation in frequency algorithms – Linear and circular convolution - Overlap add and save method.

UNIT – II **9**

FIR Filter Design: Amplitude and phase response of FIR filters - Windowing techniques – Rectangular -Hamming-Hanning- Blackmann windows –Kaiser window (Procedure only) - Frequency sampling technique.

UNIT –III **9**

IIR Filter Design: Analogue Butterworth and Chebyshev type-I filters-Frequency transformation in analog domain – Impulse invariance technique –Bilinear transformation – Pre warping – Frequency transformation in digital domain.

UNIT – IV **9**

Effects of Finite Word Length: Quantization noise – Derivation for quantization noise power –Truncation and rounding error – Input quantization error-Coefficient quantization error-Product quantization error – Limit cycle oscillations- Overflow error-Signal scaling.

UNIT – V **9**

DSP Processor and its Implementation: Introduction to programmable DSPs –TMS320C67xx – Architecture of C67X – C67X buses – Memory organization- CPU – ALU – Barrel shifter – Multiplier / adder unit –Addressing modes– Instruction set – Application programs.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS:

1. Proakis John G and Manolakis Dimtris G., "Digital Signal Processing: Principles, Algorithms and Application", 4th Edition, PHI Learning, New Delhi, 2007

REFERENCE BOOKS:

1. Venkataramani. B and Bhaskar M., "Digital Signal Processor Architecture, Programming and Application",2nd Edition, McGraw-Hill, 2002
2. Nagoorkani. A, "Digital Signal Processing",2nd Edition, McGraw Hill, 2012.
3. Poornachandra S, and Sasikala B, "Digital Signal Processing", 2nd Edition, McGraw-Hill, New Delhi, 2008
4. www.ti.com/lit/ug/spru733a/spru733a.pdf
5. http://www.cs.cmu.edu/afs/cs/academic/class/15745-s05/www/c6xref/tms320c6000.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: design digital filters for real time application
CO2: apply the concepts of finite word length effects in DSP processors
CO3: find the frequency components of a signal using efficient algorithms
CO4: write programs using DSP processors
CO5: implement DSP algorithms in DSP processors

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT52 LINEAR INTEGRATED CIRCUITS

(Common to ECE, EEE & EIE branches)

3 1 0 4

UNIT – I **9**

Introduction to Operational Amplifier: Basics of operational amplifier - Ideal and practical characteristics of Op-Amp – Block schematic of Operational amplifier - Differential amplifier – Transfer characteristics – Low frequency small signal analysis using 'h' parameters – Circuits for improving CMRR: Constant current sources, Widlar and Wilson current sources.

UNIT – II **9**

Characteristics of Operational Amplifiers: DC Characteristics: Input bias current- Input offset current- Input offset voltage - Thermal drift – AC characteristics: Frequency response- Stability and slew rate – Frequency compensation methods.

UNIT – III **9**

Applications of Operational Amplifier: Adder - Subtractor- Instrumentation amplifier – Differentiator – Integrator – V/I and I/V converter - Comparator- Signal generators: Astable and monostable multivibrator - Schmitt trigger- Sinewave generators: RC phase shift oscillator and Wien bridge oscillator- Triangular wave generator.

UNIT – IV **9**

Operational Amplifier in Signal Conditioning Circuits: Active Filter: I and II order low pass and high pass filters – Switched capacitor filter - Analog to digital Converter: Flash type, Integrating type and successive approximation type- Digital to analog converter: Weighted resistor type, R-2R ladder type and inverted R-2R ladder type.

UNIT – V **9**

Special ICs: Timer (IC 555): Functional block diagram - Astable and monostable operation – Applications. Voltage controlled oscillator (IC 566) – Phase locked loop (IC 565) - Functional block diagram, Application: AM,FM demodulators and Frequency synthesizers – Voltage regulator IC: Series op-amp regulator (78XX) – Switching regulator - Switching voltage regulator IC

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Roy Choudhry, D and Shail Jain, "Linear Integrated Circuits", 4th Edition, New Age International, New Delhi, 2010,Reprint 2014.

REFERENCE BOOKS:

1. Gaykwad, Ramakant A., "OP-AMP and Linear IC"s", 4th Edition, PHI Learning, New Delhi, 2009.
2. Salivahanan, S and Kanchana bhaaskaran, V, S, "Linear Integrated Circuits", 2nd Edition, McGraw Hill Education Private Limited, India, 2014.
3. Sergio Franco., "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, McGraw-Hill, New York, 2008.
4. Coughlin Robert and Driscoll F, "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, Pearson Education Asia, 2001.
5. https://guptaabhay.files.wordpress.com/2017/04/linear-integrated-circuit-2nd-edition-d-roy-choudhary.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: evaluate the characteristics and basic applications of operational amplifier.
CO2: design electronic circuits with operational amplifier
CO3: implement A/D and D/A converters for various applications
CO4: realize the applications of PLL and special function ICs
CO5: design power supply circuits with special function ICs

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT53 DATA COMMUNICATION AND INTERNETWORKING

3 0 0 3

UNIT – I **9**

Network Architecture: OSI model - TCP/IP model - Guided Media and Unguided Media - Circuit switching networks - Datagram Networks - Virtual circuit networks - Connecting devices - Back Bone networks

UNIT – II **9**

Interface Layer: Linear Block Codes - Cyclic Codes – Checksum - Stop and Wait - Go-Back-N - Selective Repeat – HDLC – PPP - Random Access - Controlled Access - IEEE 802.3 - Gigabit Ethernet - IEEE 802.11- WLAN

UNIT – III **9**

Internetwork Layer: IPV4 - IPV6 - Sub-netting - Address mapping ICMP – IGMP - Routing Protocols: DVR , LSR, BGP, OSPF and RIP.

UNIT – IV **9**

Transport Layer: Process-To-Process Delivery – UDP - TCP - Packet format – Services - Error and flow control - Congestion Control in TCP - Techniques to improve QoS- Token Bucket and Leaky Bucket - DCCP frame format and functionalities

UNIT – V **9**

Application: E-Mail - File Transfer Protocol (FTP) - VoIP and DNS

TOTAL: 45

TEXT BOOKS:

1. Forouzan, Behrouz A., "Data communication and Networking", 5th Edition, Tata Mc Graw Hill, New Delhi, 2013

REFERENCE BOOKS:

1. Tanenbaum, Andrew S and David Wetherall, "Computer Networks", 5th Edition, PHI Learning, New Delhi, 2010.
2. Kurose, James F. and Ross, Keith W., "Computer Networking: A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, New Delhi, 2012.
3. M Barry Dumas and Morris Schwartz, "Principles of Computer Networks and Communications", 1st Edition, PHI Learning, New Delhi, 2009.
4. M. S. Narayanan & Douglas E. Comer, " Computer Networks and Internets with Internet Applications ", 4th Edition, Pearson Education, New Delhi, 2008.
5. Network Fundamentals: https://www.youtube.com/watch?v=n2D1o-aM-2s
6. Network Fundamentals: https://www.youtube.com/watch?v=svkGASq8mNM

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend how data communication works in networks and Internet
CO2: recognize the different internetworking devices and their functions
CO3: analyze the services, roles and features of the various layers of data networks
CO4: design, calculate, and apply subnet masks and addresses to fulfil networking requirements
CO5: differentiate various types of network configurations, components and protocols and applying them to meet the changing and challenging networking needs

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT54 MICROCONTROLLER: ARCHITECTURE AND APPLICATIONS

3 0 0 3

UNIT – I **9**

Introduction to 8 - bit Microcontroller: Architecture of PIC 16F877- Register file structure – CPU Register –Status Register- Instruction sets-Addressing modes –Memory organization: Program memory-Data memory-Oscillator and reset circuits.

UNIT – II **9**

On-chip Peripherals: Timers- Compare, Capture and PWM Modules- Interrupts- Watch dog timer

UNIT – III **9**

PIC Programming: Simple assembly language programming –I/O port programming – Timer programming - Programming in C: Real time clock programming with I2C – ADC-USART.

UNIT – IV **9**

16 - Bit Microcontroller: Introduction to S12 and S12X Microcontroller – Interrupts - Clock Generation – Resets - Parallel ports - Timer functions - Serial peripheral interface (SPI)

UNIT – V **9**

Development Tools: Hardware and software development tools – Basics of embedded C programming - Codewarrior tools – Project IDE - Compiler - Assembler and debugger - JTAG and hardware debuggers – Code optimization.

TOTAL: 45

TEXT BOOKS:

1. PIC16f87x Datasheet - http://ww1.microchip.com/downloads/en/DeviceDoc/39582C.pdf
2. Huang Han-Way, "The HCS12/9S12: An Introduction to Hardware and Software Interfacing", 2nd Edition, Minnesota State University, Mankota, 2010.

REFERENCE BOOKS:

1. Peatman, John B., "Design with PIC Microcontrollers", 8th Impression, Pearson Education, New Delhi, 2009
2. Dongan Ibrahim, "Advanced PIC Microcontroller Projects in C", 1st Edition, Newnes Elsevier, 2008.
3. Cady Fredrick M., "Assembly and C Programming for the Freescale HCS12 Microcontroller", 2nd Edition, Oxford University Press, New York, 2008
4. Valvano Jonathan W., "Embedded Microcomputer Systems: Real Time Interfacing", 2nd Edition, Thomson Asia, Singapore, 2001.
5. https://electrosome.com/category/tutorials/pic-microcontroller/
6. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/Course_home3_16.htm

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend the organization of an 8-bit microcontroller
CO2: integrate internal modules for different applications
CO3: program on-chip peripherals for various applications using 8/16-bit microcontrollers
CO4: use the development tools for writing and optimizing embedded C programming
CO5: design microcontroller based projects for real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL51 LINEAR INTEGRATED CIRCUITS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

Design and implementation of

1. Linear Op-Amp circuits- Inverting and non-inverting amplifiers, Voltage follower, Differentiator and integrator.
2. Design of half-wave and full wave rectifiers using Op-Amps.
3. RC phase shift oscillator using Op-Amps.
4. Wien bridge oscillator using Op-Amps.
5. Active filters using Op-Amps-2nd order LPF, BPF.
6. Applications of comparator: Zero crossing detector and Window detector.
7. Monostable multivibrator using Op-Amps and IC 555.
8. Astable multivibrator using Op-Amps and IC 555.
9. Schmitt trigger circuit using IC 555
10. Design of R-2R ladder type DAC.
11. Voltage regulator using 78XX
12. Application of instrumentation amplifier using sensors

TOTAL: 45

REFERENCES/MANUALS/SOFTWARE:

http://nptel.ac.in/courses/117106030/
http://nptel.ac.in/courses/122106025/32

COURSE OUTCOMES:

On completion of the course the students will be able to:

CO1: design oscillator circuits
CO2: design filters and multivibrators
CO3: develop circuits for real time applications
CO4: design power supply circuits using ICs

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL52 DIGITAL SIGNAL PROCESSING LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

MATLAB Experiments

1. Generation of signals & basic operation of signals
2. Convolution using FFT and IFFT
3. Filter design and its analysis
4. Evaluation of time and frequency domain specifications of a second order system.

Basic Experiments using Simulink

5. Signal generation and basic operation on signals
6. Frequency spectrum of a signal
7. Filter design

MATLAB Toolbox based Experiments

8. Modulation and demodulation using communication Toolbox
9. Filter design using signal processing toolbox

USING TMS320C67xx DSP PROCESSOR

10. Generation of signals
11. Real time signal acquisition and processing
12. Implementation of simulink based experiments into DSP Processor
13. Study of Pro Audio Development Kit (PADK)

TOTAL: 45

REFERENCES / MANUALS/SOFTWARE:

- MATLAB
- Code Compose Studio
- http://eceweb1.rutgers.edu/~orfanidi/ece348/labs-2012.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: use engineering tools to analyze various parameters of a system
CO2: simulate the frequency domain components of a signal
CO3: design a filter and implement using DSP processor
CO4: relate simulated results with real time output

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL53 MICROCONTROLLER AND ITS APPLICATIONS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Device ON / OFF using PIC 16F877 microcontroller (Relay and LED).
2. Interfacing of 7-segment and switch with PIC 16F877 microcontroller.
3. Interfacing of LCD with PIC 16F877 microcontroller.
4. Keypad interfacing with PIC 16F877 microcontroller.
5. Timers interrupt programming in PIC16F877 microcontroller.
6. PWM based speed control of DC motor using PIC16F877 microcontroller.
7. Interfacing of Real Time Clock with PIC 16F877 microcontroller.
8. Analog sensor interfacing with PIC16F877 microcontroller.
9. Interfacing of switch and LED with S12X controller.
10. Serial communication interface using S12X controller

TOTAL: 45

REFERENCES / MANUALS/SOFTWARE:

- CCS Compiler
- Proteus Simulator
- Codewarrior IDE
- https://electrosome.com/category/tutorials/pic-microcontroller/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: write efficient embedded C programs for different applications
CO2: debug embedded hardware and software
CO3: interface different peripherals with microcontroller
CO4: design and develop microcontroller based embedded systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GET61 ECONOMICS AND MANAGEMENT FOR ENGINEERS

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Economics – Basics Concepts and Principles – Demand and Supply – Law of demand and Supply – Determinants – Market Equilibrium – Circular Flow of Economic activities and Income.

UNIT – II **9**

National Income and its measurement techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle. Forms of business – Management Functions: Planning, Organizing, Staffing, Leading and Controlling - Managerial Skills - Levels of Management - Roles of manager.

UNIT – III **9**

Marketing - Core Concepts of Marketing - Four P's of Marketing - New product development - Product Life Cycle - Pricing Strategies and Decisions.

UNIT – IV **9**

Operations Management - Resources - Types of Production system - Site selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination.

UNIT – V **9**

Accounting Principles – Financial Statements and its uses – Depreciation: Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting: Meaning – Types of decisions – Methods (Theory).

TOTAL : 45

TEXT BOOK:

1. "Economics and Management for Engineers", Complied by Department of Management Studies, Kongu Engineering College, McGraw-Hill Education, India, 2013.

REFERENCE BOOKS:

1. Geetika, Piyali Ghosh and Purba Roy Choudhury, "Managerial Economics", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Jeff Madura, "Fundamentals of Business", Cengage Learning Inc., India, 2007.
3. Stanley L. Brue and Campbell R. Mcconnell, "Essentials of Economics", Tata McGraw-Hill, New Delhi, 2007.
4. Jain S.P., Narang K.L. and Simi Agrawal, "Accounting for Management", 1st Edition, Tata McGraw-Hill, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: estimate market equilibrium and interpret national income calculation and inflation issues

CO2: categorize the forms of business and analyse the functions of management

CO3: appraise marketing management decisions

CO4: apply appropriate operation management concept in business situations

CO5: interpret financial and accounting statements

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT61 VLSI DESIGN

3 0 0 3

UNIT – I **9**

Verilog HDL: Basic concepts: VLSI design flow - Design hierarchies- Basic concepts - Identifiers- Gate primitives-Values- Port-Gate delays-Structural level-Gate level modeling - Data flow modeling: Operators- Timing controls - Structural and dataflow description of combinational and sequential circuits.

UNIT – II **9**

Verilog HDL: Behavioral modeling - Procedural assignments- Conditional statements - Switch level modeling- Behavioral description of combinational and sequential circuits.

UNIT- III **9**

MOS Transistor: An overview of silicon semiconductor technology - Basic CMOS technology: Nwell- P well, Twin tub and SOI Process- Latch up and prevention- NMOS, PMOS enhancement transistor – Basic DC equation- Second order effects - Small signal AC characteristics - CMOS inverter- DC characteristics- Noise Margin- Rise time- Fall time- Power dissipation.

UNIT – IV **9**

Logic and Subsystem Design: Combinational Logic design with CMOS: Static CMOS - Ratioed CMOS- MOSFETS as switches-Muxes- Cascode voltage switch logic- Dynamic circuits- Pass transistor logic- Transmission gates- Sequential circuit design: Circuit design with conventional CMOS latches and flipflops

Datapath circuit - Addition - Subtraction - One zero detector-Comparator-Counter – Shifter - Array multiplier-Booth Encoding. – Xilinx 3000

UNIT – V **9**

Physical design and CMOS Testing: Physical design: Stick diagram-Layout design rules- Physical design of all logic gates. - Need for testing- Manufacturing Test Principles-Design for testability- Chip level and system level test techniques.

TOTAL : 45

TEXT BOOKS:

1. Neil Weste,David Harris,Ayan Banerjee,"CMOS VLSI Design-A circuits & System Perspective",3rd Edition, Pearson education,2007
2. Palnitkar Samir., "Verilog HDL: Guide to Digital Design and synthesis", 3rd Edition, Pearson Education NewDelhi, 2007.

REFERENCE BOOKS:

1. Pucknell, Douglas A. and Eshragian, K.., "Basic VLSI Design", 3rd Edition, PHI Learning, 2006.
2. Rabaey J. M, Chandrakasan A, and Nikolic B, 'Digital integrated circuits: a design perspective', 2nd Edition, PHI Learning, 2003.
3. Abramovici, M., Breuer, M.A and Friedman, A.D., "Digital Systems and Testable Design", 1st Edition, Jaico Publishing House, 2005.
4. Kaushik Roy and Prasad.S.C, "Low power CMOS VLSI circuit design", 1st Edition, Wiley, 2000.
5. http://nptel.ac.in/syllabus/117101058/
6. http://nptel.ac.in/courses/117106092/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: model different digital VLSI systems using Hardware Design Language such as Verilog
CO2: comprehend the fabrication techniques and basics of MOS transistor
CO3: design a VLSI Subsystem
CO4: design, analyze and implement IC's using design tools for different application
CO5: test and improve the performance of VLSI chips

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT62 ANALOG AND DIGITAL COMMUNICATION SYSTEMS

3 1 0 4

UNIT – I **9**

Analog Modulation- Continuous Wave Modulation: AM modulation - Linear modulation schemes – Frequency translation – Frequency division multiplexing – Angle modulation – Frequency modulation – Non linear effects in FM system – Superheterodyne receivers – Noise in CW systems – Noise in AM and FM receivers

UNIT – II **9**

Pulse Modulation: Introduction – Sampling process – PAM – Bandwidth noise tradeoff – Quantization process – PPM – PWM - PCM – Noise consideration – TDM – Digital multiplexers – Limitations – Delta modulation – Linear prediction – DPCM - ADPCM

UNIT – III **9**

Baseband Pulse Transmission: Digital line encoding techniques: Manchester- RS 232 - Bipolar AMI- High density bipolar 3 (HDB -3) - Matched filter- Inter Symbol Interference and Nyquist criteria for ISI cancellation - Pulse shaping with raised cosine filter- Correlative level coding – M-ary PAM transmission – Optimum linear receivers – Adaptive equalization – Eye pattern

UNIT – IV **9**

Digital Modulation Techniques and Spread Spectrum:

Passband Digital Transmission : Brief on ASK, FSK - Generation, detection, signal constellation, error probability and power spectrum of BPSK, QPSK and QAM coherent schemes.

Spread Spectrum: PN sequence code and its properties- Direct sequence spread spectrum system - Processing gain- Frequency hopping spread spectrum.

UNIT – V **9**

Error Control Codes: Discrete memoryless channel - Linear block codes- Hamming code - Cyclic codes -BCH Code -Reed solomon Code- Convolution codes - Viterbi decoding algorithm – Turbo codes – Trellis coded modulation

Lecture:45, Tutorial:15, TOTAL : 60

TEXT BOOKS:

1. Simon Haykin , "Communication Systems", 4th Edition, John Wiley, 2016

REFERENCE BOOKS:

1. Wayne Tomasi , "Electronic Communications Systems :Fundamentals Through Advanced" ,5th Edition, Pearson Education, 2009.
2. Simon Haykin, "Digital Communication", 4thEdition,John Wiley, Reprint 2010.
3. R.P. Singh, SP Sapre, "Communication Systems" 2nd Edition, McGraw-Hill, 2007.
4. Taub & Schilling, Gautam Sahe, "Principles of Communication Systems" , 3rd Edition, McGraw-Hill, 2007.
5. https://www.tutorialspoint.com/digital_communication/index.html
6. http://www.tutorvista.com/content/physics/physics-iv/communication-systems/analog-and-digital-communication.php

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: compare various analog modulation techniques

CO2: analyze the behavior of analog systems in the presence of noise .

CO3: analyze the behavior of baseband and passband transmission systems

CO4: comprehend various digital modulation techniques

CO5: apply suitable encoding and decoding techniques for real time communication

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT63 ANTENNAS AND WAVE PROPAGATION

3 1 0 4

UNIT – I **9**

Fundamentals of Antenna: Concept of retarded vector potential - Radiation from Hertzian dipole, half-wave dipole and quarter-wave monopole – Power radiated and radiation resistance – Definitions: Radiation intensity – Directive gain – Directivity – Power gain – Beam width – Band width – Gain and radiation resistance of current element – Half wave dipole and folded dipole – Reciprocity principle – Effective length and effective area – Relation between maximum aperture and gain- Effective length and radiation resistance.

UNIT – II **9**

Antenna Arrays: Expression for electric field from two element arrays – Uniform linear array – Method of pattern multiplication – Binomial array - Yagi Uda antenna

UNIT – III **9**

Special and Aperture Antennas: Helical antenna: Normal mode and axial mode operation- Log periodic antenna – Horn antenna- Reflector antennas: Parabolic reflectors and their feed systems- Microstrip patch antenna: Radiated fields of rectangular and circular patch.

UNIT – IV **9**

Propagation of Radio Waves: Modes of propagation - Structure of atmosphere - Ground wave propagation - Tropospheric propagation - Duct propagation- Flat earth and Curved earth concept- Sky wave propagation – Virtual height- Critical frequency - Maximum usable frequency – Skip distance- Fading - Multi hop propagation

UNIT – V **9**

Antenna Measurements: Measurement of antenna impedance – Pattern measurements – Measurement of Antenna gain – Beam width – Radiation resistance – Antenna efficiency – Directivity – Polarization.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Prasad K. D, "Antennas and Wave Propagation", 3rd Edition, Satya Prakashan Publications, New Delhi, 2013.

REFERENCE BOOKS:

1. Kraus John D ,Marhefka Ronald J and Ahmad S Khan., "Antennas and wave propagation", 4th Edition , McGraw Hill, New Delhi, 2010
2. Jordan Edward C and Balmain Keith G., "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI Learning, New Delhi, 2010
3. Balanis Constantine A., "Antenna Theory", 2nd Edition, John Wiley & Sons, New York, 2012.
4. http://homedirs.ccs.neu.edu/rraj/Courses/6710/S10/Lectures/AntennasPropagation.pdf
5. https://onlinecourses.nptel.ac.in/noc17_ee03

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret various antenna terminologies
CO2: draw the radiation pattern of antennas
CO3: design various antennas
CO4: analyze the ray propagation effects
CO5: comprehend the importance of measurement of antenna parameters

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL61 ANALOG AND DIGITAL COMMUNICATION SYSTEMS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Pulse amplitude modulation and demodulation using discrete components
2. Pulse position modulation and demodulation using discrete components
3. Pulse width modulation and demodulation using discrete components
4. Pulse code modulation and demodulation
5. Delta modulation and demodulation
6. Time Division Multiplexing
7. Modulation and demodulation of shift keying techniques
8. AM modulation and demodulation using discrete components
9. FM transmitter & receiver
10. Radiation pattern measurement of dipole antenna
11. Radiation pattern measurement of Yagi-uda antenna
12. Radiation pattern measurement of helical antenna
13. Design and simulate the radiation pattern of a dipole antenna
14. Design and simulate the radiation pattern of a microstrip patch antenna
15. Design and simulate the shift keying techniques

REFERNCES/MANUALS/SOFTWARE:

- Matlab
- Lab Manual
- https://www.docsity.com/en/analog-digital-communications-lab-manual/468662/
- https://www.scribd.com/document/297191055/DIGITAL-COMMUNICATION-LAB-MANUAL

TOTAL: 45

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyze analog and digital communication systems to meet desired needs

CO2: design basic analog or digital communication systems to solve a given communications problem

CO3: garner simulation techniques in the design of antennas

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL62 VLSI LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Design and simulation of combinational circuits.
2. Design and simulation of sequential circuits.
3. Design and simulation of parallel adder and subtractor.
4. Design and simulation of serial adder and subtractor.
5. Design and simulation of MAC and memory
6.Design and simulation of Wallace tree multiplier.
7.Design and simulation of Booth multiplier.
8.Design and simulation of FSM.
9.Design and implementation of 4 bit ALU on FPGA board.
10.Design and implementation of traffic controller on the FPGA board.
11.Design a Real time clock (2 digits, 7 segments LED displays each for HRS, MTS, and SECS.) and demonstrate its working on the FPGA board.
12. Basic gates using Microwind tool.
13. Implementation of digital circuits

TOTAL : 45

REFERENCES / MANUALS/SOFTWARE:

- Model Sim
- XILINX
- Microwind
- http://www.asic-world.com/examples/verilog/
- http://asic.co.in/Index_files/verilogexamples.html

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: model and simulate digital systems using hardware description language like verilog
CO2: synthesis digital systems from register transfer level to higher level of description
CO3: implement the logic circuit designs in FPGA board
CO4: formulate, design and analyze VLSI circuits for various application using design tools

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL63 NETWORKS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Simulation and analysis of Ethernet and Token Ring.
2. Design and implement network topologies: Star, Bus, Mesh, Ring, Bottleneck and Dumbbell topology.
3. ARQ mechanism: Stop & Wait, GoBack N and Selective Repeat.
4. Error detection using CRC and LRC.
5. Bit stuffing and character stuffing.
6. ARP/RARP realization using NetSim.
7. Distance vector routing.
8. Link state routing.
9. Token bucket algorithm and leaky bucket algorithm
10. Subnetting using IPV4.
11. TCP and UDP simulation using NetSim.
12. Packet analysis using Wireshark/Tcpdump/Net patrol.

TOTAL: 45

REFERENCES / MANUALS/SOFTWARE:

- Netsim
- Wireshark/Tcpdump

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend the concepts of IP subnetting and network programming
CO2: analyze wireless networking concepts of OSI reference model and TCP/IP reference model
CO3: analyze contemporary issues in networking technologies
CO4: master the concepts of protocols, network interfaces and design LAN, MAN and WAN

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GET71 TOTAL QUALITY MANAGEMENT

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Quality (Basic concepts and principles) : Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs, Basic concepts of Total Quality Management, Historical Review. Principles of TQM, Leadership – Concepts, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II **9**

TQM Principles and strategies : Customer satisfaction – Customer Perception of Quality, Customer Complaints, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits. Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development

UNIT – III **9**

TQM Tools (Process Control): The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT – IV **9**

TQM Tools: Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, Poka Yoke.

UNIT – V **9**

Quality Systems -Need for ISO 9000 and Other Quality Systems, ISO 9000:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, Introduction to TS 16949, QS 9000, ISO 14000, ISO 18000, ISO 20000, ISO 22000.

TOTAL : 45

TEXT BOOKS:

1. Besterfield, Dale H. et al., "Total Quality Management", 3rd Edition (Revised), Pearson Education, 2011.
2. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill, New Delhi, 2008.

REFERENCE BOOKS:

1. Feigenbaum A.V., "Total Quality Management", 4th Edition, Tata McGraw Hill, New Delhi, 2004.
2. Suganthi L. and Samuel A. Anand, "Total Quality Management", PHI Learning, New Delhi, 2011.
3. Evans James R. and Lindsay William M., "The Management and Control of Quality", 7th Edition, South-Western (Thomson Learning), 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the meaning of quality and its importance

CO2: know the principles of total quality management and peculiarities of their implementation

CO3: develop in-depth knowledge on various tools and techniques of quality management

CO4: learn the applications of quality tools and techniques in both manufacturing and service industry

CO5: develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT71 CELLULAR AND MOBILE COMMUNICATION

3 1 0 4

UNIT – I **9**

Cellular Concept: Frequency reuse –Channel assignment strategies- Handoff strategies-Interference and system capacity-Co-channel interference and system capacity- Trunking and GoS- Coverage and capacity improvement methods

UNIT – II **9**

Propagation Model: Free space propagation model- Terrestrial propagation: Physical models and statistical models-Reflection- Two ray ground model- Knife edge diffraction models- Scattering model- Indoor propagation model – Outdoor propagation model –Longley–Rice and Durkin

UNIT – III **9**

Channel Model: Small-scale multipath propagation and measurements - Mobile multipath channels parameters- Types of small scale fading- Rayleigh and Rician channel model- Free-space link budget calculation – Terrestrial link budget calculations

UNIT – IV **9**

Equalizers and Diversity Techniques: Equalizers: Training - Equalizers in a communication receiver- Linear and nonlinear equalizers- Equalizer algorithms – Zero forcing- Least mean square- Recursive least squares

Diversity: Selection diversity model - Maximal ratio combining model - Polarization diversity-Theoretical model- RAKE receiver

UNIT – V **9**

Multiple Access Techniques for Wireless Communications: FDMA-TDMA- Spread spectrum multiple access-Capacity of cellular CDMA – Multiple cell CDMA - SDMA- Capacity of SDMA- Packet radio protocols- Reservation protocols-Capture effect in packet radio.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Rappaport. S. Theodore, "Wireless Communications", 2nd Edition, Pearson education, 2010

REFERENCE BOOKS:

1. Simon Haykin "Modern Wireless Communications",1st Edition, Pearson education, 2011
2. Stuber L. Gordon, "Principles of Mobile Communications", 2nd Edition, Springer International, 2007
3. W.C.Y. Lee, "Mobile Cellular Telecommunications",3rd Edition, McGraw Hill, 2006
4. https://www.youtube.com/watch?v=KWlLOJNH88Q
5. https://www.youtube.com/watch?v=FcJVq0bql5s

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: design and analyze mobile cellular systems
CO2: apply diversity and equalization techniques in mobile receivers.
CO3: involve in research activities related to advanced wireless technologies.
CO4: analyze the different interference concepts influencing cellular communication
CO5: apply the role of cellular and mobile communication in frequency management issues

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT72 MICROWAVE AND OPTICAL ENGINEERING

3 1 0 4

UNIT – I **9**

Microwave Networks and Circuit Representation: Microwave frequency – S parameter representation of N ports – Properties – Advantages - S Matrix of a directional coupler- Waveguide tees – Isolator – Circulator – Slotted section – Attenuator – Waveguide corners- Bends- Twists- Matched loads and movable shorts

UNIT – II **9**

Microwave Semiconductor Devices and Vacuum Tubes:- Transferred electron devices – Gunn diode – Avalanche transit time devices - Read diode – IMPATT – TRAPATT – BARITT diodes - Reflex klystron: Velocity modulation - Power output - Efficiency and electronic admittance- Magnetron: Cylindrical magnetron.

UNIT – III **9**

Microstriplines and Microwave Measurements: Microstrip lines – Derivation of characteristic impedance of microstrip lines using quasi static analysis – Losses in microstrip lines – Quality factor Q of microstrip lines. Measurements: Impedance – Frequency – Power – VSWR using VSWR meter

UNIT – IV **9**

Optical Fiber Structures and Digital Transmission Systems: Evolution of fiber optic system- Elements of an optical fiber transmission link- Total internal reflection, Acceptance angle, Numerical aperture – Optical fiber modes and configurations – Overview of modes- Linearly polarized modes - Fiber fabrication

UNIT – V **9**

Optic Sources and Optical Receivers: Direct and indirect band gap materials- LED structures: SLED,ELED – Concept of lasers diodes- Operation of PIN and APD diodes- Fundamental receiver operation – Error sources- Receiver configurations- Probability of error - Point to point link system considerations- Link power Budget and rise time budget

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Samuel Y Liao, "Microwave Devices & Circuits", 3rd Edition, PHI Learning, 2012.
2. Gerd Keiser, "Optical Fiber Communication", 3rd Edition, Mc Graw Hill International, Singapore, 2000

REFERENCE BOOKS:

1. Annapurna Das and Sisir K Das, "Microwave Engineering", 2nd Edition, Mc Graw Hill Inc., 2009
2. John M. Senior," Optical Fiber Communication", 2nd Edition, Pearson Education, 2007
3. Collin R.E, "Foundations for Microwave Engineering", 2nd Edition, IEEE Press, London, 2007.
4. http://nptel.ac.in/courses/117101054/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend the features and characteristics of microwave components
CO2: measure the microwave signal parameters.
CO3: utilize the principles involved in MMIC and microstrip lines for communication.
CO4: analyze the signal propagation and losses in optical fiber cable
CO5: measure the errors in optical receiver

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL71 - OPTICAL AND MICROWAVE LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

Microwave Experiments:

1. Reflex Klystron mode characteristics
2. Radiation pattern of Horn antenna
3. Impedance measurement using VSWR.
4. Power measurement of Gunn Diode oscillator
5. Characteristics of Gunn Diode oscillator
6. Determination of coupling factor, insertion loss, isolation and directivity of directional coupler

Optical Experiments:

7. Measurement of the numerical aperture and data communication system using a fibre-optic system
8. LED and laser diode characteristics
9. Mode characteristics of an optical fibre & digital link establishment using Laser diode
10. Characteristics of APD/ PD.

Practical applications based experiments:

11. To perform communication through satellite link
12. Connectorization and splicing of optical fibers
13. Measurement of attenuation in optical fiber using light runner.

TOTAL: 45

REFERENCES/MANUALS/SOFTWARE:

- Lab Manual
- http://www.iitg.ernet.in/engfac/krs/public_html/lab/ee442/Exp5.pdf
- http://www.iitg.ernet.in/engfac/krs/public_html/lab/ee442/experiments.html

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: observe the characteristics of microwave oscillators

CO2: measure the microwave signal parameters using a microwave setup

CO3: construct an optical communication system and analyze the characteristics of source, fibre and detector

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GET81 PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Understanding: Morals – Values-Ethics– Honesty – Integrity – Work Ethic – Service Learning – Civic Virtue – caring – Sharing – Courage – Valuing Time – Co-operation – Commitment – Empathy –Self-Confidence – Character – Spirituality- Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry.

UNIT – II **9**

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. Meaning of Engineering experimentation - engineers as responsible experimenters.

UNIT – III **9**

Codes of ethics for engineers - a balanced outlook on law - the challenger case study. Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk, Bhobal Gas Tragedy and Chernobyl case studies.

UNIT – IV **9**

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – discrimination – Intellectual Property Rights (IPR) – Multinational corporations.

UNIT – V **9**

Environmental ethics - Computer ethics – weapons development-engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers(IETE).

TOTAL : 45

TEXT BOOKS:

1. Martin Mike and Schinzinger Roland, "Ethics in Engineering", 4th Edtion, Tata McGraw-Hill, New Delhi, 2014.
2. Govindarajan M., Natarajan S., and Senthil Kumar V.S., "Engineering Ethics", Prentice Hall of India, New Delhi, Reprint 2013.

REFERENCE BOOKS:

1. Fleddermann Charles D., "Engineering Ethics", 4th Edition, Pearson Education/Prentice Hall, New Jersey, 2014.
2. Harris Charles E., Protchard Michael S. and Rabins Michael J., "Engineering Ethics: Concepts and Cases", 4th Edition Wadsworth Thompson Learning, United States, 2008.
3. Seebauer Edmund G. and Barry Robert L., "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the components of ethics and values
CO2: acquire knowledge on ethical theories and attain moral autonomy
CO3: highlight ethical issues in risky situation
CO4: understand the knowledge of interpersonal and organizational issues in ethics
CO5: understand the role of professional bodies as well to identify global issues concerned to ethics

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE01 - TRANSMISSION LINES AND NETWORKS

3 0 0 3

Pre-requisites : Electro Magnetic and Waveguides

UNIT - I **9**

Transmission Line Parameters : A line of cascaded T sections - Transmission lines - General Solution- Physical Significance of the equations, the infinite line – wavelength - velocity of propagation - Distortion line - Reflection on a line not terminated in Zo - Reflection Coefficient - Open and short circuited lines - Insertion loss.

UNIT-II **9**

The Line at Radio Frequency : Parameters of open wire line and Coaxial cable at RF – Line constants for zero dissipation - Voltages and currents on the dissipationless line - Standing waves – Standing wave ratio - Input impedance of dissipationless line - Input impedance of open and short circuited lines - Power and impedance measurement on lines – The eighth wave line - The quarter wave line - The half wave line.

UNIT- III **9**

Stub Matching and Smith chart: Single stub impedance matching on a line-Derivation of location and length of stub- The circle diagram for the dissipationless line-Introduction to Smith chart – Applications: Plotting Complex impedance- Admittance for given Impedance- Input impedance of a TL terminated in a short or open - Input impedance of a TL at any distance from a load-Locating First maximum and Minimum from any load- Matching a TL to a Load with a parallel Tuning single stub.

UNIT – IV **9**

Networks: Functional Classification of Networks-Electrical Characteristics of Symmetrical and Asymmetrical Network- Iterative Impedances- Image Transfer Constant- Iterative Transfer Constant- Characteristics of Passive Four Terminal Network-T Network-π Network- Equivalence of T and π Network-L Section- Half Section-Lattice Network- Bridged T Network- Twin T Network-Matching Networks.

UNIT – V **9**

Network parameters and Filters: Network Parameters and Characteristics-x,y,h,ABCD Parameters-Equivalent Circuits-Relationship between Two port Network- Reciprocity and Symmetry in Two Port Networks - Passive Filter:Characteristics-Types-Concepts of decibel and Neper- Constant K Filters-Phase shift and Attenuation constant of Constant K filters-m-derived Filters.

TOTAL :45

TEXT BOOKS:

1. Ryder J.D, “Networks Lines and Fields”, Prentice Hall of India, New Delhi, 2003, ISBN: 9788120302990
2. Umesh Sinha., “Transmission Lines and Networks”, Eighth Edition, Satya Prakasan Publications, New Delhi, 2013. ISBN : 8176841887

REFERENCE BOOKS:

1. Jordan E. C. , Balmain K. G., “Electromagnetic Waves and Radiating Systems”, 4th Edition Pearson Education/PHI 2006. ISBN : 8129702983
2. Hund. E, “Microwave Communications: Components and Circuits”, McGraw-Hill, 1989, ISBN : 9780070312777, 007031277X
3. www.worldcat.org
4. www.nptel.ac.in/courses/117101056

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CO1: analyze different types of transmission lines and its parameters
CO2: determine the parameters of stub for impedance matching
CO3: comprehend different types of networks
CO4: analyze various network parameters
CO5: analyze the characteristics of different types of filters

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE02 - MODERN ELECTRONIC INSTRUMENTATION

3 0 0 3

Pre-requisites : Analog Electronics

UNIT – I **9**

Measurement Concepts and Measuring Instruments: Measurement systems- Static and dynamic characteristics – Units and standards of measurements – Error analysis – Moving coil – Torque equations - Moving iron instruments – DC ammeters - DC voltmeters - Digital meters: Wattmeters - Energy meters – Bridge measurements: Maxwell-Kelvin- Schering- Anderson and Wien bridge.

UNIT – II **9**

Transducers: Strain gauge- Thermistor - Humidity sensor- Variable reluctance transducers – Linear variable differential transformer- Capacitive transducer – Piezoelectric transducers – Vibration sensor – Proximity sensor-Optoelectronic transducers-Instrumentation amplifier using operational amplifier.

UNIT – III **9**

Virtual Instrumentation & Software: Block diagram of a virtual instrument – Physical quantities and analog interfaces - Hardware and software – User interfaces – Advantages– Architecture of a virtual instrument and its relation to operating system. LabVIEW – Graphical user interfaces - Controls and indicators.

UNIT – IV **9**

VI Software Tools & Programming Techniques: Editing, debugging and running a virtual instrument – Graphical programming palettes and tools – Front panel objects – Function and libraries – VI and sub-VI–Programming of temperature conversion

UNIT – V **9**

PLC Programming: PLC: Evolution – Components of PLC – Advantages over relay logic – PLC programming languages – Ladder diagram – Programming timers and counters

TOTAL : 45

TEXT BOOKS

1. Helfrick Albert D, and Cooper William D., "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2003, ISBN : 9780135932940, 0135932947
2. Jeffery Travis , Jim Kring, "LabVIEW for Everyone: Graphical programming made easy and Fun", 3rd Edition, Pearson Education, India, 2009, ISBN : 9780131856721, 0131856723
3. Webb John W. and Reis Ronald A., "Programmable Logic Controllers: Principles & Applications", 5th Edition Prentice Hall Publications, New Delhi, 2005, ISBN: 9780130416728, 013041672X

REFERENCE BOOKS

1. Ranganathan, S., "Transducer Engineering", Allied Publishers, New Delhi, 2003, ISBN : 9788170239109
2. "LabVIEW Basics I and II Manual", National Instruments, 2005.
3. Jovitha Jerome, "Virtual Instrumentation using LabVIEW" PHI Learning Private Limited, NewDelhi, 2010, ISBN : 9788120340305, 8120340302
4. Gupta, Joseph, John, "Virtual Instrumentation using LabVIEW", 2nd Edition, Tata McGrawHill, 2010, ISBN : 9780070700284, 0070700281
5. http://www.ni.com/academic/students/learn-labview/
6. https://onlinecourses.nptel.ac.in/noc17_ec09/preview

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: use different measuring instruments and sensors

CO2: compare the features of various transducer

CO3: develop programs for virtual systems using LabVIEW

CO4: create virtual system using the features of LabVIEW

CO5: draw ladder diagram for industrial applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE03 - COMPUTER ARCHITECTURE AND INTERFACING

3 0 0 3

UNIT - I **9**

Basic Structure of Computers : Functional units- Basic operational concepts, Bus structures, Software performance – Memory locations & addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic i/o operations – Stacks and queues.

UNIT - II **9**

Arithmetic : Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers- Signed operand multiplication and fast multiplication – Integer division – Floating point numbers and operations.

UNIT - III **9**

Basic Processing Unit : Fundamental concepts – Execution of a complete Instruction – Multiple bus organization – Hardwired control – Microprogrammed control. Pipelining – Basic concepts – Data hazards – Instruction hazards

UNIT - IV **9**

Memory System : Basic concepts – Semiconductor RAMs, ROMs – Speed, size and cost – Cache memories – Mapping functions- Performance consideration – Virtual memory – Address translation

UNIT - V **9**

I/O Organization : Accessing I/O devices – Interrupts – Direct Memory Access (DMA) – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

TOTAL : 45

TEXT BOOK

1. Hamacher Carl, Vranesic Zvonko and Zaky Safwat, "Computer Organization", 5th Edition, McGraw Hill, New York, 2002, ISBN : 1259005275

REFERENCE BOOKS

1. Stallings William, "Computer Organization and Architecture: Designing for Performance", 6th Edition, Pearson Education, New Delhi, 2003, ISBN : 0136073735
2. Hayes John P, "Computer Architecture and Organization", 3rd Edition, McGraw-Hill, New York, 1997, ISBN : 0070273553
3. Miles Murdocca and Vincent Heuring, "Computer Architecture and Organization: An Integrated Approach", John Wiley and Sons Inc., 2008, ISBN : 9788126511983
4. http://en.bookfi.net/s/?q=computer+organozation+by+hamacher+vranesic+zaky&t=0
5. http://nptel.ac.in/courses/106103068/9

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: comprehend the micro level operations of a computer
CO2: utilize different types of memory devices
CO3: avoid various hazards in pipelining a system
CO4: organize I/O devices for various operations
CO5: increase the speed of arithmetic computations

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE04 MEDICAL ELECTRONICS

3 0 0 3

Pre-requisites: Solid State Devices

UNIT - I **9**

Human Physiology: Introduction to the Man-Instrument System - Components of the Man-Instrument System – Physiological systems of the Body – Problems encountered in measuring a living system -Resting and action potentials – Propagation of action potentials - The bioelectric potentials – Skin-contact impedance

UNIT - II **9**

Basic Medical Recording System: Electrodes for ECG - Electrodes for EEG - Electrodes for EMG – Basic recording system – General consideration for electronic recorder amplifiers – Sources of noise in low level recording circuits – Preamplifiers - The main amplifier and driver stage.

UNIT - III **9**

Recording and Monitoring Instruments: Electrocardiograph – Phonocardiograph – Electroencephalograph – Electromyograph – Measurement of heart rate – Blood pressure measurement – Measurement of temperature – Measurement of respiration rate – Wireless telemetry – Single channel telemetry systems – Temperature telemetry system – Multichannel wireless telemetry system – Multipatient telemetry

UNIT - IV **9**

Measurements and Analysis Techniques: Basic principles of cardiac pacemaker -Defibrillator-Electric shock hazards – Leakage currents – Test instruments for checking safety parameters of biomedical equipments– Measurement of blood pCO2 – Blood pO2 measurement – ECG arrythmia analysis monitoring.

UNIT - V **9**

Medical Instrumentation: Hemodialysis machine - MRI and CT scan - Surgical diathermy machine – Electrodes used with surgical diathermy – Safety aspects in electrosurgical units – Surgical diathermy analysers.

TOTAL : 45

TEXT BOOK:

1. Khandpur R.S., "Handbook of Biomedical Instrumentation," 3rd Edition, McGraw- Hill New Delhi, 2014.

REFERENCE BOOKS:

1. Reddy D.C., "Biomedical Signal Processing Principles and Techniques," 1st Edition, 2nd Reprint, Mc Graw-Hill, New Delhi, 2008.
2. Cromwel Leslie., Weibel Fred. J. and Pferffer Erich. A., "Biomedical Instrumentation and Measurements", 2nd Edition, PHI Learning, New Delhi, 2010.
3. Rangayyan Rangaraj. M., "Biomedical Signal Analysis: A Case Study Approach", 2nd Edition, IEEE Press, John Wiley & Sons Inc, New York, 2002.
4. http://highered.mheducation.com/sites/dl/free/0073519758/965924/Chapter16.ppt

COURSE OUTCOMES:

On completion of the course the students will be able to:

CO1 comprehend the physiological systems of human body

CO2 develop a knowledge of basic recording system

CO3 understand the principles of recording and monitoring instruments

CO4 use various biomedical instruments and apply their knowledge to analyze the biosignals

CO5 comprehend the principle of working of imaging equipments

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT41 NUMERICAL METHODS

3 1 0 4

UNIT – I **9**

Solution to Algebraic and Transcendental Equations: Iteration method – Method of false position – Newton-Raphson method – Solution of linear system of equations – Direct methods: Gauss elimination method and Gauss - Jordan method – Iterative methods: Gauss Jacobi and Gauss – Seidel methods.

UNIT – II **9**

Interpolation: Interpolation with equal intervals: Newton‟s forward and backward difference formulae – Central difference interpolation formulae: Gauss forward and backward interpolation formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula.

UNIT – III **9**

Numerical Differentiation and Integration: Differentiation using Newton's forward, backward and divided difference formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule – Double integrals using Trapezoidal and Simpson‟s rules.

UNIT – IV **9**

Numerical Solution of First order Ordinary Differential Equations: Single step methods**:** Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method – Adam's Bashforth method.

UNIT – V **9**

Solutions of Boundary Value Problems in PDE: Solution of one dimensional heat equation – Bender -Schmidt recurrence relation – Crank - Nicolson method – One dimensional wave equation – Solution of two dimensional Laplace equations – Solution of Poisson equation.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy. P, Thilakavathy.K, and Gunavathy. K, "Numerical Methods", Reprint Edition, S.Chand & Co, New Delhi, 2014.
2. Veerarajan. T, Ramachandran.T, "Numerical Methods with Programming C", 2nd Edition, McGraw-Hill Publishing Company Ltd., New Delhi, 2008.

REFERENCE BOOKS:

1. Balagurusamy.E, "Numerical Methods", Reprint Edition, McGraw-Hill Publishing
2. Jain.M.K, Iyengar,S.R.K and Jain.R.K, "Numerical Methods for Scientific and Engineering Computation", 6th Reprint, New Age International Pvt. Ltd., New Delhi, 2014.
3. Sankara Rao. K, "Numerical methods for Scientists and Engineers", 3rd Edition, PHI Learning., New Delhi, 2008.
4. Gerald. C. F and Wheatley. P. O, "Applied Numerical Analysis", 7th Edition, Pearson Education, Asia, New Delhi, 2006.
5. Grewal.B.S, "Numerical Methods in Engineering and Science", 9th Edition, Khanna Publishers, 2007.
6. http://www.nptel.ac.in/courses/122102009/
7. http://www.nptel.ac.in/courses/111101003/34

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: know the various methods of solving algebraic and transcendental equations numerically
CO2: understand the concept of interpolation
CO3: gain knowledge on the concepts of numerical differentiation and integration
CO4: obtain the solution of ordinary differential equations numerically
CO5: apply various numerical techniques in solving complex partial differential equations

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE04 SOFT COMPUTING TECHNIQUES

3 0 0 3

UNIT – I **9**

Introduction: Biological neural network - Artificial Neural Network (ANN): Basic Models of ANN, Important terminologies of ANN - McCulloch-Pitts neuron - Linear separability - Hebb network- Perceptron networks - Back propagation network.

UNIT – II **9**

Learning Networks: Adaptive linear neuron - Radial Basis Function Network (RBFN) - Associative memory networks: Discrete hop field network - Fixed weight competitive nets - Kohonen self organising feature maps

UNIT – III **9**

Basic Concepts of Fuzzy Logic: Introduction to fuzzy logic - Classical sets and fuzzy sets - Fuzzy relations - Membership function: Features of membership function – Fuzzification - Methods of membership value assignments - Fuzzy rules and reasoning: Fuzzy If-Then Rules. Fuzzy Inference Systems (FIS): Introduction – Methods of FIS: Mamdani - Sugeno and Tsukamoto. Defuzzification**:** Lambda-Cuts for Fuzzy sets and Fuzzy Relations, Defuzzification Methods.

UNIT – IV **9**

Genetic Algorithm: Introduction to Genetic Algorithms (GA) – Biological background – Operators: Encoding – Selection - Cross over – Mutation - Problem solving using genetic algorithm: Maximizing a function.

UNIT – V **9**

Neuro-Fuzzy Hybrid System: Classification of neuro fuzzy hybrid systems - Adaptive Neuro Fuzzy Inference System (ANFIS) - Simplified fuzzy ARTMAP - Applications: Printed character recognition - Fuzzy based PID controller.

TOTAL : 45

TEXT BOOKS:

1. Sivanandam.S.N, Deepa.S.N, "Principles of Soft Computing", 2nd Edition, Wiley, 2014.
2. Rajasekaran.S, Vijayalakshmi Pai.G.A, "Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications", 1st Edition,PHI Learning, 2003.
3. Jang.J.S.R, C.T.Sun, E.Mizutani, "Neuro – Fuzzy and Soft Computing", 1st Edition, PHI Learning Pvt. Ltd., 2012.

REFERENCE BOOKS:

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Willey, 2010.
2. Samir Roy, Udit Chakraborty, "Introduction to Soft Computing – Neuro Fuzzy and Genetic Algorithms",1st Edition, Pearson, 2013.
3. www.flll.jku.at/div/teaching/Ga/GA-Notes.pdf
4. http://nptel.ac.in/courses/106106046/41

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the concepts of Neural Network
CO2: develop a rule based Fuzzy systems
CO3: apply Neural Network and Fuzzy Logic control to real time systems
CO4: apply Genetic algorithm in problem solving
CO5: develop a Hybrid Neuro – Fuzzy model

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE05 WIRELESS NETWORKS

3 0 0 3

Pre-requisites: Data Communication and Internet Working

UNIT – I **9**

Wireless Personal Area Network (WPAN): IEEE 802.15.1(Bluetooth): Protocol stack- Bluetooth link types, Bluetooth network connection establishment. **IEEE 802.15.3 (WPAN-LR):** Wireless sensor network model- 802.15.3-Protocol stack- Device architecture- ZigBee technology . **IEEE 802.15.3a (WPAN-HR):** Ultra wide band

UNIT – II **9**

Wireless Local Area Network (WLAN): WLAN technologies and topologies- IEEE 802.11 architecture- Physical layer- Data link layer-MAC layer - MAC sub layer- Power management- 802.11 b/n.

UNIT – III **9**

Wireless Local Area Network (WLAN): HIPERLAN- Multimedia access communication, Co-existence (Bluetooth and WLAN)- IEEE 802.16 - WiMAX : Physical layer- Media access control- Spectrum allocation

UNIT – IV **9**

Wide-area Wireless Networks: GSM: GSM evolution for data - High speed circuit switched data- Enhanced data rates for GSM enhancement- General packet radio service - CDMA 2000: Layering structure - Forward and reverse Link

UNIT – V **9**

Mobile Network and Transport Layer: Wireless TCP: Wireless TCP/IP - Network layer in internet - TCP enhancements for wireless networks - Wireless TCP implementation-Mobile IP – SIP - WAP – Model and architecture

TOTAL:45

TEXT BOOK:

1. Vijay K. Garg, "Wireless Communications and Networking", 1st Edition, Morgan Kaufmann Publishers, 2007.

REFERENCE BOOKS:

1. Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", 1st Edition, Pearson Education Asia, 2002
2. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, 2nd Edition, Pearson Education, 2007.
3. Clint Smith, P.E. & Daniel Collins, “3G Wireless Networks”, 2nd Edition, McGraw Hill, 2007.
4. https://www.youtube.com/watch?v=WcMoZ2VUyfU
5. https://www.youtube.com/watch?v=X09oLY4ozpw

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: perceive various wireless standards and technologies
CO2: comprehend the functionalities of TCP / IP suite in wireless systems.
CO3: apply the concepts of WLAN and PAN for real time applications
CO4: design and implement wireless TCP
CO5: investigate different concepts in wireless data networks

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE06 SATELLITE COMMUNICATION

3 0 0 3

UNIT – I **9**

Overview of Satellite Systems: Introduction – Frequency allocations for satellite services –Kepler's law – Definitions of terms for earth orbiting satellites –Orbital elements – Apogee and Perigee heights – Orbital perturbations – Effects of a nonspherical earth – Atmospheric drag – Inclined orbits – Calendars – The Orbital plane – The Geocentric equatorial coordinate system – Earth station referred to the IJK frame – The topocentric horizon coordinate system – The subsatellite point

UNIT – II **9**

Geostationary Orbit and Space Segment: Antenna look angles – The polar mount antenna – Limits of visibility – Near geostationary orbits – Earth eclipse of satellite – Sun transit outage – Launching orbits -Attitude control-Station keeping -Telemetry tracking and command subsystem-Transponders- Wideband receiver-Input demultiplexer-Power amplifier

UNIT – III **9**

Earth Segment and Space Link: Introduction – Receive only home TV systems – Outdoor unit –Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system –Transmit receive earth stations – Equivalent isotropic radiated power – Transmission losses – Free space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation – Carrier to noise ratio – Uplink –Saturation flux density – Input back off – The earth station HPA – Downlink – Output back off – Satellite TWTA output– Intermodulation noise.

UNIT – IV **9**

Satellite Access: Single access – Preassigned FDMA- Demand assigned FDMA- SPADE system. TDMA: Reference burst - Preamble and Post-amble- Carrier recovery- Network synchronization- Unique word detection- Traffic data-Frame efficiency and channel capacity- preassigned TDMA- Demand assigned TDMA. Code Division Multiple Access – Direct sequence spread spectrum – Code signal c(t) – Autocorrelation function for c(t) – Acquisition and tracking – Spectrum spreading and despreading – CDMA throughput- Space Division Multiple Access

UNIT – V **9**

Satellite Applications: MPEG compression standards- Satellite mobile services - IMMARSAT - VSATs-Radarsat-GPS system- Satellite networks: ATM over satellite-TCP link- Satellite links and TCP- Enhancing TCP over satellite channels using standard mechanisms RFC(2488)-Split TCP connections.

Total: 45

TEXT BOOK:

1. Roddy Dennis- "Satellite Communications", 4th Edition, Mc Graw Hill, New York, 2009.

REFERENCE BOOKS:

1. Pratt Timothy, Bostian Charles and Allnutt Jeremy, "Satellite Communications", 2nd Edition, John Wiley & Sons, Singapore, 2004.
2. Pritchard Wilbur L, Suyder Hond, Henri G. and Nelson Robert A, "Satellite Communication Systems Engineering", 2ndEdition, Pearson Education Ltd, New Delhi, 2003.
3. Richharia M, "Satellite Communication Systems: Design Principles", 2ndEdition, Macmillan Press Ltd, London, 2003.
4. http://nptel.ac.in/courses/117105131/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend the various terminologies in satellite communication

CO2: relate the need of solution for the global communication

CO3: analyze and understand the effect of losses and noise and to apply them in design.

CO4: take up research and develop network configurations for different applications.

CO5: design different access methodologies for satellite communication

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE07 EMBEDDED SYSTEMS DESIGN

3 0 0 3

Pre-requisites: Microcontroller Architecture and Applications

UNIT – I **9**

Embedded Design Life Cycle: Embedded design life cycle – Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing selection processes – Microprocessor Vs Microcontroller – Performance tools – Benchmark – RTOS availability – Tool chain availability – Other issues in selection processes.

UNIT – II **9**

Partitioning Decision: Hardware / Software duality – Coding hardware – ASIC revolution - Managing the risk – Co-verification – Execution environment – Memory organization –System start-up – Hardware manipulation – Memory mapped access –Speed and code density.

UNIT – III **9**

Embedded Toolset: Interrupt service routines – Watch dog timers – Flash memory - Basic toolset – Host Based debugging – Remote debugging – ROM emulators – Logic analyzer – Caches – BDM – JTAG

UNIT – IV **9**

In circuit Emulators: Bullet proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers

UNIT – V **9**

Testing: Bug tracking – Reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance

TOTAL: 45

TEXT BOOK:

1. Arnold S. Berger, “Embedded System Design”, 1st Edition, CMP books, USA 2002.

REFERENCE BOOKS:

1. Sriram Iyer, “Embedded Real time System Programming”, 1st Edition, McGraw-Hill, 2008.
2. Rajkamal, “Embedded Systems Architecture, Programming and Design”, 1st Edition, McGraw-Hill, New Delhi”, 2003
3. David E. Simon, “An Embedded Software Primer”,12th Indian Reprint, Pearson Education, 2005.
4. http://nptel.ac.in/courses/108102045/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend the design flow of an embedded system
CO2: analyze the memory organization of an embedded system
CO3: use various tools for hardware- software debugging
CO4: debug and emulate an embedded design using ICE
CO5: validate and test the embedded system programs

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE08 DIGITAL IMAGE PROCESSING

3 0 0 3

Pre-requisites: Digital Signal Processing

UNIT – I **9**

Digital Image Fundamentals: Elements of digital image processing systems- Elements of visual perception- Brightness- Contrast- Hue- Saturation- Mach band effect -Image sampling- Quantization - Basic relationship between pixels - Color image fundamentals - RGB- HSI models – 2D Image transforms: DFT – DCT – KLT – Haar – Walsh - Hadamard

UNIT – II **9**

Image Enhancement: Basic intensity transformations – Piecewise linear transformation functions - Histogram equalization - Spatial filtering : Smoothing and sharpening Filters – Frequency domain filtering : Smoothing and sharpening filters – Homomorphic filters – Color image enhancement

UNIT – III **9**

Image Restoration: Degradation model – Noise distributions- Median – Geometric mean – Harmonic mean – Contra harmonic mean filters – Order Statistics filters - Inverse and wiener filtering - Constrained least square filtering

Morphological Image Processing: Preliminaries – Erosion – Dilation – Duality – Opening – Closing – Hit or Miss Transformation

UNIT – IV **9**

Image Segmentation, Representation & Description: Point, line and edge detection – Basics of intensity thresholding – Region based segmentation : Region growing - Region splitting and merging – Image representation : Chain codes, – Boundary descriptors - Regional descriptors

UNIT – V **9**

Image Compression: Fundamentals: Types of redundancy – Huffmann – Run length coding – Arithmetic coding - Bit-plane coding – Block Transform coding -Wavelet Coding – Lossless and Lossy Predictive coding – JPEG standard

Total : 45

TEXT BOOK:

1. Gonzalez.R.C &Woods.R.E,"Digital Image Processing", 4th Edition, Pearson Education, 2009

REFERENCE BOOKS:

1. Jain.A.K, "Fundamentals of Digital Image Processing", 4th Edition, PHI Learning, 1995.
2. Salomon David., "Data Compression: The Complete Reference", 2nd Edition, Springer, Verlag, New York, 2001.
3. Milan Sonka,Roger Boyle and Vaclav Hlavac, "Image Processing, Analysis, and Machine Vision", 4th Edition, Cengage Learning, 2015
4. http://nptel.ac.in/courses/117105079/
5. http://www.nptelvideos.in/2012/12/digital-image-processing.html

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyze the real time images using 2D transforms
CO2: improve the quality of images with various enhancement techniques
CO3: apply the concepts of color image processing
CO4: realize edge detection and segmentation algorithms for images
CO5: perform compression of images

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE09 DSP PROCESSORS

3 0 0 3

Pre-requisites: Digital Signal Processing.

UNIT – I **9**

Fundamentals of programmable DSPs: Multiplier and Multiplier accumulator (MAC) – Modified bus structures and memory access in programmable DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special addressing modes in P-DSPs – On chip peripherals

UNIT – II **9**

TMS320C5416: Fundamentals of programmable DSPs - Architecture of TMS320C5416-5416 Buses-Memory organization-Computational units-Pipeline operation-On-chip peripherals –Address generation Units- Addressing modes and instruction set-assembly language instructions

UNIT – III **9**

TMS320C67X :TMS320C67x DSP features and options - TMS320C67x DSP Architecture- CPU Data paths and control - Instruction set - Pipeline - Interrupts

UNIT – IV **9**

Code Composer Studio : Code Composer Studio Overview- Developing a simple program-Developing a DSP/BIOS program-Testing algorithms and data from a file - Debugging program behavior- Analyzing real-time behaviour

UNIT – V **9**

Applications Using TMS320C54X/C67X: Filter design for real time signals - Real time voice synthesis applications

TOTAL: 45

TEXT BOOK:

1. Venkataramani. B and Bhaskar M., "Digital Signal Processor Architecture, Programming and Application", 2nd Edition, McGraw-Hill, 2002

REFERENCE BOOKS:

1. http://www.ti.com/lit/ug/spru226/spru226.pdf
2. http://www.ti.com/lit/ug/spru307a/spru307a.pdf
3. http://www.ti.com/lit/ug/spru733a/spru733a.pdf
4. http://www.ti.com/lit/ug/spru301c/spru301c.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: program using DSP processors
CO2: design filters for various applications
CO3: select suitable processor for real time applications
CO4: utilize DSP processor for real time applications
CO5: design various applications using DSP processors

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ITE13 JAVA TECHNOLOGIES

3 0 0 3

Pre-requisites: Object Oriented Programming

UNIT – I **9**

RMI: Serialization- Remote Interfaces and Implementation-Architecture – Developing Applications – Parameter Passing – Exceptions- Dynamically loading classes – Remote Object Activation -JDBC

UNIT – II **9**

Middleware: Middleware -Interface Definition Language (IDL)– CORBA-Architecture-Implementation-Object Request Broker (ORB) – Object adapter-RMI-IIOP

UNIT – III **9**

Sockets and JSP: Socket-TCP-UDP-Multicast-JSP Engine Structure- JSP objects and directives-Scripting tags-Declarations-Action Tags-Taglibs

UNIT – IV **9**

J2EE: Java Naming and Directory Interface (JNDI)-J2EE architecture – EJB – Session, Entity and Message driven beans – Model View Control (MVC) architecture

UNIT – V **9**

J2EE SERVICES : Java Messaging Service (JMS) - Transactions – Java Transaction Service (JTS) – Java Connector Architecture (JCA) – Java Authentication and Authorization Service (JAAS)

TOTAL : 45

TEXT BOOKS:

1. Asbury, Stephen and Weiner, Scott R., "Developing Java Enterprise Applications", 2nd Edition, Wiley Publications, 2001.
2. Schildt, Herbert, "Java 2: The Complete Reference", 5th Edition, McGraw Hill, 2002.

REFERENCE BOOKS:

1. Hortsmann and Cornell, "Core Java 2 Advanced Features, Volume - II", 9th Edition, Pearson Education, 2013.
2. Java Server Programming Java EE7 (J2EE 1.7), Platinum Edition, Black Book by Kogent Learning Solutions Inc. Paperback 2014
3. Elliotte Rusty Harold, "Java Network Programming", 4th Edition, O"Reilly publishers, 2000.
4. https://www.youtube.com/watch?v=r59xYe3Vyks&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: develop applications in distributed environment
CO2: understand the middleware concepts in java
CO3: explore the concepts of server side programming skills
CO4: design and Develop the Enterprise applications in java
CO5: understand the various J2EE Services

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE10 HIGH SPEED NETWORKS

3 0 0 3

Pre-requisites: Data Communication and Internet Working

UNIT – I **9**

High Speed Networks: Frame relay networks – Asynchronous Transfer Mode (ATM) – ATM protocol architecture, ATM logical connection, ATM cell – ATM service categories – AAL High Speed LANs: Fast Ethernet- Gigabit ethernet.

UNIT – II **9**

Congestion and Traffic Management: Queuing analysis- Queuing models – Single server queues – Effects of congestion – Congestion control – Traffic management – Congestion control in packet switching networks – Frame relay congestion control.

UNIT – III **9**

TCP and ATM Congestion Control: TCP flow control – TCP congestion control – Retransmission – Timer management – Exponential RTO backoff – KARN's algorithm – Window management – Performance of TCP over ATM - Traffic and congestion control in ATM – Requirements.

UNIT – IV **9**

Integrated and Differentiated Services: Integrated services architecture – Approach, components, services- Queuing discipline – Random early detection (RED) - Differentiated services.

UNIT – V **9**

Protocols for QoS Support: RSVP – Goals & characteristics - Data flow - RSVP operations - Protocol mechanisms – Multiprotocol Label Switching – Operations - Label stacking - Protocol details – RTP – Protocol architecture - Data transfer protocol - RTCP.

TOTAL:45

TEXT BOOKS:

1 William Stallings, "High-speed networks and internets: performance and quality of service", 2nd Edition, Pearson Education India, 2010.

REFERENCE BOOKS:

1. Walrand Jean and VaraiyaPravin., "High Performance Communication Networks", 2nd Edition, Harcourt Asia Pvt. Ltd., Singapore, 2001.
2. PepelnjkIrvan, Guichard Jim and Apcar Jeff, "MPLS and VPN Architecture", Volume I & II, 1st Edition, Cisco Press, London, 2003.
3. William Stallings, "High-speed networks: TCP/IP and ATM Design Principles", 2nd Edition, Pearson Education, 1998.
4. https://www.youtube.com/watch?v=xpXhudbsrr8
5. https://www.youtube.com/watch?v=vrh0epPAC5w

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: evaluate various broadband networking algorithms
CO2: design queuing algorithms for high performance networks
CO3: analyze the congestion control algorithms in high speed networks
CO4: analyze the concepts of various networking services supporting high speed communication
CO5: apply various protocols in high speed networks for maintaining QoS

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE11 RF COMMUNICATIONS

3 0 0 3

Pre-requisites: Analog and Digital Communication

UNIT – I **9**

Transceiver Specifications and Architectures: Transceiver architectures: Receiver: Homodyne – Heterodyne - Image reject - Low IF architectures – Transmitter: Direct upconversion - Two step upconversion - Transceiver specifications: THD - IP2 - IP3 – Sensitivity – SFDR - Noise: Thermal, shot, flicker, popcorn noise

UNIT – II **9**

Components and Amplifiers: Passive IC components characteristics - OC time constants in bandwidth estimation and enhancement - High frequency amplifier design: Shunt – Series amplifier

UNIT – III **9**

LNA Design: MOSFET two port noise parameters - LNA topologies - Power constrained noise optimization - Low Noise Amplifiers – Single ended and differential LNAs – Terminated with resistors and source degeneration LNAs.

UNIT – IV **9**

PLL and Frequency Synthesizers: PLL: Linearised Model – Noise properties - Phase detectors – Loop filters and charge pumps - Frequency synthesizers - Integer-N frequency synthesizers – Direct digital frequency synthesizers

UNIT – V **9**

Mixers and Oscillators: Mixer: Characteristics – Non-linear based mixers: Quadratic mixers – Multiplier based mixers - Single balanced and active double balanced mixers – Subsampling mixers

Oscillators: Colpitts oscillators – Resonators – Tuned oscillators – Negative resistance oscillators – Phase noise – Phase noise of an ideal oscillator - Link budget analysis using Friis Formula

TOTAL: 45

TEXT BOOKS:

1. Lee. T, "Design of CMOS RF Integrated Circuits", 2nd Edition, Cambridge, 2004

REFERENCE BOOKS:

1. Razavi. B, "RF Microelectronics", 2nd Edition, Pearson Education, 1997.
2. Jan Crols, MichielSteyaert, "CMOS Wireless Transceiver Design", 1st Edition, Kluwer Academic Publications, 2003.
3. Razavi. B, Design of analog CMOS Integrated Circuits", 3rd Edition, McGraw Hill,2001
4. Robertson.I.D &Lucyszyn.S, "RFIC and MMIC Design and Technology", IEEE Circuits, Devices and Systems series 13, London, UK, 2001
5. NPTEL Video: nptel.ac.in/courses/117102012
6. http://www.ebooks.com/302701/rf-system-design-of-transceivers-for-wireless-communications/gu-qizheng/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: characterize the RF system circuits and components.
CO2: analyze the performance of RF system
CO3: comprehend the performance of the mixer circuits.
CO4: evaluate the performance of an RF radio system for wireless applications
CO5: analyze the various topologies of LNA.

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE12 BROADBAND COMMUNICATION

3 0 0 3

Pre-requisites: Data Communication and Internet Working

UNIT – I **9**

Wireless Broadband-Introduction: Spectrum options for broadband wireless - Technical challenges for broadband wireless – WiMAX - WiBro - Multicarrier modulation - OFDM basics - Block transmission

UNIT – II **9**

Orthogonal Frequency Division Multiplexing: OFDM - Circular convolution and the DFT - Cyclic prefix-Frequency equalization - Timing and frequency synchronization, PAR Problem-Clipping-PAR reduction strategies

UNIT – III **9**

WiMAX PHY Layer: Channel coding - Convolutional coding - Hybrid –ARQ - Interleaving - Symbol mapping OFDM symbol structure - Sub channel and subcarrier permutations, Slot and frame structure, MIMO Closed loop - MIMO Power control - Channel Quality measurements

UNIT – IV **9**

WiMAX MAC Layer: Convergence sub layers - MAC construction and transmission - Bandwidth request and allocation – QoS - Network entry and initialization – Power saving - Mobility management.

UNIT – V **9**

WiMAX Network Architecture: Network reference model - Protocol layering network discovery and selection - IP address assignment - QoS architecture - Mobility management - Radio resource management.

Total : 45

TEXT BOOK

1. Jeffrey G. Andrews, Arunabha Ghosh and Rias Muhamed, "Fundamentals of WiMAX Understanding Broadband Wireless Networking",1st Edition, Pearson Education, 2010.

REFERENCE BOOKS

1. Uma Shanker Jha and Ramjee Prasad, "OFDM Towards Fixed and Mobile Broadband Wireless Access",1st Edition, Artech House, 2007.
2. Kamran Etemad and Ming-Yee Lai, "WiMAX Technology and Network Evolution",1st Edition, Wiley-IEEE Press, February 2011.
3. Amitabh Kumar,"Mobile Broadcasting with WiMAX: Principles, Technology, and Applications", 1st Edition, Focal Press-2013.
4. Ahmad R.S. Bahai, Burton R. Saltzberg and Mustafa Ergen, "Multi-Carrier Digital Communications: Theory and Applications of OFDM", 2nd Edition Springer-2004
5. NPTEL Video: nptel.ac.in/courses/117101050
6. http://www.ebooks.com/2509568/broadband-communications/mason-lorne-g-casaca-augusto/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: apprehend the next generation wireless communication
CO2: apply the suitable intelligence in designing broadband wireless networks for real time applications
CO3: provide technological solution for Wi-Max related issues
CO4: generate a proper perspective in understanding broadband systems
CO5: analyze the different technologies that contribute to the implementation of broadband systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE13 VLSI FOR ASIC DESIGN

3 0 0 3

Pre-requisites: VLSI Design

UNIT – I **9**

Introduction to ASICs, CMOS Logic, ASIC Library Design: Types of ASICs - Design flow – CMOS transistors- CMOS design rules –Combinational logic cell - Sequential logic cell – Data path logic cell - Transistor as resistors - Transistor parasitic capacitance – Logical effort

UNIT – II **9**

Programmable ASICs: Antifuse - Static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs – Clock & power inputs- Xilinx I/O blocks.

UNIT – III **9**

Interconnects and Design Tools: Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX - Design systems - Half gate ASIC - Low level design language

UNIT – IV **9**

Logic Synthesis and Floorplanning: Verilog logic synthesis-.System partition - FPGA partitioning - Partitioning methods - Floorplanning

UNIT – V **9**

Placement and Routing: Placement - Physical design flow - Global routing - Detailed routing - Special routing -Circuit extraction –DRC

TOTAL: 45

TEXT BOOK:

1. Smith.M.J.S, “Application Specific Integrated Circuits”, 12th impression, Pearson Education, 2013

REFERENCE BOOKS:

1. Farzad Nekoogar and Faranak Nekoogar, “From ASICs to SOCs: A Practical Approach”, 1st Edition, PHI Learning, 2003.
2. Wayne Wolf, “FPGA-Based System Design”,1st Edition, PHI Learning, 2009
3. Rajsuman.R, “System-on-a-Chip Design and Test”,1st Edition, Santa Clara, CA: Artech House Publishers, 2000
4. Nekoogar.F, “Timing Verification of Application-Specific Integrated Circuits (ASICs)”, PHI Learning, 1999
5. Srinivasan.S, “VLSI Circuits”, NPTEL Courseware, 2007.
6. http://nptel.ac.in/courses/106105161/
7. https://www.ece.ncsu.edu/asic/lect/Intro_2up.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyze the different types of ASICs design
CO2: comprehend the different logic cell architecture and interconnects.
CO3: use different programmable ASIC design software
CO4: analyze floorplanning and placement in an ASIC.
CO5: perform routing design in an ASIC

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE14 REAL TIME OPERATING SYSTEMS

3 0 0 3

Pre-requisites: Microcontroller Architecture and Applications

UNIT – I **9**

Real Time Operating Systems: Basic definitions – Foreground/Background systems – Shared resources – Multitasking – Tasks – Priority inversion problem – Context switches – Kernels – Scheduling approaches – FIFO – Non-preemptive and preemptive kernels – Round-Robin scheduling – Rate monotonic scheduling – Mutual exclusion – Deadlock – Synchronization – Event flags – Interrupts – Clock ticks – Advantages and disadvantages of real time kernels.

UNIT – II **9**

Task Management: Tasks –Task states – TCB – Task scheduling – Locking and unlocking the schedulers – Idle task – Statistics task - Creating tasks – Task stacks – Stack checking – Deleting – Changing a task's priority – Suspending task – Resuming task – Task query. **Hardware Implementation:** Task creation and execution for three tasks.

UNIT – III **9**

Time Management: Delaying a task – Resuming a delayed task – System time. **Event control blocks**: Placing a task in the ECB wait List – Removing a task from an ECB wait list – Finding the highest priority task – List of free ECBs – Initialize – Task ready, wait and time out of an event.

UNIT – IV **9**

Inter-task Communication Management: Semaphore Management: Creating – Deleting – Waiting – Signaling - Non-Blocking and Query.Message Mailbox Management: Creating – Deleting – Waiting - Sending and getting a message - Query and using a mailbox as a binary semaphore Message Queue Management: Creating – Deleting – Waiting - Sending (FIFO and LIFO) and getting a message – Flushing – Query - Using a queue when reading analog inputs and using a queue as a counting semaphore Hardware Implementation: Semaphore - Mailbox - Message queue for LCD application

UNIT – V **9**

Memory Management: Memory control blocks - Creating partition - Obtaining a memory block - Returning a memory block – Query - Memory partition and waiting for memory blocks from a partition

Case study: Digital camera using µC/OS-II.

Total : 45

TEXT BOOK:

1. Jean J. Labrosse, "MicroC/OS – II The Real Time Kernel", 2nd Edition, CMP Books, 2011.

REFERENCE BOOKS:

1. Rajkamal, "Embedded Systems Architecture, Programming and Design", 3rd Edition, McGraw-Hill, New Delhi, 2014.
2. David E. Simon, "An Embedded Software Primer", 2nd Edition, Pearson Education, 2005.
3. Chowdary Venkateswara Penumuchu, "Simple Real-time Operating System: A Kernel Inside View for a Beginner", 1st Edition, Trafford Publishing, 2008
4. http://www.freertos.org/about-RTOS.html
5. http://www.nptelvideos.in/2012/11/real-time-systems.html

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: realize the basic concepts of RTOS
CO2: develop a real time system with suitable scheduling techniques
CO3: manage different task resources and timings
CO4: comprehend various inter process communication
CO5: customize real time operating systems for embedded applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE15 PATTERN RECOGNITION

3 0 0 3

UNIT – I **9**

Pattern Classifier: Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation -Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm - Problems with bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

UNIT – II **9**

Unsupervised Classification: Clustering for unsupervised learning and classification - Clustering concept – C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.

UNIT –III **9**

Structural Pattern Recognition: Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing - Stochastic grammars and applications - Graph based structural representation

UNIT – IV **9**

Feature Extraction and Selection: Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection

UNIT – V **9**

Soft Computing Techniques for Pattern Recognition: Neural network structures for pattern recognition - Neural network based pattern associators – Unsupervised learning in neural pattern recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers -Pattern classification using genetic algorithms.

TOTAL : 45

TEXT BOOKS:

1. Robert J.Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", 1st Edition, John Wiley &Sons Inc., New York, 2007.

REFERENCE BOOKS:

1. Tou and Gonzales, "Pattern Recognition Principles", 2nd Edition, Wesley Publication Company, London, 2010.
2. Narasimha Murthy.M and Susheela Devi.V, "Pattern Recognition", 1st Edition, Springer 2011.
3. Theodoridis.S and Koutroumbas.K, "Pattern Recognition", 4th Edition., Academic Press, 2009.
4. Duda R.O., Hart.P.E., and Strok, "Pattern Classification", 2nd Edition Wiley, New York, 2001.
5. Morton Nadier and Eric Smith P., "Pattern Recognition Engineering", 1st Edition, John Wiley & Sons, New York, 1993.
6. http://nptel.ac.in/courses/106106046/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret various pattern recognition algorithms
CO2: realize clustering concepts and algorithms
CO3: analyze data using structural pattern recognition techniques
CO4: extract and select the features from the dataset
CO5: perform pattern classification using neural networks and fuzzy logic

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT16 STATISTICAL THEORY OF SIGNAL PROCESSING

3 0 0 3

Pre-requisites: Digital Signal Processing

UNIT – I **9**

Discrete Random Signal Processing: Discrete time random process – Random process: Ensemble averages- Gaussian process – Stationary process – The autocovariance and autocorrelation matrices – Ergodicity – White noise- Power spectrum. Filtering random process – Spectral factorization - Parseval's theorem – Wiener Khintchine relation.

UNIT – II **9**

Spectrum Estimation: Non parametric Spectrum Estimation: Periodogram - Performance of periodogram - Modified periodogram - Bartlett's method - Welch's method - Blackman Tukey method - Parametric Spectrum Estimation: ARMA process – Yule-Walker method - AR process – MA process

UNIT –III **9**

Signal Modeling: The Least Squares Method – Pade approximation – Prony's method – Pole zero modeling – Stochastic models – The Levinson Durbin Recursion: Development of the Recursion – The Lattice Filter – Properties – The Step Up and Step Down Recursions

UNIT – IV **9**

Wiener Filtering: Least mean squared error criterion – FIR Wiener filter – Filtering – Linear prediction- IIR Wiener filters – Non causal IIR Wiener filter – Causal IIR Wiener filter.

UNIT – V **9**

Adaptive Filter: Concepts of adaptive filter – FIR adaptive filters – LMS algorithm – Applications: Noise cancellation- Adaptive recursive filters - Simplified IIR LMS adaptive filter

TOTAL : 45

TEXT BOOKS:

1. Hayes, Monson H. "Statistical Digital Signal processing and Modeling",1st Edition, John Wiley and Sons, Inc., 2008

REFERENCE BOOKS:

1. Ifeachor, Emmanuel C. and Jervis, Barrie N. "Digital Signal Processing: A Practical Approach", 2nd Edition, Addison-Wesley Publishing Company, 2002
2. Proakis, John G. and Manolakis, Dimitris G. "Digital Signal Processing: Principles Algorithms and Applications", 4th Edition, Pearson Education, 2009.
3. Vaidyanathan,P.P, "Multirate Systems and Filter Banks",1st Edition, PHI Learning, 1992.
4. Sophoncles J. Orfanidis, "Optimum Signal Processing ", 1st Edition, Mc Graw-Hill, 2000.
5. http://www.nptel.ac.in/syllabus/117103019/
6. http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/chapters/Statistical%20Signal%20Processing.pdfta

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: apply the concepts of discrete random signal processing in real time applications
CO2: estimate and analyze the spectrum using parametric and non-parametric approach
CO3: design adaptive filters
CO4: model and analyze the signals
CO5: apply the concepts of Wiener filtering to various applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MTE07 AUTOMOTIVE ELECTRONICS

(Common to Mechatronics, ECE and EIE branches **)**

3 0 0 3

Pre-requisites: Sensors and Transducers

UNIT – I **9**

Introduction: Evolution of electronics in automobiles – Emission test – Introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working, charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT – II **9**

Ignition and Injection Systems: Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control - Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT – III **9**

Sensors and Actuators: Working principle and characteristics of sensors: Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, Temperature, Exhaust gas oxygen sensor. Study of fuel injector, Exhaust gas recirculation actuators, Stepper motor actuator and Vacuum operated actuator.

UNIT – IV **9**

Engine and Emission Control Systems: In vehicle networks: CAN, LIN, FLEXRAY, MOST, KWP2000. Control modes for fuel control-engine control subsystems – Ignition control methodologies – Engine management system. Catalytic converter – EGR – SCR – DeNox Trap.Diagnostics systems in modern automobiles.

UNIT – V **9**

Chassis and Safety Systems: Electronic transmission control. Traction control system – Adaptive cruise control – Electronic control of automatic transmission - Antilock braking system - Electronic Stability Program – Electronic suspension system – Working of airbag and role of MEMS in airbag systems –Seat belt tensioners. Centralized door locking system – Climate control of cars.

TOTAL : 45

TEXT BOOKS:

1. Tom Denton, "Automobile Electrical and Electronics Systems", 4th Edition, Edward Arnold Publishers, London, 2013.
2. Ribbens, William B., "Understanding Automotive Electronics", 7th Edition, Butterworth- Heinemann, Burlington, 2012.

REFERENCE BOOKS:

1. Hollembeak, Barry., "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, New York, 2002.
2. Tim, Gilles., "Automotive Engines: Diagnosis, Repair, Rebuilding", 7thEdition, Delmar Publishers, New York, 2015.
3. Donald Christiansen, Charles K Alexander., "Standard Handbook Of Electronic Engineering", 5th Edition, McGraw-Hill, 2005.
4. Robert Bosch GmbH, "Automotive Hand Book", 9th Edition, Wiley, 2014.
5. http://www.boschindia.com/en/in/our_company_5/business_sectors_and_divisions_5/automotive_electronics_5/automotive-electronics.html
6. http://www.mitindia.edu/en/it-research/108-mitindia/departments/automobile/auto-general

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: adapt to the continuous changes in emission and safety norms of India
CO2: analyze the use of electronic ignition and injection system used in automobile
CO3: identify the various sensors and actuators for automotive applications
CO4: design the control system for ECU used in engine management system
CO5: utilize the safety systems for automobile upgradation

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CSE20 .NET TECHNOLOGIES

3 0 0 3

UNIT-I **9**

C# Fundamentals: Overview of C# and the .NET framework, C# language fundamentals- Classes and Objects- Structs- Arrays- Indexers- Collections- Strings and regular expressions

UNIT – II **9**

Object Oriented Concepts: Inheritance and polymorphism- Operator overloading- Interfaces- Handling exceptions- Delegates and events.

UNIT – III **9**

CLR AND .NET Framework: Assemblies and versioning- Attributes and reflection- Marshaling and remoting- Threads and synchronization

UNIT – IV **9**

Windows Forms and Controls: Windows forms - Forms namespace- Properties- Inheritance- Dialog boxes – Dialog result- Common dialog classes- Control class- Mouse events- Label- Buttons- Text controls- Menus and bars

UNIT – V **9**

ADO.NET: ADO.NET: ADO.NET object model- Managed providers- Binding data- Data reader and data grid. Updating ADO.NET: Updating with SQL- Updating data- Multiuser updates- Command builder

TOTAL : 45

TEXT BOOKS

1. Liberty J., "Programming C#", 2nd Edition, O'Reilly, 2002.
2. Liberty J. and Hurwitz D.,"Programming .NET Windows Applications", 2nd Edition, O'Reilly, 2003.

REFERENCE BOOKS

1. Schildt, Herbert, "The Complete Reference: C#", 4th Edition, McGraw-Hill, 2004.
2. Troelsen,Andrew., "C# and the .NET Platform", 2nd Edition, A Press, 2003.
3. Thuan L. Thai, ".NET Framework Essentials", 3rdEdition, Hoang Lam Publisher: O'Reilly Media Publisher, 2003.
4. https://www.youtube.com/watch?v=k2wWcHfDIvg
5. https://www.youtube.com/watch?v=ywN0vTFJNcw

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: develop, design and implement simple C# programs
CO2: display proficiency in C#.NET by building stand-alone applications
CO3: build object-oriented applications using C#.NET
CO4: create data-driven windows applications using C#.NET and ADO.NET
CO5: use Microsoft ADO.NET to access and manipulate data in a database

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GEE81 ENTREPRENEURSHIP DEVELOPMENT

(Common to all Engineering and Technology branches except Civil and Chemical Engg.)

3 0 0 3

Unit-I **9**

Entrepreneurship Concepts: Meaning and concept of entrepreneurship, Role of Entrepreneurship in Economic Development. Factors affectingEntrepreneurship –Creativity, Innovation and Entrepreneurship, Intrapreneurship

UNIT – II **9**

Entrepreneur: Definition, Entrepreneurial Motivation, Characteristics of Entrepreneurs, Distinction between an Entrepreneur and a Manager.

UNIT – III **9**

Business Plan: Objectives of a Business Plan, Business Planning Process, Opportunity Identification and Selection, Contents of a Business Plan, Functional Plans.

UNIT – IV **9**

Entrepreneurial Eco System: Forms of Business Ownership, Sources of Finance, Institutional Support to Entrepreneurs.

UNIT – V **9**

Small Business Management: Definition of Small Scale Industries, Strengths and Weaknesses of Small Business, Growth Strategies in Small Scale Enterprises, Sickness in Small Enterprises – Symptoms, Causes and Consequences.

TOTAL : 45

TEXT BOOK:

1. S.S.Khanka, ―Entrepreneurial Development‖, 4th Edition, S.Chand & Company Ltd., 2012.
2. Madhurima Lall and Shikha Sahai, ―Entrepreneurship‖, 2nd Edition, Excel Books, New Delhi, 2008.

REFERENCE BOOKS:

1. Raj Shankar, ―Entrepreneurship, Theory and Practice‖, Vijay Nicole Imprints Pvt. Ltd., Chennai 2012.
2. Barringer and Ireland, ―Entrepreneurship‖, 3rd Edition, Pearson Education, 2012.
3. Zimmer and Scarborough, ―Essentials of Entrepreneurship and Small Business Management‖, 5th Edition, PHI Learning Pvt. Ltd., 2009.
4. https://www.scribd.com/doc/32063037/1-Concept-of-Entrepreneur-Entrepreneurship
5. http://www.oecd.org/cfe/leed/entrepreneurial-ecosystems.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the concepts of entrepreneurship and its importance

CO2: understand the traits of an entrepreneur and the sources of his motivation

CO3: understand the components of a business plan

CO4: demonstrate knowledge of various sources of finance and institutions supporting entrepreneurship

CO5: understand the nature of small business and causes of industrial sickness

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE17 CYBER PHYSICAL SYSTEM

3 0 0 3

Pre-requisites : Embedded System Design

UNIT – I **9**

Introduction: Embedded computing – Design methodologies – Model based design – Formal methods - Computational models – Reliability – Safety – Security – Applications

UNIT – II **9**

Design of Embedded Systems: Embedded processors – Multiprocessor architectures – Operating system and middleware considerations – Hardware/software co-design algorithms.

UNIT – III **9**

Synchronous Model: Reactive components – Finite state components – Combinational components – Non deterministic components – Input enabled components – Composing components – Synchronous designs

UNIT – IV **9**

Asynchronous Model: Asynchronous processes – Asynchronous design primitives – Protocols – Temporal logic – Model checking

UNIT – V **9**

Hybrid Dynamical Systems: Continuous time models – Designing controllers – Hybrid dynamical models – Designing hybrid systems

TOTAL: 45

TEXTBOOKS:

1. Rajeev Alur, "Principles of Cyber Physical Systems" 1st Edition, MIT Press, 2015.
2. Lee Edward, Seshia Sanjit Arunkumar, "Introduction to Embedded Systems – A Cyber Physical Systems Approach", 2nd Edition, 2015.

REFERENCE BOOKS:

1. Marilyn Wolf, "High-Performance Embedded Computing: Applications in Cyber-Physical Systems and Mobile Computing", 2nd Edition, 2014.
2. Krishna.C.M, Kang G. Shin, "Real – Time Systems", 3rd Reprint, McGraw Hill, 2010.
3. Stuart Bennett, "Real Time Computer Control – An Introduction", 2nd Edition, PHI Learning, 1998.
4. http://nptel.ac.in/courses/108102045/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend various design constraints in an embedded system
CO2: use various methods/algorithms for hardware- software co-design
CO3: appreciate the concepts of synchronous and asynchronous models
CO4: develop applications based on cyber physical system concepts
CO5: design hybrid cyber physical systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE18 NETWORK INFORMATION SECURITY

3 0 0 3

UNIT – I **9**

Introduction: Security Services: Confidentiality - Integrity and availability - Understanding the Threats: Malicious software: Viruses - Trojans- Rootkits- Worms- Botnets-Buffer overflow and Denial of service attacks - Access Control: Principles and Policies: DAC and RBAC.

UNIT – II **9**

Cryptography Tools: Confidentiality with symmetric key encryption- Message authentication and hash function-Public key encryption – Digital signature and key management-User authentication: Password based - Token based – Biometric - Remote user.

UNIT – III **9**

Cryptographic Algorithms: Symmetric Encryption: Symmetric encryption principles - Data encryption standard - Advanced encryption standard – Public Key Cryptography: Secure hash functions (SHA) - HMAC and RSA

UNIT – IV **9**

Securing Information at Different Levels: Database Security: Need – Management systems-Relational database - Access control - Database encryption - Software Security: Handling program input - Writing a safe code - Interfacing with OS - Internet Security: Firewalls.

UNIT – V **9**

Management Issues: IT Security: Organizational context and policy - Risk assessment - Security controls - Security plan - Physical and Infrastructure: Threats – Prevention - Legal and Ethical Issues: Cybercrime and computer crime.

Total : 45

TEXT BOOK:

1. William Stallings, "Computer Security Principles and Practice", 2nd Edition, Pearson, 2012.

REFERENCE BOOKS:

1. Stamp .M, "Information Security: Principles and Practice," 2nd Edition, Wiley, 2011.
2. Charles Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 4th Edition, Pearson, 2007
3. Whitman M.E and Mattord H.J, "Principles of Information Security", 4th Edition, Course Technology, 2011.
4. https://www.youtube.com/watch?v=6pYZ2N9y2fQ
5. https://www.youtube.com/watch?v=0_59AocrBVo

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: apply the concepts of information security, technology and its principles to security systems
CO2: frame the concepts related to various cryptographic tools
CO3: determine the requirements and mechanisms for identification and authentication
CO4: design Cryptographic algorithms for securing information at different levels
CO5: identify various management issues related to security systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE19 TESTING AND FAULT DIAGNOSIS OF VLSI CIRCUITS

3 0 0 3

Pre-requisites : VLSI Design

UNIT I **9**

Fault Modeling and Simulation : Defect, errors and faults- Functional versus structural testing-Levels of fault models-Single stuck at fault-Modeling circuits for simulation- Algorithms for true-value simulation- Algorithms for fault simulation- Statistical methods for fault simulation

UNIT–II **9**

Test Generation of Combinational Circuits: Algorithms and representation- Redundancy identification- Testing as a global problem-Combinational ATPG algorithm-D-algorithm-PODEM-FAN-Test generation Systems-Test compaction.

UNIT-III **9**

Test Generation of Sequential Circuits: ATPG for single clock synchronous circuits- Time-Frame expansion method-Simulation based sequential circuit

UNIT- IV **9**

Design for Testability: Testability –AdHoc design for testability techniques- Controllability and observability by means of scan registers- Generic scan based design- Classical scan designs- Board level and system level DFT approaches-Boundary scan standards

UNIT –V **9**

Logic level Diagnosis: Basic concepts- Fault dictionary- Guided probe testing- Diagnosis by UUT reduction-Fault diagnosis for combinational circuits- Expert systems for diagnosis - Effect cause analysis- Diagnostic reasoning based on structure and behavior

TOTAL :45

TEXT BOOK:

1. Bushnell, M.L and. Agrawal, V.D., “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Kluwar Academic Publishers, 2002.

REFERENCE BOOKS:

1. Abramovici, M., Breuer, M.A and Friedman, A.D., “Digital Systems and Testable Design”, Jaico Publishing House, 2002.
2. Nilcolici Nicoda, Al- HAshmini, “Power constrained Testing of VLSI Circuits”, Kluwer Academic Publishers, 2003.
3. Laung – Terng wang,Charles E.Stroud and Nur A.Touba., “System on Chip Test Architectures: Nano meter design Design for Testability”, Morgan Kaufmann Publisher, 2007.
4. Laung – Terng wang, Cheng – wen wu, Xidogingwen, “VLSI Testing Principles and Architectures: Design for Testability”, Morgan Kaufmann Publisher, 2006.
5. https://www.ee.iitb.ac.in/~viren/Courses/2012/EE709.htm
6. http://nptel.ac.in/courses/106103016/21

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret the different types of fault models
CO2: generate test patterns to detect the fault in combinational circuits
CO3: generate test patterns to detect the fault in sequential circuits
CO4: design a circuit for testability
CO5: perceive the different measures of system diagnosability

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE20 LOW POWER VLSI DESIGN

3 0 0 3

Pre-requisites : VLSI Design

UNIT – I **9**

Power Dissipation in CMOS: Sources of power dissipation – Designing for low power-Physics of power dissipation in MOSFET devices-MIS structure–Long channel MOSFET – Submicron MOSFET- Gate –Induced drain leakage - Power dissipation in CMOS - Hierarchy of limits.

UNIT – II **9**

Power Estimation: Modeling of signals- Signal probability calculation- Probabilistic techniques for signal activity estimation- Statistical techniques- Estimation of glitching power- Sensitivity analysis- Power estimation using input vector compaction

UNIT – III **9**

Synthesis for Low Power: Behavioral level transform – Logic level optimization for low power-Circuit level

UNIT – IV **9**

Design and Test of Low Voltage CMOS Circuits: Circuit design style - Leakage current in deep sub micrometer transistors- Deep sub micrometer device design Issues- Key to minimizing short channel effects-Low voltage circuit design techniques- Testing deep sub micrometer ICs and elevated intrinsic leakage- Multiple supply voltage

UNIT – V **9**

Software Design for Low Power: Sources of Software power dissipation- Software power optimizations- Automated low-power code generation- Co design for Low Power

Total : 45

TEXT BOOK:

1. Kaushik Roy and S.C.Prasad, “Low power CMOS VLSI circuit design”, 1st Edition, Wiley, 2000.

REFERENCE BOOKS:

1. Chandrasekaran A.P and Broadersen R.W, “Low power digital CMOS design”, 1st Edition, Kluwer, 1995.
2. Gary Yeap, “Practical low power digital VLSI design”, 1st Edition, Kluwer, 1998.
3. Kiat-Seng Yeo, Kaushik Roy, “Low-Voltage, Low-Power VLSI Subsystems”, McGraw Hill, 2005.
4. Rabaey, M. Pedram, “Low Power Design Methodologies”, 1st Edition, Kluwer Academic Publications. 1996.
5. http://nptel.ac.in/courses/106105034/
6. http://www.ee.ncu.edu.tw/~jfli/vlsi21/lecture/ch04.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret the physics of power consumption in CMOS VLSI circuits
CO2: estimate the power consumption at different levels of design abstraction
CO3: perceive the synthesis and optimization procedure for low power dissipation
CO4: use power minimization techniques and energy minimization techniques in CMOS VLSI circuits
CO5: analyse software power optimization techniques

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE21 RISC: PROGRAMMING AND APPLICATIONS

3 0 0 3

Pre-requisites : Microcontroller Architecture and Applications

UNIT – I **9**

RISC Architecture: ARM dataflow model – Pipeline – Registers – CPSR – Exception – Modes – Interrupt – ARM instructions – Thumb instruction set – ARM-Thumb interworking

UNIT – II **9**

System Peripherals: Bus structure – Memory map – Memory accelerator module – External bus interface – Phase Locked Loop – VLSI peripheral bus divider – Power control – Interrupt system

UNIT – III **9**

User Peripherals: Pin connect block – General purpose I/O – Timers – Capture – Compare – PWM modules– Watchdog timer – Analog to digital converter

UNIT – IV **9**

Peripheral Communication: UART – I2C interface – SPI interface – CAN interface

UNIT – V **9**

Implementation of Embedded OS: Simple little operating system-Directory layout-Initialization-Interrupts and exceptions handling-Scheduler-Context switch-Device driver framework

TOTAL : 45

TEXT BOOK:

1. Trevor Martin, "The Insider's Guide to the Philips ARM-7 based Microcontrollers", 2nd Edition, Hitex(UK) Ltd., 2006.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield "ARM System Developer's Guide Designing and Optimizing System Software", Morgan Kaufmann Publishers - Elsevier 2007.

REFERENCE BOOKS:

1. Steve Furber, "ARM System on chip Architecture", Addison Wesley, 2ndEdition, 2009.
2. LPC21xx User Manual
3. ttp://www.nxp.com/products/microcontrollers-and-processors/arm-processors/lpc-arm7-arm9-mcus/lpc-arm7-microcontrollers
4. http://infocenter.arm.com/help/index.jsp

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyze the different types of RISC architectures
CO2: comprehend the special function modules of an ARM7 processor
CO3: interface various peripherals with an ARM7 core
CO4: develop systems using RISC processor for various real time applications
CO5: implement embedded OS for an application

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE22 EMBEDDED INTERNET OF THINGS

3 0 0 3

Pre-requisites : Embedded System Design

UNIT – I **9**

Introduction to IoT: Definition and characteristics – Physical design – Logical design – Enabling technologies – Levels and deployment templates – Examples: Domain specific IoTs

UNIT – II **9**

IoT Networking: IoT and M2M – Software defined networking – Network function virtualization – System management with NETCONF-YANG – IoT design methodology

UNIT – III **9**

IoT Logical Design: Data types – Data structures – Control flow – Functions – Modules – Packages – File Handling – Date and time operation – Classes – Python packages of IoT. **IoT Physical Design:** Basic building blocks – Raspberry Pi – Linux on Raspberry Pi – Interfaces – Programming on Raspberry Pi with Python

UNIT – IV **9**

Raspberry Pi for Project Development: Raspberry Pi platform – GPIO – Establishment and setting of Raspberry Pi software – LAMP project – Home temperature monitoring system – Webcam and Raspberry Pi camera project

UNIT – V **9**

Arduino for Project development: Internet enabled Arduino powered garage door opener – Irrigation control system – Light controller. **Beaglebone black for Project development:** Message controller and cloud Services

TOTAL : 45

TEXT BOOK:

1. Arshdeep Bahga, Vijay Madisetti, " Internet of Things: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti , 2014
2. Donald Norris , "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", 1st Edition, McGraw Hill, 2015

REFERENCE BOOKS:

1. Donald Norris, "Raspberry Pi Projects for the Evil Genius, McGraw Hill Professional,2014
2. Adrian McEwen (Author), Hakim Cassimally, "Designing the Internet of Things",1st Edition,John Wiley and sons", 2014
3. Cuno Pfister."Getting started with the Internet of Things", 1st Edition, O'Reilly Media Inc, 2011
4. http://www.tutorialspoint.com/internet_of_things/
5. https://www.codeproject.com/Learn/IoT/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend the significance and applications of IoT
CO2: design IoT based systems for Inter-disciplines
CO3: provide IoT based solutions using Rasperry Pi development board
CO4: develop different control system with Arduino board
CO5: write programs using open source tools

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE23 OPTIMIZATION TECHNIQUES

3 0 0 3

UNIT – I **9**

Introduction to Optimization: Development- Engineering application-Statement of an optimization problem-Classification of problems-Optimization techniques: Classical optimization technique- Introduction- Single variable and multivariable with no constraints and equality constraints – Lagrange model-Optimization with inequality constraints.

UNIT – II **9**

Linear Programming Technique: Standard form of linear programming- Definition and theorems - Solution of a system of linear simultaneous equations-Simplex algorithm. **Non-linear Programming Problems:** Unimodel search **–**Elimination methods: Unrestricted search – Exhaustive search – Dichotomous search – Internal halving method - Golden selection method - Fibonacci method

UNIT – III **9**

Algorithm for Unconstrained Optimization: Direct search methods: Random search –Grid search – Indirect search methods : Gradient – Steepest descent –Newton's method – Marquardt method. **Algorithms for Constrained Optimization:** Characteristics of constrained problem- Direct Methods : Random search – Complex –DIJK's method for feasible directions – Indirect Methods: Rosan's gradient project method

UNIT – IV **9**

Evolutionary Algorithms: Particle Swarm Optimization- Covariance matrix adaptation evolution strategies-The (1 + 1)-EA - Mutation rates - Meta-evolution - Rechenberg's 1/5th rule- Self-adaptation - Iterated local search - Powell's conjugate Gradient method – Introduction to multi-objective optimization

UNIT – V **9**

Nature Inspired Algorithms: Concepts of Artificial Bee Colony algorithm – Ant Colony Optimization – Bat algorithm – Cuckoo search algorithm – Shuffled frog leaping algorithm

Total : 45

TEXT BOOK

1. S.S.Rao, "Engineering optimization –Theory and Practice", 4th Edition, John Wiley & Sons Inc, 2009
2 http://www.particleswarm.info/

REFERENCE BOOKS

1. Oliver Kramer, "A Brief Introduction to Continuous Evolutionary Optimization", Springer, 2014
2. Kalyanmoy deb, "Optimization for Engineering design: Algorithms and Examples", 2nd Edition, PHI Learning, 1995
3. Hamdy .H.Taha, "Operations Research: An Introduction", 9th Edition, Pearson India, 2011
4. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.464.446&rep=rep1&type=pdf
5. https://www.researchgate.net/publication/255971823_Bat_Algorithm_Literature_Review_and_Applications
6. http://www.tandfonline.com/doi/abs/10.1080/08839514.2014.904599?journalCode=uaai20

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: recognise and formulate problems that arise in engineering in terms of optimization
CO2: develop and promote research interest in applying optimization techniques in problems of engineering and technology
CO3: apply the mathematical results and numerical techniques of optimization theory to concrete engineering problems
CO4: apply the suitable optimization technique for real time applications
CO5: take-up research in solving various engineering problems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE24 RADAR ENGINEERING

3 0 0 3

Pre-requisites : Analog and Digital Communication

UNIT – I **9**

Radar and Radar Equation: Introduction to radar - Simple form of radar equation - Radar block diagram-Minimum detectable signal - Receiver noise – PDF – SNR - Integration of pulses.

UNIT – II **9**

CW and Frequency Modulated Radar: Doppler effect - CW radar - FMCW radar – Altimeter – Multiple frequency CW radar

UNIT – III **9**

Pulse Doppler Radar and Tracking Radar: Introduction to pulse doppler radar - Tracking radar –Tracking with radar- Sequential lobing- Conical scan- Tracking with surveillance radar.

UNIT – IV **9**

Radar Waveform Design: Bandwidth and pulse duration requirements - Range and doppler accuracy- The uncertainty relation - Pulse compression and phase coding.

UNIT – V **9**

Principles of Secondary Surveillance Radar: Synthetic aperture radar, OHR, Air surveillance radar- ECC measure- Stealth applications.

TOTAL : 45

TEXT BOOKS:

1. Skolnik.M.I, "Introduction to Radar Systems", 4thEdition, McGraw Hill Book Co., 2001.
2. Raju G.S.N, "Radar Engineering and Fundamentals and Navigational Aids", I.K. International, 2008.

REFERENCE BOOKS:

1. Simon Kingsley and Shaun Quegan, "Understanding Radar Systems", SciTech Publishing, 1999.
2. Harold R. Raemer, " Radar System Principles" CRC Press, Newyork, 1977.
3. Sharma.K.K, "Fundamentals of Radar, Sonar& Navigation Engineering" , S.K. Kataria & Sons, 2012.
4. http://www.radartutorial.eu/index.en.html
5. http://www.rfwireless-world.com/Tutorials/radar-tutorial.html

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: design and apply the radar principles on various applications
CO2: analyze the mathematical concepts of radar system
CO3: investigate different types of radar systems
CO4: be conversant with the concepts and terminologies of advanced radar systems
CO5: analyze the role of radar technology in modern surveillance systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE25 NEXT GENERATION WIRELESS COMMUNICATION

3 0 0 3

Pre-requisites : Data Communication and Internet Working

UNIT – I **9**

Next Generation Telecommunications Networks, Services and Management: Next generation technologies - Networks and services- Next generation OSS architecture - Strategic standards development and next generation management standards.

UNIT – II **9**

Software Defined Radio: 3G software radio –Applications - Hardware radio architecture; A basic SDR architecture - 2G radio architecture - Software defined radio block diagram - System level functional partitioning - Digital frequency conversion partitioning; RF System design - Digital frequency up and down converters - Frequency fundamentals - SDR requirements for processing power - Major software architectural choices - Application for wireless systems - Software defined radio examples.

UNIT – III **9**

COGNITIVE Radio: Introduction to cognitive network- Communication policy and spectrum - SDR as platform for cognitive radio - Cognitive radio technologies required - Spectrum awareness- Multiobjective GA for cognitive radios.

UNIT – IV **9**

Next Generation Wireless LAN: Introduction - MIMO/SDM basics - Robust performance - Receive diversity - Spatial expansion- Advanced channel access techniques - Transmit beam forming.

UNIT – V **9**

Multiplexing in MIMO Channel:MIMO-I spatial multiplexing and channel modelling-Multiplexing capability of deterministic MIMO channels, Physical modeling of MIMO channels-Geographically separated antennas - Line-of-sight plus one reflected path - Modeling of MIMO fading channels -**MIMO II**- capacity and multiplexing architectures - The V-BLAST architecture - Fast fading MIMO channel - Slow fading MIMO channel - D-BLAST: An outage-optimal architecture - **MIMO III**-2×2 MIMO Rayleigh channel - nt×nr MIMO i.i.d. Rayleigh channel - Universal code design for MIMO channels - **MIMO IV**- multiuser communication-uplink with multiple receive antennas - MIMO uplink, downlink with multiple receive antennas - MIMO downlink.

TOTAL : 45

TEXT BOOKS:

1. Thomas Plevyak,Veli Sahin, “Next Generation Telecommunication, Networks and Services”, IEEE press series on network management, Wiley Publications, 2010.
2. Eldad Perahia, Robert Stacey,” Next Generation Wireless LANS- Throughput, Robustness and Reliability in 802.11a”, Cambridge University Press 2008.

REFERENCE BOOKS:

1. Paul Burns, “Software Defined Radio for 3G”, Artech House, 2002.
2. Bruce Alan Fette,” Cognitive Radio Technology”, 2nd Edition, Newnes publication, Imprint of Elsevier, 2006.
3. David Tse, Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
4. nptel.ac.in/courses/106105080/pdf/M5L7.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: perceive the concepts of the next generation wireless communication
CO2: gain knowledge and understanding of intelligent networks, services and applications
CO3: provide technological solution towards transmit beam forming
CO4: comprehend software defined radio
CO5: perceive the advanced concepts in cognitive radios

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE26 REMOTE SENSING

3 0 0 3

Pre-requisites : Microwave Emgineering

UNIT – I **9**

Physics of Remote Sensing: Introduction of Remote Sensing, Electro Magnetic Spectrum Physics of Remote Sensing – Energy sources and radiation principles-Energy interactions in Atmosphere - Scattering - Absorption - Energy interactions with earth surface features- Spectral reflectance of vegetation soil and water.

UNIT – II **9**

Data Acquisition (Space and Aerial Platforms): Types of Platforms - Different types of aircrafts - Manned - Unmanned spacecrafts - Sun synchronize - Geo synchronize satellites - Photographic products, B/W - Colour-Colour IR film and their characteristics -Multi spectral scanners and thermal scanners - Geometric characteristics of scanner imagery calibration thermal scanners.

UNIT – III **9**

Earth Resource Satellites in Optical Spectrum: Overview of LANDSAT-LANDSAT -1,2 and 3, LANDSAT image interpretation- SPOT satellite program; SPOT-1,2 and 3,SPOT image interpretation

UNIT – IV **9**

Microwave and LIDAR remote sensing : Concept of microwave remote sensing - Types of RADARS - SLAR - Resolution - Range and azimuth -Real aperture and synthetic aperture RADARS -ERS - JERS - RADARSAT - LIDAR aerial laser terrain mapping.

UNIT – V **9**

Data Analysis in remote sensing: Scatterometer, altimeter. Resolution - Spatial - Spectral - Radiometric and temporal resolution - Signal to noise ratio – Different types of data products and their characteristics visual and digital interpretation –Image rectification and restoration- Geometric correction - Radiometric correction - Image enhancement - Different types – Image classification –Supervised classifications

TOTAL:45

TEXT BOOKS:

1. Lillesand T.M. and Kieer R.W., "Remote sensing and Image Interpretation", 4th Edition, 2000.
2. Paul Curran, P. J. "Principles of Remote Sensing", ELBS, 1995.of John Wiley and Sons, 2000.

REFERENCE BOOKS:

1. Sabins Jr, F.F., "Remote Sensing Principles and Image interpretation", Waveland Pr Inc., 2007
2. Rees G. . "Physical principles of remote sensing",3rd edition, Cambridge University Press 2012
3. https://www.scribd.com/doc/233973017/Remote-Sensing-and-Image-Interpret-T-M-Lillesand

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the concepts of remote sensing in the electromagnetic spectrum physics
CO2: analyze the performance of LANDSAT,SPOT and its image interpretation
CO3: appreciate and comprehend the microwave and LIDAR remote sensing
CO4: acquire knowledge on data analysis in remote sensing
CO5: evaluate the performance of space and aerial platforms

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECO01 EMBEDDED SYSTEMS

3 0 0 3

UNIT – I **9**

Principles of Embedded Systems: Introduction - Embedded systems description, definition, design considerations & requirements - Overview of Embedded system Architecture (CISC and RISC) - Categories of Embedded Systems - Embedded processor selection & tradeoffs

UNIT – II **9**

Embedded Design life cycle: Product specification – Hardware / Software partitioning –Detailed hardware and software design – Integration – Product testing

UNIT – III **9**

Introduction to RTOS –Advantage and Disadvantage of Using RTOS – Multitasking – Tasks and task states -Real Time Kernels – Scheduler - Non-preemptive Kernels - Preemptive Kernels – Round Robin Scheduling - Task Priorities -Static Priorities – Mutual Exclusion – Deadlock – Clock ticks

UNIT – IV **9**

Inter Process Communication: Semaphore Management: Overview – Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox – Deleting Mailbox – Waiting for a Message box – Sending Message to a Mailbox- Status of Mailbox .Message Queue Management: Creating Message Queue – Deleting a Message Queue – Waiting for a Message at a Queue – Sending Message to a Queue – Flushing a Queue.

UNIT – V **9**

Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memory Block – Returning a Memory Block. Case study of coding for a Digital Camera using MUCOS RTOS.

TOTAL : 45

TEXT BOOKS:

1. Frank Vahid, Givargis, "Embedded Systems Design: A Unified Hardware/Software Introduction", Wiley Publications, 2009.
2. Arnold S. Berger, "Embedded System Design" CMP books, USA 2002.
3. Jean J. Labrosse, "MicroC/OS – II The Real Time Kernel", CMP Books, 2nd Edition, 2002.

REFERENCE BOOKS:

1. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill, New Delhi", 2003.
2. Steve Furbe, "ARM System-on-Chip Architecture", Addison-Wesley Professional, 2nd Edition, 2000.
3. http://nptel.ac.in/courses/108102045/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: select the suitable Embedded processor for real time application
CO2: design embedded based applications
CO3: work with real time Operating Systems
CO4: create real time optimized scheduling algorithms
CO5: develop real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECO02 WIRELESS INTERNETWORKING TECHNOLOGIES

3 0 0 3

UNIT - I **9**

Wireless Local Area Networks: WLAN- Topologies- Technologies- Architecture- Physical Layer (PHY)- Medium Access Control- MAC Sub layer, IEEE 802.11b—High Rate DSSS, Interference between Bluetooth and IEEE 802.11

UNIT - II **9**

Wireless Personal Area Networks: Bluetooth (IEEE 802.15.1)-Protocol Stack- Connection Establishment-Bluetooth security architecture, Wireless Sensor Network (WSN) - protocol stack, sensor model, ZigBee radio module and topology, Low rate WPAN

UNIT - III **9**

Cellular System: Cellular system, frequency reuse, Channel Assignment Strategies, Handoff Strategies, Trunking and Grade of Service, Cellular System Coverage & Capacity Improvement concepts -cell splitting, Cell Sectorization , Repeaters, Micro cell zone concept

UNIT - IV **9**

Wide Area Wireless Networks: IEEE 802.16- WiMAX - Physical Layer (PHY)- MAC - Spectrum Allocation for WiMAX, GSM- Subsystem- Logical Channels- Frame Format

UNIT - V **9**

Fourth Generation (4G) Systems and Technologies: 4G Features and Challenges- Multicarrier Modulation- MIMO- Architecture of BLAST, Software Defined Radio and Cognitive Radio (CR)- Overview

TOTAL: 45

TEXT BOOKS:

1. Vijay K. Garg., "Wireless Communications and Networking", 1st Edition, Elsevier-Morgan Kaufmann Series

REFERENCE BOOKS:

1. Theodore S. Rappaport, " Wireless Communications: Principles and Practice", 2nd Edition, PHI-2010.
2. Andrea Goldsmith, "Wireless Communication", 1st Edition, Cambridge University Press, New Delhi, 2005.
3. https://www.youtube.com/watch?v=jUvIrVfDNx4
4. https://www.youtube.com/watch?v=NhA_fClcBD0&list=PLoCUlAGhY8dJe1ou5wSiqmXJcXLOefIT9

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: design the wireless architecture and technologies used in modern wireless communication and networking
CO2: apply the cellular concepts to optimize the usage and improve the coverage of mobile system
CO3: analyze the functions of different sectors of wireless infrastructure networks.
CO4: design and develop the wireless protocols for personal area network coherent with the existing IEEE standards
CO5: analyze and provide solution for real world complex problem emerging from wide area wireless networks

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECO03 BIOMEDICAL SIGNAL AND IMAGE PROCESSING

3 0 0 3

UNIT – I **9**

Adaptive Filtering Techniques: Review of the Wiener filtering problem- Principle of an adaptive filter- Steepest descent algorithm - Widrow Holf least mean square adaptive algorithm - Adaptive noise canceller - Cancellation of 60 Hz interference in electrocardiography- Canceling donor heart interference in heart transplant electrocardiography- Cancellation of the electrocardiography signal from the electrical activity of the chest muscles- Canceling method to enhance fetal ECG monitoring - Cancellation of high frequency noise in electro-surgery.

UNIT – II **9**

Cardiological Signal Processing: Basic ECG - Electrical activity of the heart- ECG data acquisition – ECG parameters & their estimation- Noise & artifacts in ECG signal processing- ECG QRS detection techniques- Estimation of R-R interval using the finite first difference model- Estimation of ST segment inclination

UNIT – III **9**

ECG Data Reduction Techniques: Direct data compression techniques –Direct ECG data compression techniques - Transformation compression techniques - Other data compression techniques – Data compression techniques comparison

UNIT – IV **9**

Neurological Signal Processing: The brain and its potentials – The electrophysiology origin of brain waves – the EEG signal and its characteristics - EEG analysis - Linear prediction theory - Autoregressive model- Recursive estimation of AR parameters.

UNIT – V **9**

Medical Imaging: Fundamentals of image processing - Image storage and retrieval - Image processing : Filters - transformation and registration - Image segmentation : Pixel based methods - Continuity based methods - Morphological operations - Edge based segmentation - Image Reconstruction : CT, PECT and SPECT - Magnetic Resonance Imaging

TOTAL : 45

TEXT BOOK:

1. D.C.Reddy ,"Biomedical Signal Processing: Principles and techniques", 4th Edition, McGraw Hill, New Delhi,2008
2. Semmlow, John L., and Benjamin Griffel, "Biosignal and medical image processing", 3rd Edition, CRC press, 2014.

REFERENCE BOOKS:

1. Rangaraj M Rangayyan**,"**Biomedical Signal Analysis, A case study approach**"** IEEE press publications, 2001.
2. Akay Metin ,"Nonlinear Biomedical Signal Processing, Fuzzy Logic, Neural Networks, and New Algorithms (IEEE Press Series on Biomedical Engineering) Volume 1 Edition Wiley-IEEE Press, 2000.
3. Kayvan Najarian , Robert Splinter, "Biomedical Signal and Image Processing", 2nd Edition, CRC Press, Taylor and Francis group, 2012.
4. http://cw.tandf.co.uk/imagingforstudents/sample-material/Chapter-1-Introduction-to-Medical-Imaging.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: design adaptive filters for real time application
CO2: implement algorithms for ECG signal processing
CO3: analyze neurological signals
CO4: perform compression of biomedical signals
CO5: analyze and interpret biomedical images

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECO04 OPTO ELECTRONICS

3 0 0 3

UNIT – I **9**

Elements of Light, Solid State Physics:: Wave nature of light- Polarization interference- Diffraction- Light Source- Review of quantum mechanical concept- Review of solid state physics- Review of semiconductor physics and semiconductor junction device.

UNIT – II **9**

Display Devices and Lasers: Photo luminescence- Cathode luminescence- Electro luminescence- Injection luminescence- LEDS plasma display- Liquid crystal displays- Numeric displays laser emission- Absorption- Radiation- Population inversion optical feedback- Threshold condition-Line shape function-Pumping - Laser modes- Classes of lasers- Mode locking- Q switching- Laser applications-Measurements of distance –Holography -Laser induced nuclear fusion

UNIT – III **9**

Optical Detectors : Photo detector- Thermal detector- Photo devices- Photo emissive devices-Photomultiplier- Noise in Photomultiplier-Photon counting technique- Image intensifier - Photo conductive detectors- Noise in photoconductive detectors - Junction detectors- Detector array - Detector performance.

UNIT – IV **9**

Optoelectronic Modulator :Introduction- Analog and digital modulation Franz-Keldysh and Stark effect modulators: Quantum well - Electro absorption modulators- Electro optic modulators- Magneto optic devices- Acousto optic devices- Optical switching and logic devices.

UNIT – V **9**

Integrated Circuits: Introduction to opto electronic ICs- Hybrid and monolithic integration- Application of opto electronic integrated circuits- Integrated transmitters and receivers- Guided wave devices.

TOTAL: 45

TEXT BOOK:

1. Wilson J and Hawkes J, "Opto-electronics: An Introduction", 3rd Edition, PHI Learning, 2007.

REFERENCE BOOKS:

1. Pallab Bhattacharya, "Semiconductor Opto-electronic Devices", 2nd Edition, PHI Learning, New Delhi, 2006.
2. Jasprit Singh, "Opto-electronics: An Introduction to Materials and Devices", McGraw-Hill International Edition, New York, 1996.
3. Emmanuel Rosencher, Berge Vinter, " Optoelectronics" , 1st Edition, Cambridge University Press, Newyork, 2002
4. http://nptel.ac.in/courses/115102026/

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret the state-of-art optoelectronic technology
CO2: analyze quantum mechanics and its role in the design and operation of optoelectronic devices
CO3: perceive semiconductor material properties and semiconductor optoelectronic device physics
CO4: customize the in-depth analysis of laser theory and rate equations in the design of laser and its types
CO5: implement theory and design of optoelectronics modulators

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECO05 NANO ELECTRONICS

3 0 0 3

UNIT-I **9**

Introduction to Nanotechnology: Introduction – Bottom-up and top-down approach- Zero-dimensional nanostructures – Nanoparticles through homogeneous nucleation and heterogeneous nucleation – One-dimensional nanostructures – Two-dimensional nanostructures – PVD – CVD - ALD

UNIT – II **9**

Special Nanomaterials and Fabrication of Nanostructures : Carbon fullerenes and nanotubes – Micro and mesoporous materials- Core shell structures – Organic Inorganic hybrids – Lithographic techniques – Structural characterization and chemical characterization

UNIT – III **9**

Hybrid Semiconductor Molecular Integrated Electronics: Introduction – Devices – Circuits – CMOL memories – CMOL FPGA circuits – CMOL DSP circuits. Naonomechanics: Surface effect – Defects – Phase transitions – Sensors – High density data storage – Optics and telecommunications – Nanomanipulators – Catalysis

UNIT – IV **9**

Transport in Nanostructures: Introduction – Semiconductor device scaling – Quantum effect devices – Electronic transport in semiconductors – Transport in nanoscale systems – Diffusive transport in quantum confined systems – Transmission and transport in nanoscale systems – Single electron tunneling

UNIT – V **9**

Spintronics: Introduction – Metallic magnetic multilayers – Interlayer exchange coupling – Giant Magneto Resistance - Magnetic tunnel junctions- Spin torque – Magnetic Hard Drives – Magnetic Random Access Memory – Semiconductor spintronics: Ferromagnetic semiconductors – Spin coherence – Spin orbit coupling – Spin injection – Spin extraction and ferromagnetic proximity polarization – Lateral spin valve – Hanle effect – Spin hall effect

TOTAL : 45

TEXT BOOKS:

1. Guozhong Cao, "Nanostructures and Nanomaterials: Synthesis, Properties and Applications", 2nd Edition, Imperial College press, 2011.
2. Anatoli Korkin and Federico Rosei, "Nanoelectronics and Photonics: From Atoms to Materials, Devices, and Architectures", Springer, 2008.

REFERENCE BOOKS:

1. Pradeep.T, "Nano The Essentials : Understanding nanoscience and nanotechnology", McGraw Hill Publishing Company Limited Principles of Communication Systems - Simon Haykin, 2nd Edition, John Wiley
2. Simon Deleonibus, "Electronic Device Architectures for the Nano-CMOS Era: From ultimate CMOS scaling to Beyond CMOS devices", Pan Stanford Publishing, Singapore, 2009
3. Teruya Shinjo , " Nanomagnetism and Spintronics" , 2nd Edition, Elsevier, 2013
4. http://nptel.ac.in/courses/117108047/
5. http://www.circuitstoday.com/nanoelectronics

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: comprehend the concepts of various synthesis process
CO2: analyze the special nanomaterials and its characterization
CO3: design and construct the CMOL circuits
CO4: perceive the electronic transport in nanoscale systems
CO5: utilize the concepts of spintronics

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECO06 SPEECH SIGNAL PROCESSING

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UNIT – I **9**

Mechanics of Speech: Speech production: Mechanism of speech production- Acoustic phonetics - Digital models for speech signals - Representations of speech waveform - Psycho acoustics.

UNIT – II **9**

Time Domain Methods for Speech Processing: Time domain parameters of speech signal – Methods for extracting the parameters: Energy- Average- Magnitude- Zero crossing Rate – Silence discrimination using ZCR – Short time auto correlation function – Pitch period estimation using auto correlation function.

UNIT – III **9**

Frequency Domain Methods for Speech Processing: Short time Fourier analysis: Fourier transform and linear filtering interpretations- Sampling rates – Spectrographic displays – Pitch and formant extraction - Homomorphic speech analysis: Cepstral analysis of speech- Formant and pitch estimation.

UNIT – IV **9**

Linear Predictive Analysis of Speech: Basic principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's recursive algorithm – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

UNIT – V **9**

Application of Speech & Audio Signal Processing: Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Hidden markov modeling - Automatic speech recognition: Feature extraction for ASR- Deterministic sequence recognition- Statistical sequence recognition- Language models - Speaker identification and verification.

TOTAL : 45

TEXT BOOK:

1. Rabiner.L. R and Schaffer.R.W, "Digital Processing of Speech signals",1st Edition, Pearson Education, 2009

REFERENCE BOOKS:

1. Quatieri, "Discrete-time Speech Signal Processing", 1st Edition, PHI Learning, 2008.
2. Rabiner. L.R and Juang.B.H., "Fundamentals of speech recognition", 1st Edition, Pearson Education, 2009
3. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", 2nd Edition, John Wiley and Sons Inc., Singapore, 2011.
4. nptel.ac.in/courses/117101055/cdeep%20demo%20ppt/processing.html
5. http://www.ee.ic.ac.uk/hp/staff/dmb/courses/speech/speech.htm

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: perform both time and frequency domain analysis of speech
CO2: perceive the acoustics of speech production
CO3: apply knowledge of speech recognition techniques for real time projects
CO4: design a simple system for speech processing
CO5: interpret the practical aspects of speech algorithms

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial