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 ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To be a centre of excellence for the development and dissemination of knowledge in Electrical and Electronics Engineering to benefit the society in the National and Global level.

MISSION

Department of Electrical and Electronics Engineering is committed to:

MS1: Develop innovative, competent, ethical and quality engineers to contribute for technical advancements to meet societal needs.

MS2: Provide state-of-the-art facilities for continual improvement in teaching-learning process and research activities.

MS3: Enrich the knowledge and skill of the students to cater to the industry needs and motivate them to become entrepreneurs.

2011 REGULATIONS

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Electrical and Electronics Engineering will

PEO1: Succeed in professional career by utilizing fundamental knowledge of basic sciences and engineering.

PEO2: Design, simulate, analyze and develop Electrical and Electronics Engineering based products which are reliable, cost effective and safe.

PEO3: Demonstrate communication skills, team work, ethics, codes of professional practice as well as an aptitude for continuous learning.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Graduates of Electrical and Electronics Engineering will be able to

a. apply knowledge of mathematics, science and engineering to domain specific applications.

b. identify, analyze and formulate Electrical and Electronics Engineering problems based on the knowledge of basic sciences and engineering.

c. design and develop Electrical and Electronic Engineering based solutions to meet the desired requirements.

d. investigate complex problems in the areas of power, control and energy to provide suitable solutions.

e. use the techniques, skills and modern engineering tools necessary for real world applications within realistic constraints.

f. apply engineering solutions in societal and global contexts.

g. understand the impact of the solutions on the environment to ensure sustainability.

h. understand the value of ethics and codes of professional practice in their professional endeavours.

i. function as an individual and as a part of multidisciplinary team to accomplish a common goal.

j. communicate effectively in both verbal and written forms.

k. exhibit knowledge of finance and project management useful to become an entrepreneur.

l. recognize the need for life-long learning in the context of continuous technological and other challenges.

MAPPING OF PEOs WITH POs

PEO\PO	a	b	c	d	e	f	g	h	i	j	k	l
PEO1	3	2	2	2	1	-	-	-	-	-	-	1
PEO2	2	2	3	3	3	2	2	-	-	-	-	-
PEO3	-	-	-	-	-	3	3	3	3	3	2	3

1 – Slight, 2 – Moderate, 3 – Substantial

CURRICULUM BREAKDOWN STRUCTURE UNDER REGULATION 2011

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)	16.21	510	30
Engineering Sciences(ES)	17.29	660	32
Humanities and Social Sciences(HS)	8.64	270	16
Program Core(PC)	46.48	1620	86
Program Electives(PE)	4.86	135	9
Open Electives(OE)	1.62	45	3
Project(s)/Internships(PR)	4.86	270	9
Total			**185**

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B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011-12 onwards)

SEMESTER – I

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11EL101	Technical English	3	0	0	3	50	50	100	HS
11MA101	Engineering Mathematics-I	3	1	0	4	50	50	100	BS
11PH101	Applied Physics	3	0	0	3	50	50	100	BS
11CY101	Applied Chemistry	3	0	0	3	50	50	100	BS
11ME101	Basics of Civil and Mechanical Engineering	3	0	0	3	50	50	100	ES
11ME102	Engineering Drawing	2	0	3	3	50	50	100	ES
	PRACTICAL								
11PH102	Physical Sciences Laboratory-I	0	0	3	1	50	50	100	BS
11ME103	Engineering Practices Laboratory	0	0	3	1	50	50	100	ES
				Total	**21**				

CA- Continuous Assessment, ESE- End Semester Examination
CBS – Curriculum Breakdown Structure

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CURRICULUM

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SEMESTER – II

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11EL201	Communication Skills	3	0	0	3	50	50	100	HS
11MA201	Engineering Mathematics-II	3	1	0	4	50	50	100	BS
11PH201	Materials Science	3	0	0	3	50	50	100	BS
11CY201	Environmental Science	3	0	0	3	50	50	100	BS
11CS101	Problem Solving and Programming	3	0	0	3	50	50	100	ES
11EE201	Circuit Theory	3	1	0	4	50	50	100	PC
	PRACTICAL								
11PH202	Physical Sciences Laboratory-II	0	0	3	1	50	50	100	BS
11CS102	Programming Laboratory	0	0	3	1	50	50	100	ES
11EE202	Circuits Laboratory	0	0	3	1	50	50	100	PC
				Total	**23**				

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B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011-12 onwards)

SEMESTER - III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11MA301	Engineering Mathematics - III	3	1	0	4	50	50	100	BS
11EC307	Electron Devices	3	0	0	3	50	50	100	PC
11CS308	Object Oriented Programming	3	0	0	3	50	50	100	ES
11EE302	Network Theory	3	1	0	4	50	50	100	PC
11EE303	DC Machines and Transformers	3	1	0	4	50	50	100	PC
11EE305	Electromagnetic Theory	3	1	0	4	50	50	100	PC
	PRACTICAL								
11EE306	DC Machines and Transformers Laboratory	0	0	3	1	50	50	100	PC
11EE307	Devices and Networks Laboratory	0	0	3	1	50	50	100	PC
11CS307	Object Oriented Programming Laboratory	0	0	3	1	50	50	100	ES
				Total	**25**				

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B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011-12 onwards)

SEMESTER - IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11MA401	Numerical Methods	3	1	0	4	50	50	100	BS
11EI304	Digital Logic Circuits	3	1	0	4	50	50	100	PC
11ME408	Thermodynamics and Fluid Mechanics	3	1	0	4	50	50	100	ES
11EC409	Electronic Circuits	3	1	0	4	50	50	100	PC
11EE401	Synchronous and Induction Machines	3	1	0	4	50	50	100	PC
11EI402	Measurements and Instrumentation	3	0	0	3	50	50	100	ES
	PRACTICAL								
11EE402	Synchronous and Induction Machines Laboratory	0	0	3	1	50	50	100	PC
11EE403	Analog and Digital Electronics Laboratory	0	0	3	1	50	50	100	PC
11EL202	Communication Skills Laboratory	0	0	3	1	50	50	100	HS
				Total	**26**				

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B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011-12 onwards)

SEMESTER – V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11EE501	Transmission and Distribution	3	1	0	4	50	50	100	PC
11EE502	Power System Protection and Switchgear	3	0	0	3	50	50	100	PC
11EI403	Analog Integrated Circuits	3	0	0	3	50	50	100	PC
11EE503	Control Systems	3	1	0	4	50	50	100	PC
11EC408	Communication Engineering	3	0	0	3	50	50	100	PC
11EE504	Microprocessors and Microcontrollers	3	0	0	3	50	50	100	PC
	PRACTICAL								
11EE505	Measurements and Integrated Circuits Laboratory	0	0	3	1	50	50	100	ES
11EE506	Microprocessors and Microcontrollers Laboratory	0	0	3	1	50	50	100	PC
11ME510	Thermodynamics and Fluid Mechanics Laboratory	0	0	3	1	50	50	100	ES
				Total	**23**				

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B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011-12 onwards)

SEMESTER – VI

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11GE601	Economics and Management for Engineers	3	0	0	3	50	50	100	HS
11EE601	Advanced Control Theory	3	1	0	4	50	50	100	PC
11EE602	Power System Analysis and Stability	3	1	0	4	50	50	100	PC
11EE603	Power Electronics	3	0	0	3	50	50	100	PC
11EE604	Digital Signal Processing and Applications	3	1	0	4	50	50	100	ES
11EI502	VLSI Systems	3	0	0	3	50	50	100	PC
	PRACTICAL								
11EE605	Power Electronics Laboratory	0	0	3	1	50	50	100	PC
11EE606	Digital Signal Processing and Applications Laboratory	0	0	3	1	50	50	100	ES
11EI606	Control and Instrumentation Laboratory	0	0	3	1	50	50	100	PC
				Total	**24**				

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B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011-12 onwards)

SEMESTER – VII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11GE701	Total Quality Management	3	0	0	3	50	50	100	HS
11EE701	Optimization Techniques for Electrical Engineers	3	1	0	4	50	50	100	PC
11EE702	Electric Drives and Control	3	0	0	3	50	50	100	PC
11CS707	Computer Architecture	3	0	0	3	50	50	100	ES
	Elective - I	3	0	0	3	50	50	100	PE
	Elective - II	3	0	0	3	50	50	100	PE
	PRACTICAL								
11EE703	Electric Drives Laboratory	0	0	3	1	50	50	100	PC
11EE704	Power System Laboratory	0	0	3	1	50	50	100	PC
11EE705	Electronic Design Laboratory	0	0	3	1	50	50	100	PC
				Total	**22**				

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B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2011-12 onwards)

SEMESTER – VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
11GE801	Professional Ethics and Human Values	3	0	0	3	50	50	100	HS
11EE801	High Voltage Engineering	3	0	0	3	50	50	100	PC
	Elective - III	3	0	0	3	50	50	100	PE
	Elective - IV	3	0	0	3	50	50	100	OE
	PRACTICAL								
11EE802	Project work and Viva-voce	0	0	18	9	100	100	200	PR
				Total	**21**				

CA- Continuous Assessment, ESE- End Semester Examination
CBS – Curriculum Breakdown Structure

LIST OF ELECTIVES						
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**CBS**
11CS403	Computer Networks	3	0	0	3	PE
11EC702	Optical Communication	3	0	0	3	PE
11EI605	Embedded Control	3	0	0	3	PE
11EE011	Power System Operation and Control	3	0	0	3	PE
11EE012	Renewable Energy Sources	3	0	0	3	PE
11EE013	Electric Power Utilization and Energy Auditing	3	0	0	3	PE
11EE014	Special Electrical Machines	3	0	0	3	PE
11EE015	Design , Estimation and maintenance of Electrical equipment	3	1	0	4	PE
11EE016	Power Quality	3	0	0	3	PE
11EI018	Neural Networks and Fuzzy Systems	3	0	0	3	PE
11EE017	Nano Computing	3	0	0	3	PE
11EC021	Analog VLSI Design	3	0	0	3	PE
11EI701	PLC,SCADA and DCS	3	0	0	3	PE
11EI021	Virtual Instrumentation	3	0	0	3	PE
11EI603	Biomedical Instrumentation	3	0	0	3	OE
11MA601	Probability and Statistics	3	1	0	4	PE
11GE011	Entrepreneurship Development	3	0	0	3	PE
11MT012	Micro Electro Mechanical Systems	3	0	0	3	PE
11MT702	Robotics and Machine Vision System	3	0	0	3	PE
11EI012	Electronic Instrumentation	3	0	0	3	PE

11EL101 TECHNICAL ENGLISH

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **17**

Grammar and Vocabulary: Word formation with prefixes and suffixes – Synonyms and Antonyms – Verb Patterns – Tenses (simple and compound tenses) - Simple, Compound and Complex Sentences - Voice – Use of Conditionals - Comparative Adjectives (affirmative and negative) – Expanding Nominal compounds - Articles - Use of Prepositions – Identifying Odd Words – Acronyms.

MODULE – II **13**

Listening: Listening for General Content – Intensive Listening – Listening for Specific Information : Retrieval of Factual Information – Listening to Identify Topic, Context, Function, Speaker's Opinion, Attitude, etc. – Global Understanding Skills and Ability to infer, extract gist and understand main ideas – Note-taking: Guided and unguided- Listening to fill up gapped texts.

Writing: Introduction to the Characteristics of Technical Style - Writing Definitions and Descriptions - Paragraph Writing (topic sentence and its role, unity, coherence and use of cohesive expressions) - Process Description(use of sequencing connectives)– Comparison and Contrast - Classifying the data - analysing / interpreting the data – Personal letter - Formal letter writing (Inviting Guest Speakers, letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries) – editing (punctuation, spelling and grammar) – Recommendations & Suggestions.

MODULE- III **15**

Reading: Exposure to different Reading Techniques - Reading for Gist and global meaning - Predicting the content - Skimming the text – Identifying the Topic Sentence and its role in each paragraph - Scanning - Inferring / identifying lexical and contextual meanings - Reading for structure and detail - Transfer of information / guided note-making - Understanding discourse coherence - Sequencing of sentences.

Speaking: Verbal and Non Verbal Communication - Pronunciation drills/ Tongue Twisters – Formal and Informal English - Oral practice – Developing Confidence - Introducing Oneself - Asking for or Eliciting Information - Describing Objects – Offering Suggestions and Recommendations – expressing opinions (agreement / disagreement.

TOTAL : 45

TEXT BOOK

1. "English for Engineers and Technologists", Combined Edition, Volume. I & II, Orient Longman, Oxford University Press, New Delhi, 2006.

REFERENCE BOOKS

1. Aysha Viswamohan, "English for Technical Communication", Tata McGraw-Hill, New Delhi, 2008.
2. Rizvi M Ashraf, "Effective Technical Communication", Fifth Edition, Tata McGraw- Hill, New Delhi, 2007.
3. Mark Ibbotson, "Cambridge English for Engineering", Cambridge University Press, New Delhi, 2009.
4. Rama Krishna Rao, A, "Learning English: A Communicative Approach" Orient Black Swan, Hyderabad, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Improve their vocabulary and appropriate usage of words in different academic and professional contexts.
CO2: Familiarize with different rhetorical functions of technical English.
CO3: Develop strategies that could be adopted while reading texts.
CO4: Speak effectively in English and career related situations.
CO5: Acquire knowledge in academic and professional writing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1									2	3		1
CO2									2	3		
CO3				2					2	3		1
CO4									2	3		
CO5				1					1	3		1

3 – Substantial, 2 – Moderate, 1 – Slight

11MA101 ENGINEERING MATHEMATICS – I

(Common to all Engineering and Technology branches)

3 1 0 4

MODULE – I **15**

Matrices: Linear independent and dependent of vectors – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigen vectors (without proof) – Cayley – Hamilton theorem (without proof).

Diagonalisation: Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Nature of quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE – II **15**

Differential Calculus: Curvature – Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature. Involutes and evolutes – Envelopes – Properties of envelopes and evolutes.

Functions of several variables: Functions of two variables – Partial derivatives – Total differential – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians.

MODULE - III **15**

Differential Equations: Linear differential equations of Second and higher order with constant coefficients when the R.H.S is e^{ax}, x^n, $n > 0$, Sinax, Cosax, $e^{ax}x^n$, $e^{\alpha x}$ Sinβx, $e^{\alpha x}$ Cosβx, x^n Sinαx and x^n Cosαx– Differential Equations with variable coefficients (Cauchy's form). Method of variation of parameters - Simultaneous first order linear equations with constant coefficients.

Applications of Differential Equations: Solution of specified differential equations connected with electric circuits, simple harmonic motion (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 2011, S.Chand and Co., New Delhi.
2. Veerarajan. T., "Engineering Mathematics, (for first year), Reprint Edition 2011, Tata McGraw-Hill New Delhi.

REFERENCE BOOKS

1. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, New Delhi, 2007.
2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, 2007.
3. Bali N.P and Manish Goyal, "Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publications, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Solve engineering problems which needs matrix computations.

CO2: Utilize the geometrical aspects of differential calculus and extremal problems which arise in function of several variables.

CO3: Apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3										1
CO3	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11PH101 APPLIED PHYSICS

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Acoustics : Classification of sound – Characteristics of musical sound – Weber-Fechner law – Absorption Coefficient – Reverberation – Reverberation time – Sabine's formula (growth & decay) – Factors affecting acoustics of buildings (reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies.

Ultrasonics : Introduction – Production – Magnetostriction effect – Magnetostrictive generator - Inverse piezoelectric effect - Piezoelectric generator - Detection of ultrasonics - Properties – Cavitation - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non destructive testing – Ultrasonic pulse echo system - Medical applications – A, B and C Scan displays – Ultrasonic imaging technique.

MODULE – II **15**

Lasers: Introduction – Principle of spontaneous emission and stimulated emission - Population inversion, Pumping, Einstein's Coefficients (A&B) - Types of lasers – Nd:YAG, CO_2, Semiconductor lasers: Homojunction and Heterojunction – Laser Applications – Industrial applications – Laser welding, Laser cutting, Laser drilling – Holography – Construction and reconstruction of images.

Fiber Optics & Applications: Principle – Classification based on materials, Modes of propagation, Refractive index profile - Crucible-crucible technique of fiber fabrication - Light sources for fiber optics – Detectors - Fiber optical communication links - Losses in optical fibers – Fiber optic sensors – Temperature, displacement, voltage and magnetic field measurement.

MODULE - III **15**

Quantum Physics and Applications: Black body radiation – Planck's theory (derivation)– Deduction of Wien's displacement law and Rayliegh – Jean's Law from Planck's theory – Compton effect – Theory and experimental verification - Matter waves – Uncertainty principle - Experimental verification – Schroedinger's wave equations – Time independent and time dependent equation – Physical Significance of wave function – Particle in a box (One dimensional) - Optical microscope – Limitations of optical microscopy - Scanning electron microscope - Transmission electron microscope.

TOTAL : 45

TEXT BOOKS

1. Avadhanalu M N and Kshirsagar P G, "A Text Book of Engineering Physics", S.Chand & company Ltd, New Delhi, 2007.
2. Palanisamy P K, "Engineering Physics", Scitech Publications, Chennai, 2008.

REFERENCE BOOKS

1. Gaur R K and Gupta S L , "Engineering Physics", Dhanpat Rai and Sons, New Delhi, 2006.
2. Rajendran V, "Engineering Physics", Prentice Hall of India, New Delhi, 2008.
3. Rajagopal K, "Textbook of Engineering Physics", Part I, PHI Learning Pvt. Ltd., New Delhi, 2008.
4. Personick S D, "Fibre Optics, Technology and Applications", Khanna Publishers New Delhi, 1987.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Infer and apply the basic concepts of design of acoustically good buildings and ultrasonics in engineering and technology.

CO2: Demonstrate the basics of fiber optic communication system and laser phenomena, and make use of them in engineering and technology.

CO3: Relate and inference the concepts of quantum physics to optical, electrical and other physical phenomena.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						1		1
CO2	3	3		2						1		1
CO3	3	3		2						1		1

3 – Substantial, 2 – Moderate, 1 – Slight

11CY101 APPLIED CHEMISTRY

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Water: Introduction - Sources of water - impurities in water - Types of water - Water quality standards - Water quality parameters (Discussion not required) - 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 - Lime soda, 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. **Electrochemistry:** Introduction - Cells – Representation of a galvanic cell - EMF measurements and its applications – 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 and Ni-Cd batteries.

MODULE – II **15**

Corrosion and Its Control: Introduction – Mechanism of dry and wet corrosion – galvanic corrosion - concentration cell corrosion – Galvanic series - Factors influencing rate of corrosion – corrosion control methods - Sacrificial anode and impressed current cathodic method – Corrosion inhibitors - Protective coatings - classifications - Pretreatment of metal surface - Metallic coating -electroplating and electrolessplating (General discussion) - Hot dipping (Tinning and galvanising) - Nonmetallic 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) **Combustion:** Introduction – Calorific Values – Gross and net – Theoretical calculation of minimum air for combustion (Theoretical aspects only) – flue gas analysis – Orsat's method - Explosive range and Spontaneous Ignition Temperature.

MODULE - III **15**

Fuels: coal – proximate and ultimate analysis – their importance – metallurgical coke - Otto-Hoffman byproduct method - Liquid fuel - refining of petroleum - Straight run, cracked and polymer petrol – Manufacture of synthetic petrol - polymerization (thermal and catalytic methods) - Hydrogenation of coal (Fisher Tropsch and Bergius methods) - knocking - octane number – improving octane number by additives – Diesel – cetane number – Gaseous fuels (Water gas, producer gas and biogas)

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

TOTAL : 45

TEXT BOOK

1. Jain PC and Monica Jain, "Engineering Chemistry", 15th Edition, Dhanpat Rai publication Co., New Delhi, 2008.

REFERENCE BOOKS

1. Dara S.S., "A Text Book of Engineering Chemistry", S.Chand & Co. Ltd., New Delhi, 2006.
2. Sharma B.K., "Engineering Chemistry", Krishna Prakasan Media (P) Ltd., Meerut, 2001.
3. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill, New Delhi, 2008.
4. 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: Represent the water quality parameters, water treatment methods for potable and industrial purpose and apply the principles of electrochemistry for EMF measurement and energy storing devices

CO2: Comprehend the effect of corrosion and corrosion control methods.

CO3: Represent the calculation for calorific values, theoretical amount of minimum air required for complete combustion and flue gas analysis.

CO4: Represents the types of fuel, engines , some individual polymers ,fabrications of plastics.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2	2	1				3		2
CO2	3	3		2	2	1				3		2
CO3	3	3		2	2	1				3		2
CO4	3	3		2	2	1				3		2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME101 BASICS OF CIVIL AND MECHANICAL ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **7**

Construction Materials: Introduction – Civil Engineering – Materials – bricks – stones – sand – cement – concrete – steel sections – Site selection for foundations – Bearing capacity – loads – Types of foundations – requirements.

MODULE – II **7**

Elements of Structures: Superstructure – brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Types of Bridges and Dams.

MODULE - III **8**

Elements of Surveying: Surveying – Objects – types – classification – principles – measurements of distances – Determination of areas –Building area calculation – illustrative examples – Basics of Interior and Landscaping.

PART–B: BASIC MECHANICAL ENGINEERING

MODULE – I **Metal Forming and Joining Processes** **7**

Foundry: Introduction- patterns – molding –casting - cupola furnace.

Forming: Introduction-Classification- Rolling, extrusion, and drawing.

Welding: Introduction-Classification - TIG, MIG welding, Gas welding, soldering and brazing.

Machining process: Introduction-Classification – lathe and drilling machines.

MODULE – II **Boilers and Power Plants** **8**

Steam Boilers: Introduction-Classification- Working Principle of Cochran boiler, Babcock and Wilcox boiler- Benson boiler - Boiler Mountings and accessories.

Power Plants: Classification of power plants – working principle of steam, Diesel, Hydro-electric and Nuclear Power plants- Merits and Demerits.

MODULE – III **IC Engines, Refrigeration and Air-conditioning** **8**

IC Engines: Classification-components - Working principle of Petrol and Diesel Engines- Four stroke and two stroke cycles- Comparison of four stroke and two stroke engines. Working principle of carburetor, fuel pump and multi point fuel injector.

Refrigeration and Air Conditioning System: Terminology of Refrigeration and Air conditioning, Properties of refrigerant - Principle of vapour compression and absorption system - Layout of typical domestic refrigerator - Window and Split type room Air conditioner.

TOTAL : 45

TEXT BOOKS

1. Palanichamy, M S., "Basic Civil Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Shanmugam, G, "Basic Mechanical Engineering", 4th Edition, Tata McGraw-Hill, New Delhi, 2011.

REFERENCE BOOKS

1. Rao, M.S., "Basics of Civil Engineering", Dhanpat Rai and Co, New Delhi, 2006.
2. Venugopal, K and Prabhu Raja, V, "Basic Mechanical Engineering", Sixth Edition, Anuradha Publishers, Kumbakonam, 2005.
3. Rao, P N, "Manufacturing Technology: Foundry, Forming And Welding", Tata McGraw-Hill, New Delhi, 2008.
4. Rajan, T.S, "Basic Mechanical Engineering, 3rd Edition, New Age International Publishers, NewDelhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: select the suitable construction materials and foundation required for a building
CO2: recall the various elements of the super structure
CO3: point out the various elements of surveying and landscaping
CO4: demonstrate the ability to describe the basics of metal forming and joining processes
CO5: demonstrate the knowledge on patterns, molding, casting, rolling, extrusion, drawing, TIG, MIG welding, gas welding, soldering and brazing
CO6: describe basics of boilers and power plants
CO7: explain the working principle of steam, Diesel, Hydro-electric and Nuclear power plants
CO8: demonstrate the working of IC engines, Refrigeration and Air-conditioning systems

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2	2	2	2	1						
CO2	3	2	2	2	2	1						
CO3	3	2	2	2	2	1						
CO4	3				2			1				3
CO5	3				2			3				2
CO6	3				2			1				3
CO7	3				3			2				3
CO8	3				2			1				3

3 – Substantial, 2 – Moderate, 1 – Slight

11ME102 ENGINEERING DRAWING

(Common to all Engineering and Technology branches)

2 0 3 3

Concepts (Not for Exam)

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

MODULE – I **15**

Projections of Points, Lines, Planes and Solids:

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.

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

MODULE – II **15**

Sectioning and development 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.

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

MODULE- III **15**

Isometric projection 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. Venugopal K. and Prabhu Raja V. "Engineering Graphics", New Age International (P) Limited, New Delhi, 2008.
2. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD", Tata McGraw Hill, 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. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw-Hill, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: prepare elementary sketches of 2D and 3D objects with correct interpretation and mark dimensions properly.

CO2: draw multi-view orthographic and other projections including isometric, sectional, true and perspective.

CO3: read, understand, interpret drawings and communicate effectively.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3				2				3			
CO2	3				2				2			
CO3	3				2				2			

3 – Substantial, 2 – Moderate, 1 – Slight

11PH102 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 /EXERCISES

1. (a) Particle size determination using Diode Laser.
   (b) Determination of Laser parameters – Wavelength and angle of divergence.
   (c) Determination of acceptance angle in an optical fiber.
2. Determination of thickness of a thin wire – Air wedge method.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Determination of dispersive power of a prism using spectrometer.
6. Determination of Young's modulus of the material – non uniform bending.

PART-B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS /EXERCISES

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 a water Sample.
4. Conductometric titration - Mixture of acids.
5. Estimation of Hydrochloric acid using PH meter.
6. Estimation of Ferrous ion by Potentiometric titration.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Perform experiments on fiber, laser, optics, ultrasonic wave and Carey Foster's bridge.

CO2: Understand the concepts of numerical aperture, acceptance angle, wavelength, dispersive power, interference, velocity, compressibility and specific resistance.

CO3: Get a basic idea about the analysis of hardness, amountof Ca2+ and Mg2+ , presence of alkalinity in water

CO4: Get a basic idea about the handling of instruments like pH meter and conductivity meter for the estimation of unknown concentration of acids.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						2		1
CO2	3	3		2						2		1
CO3	3	3		2						2		1
CO4	3	3		2						3		3

3 – Substantial, 2 – Moderate, 1 – Slight

11ME103 ENGINEERING PRACTICES LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: CIVIL & MECHANICAL

LIST OF EXPERIMENTS

1.FITTING

Tools & Equipments – Practice in Filing and Drilling.

Making Vee Joints, Square, dovetail joints, Key Making.

2. PLUMBING

Tools & Equipments - Pipe connection for a bath room, Pipe connection for multi-storey building,

Pipe connection with different components like valves, tap, coupling, union, reducers, elbows etc.

Plumbing work with metal, PVC and flexible hoses (Threading, joining of pipes)

3.CARPENTRY

Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.

Making of Pen stand, Box, etc. from plywood. (Use of modern power tools for cutting)

4.SHEET METAL

Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

5.WELDING

Tools and equipments - Arc and Gas welding of butt joint, Lap Joint and Tee Fillet.

REFERENCES / MANUALS / SOFTWARE:

1. Suyambazhahan, S, "Engineering Practices Laboratory Manual", PHI Learning, New Delhi, 2010.
2. John, K. C., "Mechanical Workshop Practice", Second Edition, PHI Learning, New Delhi, 2009.

PART-B: ELECTRICAL & ELECTRONICS

1. Safety aspects of Electrical wiring.
2. Wiring circuit for a lamp using single and two way switches (stair case).
3. Wiring circuit for fluorescent lamp.
4. Study of Electronic components and equipment – Resistor-colour coding, measurement of AC Signal parameter (Peak-Peak, RMS Value, Frequency and Power factor) using CRO
5. Assembling electronic components on a small PCB (Etching, Fabrication and Testing)
6. Measurement of earth resistance and insulation resistance of an electrical equipment
7. Study of Telephone, FM radio & Transducers.
8. Study of Mixie, Iron box, Ceiling & Table Fans.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the functions of different tools used in fitting, carpentry, sheet metals and welding.

CO2: prepare different types of joints in metal pieces, sheet metals and wooden pieces.

CO3: plan and fabricate simple models.

CO4: utilize the basic laboratory equipment

CO5: build the layout of domestic wiring circuits and troubleshoot it.

CO6: estimate Earth Resistance, assemble electronic components in PCB and understand operation of various domestic appliances

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2							2			1	
CO2	2							3			2	
CO3	3							2			2	
CO4	3		1		3						2	3
CO5	3	2			2	3						3
CO6	3					2						3

3 – Substantial, 2 – Moderate, 1 – Slight

11EL201 COMMUNICATION SKILLS

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Focus on language: Cause and effect expressions - indicators of purpose and function - connectives -imperatives - modal verbs - infinitives and gerunds - reporting verbs - homonyms - commonly confused (mispronounced and misspelt) words - phrasal verbs - British and American Vocabulary.- rules for writing SI [system international] units - concord.

MODULE – II **15**

Listening: Listening practice - Radio / TV news - documentaries - listening to short and long conversations in different domains of activity/ live speech - new inventions, products, announcements, casual conversation, and academic lectures.

Writing: Formal letter writing (letter of application - job application) , Business (calling for quotation, placing orders , letter of complaint) - structure of memorandum and technical reports (reports on visits made to industries, report on an accident in the factory, meeting report) – notices - agenda - instructions - e-mails - Preparing Checklist- note taking and note making.

MODULE- III **15**

Speaking: Communication – accuracy, fluency, appropriateness – levels of formality – oral practice activities related to professional skills – role play using different functions (persuasion, negotiation, giving directions and guidance) – conversational etiquette (greetings, making requests, permission, accepting, denying, declining, politeness strategies, turn-taking, body language) – making speeches – describing people, place, things and events.

Reading: Reading comprehension – guided note- making – providing a suitable title - identifying main points, supporting ideas – evaluating the style (argumentative / descriptive etc) – drawing inferences separating facts from opinions – interpreting text in different genres.

TOTAL : 45

TEXT BOOK

1. Department of Science and Humanities, Anna University, Chennai. “English for Engineers and Technologists”, Combined Edition Volumes (I & II), Orient Longman, Oxford University Press, New Delhi, 2006.

REFERENCE BOOKS

1. Kiranmai. Dutt P, Geetha Rajeevan and Prakash, C. L. N., “A Course in Communication Skills”, Cambridge University Press, New Delhi, 2007.
2. Meenakshi Raman and Sangeetha Sharma, “Technical Communication”, Oxford University Press, New Delhi, 2006.
3. Sangeetha Sharma 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: Improve their vocabulary and appropriate usage of words.

CO2: Familiarize with different rhetorical functions of technical English.

CO3: Speak effectively in English in real-life and career-related situations.

CO4: Acquire knowledge in academic and professional writing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1									2	3		1
CO2									2	3		
CO3									1	3		
CO4				1					1	3		1

3 – Substantial, 2 – Moderate, 1 – Slight

11MA201 ENGINEERING MATHEMATICS – II

(Common to all Engineering and Technology branches)

3 1 0 4

MODULE – I **15**

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

Vector Calculus: Gradient, divergence and curl – Line, surface integral (Concept Only) and volume integrals (Concept Only) – Green's, Gauss divergence and Stoke's theorems (without proof) – Verification of the above theorems and evaluation of integrals using them (Simple problems only).

MODULE – II **15**

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

Complex Integration: Cauchy's theorem (without proof) – Cauchy's integral formula – Taylor and Laurent's series (without proof) – Singularities – Classification – Cauchy's residue theorem (Statement only) – Contour integration – circular and semi-circular contours (excluding poles on real axis).

MODULE – III **15**

Laplace Transforms: 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 transforms: Inverse Transform of elementary functions – Partial fraction method – Convolution theorem (without proof) – 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 2011, S.Chand and Co., New Delhi.
2. Veerarajan. T., "Engineering Mathematics, (for first year), Reprint Edition 2011, Tata McGraw-Hill New Delhi.

REFERENCE BOOKS

1. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, New Delhi, 2007.
2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Third Edition, Narosa Publishing House, New Delhi, 2007.
3. Bali. N.P and Manish Goyal, "Text Book of Engineering Mathematics", Third Edition, Laxmi Publications, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Identify problems involving vectors, double and triple integrals

CO2: Measure the knowledge of analytic functions.

CO3: Evaluate complex integrals which are extensively applied in engineering.

CO4: Adapt Laplace transforms to solve practical problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3											1
CO3	3	3		1	2							1
CO4	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11PH201 MATERIALS SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Crystal Physics: Introduction – Lattice – Unit cell – Crystal systems – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Crystal imperfections : Point, line and surface imperfections.

Conducting Materials: Conductors – Classical free electron theory of metals – Electrical and thermal conductivity – 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.

MODULE – II **15**

Semiconducting Materials: Intrinsic semiconductor – Carrier concentration derivation – Extrinsic semiconductors – Carrier concentration derivation in n-type and p-type semiconductors – Hall effect – Determination of Hall coefficient – Applications - Semiconductor devices – Solar cells - LDR.

Magnetic and Dielectric Materials: Types of magnetic materials – Domain theory – Hysteresis – Soft and hard magnetic materials - Magnetic devices – Transformer core - Magneto optical recording - Dielectric constant - Qualitative study of polarization – Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – Uses of dielectric materials (capacitor and transformer) – Ferro electric materials.

MODULE- III **15**

Smart Materials : Metallic glasses: Preparation, properties and applications - Shape memory alloys (SMA): Characteristics, properties, applications, advantages and disadvantages of SMA – Superconductors: Properties – Types of superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID – cryotron - magnetic levitation.

Nano Materials: Synthesis: Lithographics – Vapour phase physical and chemical deposition methods - Colloidal and solgel methods - Properties of nanoparticles and applications - Carbon nanotubes: Structure – Properties – Fabrication by Laser ablation – Applications.

TOTAL : 45

TEXT BOOKS

1. Kittel. Charles, “Introduction to Solid State Physics”, Seventh Edition, John Wiley & sons, Singapore, 2007.
2. Poole. Charles P and Ownen. Frank J., “Introduction to Nanotechnology”, Wiley India, 2007. (For Module III).

REFERENCE BOOKS

1. Pillai. S O, “Solid State Physics”, Fifth Edition, New Age International, New Delhi, 2003.
2. Rajendran. V, “Engineering Physics”, Prentice Hall of India, New Delhi, 2008.
3. Palanisamy. P K, “Engineering Physics - II”, SciTech publications (India), Chennai 2008.
4. Raghavan. V, “Materials Science and Engineering: A first course”, Fifth Edition, Prentice Hall of India, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Infer the basics of crystal physics and conducting materials.

CO2: Apply the concepts of semiconducting materials, devices, and magnetic and dielectric materials in engineering and technology.

CO3: Interpret the preparation and applications of smart materials and nano materials.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						1		1
CO2	3	3		2						1		1
CO3	3	3		2						1		1

3 – Substantial, 2 – Moderate, 1 – Slight

11CY201 ENVIRONMENTAL SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

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. **Ecosystems:** Concept of an ecosystem – Structural features – Functional attributes (Food chain and Food web only) – Introduction, types, characteristic features, structure and functions of the (a) Forest ecosystem (b) Aquatic ecosystems (ponds, rivers and oceans). **Biodiversity:** Introduction to Biodiversity – Definition - genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic, option values and ecosystem service value– Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife – Endangered and endemic species of India – In-situ and Ex-situ conservation of biodiversity.

MODULE – II **15**

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 (d) Radioactive 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 - Bacteriological examination of water - Sewage treatment (Primary, Secondary & Tertiary methods) - Miscellaneous methods of Sewage treatments (Oxidation Ponds, Aerated Lagoons, Oxidation ditch, Anaerobic Lagoons, Septic tanks) – Methods of Sewage treatment by activated sludge process – Introduction to industrial waste water treatment using Reverse Osmosis Technology- Self purification of Natural Waters - Membrane Technology for wastewater treatment - Activated carbon in pollution abatement of wastewater.

MODULE- III **15**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people - case studies – Environmental ethics - Issues and possible solutions - Wasteland reclamation – Consumerism and waste products – 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 – Environment and human health – Human Rights – Value Education – HIV / AIDS – Women and Child welfare – Role of Information Technology in Environment and human health – Case studies.

TOTAL : 45

TEXT BOOK

1 Anubha Kaushik, and Kaushik C P, "Environmental Science and Engineering", Third Edition: 2008, (Reprint 2010), New Age International (P) Ltd, New Delhi.

REFERENCE BOOKS

1 B.K.Sharma, **"** Industrial Chemistry",Tenth Edition, Krishna Prakashan Media(P) Ltd,Meerut-250001(UP), India.
2 B Uppal M M revised by S C Bhatia, "Environmental Chemistry", Sixth Edition Khanna Publishers, New Delhi, 2002.
3 Trivedi R.K. and Goel P. K., "Introduction to Air Pollution", Techno-Science Publications, Jaipur, 2003.
4 Masters. Gilbert M, "Introduction to Environmental Engineering and Science", Second Edition, Pearson Education, New Delhi, 2004.
5 Miller, T.G., "Environmental Science", Wadsworth Publishing Co.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Represent the importance of conservation of natural resources and gain the basic knowledge of maintaining ecological balance and conservation of biodiversity

CO2: Comprehend the different types of pollution and waste water treatment methods

CO3: Represent the awareness about making a clean environment and useful environment for the future generations, Consequences of population explosion and Social Issues.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1					2	3	3		3		2
CO2	3	2				2	3	3		3		2
CO3	3	2				2	3	3		3		2

3 – Substantial, 2 – Moderate, 1 – Slight

11CS101 PROBLEM SOLVING AND PROGRAMMING

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Basics: Evolution of computers- Generations of computers- Classification of computers- Applications of computers- Hardware - Software-Information Technology-Internet Problem-Solving Techniques- Program Control Structures- Programming Paradigms and Languages-Generations of Programming Languages.

Problem Solving: Introduction – Problem Solving Aspects- Top-Down Design-Implementation of Algorithms-Program Verification- Efficiency of Algorithms- Analysis of Algorithms- Fundamental algorithm- Factorial Computation - Generation of Fibonacci Sequence.

MODULE – II **15**

C Fundamentals and Arrays: Introduction to C – C programming structure – C character set – Identifiers – keywords. Data types – Constants – variables- Operators – Expressions – Library functions Managing Input and Output – formatted input and output. Control statements – Decision making and branching – Looping structures- Arrays – One dimensional array – Two dimensional arrays – Multidimensional arrays. Character arrays and strings.

MODULE - III **15**

Functions, Structures and Files: Functions - User defined functions: declaration, definition function call and parameter passing mechanisms – Recursion –Array and Functions - User defined data types –typedef - Structures – Unions –File operations in C- Introduction to pointer –Pointer Declaration and Initialization-Accessing a Variable through a pointer-Difference between array and Pointers.

TOTAL : 45

TEXT BOOKS

1. Kamthane, Ashok N. “Computer Programming”, Pearson Education, New Delhi, 2007.
2. Dromey, R.G., “How to solve it by Computers”, Pearson Publishers, New Delhi, 2007.

REFERENCE BOOKS

1. Gottfried Byron S, “Programming with C”, Second Edition, Tata McGraw-Hill, New Delhi, 2006.
2. Kanetkar Yashavant P., “Let us C”, Fifth Edition, BPB publications, New Delhi, 2005.
3. Schildt Herbert, “The Complete Reference C”, Fourth Edition, Tata McGraw-Hill, New Delhi, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Outline the changes in hardware and software technologies with respect to evolution of computers and programming languages

CO2: Apply fundamental principles of problem solving techniques

CO3: Develop programs using basic programming principles of C language

CO4: Design simple applications using structured programming techniques and file concepts

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	2	2									2
CO2	2											2
CO3	1	1	2									2
CO4	1	2	2									2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE201 CIRCUIT THEORY

(Common to ECE, EEE, EIE and Mechatronics Engineering)

3 1 0 4

MODULE – I **15**

DC Circuit Analysis: Ohms law, Temperature coefficient of resistors, resistors in series and parallel circuits, Kirchhoff's laws, Voltage and current division, Dependent and independent sources, source transformation, star delta transformation, mesh and nodal analysis for DC circuits. Steady state analysis of DC circuits.

Simple AC Circuits: Sinusoidal voltage and current, definitions, analysis of simple AC series and parallel circuits, RL,RC,RLC-concept of power and power factor

MODULE – II **15**

Three phase AC circuits: Three phase system- Relation between phase and line values in star and delta. Three phase balanced and unbalanced system- Three phase power measurement.

Network Theorems: Thevenin's and Norton's theorem, Superposition theorem, maximum Power Transfer theorem, Reciprocity theorem and Substitution theorem for DC and AC circuits.

MODULE- III **15**

Resonance Circuits: Series and Parallel Resonance, Frequency response, Quality factor and Bandwidth.

Transients in DC circuit: Transient of RL, RC, RLC circuit analysis with source free and forced (step) response.

Coupled Circuits: Mutual Inductance, Co efficient of coupling, dot convention, analysis of simple coupled circuits.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOK

1. Sudhakar A and Shyam Mohan S.P, "Circuits and Network Analysis and Synthesis", Tata McGraw-Hill, New Delhi, 2007.

REFERENCE BOOKS

1. Edminister Joseph A. and Nahri, Mahmood., "Electric Circuits", Schaum's Series, Tata McGraw-Hill, New Delhi, 2007.
2. Arumugam, M and Premkumar, N., "Electric Circuit Theory", Khanna Publishers, New Delhi, 1989.
3. Hayt William H., Kemmerly, Jack E. and Durbin ,Steven M., "Engineering Circuit Analysis", Sixth edition, Tata McGraw –Hill, New Delhi, 2007.
4. Chakrabati, A., "Circuit Theory: Analysis and Synthesis", Dhanpath Rai & sons, New Delhi, 1999.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Solve simple DC and AC circuits.

CO2: Apply network theorems to simplify the circuits.

CO3: Analyse poly phase, resonant and coupled circuits.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3	2		1						1
CO2	3	2	3	2								
CO3	3	2	2	3								

3 – Substantial, 2 – Moderate, 1 – Slight

11PH202 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 /EXERCISES

1. Determination of band gap of a semiconductor material.
2. Determination of wavelength of mercury spectrum – spectrometer grating.
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
4. Determination of hysteresis loss in a ferromagnetic material.
5. Determination of Young's modulus of the material – uniform bending.
6. Determination of viscosity of liquid – Poiseuille's method.

PART - B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS /EXERCISES

1. Estimation of Chloride in a given water sample.
2. Determination of Dissolved Oxygen in a sample of water / sewage.
3. Estimation of Chromium in Industrial waste water.
4. Estimation of Ferrous ion in rust solution.
5. Estimation of percentage of Copper present in brass.
6. Estimation of ferric ion by Spectrophotometeric method.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Perform experiments on semiconductors, thermal conductivity, optics, elasticity, viscosity of liquids.

CO2: Understand the concepts of wavelength, band gap, thermal conductivity, Young's modulus and viscosity.

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 Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		2						2		1
CO2	3	3		2						2		1
CO3	3	3		2						2		1
CO4	3	3		2						2		1

3 – Substantial, 2 – Moderate, 1 – Slight

11CS102 PROGRAMMING LABORATORY

(Common to all Engineering and Technology branches)

LIST OF EXPERIMENTS /EXERCISES

A) APPLICATION PACKAGES

1. To create an advertisement using word
2. To illustrate the concept of mail merging using word
3. To create a spread sheet to analyse the marks of the students of a class and also to create appropriate charts using excel
4. To create the presentation for the department using power point
5. To create the presentation for digital computers using power point

B) C PROGAMMING (ANY TWO PROGRAMS IN EACH SECTION)

6. Simple programs using decision making and branching:
   a. Program to find biggest of three numbers
   b. Design of simple menu driven calculator
   c. Program to find the roots of the quadratic equation
   d. Program to convert the given decimal number to binary
   e. Program to print the prime numbers between 100 to 500
   f. Program to print the electricity bill in a specified format applying specified rules
7. Programs using arrays:
   a. Program to find the biggest number in the array
   b. Menu driven program to insert and delete a specified element from the array
   c. Program to arranged the elements of the array in ascending order
   d. Program to merge given two one dimensional arrays and to remove the duplicates
   e. Program for multiplication of two matrices
8. String manipulations:
   a. Program to find the length of the string, copy one string to another and compare two strings, concatenate two strings without using library functions.
   b. Program to check whether the given string is a palindrome or not without reversing
   c. Program to find the occurrence of a substring in a main string and replace the substring by another string.
   d. Arranging the list of names in alphabetical order
   e. Program to count the number of occurrences of vowels, consonants, words, white spaces and special characters in the given statement.
9. Functions:
   a. Program to swap the contents of two variables using functions (Pass by address and pass by reference)
   b. Program to print the Fibonacci series using recursive function
   c. Program to print the average and standard deviation of the elements of the one- dimensional array using function.
   d. Program to print the transpose of a matrix using functions
   e. Menu driven program to perform string operations using functions
10. Structures and file operations:
    a. Define a structure to store the student details viz., Roll no, name, marks in three subjects, total, avg and class obtained. Read the first three fields and write your logic to calculate the total, average and class obtained for ten students.
    Print the results in the order of ran obtained.
    b. Structure based program to print the pay slip of an employee.
    c. Program using files to copy the contents of one file to another

REFERENCES / MANUALS/SOFTWARE:

Software requirements

Operating System : Windows / Linux

Compiler : C compiler

Packages: MS office or Equivalent

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Utilize the features of MS office package to create documents, presentation and reports.
CO2: Write and execute programs to illustrate decision making and branching.
CO3: Develop programs using 1D and 2D arrays.
CO4: Create programs for manipulating strings.
CO5: Demonstrate the use of functions and structures to develop applications.
CO6: Build programs that implement the concepts of files.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1					1							1
CO2	1	2	2									1
CO3	1	2	2									1
CO4	1	2	2									1
CO5	1	2	2									2
CO6	1	2	2									2

3– Substantial, 2 – Moderate, 1 – Slight

11EE202 CIRCUITS LABORATORY

(Common to ECE, EEE and EIE)

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES

1. Verification of Ohm's Laws and Kirchhoff's Laws.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition Theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Verification of Reciprocity Theorem.
6. Transient response of RL and RC circuits (also using PSPICE).
7. Frequency response of Series and Parallel Resonance Circuits (also using PSPICE).
8. Study of Frequency response of Single and double Tuned coupled Circuits.
9. Measurement of real power, reactive power, power factor and impedance of RC, RL and RLC Circuits.
10. Power measurement in a three phase circuit by two Watt meters.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyse the electric circuits by applying various theorems

CO2: Measure the real and reactive power in AC circuits.

CO3: Develop DC and AC circuits using Simulation tools

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2	3								
CO2	3	3	3	3		1						
CO3	1	3	3	1	3							

3 – Substantial, 2 – Moderate, 1 – Slight

11MA301 ENGINEERING MATHEMATICS – III

(Common to all Engineering and Technology branches)

3 1 0 4

MODULE – I **15**

Fourier Series: Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Change of interval - Parseval's Identity - Harmonic analysis.

MODULE - II **15**

Partial Differential Equations: Formation – By elimination of arbitrary constants and arbitrary functions – Standard types– Lagrange's linear equation- Linear partial differential equations of second order with constant coefficients.

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).

MODULE - III **15**

Fourier transform: Fourier integral theorem (Statement only) – Fourier transform pair – Properties – Transforms of simple functions – Sine and Cosine transforms – Convolution theorem and Parseval's identity (Statement only).

Z-transform: Elementary properties – Transforms of simple functions - Inverse Z – transform(Partial Fraction Method and Residue method) – Convolution theorem (Statement Only) – Solution of Difference Equations.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics", Volume - III, S. Chand & Co, New Delhi, 2008.
2. Veerarajan, T., "Engineering Mathematics", Tata McGraw-Hill, New Delhi, Reprint 2010.

REFERENCE BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, New Delhi, 2007.
2. Wylie, C. Ray and Barrett, Louis, C., "Advanced Engineering Mathematics", Sixth Edition, McGraw-Hill, New York, 2004.
3. Andrews, L. A. and Shivamoggi, B. K., "Integral Transforms for Engineers and Applied Mathematicians", Macmillan, New York, 2004.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Utilize Fourier series to solve engineering problems.

CO2: Formulate and solve higher order partial differential equations.

CO3: Interpret the basic knowledge of Fourier transforms and Z-transforms in engineering field.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3		2	2							1
CO3	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EC307 ELECTRON DEVICES

3 0 0 3

MODULE– I **15**

Semiconductor Theory: Introduction -Review of Intrinsic and extrinsic semiconductors – classical theory and Energy Band theory – charge densities in semiconductors – mobility and conductivity–Drift and Diffusion current-Properties of semiconductors- Applications of semiconductors

Semiconductor Diodes: Construction of PN junction diodes – VI characteristics – Quantitative theory of PN diode, current components - Diode resistance – Transition and diffusion capacitances – Effect of temperature on PN junction characteristics – Model of diode – Diode specification – Clipping and Clamping Circuits – Voltage multipliers using diodes.

MODULE– II **15**

Bi-Polar Junction Transistor: Construction of a Transistor – Principle of Transistor action - Currents in transistor – Input and output characteristics of a transistor in CE, CB and CC configurations – cut off, active saturation and break down regions – Current gain in CE, CB and CC configurations – h parameter model for BJT – BJT specification.

Field Effect Transistors : Construction and characteristics of JFET – parameters of JFET – FET in CS, CD and CG Configurations – equivalent circuits of FET at low frequencies – FET model at high frequencies – FET specification,

MODULE– III **15**

MOSFET and UJT: MOSFET – Depletion and Enhancement mode- Construction, Theory of operation and characteristics of UJT.

Special Semiconductor Devices: Fabrication and Characteristics of Zener Diode – Tunnel Diode – Pin Diode – Varactor Diode – LASER and CCD – Photodiodes – Photo conductive cell – photo voltaic cell – LED, LCD – photo transistors – solar cell – opto couplers.

TOTAL: 45

TEXT BOOK

1. Millman, Jacob and Halkias, Christos C., "Electronic Devices and Circuits", Tata McGraw-Hill, New Delhi, 2003

REFERENCE BOOKS

1. Mottershead, Allen, 'Electronic Devices and Circuits', Sixth Edition, Pearson Education, New Delhi, 2003
2. Bell, David A., "Electronic Devices and Circuits", Fourth Edition, Prentice Hall of India, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Design electronic circuits using diodes and transistors.

CO2: Analyze the performances of various semiconductor devices and use display devices.

CO3: Select the semiconductor devices for real time applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									
CO2		3	2		1				1			
CO3		2			3	2						2

3 – Substantial, 2 – Moderate, 1 – Slight

11CS308 OBJECT ORIENTED PROGRAMMING

3 0 0 3

MODULE – I **15**

Principles of Object Oriented Programming: Object Oriented Programming paradigm - Basic concepts and benefits of OOP - Object Oriented Language - Application of OOP - Structure of C++ - Tokens, Expressions and Control Structures - Operators in C++ - Manipulators. Function Prototyping - Call by Reference - Return by reference - Inline functions - Default, Const Arguments - Function - Overloading**.**

Classes and Objects: Member functions - Nesting of Member functions - Private member functions - Memory allocation for Objects - Static data members - Static Member Functions - Arrays of Objects - Objects as Function - Arguments - Friendly Functions - Returning Objects - Const Member functions - Pointers to Members.

MODULE - II **15**

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

Overloading and Inheritance: Overloading Unary and Binary Operators – Overloading Binary Operators using Friend functions. Inheritance: Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multiple Inheritance – Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes – Nesting of Classes.

MODULE – III **15**

Pointers, Virtual functions and Polymorphism: Pointers to objects, this pointer, Pointers to derived classes, Virtual functions, Pure virtual functions.

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, fie pointers and manipulations, sequential file, Random Access file, Command line arguments.

TOTAL : 45

TEXT BOOKS

1. Balagurusamy, E, "Object Oriented Programming with C++", Fourth Edition, Tata McGraw-Hill, New Delhi, 2007.

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.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Interpret the concepts of object-oriented programming

CO2: Apply the concepts of constructors, inheritance, and overloading to develop simple applications using C++.

CO3: Examine the features of pointers, virtual functions, polymorphism, console I/O operations and file handling mechanisms.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	2	2			1						
CO2		2	3									
CO3		2	3	2		2						

3 – Substantial, 2 – Moderate, 1 – Slight

11EE302 NETWORK THEORY

3 1 0 4

MODULE - I **15**

Graph Theory: Introduction-definitions – Incidence matrix – cutest and tieset matrices – network analysis using graph theory – V shift and I shift method- Network equilibrium equations.

S Domain Analysis: S domain network – Network function -Concept of complex frequency - complex impedance and admittance - poles and zeros of network functions – Time response of pole zero plots - frequency response from pole-zero configuration - Frequency response of RLC networks

MODULE - II **15**

Fourier series representation of periodic inputs

One Port and Two Port Networks: Driving point impedance and admittance of one port networks - open circuit impedance and short circuit admittance of two port networks - transfer impedance and admittance - voltage and current ratio transfer functions - ABCD parameters - image impedance - impedance matching - equivalent networks.

Filters: Characteristics of ideal filters - low pass and high pass filters

MODULE - III **15**

Filters and Attenuators: Attenuation and phase shift - Constant K and M - derived filters - Band pass filters.

Elements of Network Synthesis: Reliability of one port networks - Hurwitz polynomials - PR function - Necessary and sufficient conditions of PR function - Properties of driving point impedance - Synthesis of LC, RL and RC driving point impedance

Lecture: 45, Tutorial:15, TOTAL: 60

TEXT BOOKS

1. ShyamMohan S.P. and Sudhakar A, "Circuits and Network Analysis and Synthesis", Tata McGraw-Hill, New Delhi, 2007.
2. Wadhwa C.L., "Network Analysis and Synthesis", Third Edition, New Age International (P) Ltd, New Delhi, 2009.

REFERENCE BOOKS

1. Arumugam, M and Premkumar, N., "Electric Circuit Theory", Khanna Publishers, New Delhi, 2006.
2. Kuo, F.F, "Network Analysis & Synthesis", Second Edition, Wiley India (P) Ltd, New Delhi, 2006.
3. Soni, M.L and Gupta, J.C., "Electrical Circuit Analysis", Dhanpat Rai and Sons, New Delhi, 1990.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze the networks using graph theory.

CO2: Develop and synthesize the two port networks .

CO3: Design filters and attenuators .

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3	2	1							
CO2	3	3	3	2							3	
CO3	3	3	3			1					3	1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE303 DC MACHINES AND TRANSFORMERS

3 1 0 4

MODULE - I **15**

Machinery Fundamentals and DC Generators: Electromagnetic Induction – Principles- Energy conversion via electric field – Principles of electromechanical energy conversion - Constructional details - working principle –Types of armature windings- EMF equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Armature reaction and commutation.

DC Motors: Principle of operation – Back EMF and torque equations – Types of DC Motors – Circuit model – Characteristics of series, shunt and compound motors — Applications.

MODULE –II **15**

Losses, efficiency and Power stages in DC machines – Condition for maximum efficiency.

Speed Control and Testing of DC Machines: Parallel operation of D.C Generators - Starting methods – Speed control methods – Separation of no load losses - Testing of DC machines – Brake test, Swinburne's test, Retardation test and Hopkinson's test.

Transformers: Constructional details – Types – Principle of operation – EMF equation – Transformation ratio

MODULE –III **15**

Equivalent circuit – Transformer on load – Regulation – Parallel operation – Auto transformer – saving of copper.

Testing of Transformers: Losses and efficiency in transformers – Condition for maximum efficiency — Testing of transformers – Polarity test, load test – Phasing out test – Sumpner's test – Separation of losses – All day efficiency. Instrument transformers – Three phase transformers – Types of Connections –Vector group of three phase transformer.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOK

1. Kothari, D. P and Nagrath, I. J, "Electric Machines", Tata McGraw-Hill, New Delhi, 2010.

REFERENCE BOOKS

1. Cotton H., "Advanced Electrical Technology", Seventh Edition, CBS Publishers and Distributors, New Delhi, 2006.
2. Say M.G., "The Performance and Design of Alternating current Machines", Third Edition, CBS Publishers and Distributors, Delhi, 2003.
3. Langsdorf Alexander S., "Theory of Alternating Current Machinery", Second Edition, Tata McGraw-Hill, New Delhi, 1987.
4. Fitzgerald, A.E., Kingsley, Charles and Umans, Stephen. D., "Electric Machinery", Tata McGraw-Hill, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Describe the construction and working principle of DC machines and transformers

CO2: Illustrate various testing methods of DC machines and transformers

CO3: Apply starting and speed control methods to DC motors

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2									
CO2	3	2			3							
CO3	3	3	2	3		3	1				1	

3 – Substantial, 2 – Moderate, 1 – Slight

11EE305 ELECTROMAGNETIC THEORY

3 1 0 4

MODULE – I **15**

Electrostatics: Introduction to Vector Algebra – Vector calculus – Coordinate systems : Cartesian, Cylindrical and Spherical coordinate system – Divergence Theorem - Stoke's theorem.

Electric charge – Coulomb's law – Electric Field Intensity : due to point charge, line charge, surface charge and volume charge distribution - Electric flux density – Gauss's law – Application of Gauss's law –Potential difference – Potential – conservative property – Potential gradient.

Dielectrics, Conductors: Polarisation – Dipole, Dipole Moment – Energy density in Electrostatic field - Current, Current density – Continuity of current – Boundary conditions at the interface of conductor and dielectric – Poisson's and Laplace's equation

MODULE – II **15**

Capacitors: Capacitance – Capacitance for different charge distribution – Multiple dielectric capacitors – Energy stored in a capacitor.

Magneto Static: Biot-Savart's law – Ampere's circuital law – Magnetic field : due to straight conductors, circular loop, solenoid, Cable – Magnetic flux – Gauss's law for magnetic flux - Magnetic flux density – Scalar and Vector magnetic potential – Forces – Torque – Magnetic boundary conditions – Magnetic circuit – Self Inductance – Inductance of solenoid, toroid, transmission line and co-axial cable – Mutual Inductance - simple problems - Energy stored in Magnetic field.

MODULE – III **15**

Maxwell's Equations: Time varying fields - Faraday's law – Displacement current – Maxwell's equation in point form and Integral form – Solution to Maxwell's equations - Comparison of circuit theory and field theory

Electro Magnetic Waves: Electromagnetic waves (Elementary ideas only) **:** Introduction – Wave equations – Poynting vector – Standing wave ratio – Wave Propagation in Lossy dielectric, Lossless dielectrics, conductors and Free space.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOK

1. Sadiku, Matthew N.O., "Principles of Electromagnetics", Fourth Edition, Oxford University Press, New Delhi, 2009.
2. Meenakumari, R and Subasri, R., "Electromagnetic Fields", Second Edition, New Age International Publishers (P) Ltd., New Delhi, 2007.

REFERENCE BOOKS

1. Hayt, W.H and Buck, John A, "Engineering Electromagnetics", Seventh Edition, Tata McGraw-Hill, New Delhi, 2009.
2. Kraus John. D and Fleishch, Daniel., "Electromagnetics", Fourth Edition, McGraw-Hill, New York, 1999.
3. Edminister, Joseph A., "Theory and Problems of Electromagnetics", Tata McGraw-Hill, New Delhi, 2004.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze the behavior of electric and magnetic fields for different configurations

CO2: Formulate fundamental field equations and solve by systematic approach.

CO3: Compare the electromagnetic wave propagation in different mediums

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3											
CO2	3	1	2		1							
CO3	3			2			2					

3 – Substantial, 2 – Moderate, 1 – Slight

11EE306 DC MACHINES AND TRANSFORMERS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of D.C separately excited shunt generator.
2. Open circuit and load characteristics of D.C self excited and shunt generator.
3. Load characteristics of D.C. compound generator with differential and cumulative connection.
4. Load characteristics of D.C. series generator.
5. Load characteristics of D.C. shunt motor and Swinburnes Test
6. Load characteristics of D.C. compound motor.
7. Load characteristics of D.C series motor
8. Speed control of D.C shunt motor.
9. Hopkinton's test on D.C motor – generator set.
10. Load test on single-phase transformer
11. Open circuit and short circuit tests on single phase transformer.
12. Sumpner's test on transformers.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Conduct performance test on various types of DC machines and differentiate between their characteristics

CO2: Predetermine the regulation of transformers

CO3: Interpret the power sharing of two DC generators and transformers

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	1		2		2			2	1		
CO2	3	2		3		2			2	1		
CO3	3			1		1			2	1		

3 – Substantial, 2 – Moderate, 1 – Slight

11EE307 DEVICES AND NETWORKS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode and Zener Diode
2. Characteristics of BJT (Common emitter configuration)
3. Characteristics of JFET
4. Characteristics of UJT
5. Characteristics of SCR
6. Measurement of Hybrid parameter
7. Design of passive filters
8. Pole – zero plot and frequency response of a transfer function.
9. Calculation of transfer parameters of a two port network
10. Study of frequency response of attenuators

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze the characteristics of Semiconductor devices

CO2: Select suitable semiconductor device for specific application.

CO3: Determine the parameters of two port networks.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1		3										
CO2	3					2						3
CO3		3	2		3							

3 – Substantial, 2 – Moderate, 1 – Slight

11CS307 OBJECT ORIENTED PROGRAMMING LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Functions with default arguments
2. Implement Call by Value, Call by Reference and Call by Address
3. Implement Function Overloading
4. Implement Virtual functions
5. Implement Operator Overloading for Unary Operators.
6. Implement Classes with Constructor
7. Implement Multiple and Multilevel Inheritance
8. Implement Stack using Array
9. Implement Queue using Array
10. Implement singly linked lists
11. Implement doubly linked lists
12. Implement circular linked lists

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Create objects and their members for a given problem.

CO2: Experiment the friend function, virtual function, constructor and destructor.

CO3: Develop programs using various types of operator and function overloading.

CO4: Interpret the use of inheritance, stack, queue and Linked list.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1		2	2	3								
CO2				3								
CO3			2	3								
CO4		2		3								

3 – Substantial, 2 – Moderate, 1 – Slight

11MA401 NUMERICAL METHODS

(Common to all Engineering and Technology branches except ECE & CSE)

3 1 0 4

MODULE - I **15**

Linear Algebraic Equations: Method of false position - Newton's method - Solution of linear system of equations by Gaussian elimination and Gauss - Jordan methods – Iterative methods: Gauss Jacobi and Gauss – Seidel methods.

Interpolation: Newton's forward and backward difference formulae – Bessel's formula - Lagrange's interpolation formula - Newton's divided difference formula.

MODULE - II **15**

Numerical Differentiation: Differentiation Using Newton's forward , backward and divided difference interpolation formula - Single step Methods - Taylor Series, Euler and Modified Euler methods - Fourth order Runge-Kutta method for solving first order equations - Multistep methods – Milne's and Adam's predictor and corrector methods.

Numerical Integration: Trapezoidal rule – Simpson's 1/3 – Double integrals using Trapezoidal and Simpson's rules.

MODULE - III **15**

Boundary Value Problems in PDE: Finite difference approximations to partial derivatives - Two dimensional Laplace equations - Poisson equations – One dimensional heat equation by implicit and explicit methods – One dimensional wave equation.

Lecturer: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Kandasamy, P., Thilakavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand & Co, New Delhi, reprint 2010.
2. Venkatraman, M. K, "Numerical Methods", National Publishing Company, Chennai, 2000.

REFERENCE BOOKS

1. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill, New Delhi, 1999.
2. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., "Numerical Methods for Scientific and Engineering Computation", Fourth Edition, New Age International (P) Ltd., New Delhi, 2006.
3. Sankara Rao, K., "Numerical Methods for Scientists and Engineers", Second Edition, Prentice Hall India, New Delhi, 2004.
4. Thangaraj, P, "Computer – Oriented Numerical Methods", Prentice Hall of India, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Discuss the various methods of solving linear algebraic and transcendental equations

CO2: Estimate the intermediate values using interpolation concepts.

CO3: Interpret the knowledge of numerical differentiations and integration

CO4: Apply various numerical techniques in solving complex partial differential equations.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3										1
CO3	3	3		1	2							1
CO4	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EI304 DIGITAL LOGIC CIRCUITS

(Common to EEE and EIE branches)

3 1 0 4

MODULE-I **15**

Boolean Algebra and Combinational Logic: Binary Numbers- Number Base Conversion- Signed Binary Numbers- Definitions of Boolean Algebra- Basic Theorems- Boolean functions- Canonical and standard forms- Digital Logic Gates. Combinational circuits- Analysis Procedure-Design Procedure- Gate Level minimization- Map Method-Tabulation Method – Don't care condition- NAND and NOR Implementation- Adders/Subtractors- Decoder-Encoder-Multiplexer-Demultiplexer - HDL introduction

MODULE-II **15**

Synchronous Sequential Logic: Flip flops SR, JK, T, D and Master slave – Characteristic and excitation tables and equations –Level and Edge Triggering –Realization of one flip flop using other flip flops – Analysis and design of sequential circuits with state diagram, State table, State minimization and State assignment-Ripple counters –Design of Synchronous counters, Ring counters and Sequence detector - Registers – shift registers- Universal shift register.

MODULE-III **15**

Asynchronous Sequential Logic and Digital IC's: Analysis of Asynchronous Sequential – primitive state / flow table – Minimization of primitive state table –state assignment – Excitation table - cycles – Races –Hazards: Static –Dynamic – Essential –Hazards elimination.

RTL and DTL Circuits- Transistor-Transistor Logic – Emitter Coupled Logic- Noise Margin - CMOS Logic - Classification of memories –RAM organization – Static RAM Cell-Bipolar RAM cell – MOSFET RAM cell –Dynamic RAM cell –ROM organization - PROM –EPROM –EEPROM .

Lecture: 45 , Tutorial :15, TOTAL : 60

TEXT BOOKS

1. Mano,M Morris; Ciletti,Michael.D, "Digital Design", Fourth Edition, Pearson Education India, 2008.
2. Givone, Donald D., "Digital Principles and Design", Tata McGraw-Hill, New Delhi, 15th reprint 2009.

REFERENCES BOOKS

1. John, M Yarbrough, "Digital Logic Applications and Design", Thomson Publications, New Delhi, 2007.
2. Roth, Charles, H., "Fundamentals of Logic Design", Thomson Publication Company, Singapore, 2003.
3. Floyd, 'Digital Fundamentals', Eighth Edition, Pearson Education, New Delhi, 2003.
4. Wakerly John F., 'Digital Design: Principles and Practice', Third Edition, Pearson Education, New Delhi, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: simplify the mathematical expressions using Boolean functions and to design various combinational circuits.

CO2: apply knowledge in designing synchronous logic circuits and to adopt the Hardware descriptive language in designing both combinational and digital logic circuits.

CO3: analyze the various asynchronous circuits and to identify the various memory devices and its operational function

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2						1			1
CO2	3		3		2				1			
CO3	3		2						1			

3 – Substantial, 2 – Moderate, 1 – Slight

11ME408 THERMODYNAMICS AND FLUID MECHANICS

(Common to EEE and EIE)

3 1 0 4

MODULE - I **15**

Laws of Thermodynamics: Thermodynamic systems – Boundary – Control volume – System and surroundings – Universe – Properties – State-process – Cycle – Equilibrium – Work and heat transfer – Point and path functions – First law of thermodynamics for open and closed systems – First law applied to a control volume – SFEE equations [steady flow energy equation] – Second law of thermodynamics – Heat engines – Refrigerators and heat pumps.

Gas Turbines: Open and closed cycle gas turbines – Ideal and actual cycles – Brayton cycle – Cycle with reheat, inter-cooling and regeneration – Application of gas turbines

MODULE - II **15**

Steam Generation: Formation of steam – Properties of steam – Use of steam tables and charts – Steam power cycle (Rankine) – Layout diagram and working principle of a steam power plant - Mountings and accessories – Boiler Instrumentation - Boiler energy losses - Steam traps – Total energy schemes –Prime movers for total energy system

Refrigeration and Air Conditioning: Unit of refrigeration – Basic functional difference between refrigeration and air conditioning – Various methods of producing refrigerating effects (RE) – Vapour compression cycle: P-H and T-S diagram(Qualitative treatment only)- -Vapour absorption system – Air conditioning systems – Basic psychrometry – Simple psychrometric processes – Types of air-conditioning systems – Sensible heat exchange processes. Latent heat exchange processes

MODULE - III **15**

Fluid Machineries:

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - efficiencies -performance curve

Compressors: Positive displacement compressors – Reciprocating compressors – Indicated power – Clearance volume – Various efficiencies – Clearance ratio – Volume rate – Conditions for perfect and imperfect inter-cooling(Qualitative treatment only) – Multi stage with inter-cooling

Pumps : classifications - Reciprocating pump, Centrifugal pump: classifications, working principle, performance curves - rotary pumps: working principles of gear and vane pumps – Energy conservation measures in pumps and compressors

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Rajput, R. K., "Thermal Engineering", S. Chand & Co, New Delhi, 2000
2. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Fifth Edition, Laxmi Publications, New Delhi, 1995.

REFERENCE BOOKS

1. Rogers, C and Mayhew, Y R., "Engineering Thermodynamics: Work and Heat Transfer", Addison Wesley, New Delhi, 1999.
2. Nag, P. K., "Basic and Applied Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2002.
3. Mathur, M.L. and Metha, F.S., "Thermal Engineering", Jain Brothers, New Delhi, 1997.
4. Cengel, Yunus A. and Cimbala, John M., "Fluid Mechanics Fundamentals and Applications", Tata McGraw-Hill, New Delhi, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understand the laws of thermodynamics and gas turbines

CO2: Provide the properties of steam and different types of air conditioning systems.

CO3: Classify the various fluid machineries and its working principles

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			2								
CO2	3			3								
CO3	3			3								

3 – Substantial, 2 – Moderate, 1 – Slight

11EC409 ELECTRONIC CIRCUITS

3 1 0 4

MODULE - I **15**

Small Signal and Large Signal Amplifiers: Operating point – Fixed and self biasing of BJT & FET – Small signal analysis of CE and CC amplifiers – Small signal analysis of CS amplifier - Cascade and Darlington connections – Power amplifiers – transformer coupled class A, B & AB amplifiers –Complementary type Class B amplifier – Push pull amplifiers.

Differential and Tuned Amplifiers: Differential amplifiers – Common mode analysis.

MODULE - II **15**

Differential and Tuned Amplifiers: Differential mode analysis for BJT and FET – DC and AC analysis – Characteristics of tuned amplifiers – Single & double tuned amplifier.

Feedback Amplifier and Oscillators: Characteristics of negative feedback amplifiers – voltage / current, series/shunt feedback – Theory of sinusoidal oscillators – Stability of feedback circuits using Barkhausen criteria – Phase shift and Wien bridge oscillators – Colpitts, Hartley and crystal oscillators.

MODULE - III **15**

Pulse Circuits: RC wave shaping circuits – Multivibrators – Astable, Monostable and Bistable – Schmitt triggers – UJT based saw tooth oscillators.

Rectifiers and Power Supply Circuits: Half wave & full wave rectifiers –Analysis – Inductor filter – Capacitor filter – Series and shunt voltage regulator – Concept of Switched mode power supply (Block Diagram).

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOK

1. Millman, Jacob and Halkias, Christos C., "Integrated Electronics: Analog and Digital Circuits and System", Forty Eighth Edition, Tata McGraw-Hill, New Delhi, 2008.

REFERENCE BOOKS

1. Bell, David A., "Electronic Devices and Circuits", Fourth Edition, Prentice Hall of India, New Delhi, 2003.
2. Robert L. Boylestad and Louis Nashelsky, "Electronics Devices and Circuit Theory", Eighth Edition, Pearson Education, New Delhi, 2002.
3. Schilling, Donald L. and Belove, Charles, "Electronic Circuits", Third Edition, Tata McGraw-Hill, New Delhi, 2003.
4. Millman Jacob and Terb Herbert, "Pulse, Digital and Switching Waveforms", Tata McGraw-Hill, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Illustrate and explain the configuration and biasing of different amplifier circuits.

CO2: Analyze the characteristics of tuned amplifiers, oscillators and multi-vibrators.

CO3: Design simple power supply circuits by using electronic components

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	1										
CO2	3	3	2	3	3							
CO3	3	2	3	2	3	1						1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE401 SYNCHRONOUS AND INDUCTION MACHINES

3 1 0 4

MODULE - I **15**

Alternator: Constructional details – Types of rotors – EMF equation – Synchronous reactance – concept of sub transient and transient reactance - Armature reaction – Voltage regulation – EMF, MMF and ZPF methods – Synchronizing and parallel operation – Synchronizing power - Power output and power developed equations - Change of excitation and mechanical input – Blondel's theory – Determination of X_d and X_q using slip test.

Synchronous Motor: Principle of operation – Torque equation – Starting methods -Operation on infinite bus bars – V and inverted V curves – Power input and power developed equations – Power/power angle relations – Hunting - synchronous condenser - Applications.

MODULE - II **15**

Three Phase Induction Motor: Constructional details – Types of rotors – squirrel cage & slip ring – Principle of operation – Slip – Equivalent circuit – Torque equations -Slip-torque characteristics – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Crawling and cogging – Double cage rotors – Induction generator- Linear Induction motor.

Starting of Three Phase Induction Motor: Need for starting – Types of starters – Stator resistance and reactance, rotor resistance, autotransformer, star-delta starters and DOL starters.

MODULE - III **15**

Speed Control of Three Phase Induction Motor: Speed control by changes of voltage, frequency, poles and rotor resistance – slip power recovery scheme.

Single phase Induction Motors and Special Machines: Constructional details – Double revolving field theory – Equivalent circuit – Starting methods – applications – reluctance motor, repulsion motor, Hysteresis motor, stepper motor and universal motor and Switched Reluctance motor.

Lecture: 45, Tutorial: 15 TOTAL:60

TEXT BOOK

1. Kothari, D.P. and Nagrath, I.J, "Electric Machines", Tata McGraw-Hill, New Delhi, 2002.
2. Say, M.G. "The Performance and Design of Alternating Current Machines", Third Edition, CBS Publishers and Distributors, Delhi, 2003.

REFERENCE BOOKS

1. Langsdrof, Alexander S., "Theory of Alternating Current Machinery" Second Edition, Tata McGraw Hill, New Delhi, 1987.
2. Bimbra, P.S., "Electrical Machinery", Sixth Edition, Khanna Publishers, New Delhi, 2003.
3. Fitzgerald, A.E., Kingsley, Charles and Umans, Stephen. D., "Electric Machinery", Tata McGraw-Hill, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Illustrate and differentiate between the basic constructional features and working principle of AC machines

CO2: Analyze the performance characteristics of AC machines.

CO3: Apply starting and speed control methods to AC motors and interpret the knowledge of special electrical machines

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2									
CO2	3	3	2	1		1	1					
CO3	3	3	2			3	1					

3 – Substantial, 2 – Moderate, 1 – Slight

11EI402 MEASUREMENTS AND INSTRUMENTATION

(Common to ECE and EEE branches)

3 0 0 3

MODULE – I **15**

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-Wattmeters-Energy meters- Megger — Bridge measurements – Maxwell- Kelvin- Schering-Anderson and Wien bridge-Grounding and Shielding Techniques.

MODULE –II **15**

Signal Generators and Transducers: RF signal generators – Frequency synthesizer – wave analyzer – Harmonic distortion analyzer – spectrum analyzer- frequency counters-time interval measurement Classification of transducers-selecting a transducer -strain gauges-temperature transducer-LVDT - capacitive transducers-Piezo electric transducers – optoelectronic transducers –LCD Display- Touch screen–MEMS Materials and their properties –Introduction to Microsystem Fabrication process: Photolithography- Ion implantation – Diffusion – Oxidation - Chemical Vapor Deposition-Physical Vapor Deposition-Deposition by epitaxy – Etching -Micromanufacturing- Bulk micromanufacturing, Surface Micromachining -LIGA and SLIGA process.

MODULE–III **15**

Modern Measurement Techniques and Virtual Instrumentation: A/D and D/A converters-Elements of a digital data acquisition system – interfacing of transducers – multiplexing -computer controlled instrumentation – virtual instrument - Virtual Instruments and traditional instruments- Hardware and Software in Virtual Instrumentation - Virtual Instrumentation for test, Control and Design Graphical programming and Textual programming–LabVIEW – Advantages Software environment , Creating and saving a VI - Front panel Toolbar Block diagram toolbar - palettes - Front panel - controls and indicators- Block diagram - data types - data flow programming

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.
2. Shawney A.K., “A course in Electrical and Electronics Measurement and Instrumentation”, Eighteenth Edition, Dhanpat Rai & Sons, New Delhi.

REFERENCE BOOKS

1. Tai-Ran Hsu, “MEMS & Microsystems: Design and Manufacture”, 2nd Edition, March 2002, Tata Mc Graw Hill Pvt Ltd., New Delhi, India.
2. Anand M.M.S., “Electronic Measurement and Instrumentation Technology”, Prentice Hall of India, New Delhi, 2007.
3 Jovitha Jerome,”Virtual Instrumentation using LabVIEW “PHI Learning Private Limited, New Delhi, 2010

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Utilize appropriate measurement techniques to measure unknown quantities.

CO2: Analyze the operation of sensors and MEMS.

CO3: Select and apply modern measurement techniques for real time applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2	1	2		3					2
CO2	1	1			2	3	3					
CO3	3	3	2	3	3	2	3					3

3 – Substantial, 2 – Moderate, 1 – Slight

11EE402 SYNCHRONOUS AND INDUCTION MACHINES LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Regulation of three-phase alternator by EMF, MMF and ZPF methods.
2. Load test on three-phase alternator.
3. Regulation of three-phase salient pole alternator by slip test.
4. V and Inverted V curves of Three Phase Synchronous Motor.
5. Load test on three-phase induction motor (Squirrel Cage and slip ring)
6. No load and blocked rotor test on three-phase induction motor.
7.Load test on single-phase induction motor
8.Parallel operation of alternator
9.Determination of Equivalent circuit of single-phase induction motor
10.Performance study of induction generator

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Test the performance of different types of AC machines.

CO2: Predetermine the regulation and efficiency of different types of alternators.

CO3: Choose the speed control and starting methods for different machines

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	3	2	3	2	3						
CO2	2	3		3		2	2					
CO3	2	3		3	2	2	3					

3 – Substantial, 2 – Moderate, 1 – Slight

11EE403 ANALOG AND DIGITAL ELECTRONICS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

Analog Electronics

1. Design of Half wave and Full wave rectifiers with and without filters.
2. Characteristics of Differential Amplifier using FET.
3. Design and analysis of RC Phase shift oscillators.
4. Design and analysis of Schmitt Trigger.
5. Design of astable multivibrators
6. Complementary Symmetry Class B Power amplifier.

Digital Electronics

7. Design of Half adder and subtractor
8. Design and implementation of BCD to seven segment code converters.
9. Study of D,T and JK flip flops
10. Design and implementation of Synchronous counters.
11. Design of running LED system using counters
12. Design of Frequency divider

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze various analog electronic circuits.

CO2: Design combinational and sequential logic circuits.

CO3: Construct various flip-flops and design counters.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2	3								
CO2	3	2	3	1	3		1				3	1
CO3	2		3		2						2	

3 – Substantial, 2 – Moderate, 1 – Slight

11EL202 COMMUNICATION SKILLS LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS

English Lab

1. Listening Comprehension
   Listening to instructional software packages in the communication laboratory, using them, understanding the mechanics of language like grammar, listening to native speakers' presentation, 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.
2. Reading comprehension and vocabulary:
   Reading for getting information and understanding; scanning, skimming and identifying topic sentences – reading for gaining knowledge, looking for transitions, understanding the attitude of the writer – Filling the blanks – Cloze exercises – vocabulary building – Comprehension.
3. Speaking:
   Group discussion; verbal and non-verbal communication; speaking on situational topics – maintaining eye contact, speaking audibly, clearly and with confidence – Common errors in English
   Conversations – face-to-Face conversation – Telephone Conversation – Roll play.
4. Writing Skills:
   Writing job application: resume, applications for jobs, making complaint letters – Projects: report writing – editing and proof reading – research paper and translating numerical data from charts and diagrams into verbal communication.

Career Lab

1. Letter Writing / Resume / Report preparation:
   Structuring Letter Writing / Resume / Report preparation / E-Mail
2. Presentation skills
   Elements and structure effective presentation – presentation tools – voice Modulation – Body language – Video samples
3. Group Discussion
   Structure of Group Discussion – Strategies in GD – Team work – Video Samples
4. Interview skills
   Kinds of Interview- corporate culture – video samples
5. Soft Skills
   Time management – stress management – assertiveness – case study

Communication Software Package:

1.Young India Software

a. Tense Buster Intermediate
b. Issues in English

Globarena – English Lab / Career Lab Software

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Write, read and listen English effectively

CO2: Communicate efficiently in English in real life and career related situations

CO3: Demonstrate good presentation skill.

CO4: Use the modern communication software package to enhance the soft skills

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1				2					2	3		1
CO2				2					2	3		1
CO3				2					2	3		1
CO4									2	3		

3 – Substantial, 2 – Moderate, 1 – Slight

11EE501 TRANSMISSION AND DISTRIBUTION

3 1 0 4

MODULE - I **15**

Introduction: Introduction- Structure of electric power system- Transmission and Distribution systems – overhead transmission, under ground transmission – comparison - Concept of Grid

Electrical Design of Transmission Lines: Parameters of transmission line - Resistance - skin and proximity effects - inductance and capacitance of single and three phase transmission lines with single and double circuits - solid, stranded and bundled conductors - Symmetrical and unsymmetrical spacing and transposition; application of self and mutual GMD.

Mechanical Design of Transmission Lines:

Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency.

MODULE - II **15**

Mechanical Design of Transmission Lines

Sag And Tension Calculations: Classification of towers ,Sag and tension in OH lines – Equation of sag- Calculation of Sag – Towers at equal heights – Unequal heights.

Analysis of Transmission Lines: Classification of lines: Short line, medium line and long line; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge-impedance loading, shunt and series compensation; Ferranti effect.

MODULE - III **15**

Distribution Systems: Radial and ring-main distributors; inter-connectors AC distribution: AC distributor with concentrated load; three-phase, four-wire distribution system; DC distribution; sub-mains; stepped and tapered mains.

Cables and Advanced Transmission Systems

Underground Cables: Constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics-Cable faults.

Corona: Phenomena of corona- Factors affecting corona- Disruptive Critical voltage- Visual critical Voltage- corona loss

Advanced Transmission Systems: FACTS: TCSC, SVC, STATCOM, UPFC.- Introduction, Application, Merits and Demerits of HVDC and EHV AC transmission.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Wadhwa, C.L., "Electrical Power Systems", New Age International Publishers, New Delhi, 6th Edition, 2010.
2. Singh, S.N., "Electric Power Generation, Transmission and Distribution", Prentice Hall of India, New Delhi, 2nd Edition 2009.

REFERENCE BOOKS

1. Soni, M.L., Gupta, Bhatnagar, and Chakrabarthy, "A Textbook on Power Systems Engineering", Dhanpat Rai & Sons, New Delhi, 2007.
2. Gupta, B.R, "Generation of Electrical Energy", Eurasia Publishing House, New Delhi, 1983.
3. Metha, V.K and Rohit Mehta, "Principles of Power System", S. Chand & Company Ltd., Ramnagar, New Delhi, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Model the transmission line to evaluate the performance indices.

CO2: Estimate the voltage distribution in insulator strings and cables to improve the voltage profile.

CO3: Analyze the various distribution schemes and advanced transmission systems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3			2			2			
CO2	2		2	3		2			2			
CO3					3	2	1		2			

3 – Substantial, 2 – Moderate, 1 – Slight

11EE502 POWER SYSTEM PROTECTION AND SWITCHGEAR

3 0 0 3

MODULE - I **15**

Introduction: Need for protection - Need for protective apparatus-Basic requirements of protection-Basic components of protection. Fault types and their effects. System earthing-Types-Concepts of Earth potential and Touch potential-Effect of electric shock on human beings – Sensitive earth leakage protection

Circuit breakers: Arc voltage - Arc interruption - Restriking and recovery voltage - Resistance switching - Current chopping - Classification of circuit breakers - Oil, air blast, SF6 -Vacuum circuit breaker -Operating mechanism - Selection of C.B. - Testing of C.B.

MODULE- II **15**

HRC Fuses and Switches: Fuses – Types. HRC fuses - Construction - Action of HRC fuses - Fuse characteristics - Selection of fuses - Applications – Discrimination. Resettable fuses. Types of isolators and earthing switches - Typical substation connections with protective switch gear and layout – Pantographic switches – power contactors, auxiliary contactors

Protective Relays: Principles and need for protective schemes – nature and causes of faults – types of faults – Power system earthing - Zones of protection and essential qualities of protection –construction and characteristics of relays – over current relays – directional, distance and differential relays – under frequency relays – negative sequence relays

MODULE- III **15**

Apparatus Protection: Generator protection - Stator protection - Percentage differential protection -Protection against stator inter turn faults - Stator overheating protection. Rotor protection - Field ground fault protection - Loss of excitation - Rotor overheating protection - Protection against Over voltage, Over speed, Motoring, Vibration and distortion of rotor, Voltage regulator failure, field suppression. **Transmission line protection** - Protection of feeder and ring main system - Earth fault protection- -Introduction to distance protection of HV and EHV lines - Pilot wire protection - Carrier current protection - **Transformer protection** – Incipient fault - Differential protection – Phase to phase fault, Phase to earth fault – Thermal over heating protection – Over current protection – Over fluxing protection.

TOTAL: 45

TEXT BOOKS

1 Rao, Sunil S., "Switchgear and Protection", Khanna publishers, New Delhi, 1997

2 C Wadhwa, .L., "Electrical Power Systems", Fourth Edition, New Age International (P) Ltd., New Delhi, 1997.

REFERENCE BOOKS

1 Soni M.L., P. Gupta V., Bhatnagar V.S., and Chakrabarti A., "A Text Book on Power System Engineering", Dhanpat Rai & Co., New Delhi, 2008.

2 Badri Ram, and Vishwakarma, "Power System Protection and Switchgear", Tata McGraw-Hill, New Delhi, 2003.

3 Ravindranath B. and Chander N., "Power System Protection and Switchgear", New Age Publishers, New Delhi, 1995.

4 Les Hewitson, Mark Brown, Ben Ramesh, "Practical Power Systems Protection" Newnes Publisher, Burlington,2004

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Outline the basic concepts of protective schemes and relays

CO2: Compare the working of various types of fuses and circuit breakers

CO3: Synthesize the co-ordination schemes for unit and system protection

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1			2	2								1
CO2			3		3							2
CO3					2							

3 – Substantial, 2 – Moderate, 1 – Slight

11EI403 ANALOG INTEGRATED CIRCUITS

(Common to EEE and EIE branches)

3 0 0 3

MODULE -I **15**

Characteristics of Operational Amplifier: Introduction – Basic information of operational amplifier, Ideal operational amplifier, operational amplifier internal circuit - analysis of differential amplifiers with active loads– Characteristics of OP AMP –Open Loop OP AMP –DC characteristic- input bias current-input offset voltage - thermal drift - AC characteristic - Frequency response of OP AMP – Slew Rate, stability - frequency compensation.

MODULE – II **15**

Applications of Operational Amplifiers: Basic Op-amp applications - Inverting and Non inverting Amplifiers- Instrumentation amplifier- Voltage to current converter – current to Voltage converter - Precision rectifier - sample and hold circuits- Log and Antilog Amplifiers – Multiplier and Divider - Differentiator- Integrator- Comparator- Multivibrators and Schmitt trigger- Sine wave Oscillator- Triangular wave generator- I and II order Low-pass and high-pass Butterworth filters - Switched capacitor filter - A/D converter-Flash- Dual slope-Successive approximation D/A converter: weighted resistor type, R-2R ladder and inverted R-2R ladder.

MODULE– III **15**

Analog Multiplier, PLL and Special Function IC'S: Basic Principles – Phase Detector/comparator Voltage controlled Oscillator- Monolithic PLL – PLL Applications: Frequency Multiplication/Division, Translation and FSK Demodulation. Description of Functional Diagram of IC 555 timer- Monostable Multivibrator - Astable Multivibrator using 555 Timer- Voltage regulators: Series op-amp Regulator – IC Voltage regulator – 723 General Purpose Regulator – Switching Regulator.

TOTAL:45

TEXT BOOKS

1. Roy Choudhry, D and Shail Jain, "Linear Integrated Circuits", New Age International, New Delhi, 2007
2. Gaykwad, Ramakant A., "OP-AMP and Linear IC's", Pearson Education, New Delhi, 2004.

REFERENCE BOOKS

1. Sergio Franco., "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw-Hill, New York, 1997.
2. Coughlin Robert and Driscoll F, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, Pearson Education Asia, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understand the characteristics and applications of operational amplifier.

CO2: Design electronic circuits with operational amplifier.

CO3: Realize the applications of PLL and special function ICs.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2									
CO2		3	3	2	2							
CO3			3		1							2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE503 CONTROL SYSTEMS

(Common to Mechatronics, ECE, EEE and EIE)

3 1 0 4

MODULE-I **15**

System Representation: Basic elements in control systems – Open and closed loop systems – Modeling of Electrical and mechanical systems – Electrical analogy of mechanical systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs – Masons gain formula.

Introduction to state space analysis – canonical form and companion forms.

MODULE – II **15**

Time Response and Stability Analysis: Time response – Time domain specifications – Types of test input – First and Second order system response – Error coefficients – Steady state error- Generalized error series –effect of P, PI, PID controllers on time response.

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of poles and zeros on system stability.

MODULE – III **15**

Frequency Response and Compensator Design: Frequency response – Bode plot – Polar plot – Constant M an N circles – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications– stability via gain margin and phase margin - Nyquist stability criterion- Need for compensators - Compensators design - Lag, lead and lag-lead compensator design using bode plot.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Gopal, M., "Control Systems: Principles and Design", Third Edition, Tata McGraw- Hill, New Delhi, 2008.
2. Ogata K., "Modern Control Engineering", Fourth Edition, Pearson Education/ PHI, New Delhi, 2007.

REFERENCE BOOKS

1. Nagrath I.J. and Gopal M., "Control Systems Engineering", Fifth Edition, New Age International Publishers, New Delhi, 2008.
2. Kuo, B.C., "Automatic Control Systems", Eighth Edition, John Wiley & Sons, New York, 2003.
3. Nise, Norman S., "Control Systems Engineering", Fifth Edition, Wiley Publishers, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Develop the mathematical model of an Electrical and Mechanical system.

CO2: Analyze the time response, frequency response and stability of the system.

CO3: Design the controller and Compensator to meet the system requirements.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			3	2							1
CO2	3			2	3							1
CO3	3		3	3	2							2

3 – Substantial, 2 – Moderate, 1 – Slight

11EC408 COMMUNICATION ENGINEERING

(Common to EEE and EIE branches)

3 0 0 3

MODULE - I **15**

Analog Modulation Systems: Principles of amplitude modulation – AM envelope, frequency spectrum and bandwidth, modulation index and percentage modulation, AM power distribution, AM modulator circuits – low level AM modulator, AM transmitters – low level transmitters, high level transmitters.

AM reception: AM receivers – TRF, Superheterodyne receivers, Double Conversion AM receivers (Block Diagrams only). Angle Modulation – FM and PM waveforms, phase deviation and modulation index, frequency deviation, frequency modulators and demodulators, frequency spectrum of a angle modulated waves, Bandwidth requirement, Average power FM – Direct FM, Direct FM transmitter, Indirect FM transmitter, Angle modulation Vs. amplitude modulation.FM receivers: FM demodulators, PLL FM demodulators, Frequency Vs. phase Modulation (Block Diagrams only).

MODULE - II **15**

Digital Communication and Network Protocol: Time Division Multiplexing, Digital T-carrier System – Pulse code modulation –Digital modulation: Amplitude shift keying, Frequency and phase shift keying – Modulator and demodulator, bit error rate calculation.

Data Communication codes, error control. Serial interface-RS232, RS485, CAN bus, ISDN, LAN, ISO-OSI seven layer architecture for WAN.

MODULE - III **15**

Satellite & Optical Communications and Wireless Technologies: Satellite Orbits – Satellite Communication Systems-Optical Principles – Optical Communication Systems – fiber-Optic Cables – Single mode and multi mode-step index fibers – Optical Transmitters – LED – LASER and Receivers – PIN Diode – Avalanche Photo Diode (APD) .

Cellular Telephones Systems – Cellular Concepts – Second generation (2G) and Third generation (3G) cell phone systems –PANs and Bluetooth-Zigbee and Mesh Wireless Networks-Infrared Wireless networks.

TEXT BOOKS

1. Tomasi Wayne, “Electronic Communication Systems”, Third Edition, Pearson Education, New Delhi, 2005.
2. Frenzel Louis E., “Principles of Electronics Communication Systems”, Third Edition, Tata McGraw-Hill, New Delhi, 2008.

REFERENCE BOOKS

1. Anokh Singh, “Principles of Communication Engineering”, S.Chand & Co., New Delhi, 2006.
2. Kennedy G., “Electronic Communication Systems”, Fourth Edition, McGraw-Hill, New York, 2002.
3. Miller, ‘Modern Electronic Communication’, Prentice Hall of India, New Delhi, 2003.
4. Blake Roy., “Electronic Communication Systems”, Second Edition, Thomson Delmar, Singapore, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Apply different analog and digital modulation techniques

CO2: Analyse various receivers and transmission medium

CO3: Investigate various wired and wireless technologies for satellite and optical communication

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			2								
CO2	3			2								
CO3	3			3								

3 – Substantial, 2 – Moderate, 1 – Slight

11EE504 MICROPROCESSORS AND MICROCONTROLLERS

(Common to EEE, EIE, CSE and Mechatronics branches)

3 0 0 3

MODULE– I **15**

8085 Micro processor: 8085 Architecture – Functional block diagram - Instruction set – Addressing modes – Timing diagrams – Reset and Power on Reset-Assembly language programming – Interrupts- Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface

MODULE– II **15**

89C51 Microcontroller: Introduction to RISC and CISC Machines -89C51 Micro controller hardware- Memory Bank-Memory mapping-Register organization-I/O pins – Ports and circuits- Counters and Timers-modes of operation-Serial Data communication I/O- Interrupts-Interfacing to external memory-Instruction sets-Addressing modes

MODULE-III **15**

89C51 Programming and Applications :Assembly language programming and Programming with C – Simple programming -I/O port programming -Timer and counter programming – Serial data Communication using max232 converter – Interrupt programming –89C51 Interfacing with Peripherals : LED-Seven segment display – Switch interfacing- LCD, Parallel Analog to Digital Converter- Sensors – Stepper Motors - Speed control of DC motors- Matrix Keyboard and Digital to Analog Converter .

TOTAL : 45

TEXT BOOKS

1. Gaonkar R.S, "Microprocessor Architecture, Programming, and Applications with the 8085", Fifth Edition, Prentice Hall of India, New Delhi, 2002.
2. Mazidi, Mohammed Ali, Mazidi, Janice Gillispie, McKinlay, Rolin.D "The 8051 Microcontroller and Embedded Systems", Pearson Education Asia, second edition, New Delhi, 2007.

REFERENCE BOOKS

1. Hall Douglas V, "Microprocessors and Interfacing Programming and Hardware", Tata McGraw Hill, 1995.
2. Ayala Kenneth J, "The 8051 Microcontroller Architecture Programming and Application", Second Edition, Penram International Publishers (India), New Delhi, 1996.
3. Kleitz. William, "Microprocessor and Microcontroller Fundamental of 8085 and 8051 Hardware and Software", Pearson Education, New Delhi, 1998.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Perceive the basic architecture and interfacing techniques of 8085 and 89C51.

CO2: Apply the Programming knowledge for real time applications.

CO3: Design an application specific Microcontroller system.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3											
CO2	3		3	3	3		2					
CO3	3		3		2	3						2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE505 MEASUREMENTS AND INTEGRATED CIRCUITS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Calibration of Single phase Energy Meter by Direct / Phantom loading
2. Extension of DC voltmeter and DC Ammeter Ranges.
3. Power measurement using Current transformer and Potential Transformer.
4. Measurement of DC resistance by Wheatstone and Kelvin Double Bridge.
5. Measurement of Inductance and capacitance using Maxwell's Bridge
6. Measurement of earth resistance and insulation resistance using Megger
7. Power quality measurement using power analyser
8. Design of Digital to Analog Converter
9. Design of Analog to Digital Converter.
10. Applications of Operational amplifier.
11. Design of Instrumentation amplifier
12. Multivibrator using 555 timer IC.
13. Voltage regulator using 78XX and 79XX IC.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Test and extend the range of meters

CO2: Measure different electrical parameters by suitable circuits.

CO3: Design and Implement the circuit for various applications using analog IC's.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2	2	1	2							
CO2	2		3			3						
CO3			1		3							

3 – Substantial, 2 – Moderate, 1 – Slight

11EE506 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

(common to Mechatronics, EEE, EIE and CSE branches)

0 0 3 1

LIST OF EXPERIMENTS

MICROPROCESSOR PROGRAMMING:

1. Study of 8085 Microprocessor Kits.
2. Arithmetic operations using 8085
3. Sorting of number series.
4. Code conversion
5. Arithmetic and geometrical series.
6. A/D and D/A conversions.

MICROCONTROLLER PROGRAMMING:

7. Study of 8051/8031 Microcontroller Kits.
8. Arithmetic functions using microcontroller 8051.
9. Logical operations.
10. Stepper motor control.
11. Interfacing of high power devices.
12. Hex code conversion using Keil compiler and burning into the microcontroller

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Demonstrate the programming skills in 8085 and 8051

CO2: Interface Processor and Controller with Peripheral Devices in real time

CO3: Compile and burn the coding in Keil Environment

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									
CO2	3		3		3	2	2					
CO3	3		3		2	2						2

3 – Substantial, 2 – Moderate, 1 – Slight

11ME510 THERMODYNAMICS AND FLUID MECHANICS LABORATORY

(Common to EEE and EIE)

0 0 3 1

LIST OF EXPERIMENTS - THERMAL ENGINEERING LABORATORY

1. Valve timing and port timing diagrams for IC Engines.
2. Performance test on a Petrol Engine.
3. Performance test on a Diesel Engine.
4. Heat Balance test on an IC Engine.
5. Performance and Heat Balance Test on Steam Boiler.
6. Performance test on Reciprocating Air Compressors.
7. Performance test on a Refrigerator (Determination of COP).
8. Performance test on an Air Conditioning System (Determination of COP).
9. Determination of viscosity of given oil.

LIST OF EXPERIMENTS - FLUID MECHANICS LABORATORY

1. Test on jet pump.
2. Test on Submersible pump.
3. Test on reaction turbine for obtaining the characteristics curves.
4. Test on impulse turbine to obtain its characteristics curves.
5. Test on positive displacement pump for obtaining its characteristics curves.
6. Test on centrifugal pump for obtaining its characteristics curves.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Apply theoretical concepts developed in the theory course Thermodynamics and fluid mechanics to hands-on experiments.

CO2: Determine and analyse the performance of systems in thermodynamics experiments

CO3: Determine and analyse the performance of systems fluid mechanics experiments

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2			1							
CO2	3	2			1							
CO3	3	2			1							

3 – Substantial, 2 – Moderate, 1 – Slight

11GE601 ECONOMICS AND MANAGEMENT FOR ENGINEERS

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Economics – Basics Concepts and Principles – Demand and Supply – Law of demand – Determinants of demand, Law of supply – market Equilibrium – National Income – Circular Flow of Economic activities and Income –National Income and its measurement techniques – Inflation – Causes of Inflation – Controlling Inflation –Business Cycle .

MODULE – II **15**

Forms of business – Management Functions: Planning, Organizing, Staffing, Leading and Controlling- Managerial Skills - Levels of Management - Roles of manager.

Marketing – Core Concepts of Marketing, Four P's of Marketing, New product development, Product Life Cycle, Pricing Strategies and Decisions. Operations Management – Resources – Site selection, Plant Layout, Steps in Production Planning and Control – EOQ Determination

MODULE – III **15**

Accounting Principles – Financial Statements and its uses – Time value of Money – Depreciation methods — Break Even Analysis – Capital budgeting techniques – Introduction to FDI, FII, Mergers & Acquisition.

TOTAL : 45

TEXT BOOKS

1. Geetika, Plyali Ghosh, Purba Roy Choudhury, "Managerial Economics", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Jeff Madura, "Fundamentals of Business", Cengage Learning Inc, India, 2007.

REFERENCE BOOKS

1. Stanley L. Brue and Campbell R Mcconnell, "Essentials of Economics", Tata McGraw-Hill, New Delhi, 2007.
2. S.P.Jain, K.L.Narang, Simi Agrawal, "Accounting for Management", First 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 and operations management decisions

CO4: Interpret financial and accounting statements

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	1	2			3		2	2	2	3	2
CO2		1	2			2	2	2	2	2	3	2
CO3	1	2	1			2		2	2	2	3	2
CO4	2	2				2		2	2	2	3	2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE601 ADVANCED CONTROL THEORY

3 1 0 4

MODULE - I **15**

State Space Analysis and Design: State space representation for continuous systems – Conversion from transfer function to state space-Physical variable, Phase variable and canonical forms – Solution of State equations-State transition matrix - controllability and observability

Design by state feedback –Pole assignment technique – Design of state feedback controllers – Design of reduced and full order observers – PI feedback (For continuous systems only).

MODULE - II **15**

Sampled Data Control System: Introduction to Sample data control systems –Sampling process, signal reconstruction, difference equation, Z-transform, Z-transfer function – Inverse Z transform, Z-transform analysis of sampled data control system, Z and S domain Relationship – Pulse transfer function.

State space representation for discrete systems - Physical variable, Phase variable and Canonical variables forms - State transition matrix - controllability and observability.

MODULE - III **15**

Stability Analysis and Non-Linear Systems: Stability concepts – Jury's test for stability – Bilinear Transformation - Equilibrium points – BIBO and asymptotic stability – Direct method of Liapunov.

Types of non-linearity – Typical examples – Equivalent linearization – Phase plane analysis – Limit cycles – Describing functions and analysis.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Gopal, M., "Digital Control and State Variable Methods", Second Edition Tata McGraw- Hill, New Delhi, 2010.
2. Ogata, K., "Modern Control Engineering", Fourth Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

REFERENCE BOOKS

1. Gopal, M., "Modern Control Systems Theory", New Age International Publishers, New Delhi, 2007.
2. Nagarth, I. J. and Gopal, M., "Control Systems Engineering", Fifth Edition, New Age International Publishers, 2007.
3. Kuo, B.C., "Automatic Control Systems", Eighth Edition, John Wiley & Sons, New York, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Apply the various transform techniques to develop the mathematical model of linear and nonlinear system.

CO2: Categorize the various state space models for continuous and discrete time systems and design state feedback controllers

CO3: Analyze the stability of the system.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									
CO2	3	2	2		3	2						
CO3	3		3									

3 – Substantial, 2 – Moderate, 1 – Slight

11EE602 POWER SYSTEM ANALYSIS AND STABILITY

3 1 0 4

MODULE – I 15

Introduction to Modeling of Power System Components: Need for system analysis in planning and operation of power system - necessity of modeling - types of modeling – single line diagram – per phase representation – per unit representation. Primitive network and its matrices - bus incidence matrix - Formation of bus admittance by two-rule method and singular transformation.

Power Flow Analysis: Problem definition – bus classification – derivation of power flow equation – Solution by Gauss Seidel and Newton Raphson methods - P V bus adjustments for both methods - computation of slack bus power, transmission loss and line flow - π equivalent circuit of transformer with off nominal tap ratio – Voltage control.

MODULE – II 15

Symmetrical Short Circuit Analysis: Need for short circuit study - Representation of generator, transformer, transmission line for short circuit study - Approximations in modeling –Formation of bus impedance matrix - Z-bus by building algorithm - Symmetrical short circuit analysis – Thevenin's equivalent representation – Fault MVA - Fault calculation using Z bus.

Unsymmetrical Short Circuit Analysis: Unsymmetrical Fault Analysis - Symmetrical component transformation – sequence impedances – sequence networks of Impedance louds, Transmission lines, rotating machines and transformers. Types of unsymmetrical fault - Unsymmetrical fault analysis on an Unloaded generator- single line - ground fault, double line – ground fault, line – line fault – computation of fault currents - unsymmetrical analysis on power system.

MODULE – III **15**

Stability Analysis: Introduction to numerical solution of differential equation - Concept of stability in power system - Swing equation - stability limits - methods of improving stability limits- Solution of swing equation by Euler's method and Runge-Kutta method – power angle equations - Equal area criterion - critical clearing angle and time-SMIB - Multi-machine stability

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Grainger, John J. and Stevenson, W.D., "Power System Analysis", First Edition, Tata McGraw- Hill, New Delhi, 2003.
2. Nagrath. I. J and Kothari. D.P, "Modern Power System Analysis", Third Edition, Tata McGraw- Hill, New Delhi, 2003.

REFERENCE BOOKS

1. Kimbark, E.W., "Power System Stability – Part I and II", John Wiley, 2004.
2. Wadhwa, C.L., "Electrical Power Systems", New Age International Publishers (P) Ltd., 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Model various power system components to analyze the power flow.

CO2: Analyze the different types of symmetrical and unsymmetrical faults.

CO3: Predict the stability of the power system using suitable algorithm

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			3	1							2
CO2	3		2	3								2
CO3	3		2	3	3							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE603 POWER ELECTRONICS
(Common to ECE, EEE and EIE branches)

3 0 0 3

MODULE – I **15**

Power Semi-Conductor Devices: Construction, Principle of operation – Static and dynamic characteristics of Power diodes, SCR, TRIAC, GTO, power BJT, power MOSFET, IGBT and IGCT – Safe operating Area – protection circuits – series and parallel connections. Phase Controlled Converters: AC to DC converters: single phase and three phase controlled rectifiers with R, RL and RLE load – Estimation of RMS load voltage, RMS load current and input power factor, DPF - effect of source inductance – Single phase and three phase AC voltage controllers (using thyristors and Triacs). Control circuits: Functional requirements of the switching control circuits

MODULE – II **15**

DC to DC Choppers: DC to DC converters: DC choppers using devices other than thyristors – Principle of step up and step down operation – single quadrant DC chopper with R, RL and RLE load – Time ratio control –Current Limit Control– two quadrant and four quadrant DC choppers. Voltage, current and load-commutated choppers. Introduction to buck, boost, cuk, buck-boost regulators - Step up and step down cycloconverter – single phase to single phase - three phase to single phase. Generation of timing pulses for DC choppers

MODULE – III **15**

Inverters: DC to AC converters: Inverters– Types – voltage source and current source inverters – single phase bridge inverters – three phase bridge inverters – 180o and 120o mode PWM inverters – Series inverter - Control of AC output voltage – Harmonic reduction Control Circuits and Applications: PWM techniques for DC to AC converters – Introduction to power converter control using Digital controllers. Applications: UPS HVDC systems - SMPS

TOTAL : 45

TEXT BOOKS

1. Rashid, M.H., “Power Electronics: Circuits Devices and Applications”, Third Edition, Prentice Hall of India, New Delhi, 2008.
2. Singh, M. D and Kanchandani, “Power Electronics”, Second Edition, Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS

1. Vithayathi, Joseph., “Power Electronics”, First Edition, (McGraw-Hill series in Electrical and Computer Engineering), McGraw-Hill, New York, 1995.
2. Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., “Thyristorised Power Controllers”, Wiley Eastern Limited, New Delhi, 1986.
3. Lander, W., “Power Electronics”, Third Edition, McGraw-Hill, New York, 1993.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Distinguish between various power semiconductor devices based on their construction and characteristics

CO2: Analyze the working principle of various converters.

CO3: Identify and select suitable power converters for different industrial and domestic applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2		3									
CO2			3	3	3		2					
CO3	3		3	3	3	3	3					

3 – Substantial, 2 – Moderate, 1 – Slight

11EE604 DIGITAL SIGNAL PROCESSING AND APPLICATIONS

(Common to EEE and EIE branches)

3 1 0 4

MODLUE - I **15**

Introduction and Discrete Time System Analysis:

Need and advantages of Digital Signal Processing; Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, periodic and symmetric energy and power; signal representation by singularity functions; Unit impulse, step ramp and exponential; Transformation of signals: Shifting scaling, folding in amplitude and time. Sampling, quantization, quantization error, Nyquist rate, aliasing effect.

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems – Stability analysis. convolution – Methods of evaluation convolution using Z transform.

MODLUE - II **15**

Frequency Response and FIR Filter Design

Discrete time Fourier transform, DFT - Efficient computation of DFT- Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms –Use of FFT algorithms in Linear Filtering and correlation. Computation of IDFT using DFT. Introduction to Wavelet transform:

FIR Filter Design: Amplitude and phase responses of FIR filters – Linear phase filters – symmetrical linear phase filter asymmetrical linear phase filter - windowing techniques for design of Linear phase FIR filters – Rectangular, Hamming, Hanning – Realization of FIR filters – Transversal, Linear phase and Polyphase realization structures.

MODLUE- III **15**

IIR Filter Design and DSP Processor:

IIR Filter Design: Review of design of analogue Butterworth and Chebychev Filters, Frequency transformation in analog domain – Design of IIR digital filters using impulse invariance technique – Design of IIR digital filters using bilinear transformation – pre warping – Frequency transformation in digital domain. IIR Filter structure realization – Direct, cascade, and parallel forms. **DSP Processor and Finite Word Length Effect:** Architecture and features of TMS 320C54 signal processing chip. Representation of numbers in digital system: fixed point and floating point – Quantisation by truncation and rounding – Quantisation of input data, filter coefficient – Product quantization error – limit cycles in recursive systems: Zero input limit cycle, overflow limit cycle, scaling to prevent overflow. DSP applications: Harmonic analysis, motor control.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Proakis John G, and Manolakis Dimtris G., "Digital Signal Processing: Principles, Algorithms and Application", Fourth Edition, Prentice Hall of India, New Delhi, 2007.
2. Venkataramani. B and Bhaskar M., "Digital Signal Processor Architecture, Programming and Application", Tata McGraw-Hill, New Delhi, 2002.

REFERENCE BOOKS

1. Oppenheim, Alan V. and Schafer, Ronald., "Digital Signal Processing", Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
2. Mitra S.K., "Digital Signal Processing: A Computer Based Approach", Tata McGraw-Hill, New Delhi, 1998.
3. Avtar singh and Srinivasan S, "DSP Implementation using DSP Microprocessor with Examples from TMS32C54XX", Thomson / Brooks cole Publishers, Singapore, 2003.
4. Poornachandra S, and Sasikala B, "Digital Signal Processing", Second Edition, Tata McGraw-Hill, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze the properties of signals and systems

CO2: Implement various transform techniques for signal processing applications

CO3: Design and realize various digital filter structures

CO4: Understand the architecture and features of DSP Processor

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3											2
CO2	3					2						
CO3			3			2						
CO4	3				2							

3 – Substantial, 2 – Moderate, 1 – Slight

11EI502 VLSI SYSTEMS

(Common to EEE and EIE branches)

3 0 0 3

MODULE - I **15**

CMOS Technology: - Basic CMOS technology: N well - P well - Twin tub - SOI Process – NMOS - PMOS Enhancement transistor – Transistor operation, MOS DC equations -Threshold voltage - Body effect -channel length modulation - Mobility variation - MOS models - small signal AC characteristics - complementary CMOS inverter DC characteristics - Rise time - fall time - power dissipation - Latch up and prevention. MOSFETS as switches- Pass Transistors.

MODULE - II **15**

CMOS Chip Design:, Transmission gates. Tristates, Logic design with CMOS, Multiplexers using Transmission gates, Flip-flop and latches- Stick diagram for combinational circuits, Layout design rules - Inverter, NAND, NOR. ASIC design flow- CMOS chip design options: Full custom ASICs, Std. Cell based ASICs, Gate Array based ASICs Channelled, Channelless and structured Gate Arrays, Xilinx programmable Gate Arrays- Configurable Logic Block (CLB), Input/Outputs(I/O) -VLSI Design flow.

MODULE - III **15**

VERILOG HDL: Basic Concepts - Lexical conventions-data types-system tasks and compiled directives-modules and ports- - gate level modeling- dataflow modeling- behavioral modeling- switch level modeling –procedural and continuous assignment statements–Structural- gate level description of decoder - equality detector –comparator - priority encoder - D-latch - D-Flip Flop- half adder - Full adder - Ripple Carry adder - memory design – Arithmetic Logic Unit – Multiply and Accumulate.

TOTAL : 45

TEXT BOOKS

1. Neil H.E. Weste, David Harris, Ayan Banerjee," CMOS VLSI Design A circuits and systems Perspective"Third edition, Pearson Education, New Delhi, 2007.
2. Palnitkar Samir., "Verilog HDL: Guide to Digital Design and Synthesis", Third Edition, Pearson Education, New Delhi, 2003.

REFERENCE BOOKS

1. John P.Uyemura, "Introduction to VLSI circuits and systems", John wiley& sons,2003.
2. Smith M.J.S., "Application Specific Integrated Circuits", Pearson Education, New Delhi, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Explain the basics of CMOS technology.

CO2: Analyze the different design methodologies of CMOS chips.

CO3: Develop Verilog HDL code for different digital structures.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3	2								
CO2	3		3			1			2		3	
CO3	3	3			3				3		3	1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE605 POWER ELECTRONICS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Steady state and Switching characteristics of SCR.
2. VI and Switching characteristics of MOSFET.
3. Steady state characteristics of TRIAC.
4. VI and dynamic characteristics of IGBT.
5. Design of controlled Rectifiers.
6. Design of Choppers
7. Design of inverters using IGBT.
8. Three phase AC voltage controllers
9. Design of Power Supplies
10. Simulation of device characteristics using Spice

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Examine the characteristics of various power semiconductor devices

CO2: Select various types of power converters based on the applications

CO3: Design and simulate the power converters

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2	2	1	2							
CO2	2		3			3						
CO3			1		3							

3 – Substantial, 2 – Moderate, 1 – Slight

11EE606 DIGITAL SIGNAL PROCESSING AND APPLICATIONS LABORATORY

(Common to EEE and EIE branches)

0 0 3 1

LIST OF EXPERIMENTS

1. Generation and analysis of Continuous and Discrete time Signals.
2. Verification of Sampling Theorem.
3. Linear and Circular Convolution.
4. Determination of LTI system responses.
5. Analysis of signals using various frequency transforms.
6. Design and analysis of FIR filters (All types).
7. Design and analysis of IIR filters (All types).
8. Realization of FIR and IIR filter Structures.
9. Study of TMS 320C54X DSP Processor.
10. Harmonic analysis of signals using DSP Processor.

Software Reference:

- MATLAB 7.1
- TMS320C54X Simulator

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Write the MATLAB code to generate different signals and analyze the system response.

CO2: Design and realize FIR and IIR filter structures.

CO3: Illustrate the architecture of DSP processor and perform harmonic analysis

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3				2						
CO2		2	3									
CO3	3				2							

3 – Substantial, 2 – Moderate, 1 – Slight

11EI606 CONTROL AND INSTRUMENTATION LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

CONTROL EXPERIMENTS

1. Determination of transfer function parameters of DC servomotor.
2. Determination of transfer function parameters of AC servomotor and Synchros.
3. Simulation of linear and non-linear systems.
4. Design of compensators (Lag, Lead and Lag-Lead).
5. Design of P, PI and PID controllers.
6. Stability analysis of linear systems (Using Bode and Root Locus).
7. State space model of a DC motor using MATLAB.

INSTRUMENTATION EXPERIMENTS

8. Calibration of temperature sensors (RTD / thermo couple / thermistor)
9. Measurement of strain using strain gauge.
10. Measurement of linear displacement using LVDT
11. Study of characteristics of Piezo electric transducer.
12. Study of characteristics of Inductive and Capacitive transducers

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Develop transfer function of linear and non-linear system and analyze its stability.

CO2: Design a compensator and controller for real-time process

CO3: Analyze the characteristics of transducers and measure various physical quantities.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	2	3	2							
CO2	3	3	3	3	3							
CO3	3			2	2		3					

3 – Substantial, 2 – Moderate, 1 – Slight

11GE701 TOTAL QUALITY MANAGEMENT

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Quality Systems: Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs, Basic concepts of Total Quality Management, Historical Review. 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.

MODULE – II **15**

TQM Principles: Principles of TQM, Leadership – Concepts, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation. 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, Performance Measures – Basic Concepts.

MODULE – III **15**

TQM Tools: 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, Poka Yoke. 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.

TOTAL :45

TEXT BOOKS

1. Besterfield, Dale H. et al., "Total Quality Management", Third Edition, Pearson Education, 2008
2. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill, New Delhi, 2007.

REFERENCE BOOKS

1. Feigenbaum. A.V, "Total Quality Management", Tata McGraw Hill, New Delhi, 1999.
2. Suganthi, L and Samuel A Anand., "Total Quality Management", PHI Learning, New Delhi.
3. Evans James R. and Lindsay William M., "The Management and Control of Quality", Seventh Edition, South-Western (Thomson Learning), 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: illustrate the evolution and basic concepts of TQM

CO2: interpret various ISO standards and their implementation procedures

CO3: apply the principles of TQM and its elements in real time scenario

CO4: adapt quality tools and techniques to implement TQM at the work place

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1						2	2	3	2	2	2	2
CO2						3	3	3	3	2	2	2
CO3					2	3	2	3	3	3	2	2
CO4	3	2	2	2	2	1		2	2	2	3	3

3 – Substantial, 2 – Moderate, 1 – Slight

11EE701 OPTIMIZATION TECHNIQUES FOR ELECTRICAL ENGINEERS

3 1 0 4

MODULE - I **15**

Linear Programming Problem: Mathematical Formulation – Basic definitions – Solutions of LPP Graphical method, Simplex method –Big–M method and Two phase method – Duality – Formulation of Primal – Dual pairs.

MODULE - II **15**

Transportation Model: Mathematical Formulation – Methods for finding Initial Basic Feasible Solution – Northwest Corner Rule, Least Cost Method and Vogel's Approximation method – Optimal Solution by MODI method – Degeneracy in transportation problem.

Assignment Model: Mathematical Formulation – Hungarian algorithm – Unbalanced assignment problem – Travelling Salesman problem.

MODULE - III **15**

Networks Scheduling: Basic terminology-Construction of networks - Critical Path method(**CPM**)-Programme evaluation review technique(**PERT**).

Dynamic programming: Characteristics – Dynamic programming Algorithm – Solution of Discrete Dynamic programming problem – Solution of LPP by Dynamic programming.

Lecture : 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Gupta, P.K and Hira.D.S.,"Operations Research", S.Chand & Co., Revised Edition 2008.
2. Taha, H.A., "Operations Research- An Introduction", Sixth Edition, Prentice Hall of India, 2008.

REFERENCE BOOKS

1. Kapur, J.N. and Saxena, H.C., "Mathematical Statistics", S.Chand & Co., New Delhi, 2007.
2. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Apply the various techniques for optimizing the linear programming problems.

CO2: Formulate and solve transportation and assignment problems.

CO3: Discuss scheduling of networks and concepts of dynamic programming.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3		1								1
CO3	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE702 ELECTRIC DRIVES AND CONTROL

(common to EEE and EIE branches)

3 0 0 3

MODULE – I **15**

Characteristics of Electric Drives: Motor load dynamics – steady state stability concepts - Speed – Torque characteristics of various types of loads and motors –duty cycles – heating and cooling curves – derivation -components of load torque Selection of power rating for motors with regard to thermal overloading and load variation factors – load equalization – Starting and braking – multi quadrant operation and dynamics- Selection of drives and control s chemes for Steel rolling mills, Paper mills, Lifts and Cranes.

MODULE - II **15**

DC and AC Drives: Speed control of DC motors – Ward–Leonard scheme – drawbacks – Thyristorized converter fed DC drives: Single, two and four quadrant operations – Chopper fed DC drives: control strategies – Single, two and four quadrant operations – Effect of ripples on the motor performance.

Speed control of three phase Induction Motors – Stator control: Stator voltage and frequency control – AC chopper, Inverter and cycloconverter fed Induction Motor drives, rotor control: Rotor resistance control– Static control of rotor resistance using DC chopper – Slip power recovery schemes: Static Krammer and Scherbius drives – Introduction to soft start, VFD and Vector Controlled Induction Motor Drives

MODULE - III **15**

Synchronous Motor Drives and Digital Control: Speed control of three phase Synchronous Motors– True synchronous and self controlled modes of operations – Inverter fed Synchronous Motors – Commutator less DC motors – Cyclo-converter fed Synchronous Motor – Effect of harmonics on the performance of AC motors

Digital techniques in speed control – Advantages and limitations

TOTAL : 45

TEXT BOOKS

1. Dubey, G. K., “Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi, 2003.
2. Bose, B.K., “Modern Power Electronics and AC Drives”, Pearson Education, New Delhi, 2003

REFERENCE BOOKS

1. Dubey. G. K., “Power Semiconductor Controlled Drives”, Prentice Hall of India, New Delhi, 1989.
2. Vedam Subramanyam, “Electric Drives: Concepts and Applications”, Tata McGraw –Hill, New Delhi, 2002.
3. Bose, B.K., “Power Electronics and Variable frequency Drives: Technology and Applications”, IEEE, Press, Inc. New York, 1997.
4. Krishnan R, “ Electric Motor Drives - Modeling, Analysis and Control”, Prentice Hall of India, New Delhi, 2002.
5. Boldea, Ion and Nasar, S. A., “Electric Drives”, CRC Press LLC, New York, 1999.
6. S.K.Pillai A First course on Electrical Drives, New age Publishers Ltd. Second edition, 1988

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Perform steady-state analysis on the common electric drives configuration.

CO2: Select suitable Electrical Drives for industrial applications

CO3: Apply modern digital control techniques for various drives

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									
CO2					3	2						
CO3					3							

3 – Substantial, 2 – Moderate, 1 – Slight

11CS707 COMPUTER ARCHITECTURE

3 0 0 3

MODULE – I **15**

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

Arithmetic Unit: 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.

MODULE - II **15**

Basic Processing Unit: Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control - Pipelining – Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration – Superscalar operation – RISC – CISC

MODULE - III **15**

Memory System: Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Associative memory - Cache memory - Performance consideration – Virtual memory- Memory Management requirements – Secondary storage – DVRAM – NVRAM.

I/O Organization: Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface Circuits – Standard I/O Interfaces (USB).

TOTAL : 45

TEXT BOOKS

1. Hamacher, Car.l, Vranesic, Zvonko and Zaky, Safwat., "Computer Organization", Fifth Edition, McGraw Hill, New York, 2002.
2. M.Morris Mano, "Computer System Architecture", Third Edition, Pearson Education,2008

REFERENCE BOOKS

1. Patterson, David A. and Hennessy, John L., "Computer Organization and Design: The Hardware/Software Interface", Third Edition, Elsevier, Amsterdam, 2005.
2. Stallings, William, "Computer Organization and Architecture: Designing for Performance", Sixth Edition, Pearson Education, New Delhi, 2003.
3. Heuring, V.P and Jordan, H.F., "Computer Systems Design and Architecture", Second Edition, Pearson Education, New Delhi, 2004.
4. Hayes, John P., "Computer Architecture and Organization", Third Edition, Tata McGraw-Hill, New York, 1998.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Elaborate the basic structure and operation of a digital computer

CO2: Analyze the concept of pipelining and its associated hazards

CO3: Distinguish the performance of various memory and I/O management techniques

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1		2			1	1						1
CO2		1										
CO3		2			1							

3 – Substantial, 2 – Moderate, 1 – Slight

11EE703 ELECTRIC DRIVES LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Simulation of closed loop control of converter fed DC motor.
2. Simulation of closed loop control of chopper fed DC motor.
3. Simulation of VSI fed Three phase induction motor.
4. Simulation of Three phase synchronous motor drive.
5. Speed control of DC motor using Three phase Rectifier.
6. Speed control of Three phase induction motor using PWM inverter.
7. DSP based closed loop drive for induction motor.
8. Induction motor speed control using FPGA.
9. Speed control of Brushless DC motor.
10. DSP based chopper fed DC motor drive.
11. Switched Reluctance Motor Drive using DSP.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze the performance of electric drives in Simulation Environment.

CO2: Perform speed control operation of various electric motors with modern digital control techniques

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2									
CO2					3	2						

3 – Substantial, 2 – Moderate, 1 – Slight

11EE704 POWER SYSTEM LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

Power System Analysis Experiments:

1 Computation of line parameters for single and double circuits.
2. Modeling of transmission lines.
3. Formation of bus admittance and impedance matrices.
4. Load flow analysis.
5. Symmetrical and Unsymmetrical fault analysis.
6. Transient and small signal stability analysis: single-Machine infinite bus system.

Power System Protection Experiments:

7. Current time characteristics of fuse.
8. IDMT characteristics of relays.
9. Bias characteristics of differential relay.
10. Implementation of motor protection scheme.
11. Implementation of generator protection schemes.
12. Microprocessor based distance relay.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Model the transmission line to measure the performance indices.

CO2: Distinguish between the characteristics of basic and advanced protective relays.

CO3: Apply various analysis for power system studies

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3			2			2			
CO2	1			3	2							2
CO3	3	3	3	2	2	2						2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE705 ELECTRONIC DESIGN LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

(Any Three of the following must be developed like a commercial product)

1. Design of ± 5V Constant Voltage Power supply
2. Design of 0-12 V, 1A Variable Power Supply
3. Design and Fabrication of Driver Circuit to drive an Electromagnetic relay using Microprocessor with required Protection.
4. Design and Fabrication of an isolation circuit using opto coupler which is required for Microcontroller interfacing
5. Design of signal conditioning circuit for Thermo couple.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Design, build and test electronic product and demonstrate the troubleshooting ability.

CO2: Demonstrate skills of scheduling and procuring of necessary components and controlling expenditures within constraints.

CO3: Communicate technical information by means of written and oral reports.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	2	3									
CO2	3	1		2								
CO3	3				3	2				3		2

3 – Substantial, 2 – Moderate, 1 – Slight

11GE801 PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all Engineering and Technology branches)

3 0 0 3

MODULE – I **15**

Introduction to Human Values and Engineering Ethics: 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 - 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.

MODULE - II **15**

Safety, Responsibilities and Rights: Meaning of Engineering experimentation - engineers as responsible experimenters - 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 - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights – discrimination- Intellectual Property Rights (IPR)

MODULE - III **15**

Global Ethical Issues and Codes : Multinational corporations - 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),India. etc.

TOTAL: 45

TEXT BOOKS

1. Martin, Mike and Schinzinger Roland., "Ethics in Engineering", Tata McGraw-Hill, New Delhi,2003.
2. Govindarajan M, Natarajan S, and Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS

1. Fleddermann, Charles D., "Engineering Ethics", Pearson Education/Prentice Hall, New Jersey, 2004.
2. Harris, Charles E, Protchard Michael S. and Rabins, Michael J., "Engineering Ethics –Concepts and Cases", Wadsworth Thompson Learning, United States, 2000.
3. Seebauer, Edmund G and Barry, Robert L., "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: examine the various aspects of human values

CO2: develop as responsible experimenters particularly with reference to safety

CO3: apply appropriate code of ethics to evaluate the probable consequences of actions

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1						3		3		2		3
CO2	1	2	2	2		2	2	3	3	2		3
CO3				1		2	1	3	3			3

3 – Substantial, 2 – Moderate, 1 – Slight

11EE801 HIGH VOLTAGE ENGINEERING

3 0 0 3

MODULE – I **15**

Over voltage Phenomenon and Insulation Coordination in Electric Power Systems: causes for over voltages – lightning phenomenon - Over voltages due to switching surges, System faults and other abnormal conditions – Traveling waves on transmission lines (lines terminated with open end, short circuited end, apparatus and cables)- Protection against over voltages, protection gaps,surge arresters.

Electrical Breakdown in Gases: Classical gas laws - Ionization processes – Townsend's Criterion - Paschen's law - Streamer theory - Breakdown in non-uniform fields and corona discharges – Practical considerations in using gases for insulation purposes - Vacuum insulation

MODULE – II **15**

Electrical Breakdown in Solids and Liquids:. Intrinsic breakdown in solids - Electromechanical breakdown - Thermal breakdown - Conduction and breakdown in pure and commercial liquids – Breakdown in composite dielectrics.

Generation of High Voltages and High Currents: Generation of high DC voltages, alternating voltages, impulse voltages and impulse currents – Tripping and control of Impulse Generators

MODULE – III **15**

Measurement of High Voltage and High Currents: Measurement of high DC voltages, high AC voltages and impulse voltages – Measurement of high DC currents, high AC currents and impulse currents – Potential divider-CRO for impulse voltage and current measurement – Digital techniques in high voltage measurement.

High Voltage Testing of Electrical Power Apparatus: Testing of Insulator, Bushings, Isolators, and Circuit breakers, Cables, Transformers, Surge Diverters – Tan Delta measurement – Partial Discharge measurement – Radio interference measurement – International and Indian Standards- Principles of insulation coordination on HV & EHV power systems.

TOTAL: 45

TEXT BOOKS

1. Naidu M.S. and Kamaraju V., "High Voltage Engineering", Third Edition, McGraw- Hill, New York, 2004.
2. Kuffel E, Zaengl, W.S and Kuffel J., "High Voltage Engineering Fundamentals", Second Edition, Butterworth-Heinemann, Burlington 2002.

REFERENCE BOOKS

1. Kuffel, E and Abdullah, M., "High Voltage Engineering", Pergamon Press, Oxford, 1990.
2. Razevig D.V., "High Voltage Engineering", Khanna Publishers, New Delhi, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze the concepts of over voltage and insulation coordination.

CO2: Analyze the conduction and Electrical breakdown in gases, liquids and solids.

CO3: Elucidate the various methods of high voltage generation and testing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1				2								2
CO2	3						2					
CO3	2		1		3							

3 – Substantial, 2 – Moderate, 1 – Slight

11EE802 PROJECT WORK AND VIVA-VOCE

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Choose the proper components as per the requirements of the design/system

CO2: Apply the acquainted skills to develop final model/system

CO3: Estimate, plan and execute the project as a team

CO4: Defend the finding and conclude with oral/written reports.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3	3	2	1	2	2	2	3	3	3	2
CO2	3	3	3	2	1	2	2	2	3	3	3	2
CO3						2	2	2	3	3	3	3
CO4									3	3		1

3 – Substantial, 2 – Moderate, 1 – Slight

11CS403 COMPUTER NETWORKS

(Common to EEE and CSE branches)

3 0 0 3

MODULE – I **15**

Introduction to Internet and Application Layer: Internet-network edge - network core - access networks & physical media – NAPs, ISPs and Internet backbones- delay & loss in packet-switched networks - protocol layers & their service models – Principles of Network applications, Application layer protocols : world wide web, HTTP , file transfer FTP, email SMTP, Internet directory service DNS.

MODULE - II **15**

Transport and Network Layer: Transport layer services and principles - multiplexing and demultiplexing applications - connectionless transport: UDP - principles of reliable data transfer - connection-oriented transport: TCP - principles of congestion control - TCP congestion control. Introduction & network service models –Virtual circuit and datagram networks- inside a router – Internet Protocol (IP) forwarding and addressing-routing algorithms - hierarchical routing –Routing in the internet .

MODULE - III **15**

Link Layer, LAN and Wireless Networks: Data Link Layer: Introduction and services - error detection and correction techniques - multiple access protocols – Link layer addresses, ARP, DHCP –LAN: Ethernet - Hubs and switches – Point - to - Point protocol -Wireless Networks: IEEE 802.11 LANs- Architecture – MAC protocol-Frame Format-Mobility-802.15 and bluetooth-Cellular Internet access.

TOTAL : 45

TEXT BOOKS

1. Kurose, K.F and Ross, K.W, "Computer Networking: A Top - Down Approach Featuring The Internet", Fifth Edition, Pearson Education, New Delhi, 2009.

REFERENCE BOOKS

1. Peterson, Larry L. and Davie, Bruce S. "Computer Networks - A System Approach", Second Edition , Morgan kaufmann - Harcourt Asia, New Delhi, 2002.
2. Tenenbaum, Andrew S. "Computer Networks", Fourth Edition, Pearson Education, New Delhi, 2004.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Paraphrase the fundamental principles of computer networking and the functionalities of TCP/IP protocol stack

CO2: Analyze the performance of various protocols used in computer network

CO3: Indicate the need for interconnecting devices used in networking

CO4: Examine the wireless network standards and protocols

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2					1						1
CO2	2					1						1
CO3	2					2						2
CO4	1											2

3 – Substantial, 2 – Moderate, 1 – Slight

11EC702 OPTICAL COMMUNICATION

(Common to ECE and EEE branches)

3 0 0 3

MODULE – I **15**

Optical Fibers – Structure and Digital Transmission Systems: Evolution of Fiber Optic Systems – Elements of an Optical fiber Transmission link – Basic laws and definitions – ray optics – Optical fiber modes and configurations – Mode theory of circular waveguides – Overview of modes – Key modal concepts – Linearly Polarized waves – Single Mode Fibers – Graded Index Fiber Structure.

Point to point link systems considerations – Link Power budget – Rise time budget – Noise effects on system performance – Operational principles of WDM – Solitons – EDFAs – Basic concepts of SONET/SDH

MODULE - II **15**

Signal Degradation in Optical Fibers: Fiber fabrication – Double crucible method – Chemical, Vapor oxidation method, Deposition method- Attenuation – absorption loss – Scattering loss – Bending loss – Core and Cladding loss – Signal distortion in optical wave guides – Information capacity determination – Group delay – material dispersion – Wave Guide dispersion – Signal distortion in single mode fibers – Polarization mode dispersion – Intermodal dispersion – Pulse broadening in GI fibers – Mode Coupling – RI profile and cut – off wavelength

MODULE - III **15**

Optical Sources and Optical Receivers:

LEDs – LASER Diodes : Semiconductor Laser Diodes- Fabry-Perot Lasers - Distributed Feedback (DFB) Lasers – Modulation of LASER diodes – Temperature effects - Power Launching and Coupling : Source to fiber power launching – Lensing Schemes for Coupling improvement - LED coupling to single mode fibers.

PIN Photo detector – Schottky-Barrier Photodiodes - Avalanche Photodiodes – Photo detector noise – Detector response time – Avalanche multiplication of Noise – Temperature effects on Photo detectors – Phototransistors - Fundamental Receiver operation – preamplifiers – Error sources – Receiver configuration – Probability of error – Quantum limit**.**

TOTAL: 45

TEXT BOOKS

1. Keiser Gerd., "Optical Fiber Communication", Fourth Edition, Tata McGraw-Hill, New Delhi, 2009
2. Agarwal G.P., "Fiber Optic Communication Systems", Second Edition, John wiley & Sons, New York, 1997.

REFERENCE BOOKS

1. Senior John M., "Introduction to Optical Fiber Communications", Prentice Hall, New Jersey, 2003.
2. Cherin Paul M., "Optical Fiber Communication", Third Edition, McGraw Hill, New York, 1999.
3. Dutton Harry J. R., "Understanding Optical Communications", IBM Corporation, International Technical Support Organization, 1998.
4. Franz and Jain, "Optical Communication System", Narosa Publications, New Delhi, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Ability to design and analyze a complete fibre optics system for digital data transmission

CO2: Ability to describe and demonstrate an understanding of optical fibre propagation characteristics and transmission properties, using the principles and knowledge developed throughout the course.

CO3: Ability to describe the principles of photo transmission, photo detection and optical receiver sensitivity to the extent of the material presented.

CO4: Ability to work in a team and apply sophisticated numerical skills to provide solutions to the problems related to optical communication

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1						2						1
CO2						2						1
CO3												1
CO4						2						1

3 – Substantial, 2 – Moderate, 1 – Slight

11EI605 EMBEDDED CONTROL

(Common to EIE, EEE, CSE and Mechatronics branches)

3 0 0 3

MODULE– I **15**

Introduction to 8 - Bit Microcontrollers: Architecture of PIC 18- Pin Description – Memory organization: Program memory – Data Memory: Register Organization – Oscillator and Reset circuits – Addressing Modes – Instruction set – Simple Programs.

MODULE– II **15**

PIC Programming and Applications: Timers – Counters – Capture/ Compare mode – PWM – External Hardware Interrupts – I/O Ports – USART – I^2C – ADC – Interfacing to External memory – Assembly language programming: I/O ports – Timers – Counters – PWM – External Hardware Interrupts.

MODULE-III **15**

Real-Time Operating System Concepts and Case Studies: Architecture of the Kernel - task and task scheduler - Interrupt Service Routines – Semaphores –Mutex – Mailboxes - Message Queues - Event Registers – Pipes – Signals – Timers - Memory Management – Priority Inversion Problem - Scheduling approaches - Optimality of the Earliest deadline first (EDF) algorithm - challenges in validating timing constraints in priority driven systems - Use of µC/OS-II - Case study of coding for an Automatic Chocolate Vending Machine using MUCOS RTOS

TOTAL : 45

TEXT BOOKS

1. Mazidi, Muhammad Ali, Mckinlay, Rolin D., and Causey Danny, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18", Pearson Education Asia, 2008.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS

1. Peatman, John B., "Design with PIC Microcontrollers", Pearson Education, New Delhi, 2002.
2. Microchip/PIC Microcontroller Data manuals.
3. Valvano Jonathan W., "Embedded Microcomputer Systems- Real Time Interfacing", Second Edition, Thomson Asia, Singapore, 2001.
4. Labrosse, Jean J., "Micro C/ OS –II : The real –time curnal", Second Edition, CMP Books group west publications, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understand the basic architecture and interfacing concepts of PIC18 microcontroller.

CO2: Apply the programming skills for peripheral interfacing and real time applications.

CO3: Describe the concepts of RTOS

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3											2
CO2		3	2		2	1						
CO3	3	3	2		3	3						2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE011 POWER SYSTEM OPERATION AND CONTROL

3 0 0 3

Prerequisite: Knowledge of Power System Analysis

MODULE - I **15**

Introduction: System load variation: System load characteristics, load curves- daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching.

System Operation: System load forecasting – components of system load – classification of base load - forecasting the base load – forecasting procedure. Economic dispatch – Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients.) Base point and participation factors. Economic dispatch controller added to LFC. Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority list method using full-load average production cost.

MODULE - II **15**

Overview of system control: Governor control, LFC, EDC, AVR, system voltage control, security control. MW – frequency interaction – load-frequency mechanism – load frequency control – Q-$|V|$ control – interaction between P – f and Q - $|V|$ channels – Basic control loops. Plant level control: – Real Power – Frequency Control: Fundamentals of speed governing – Transfer function model – speed governing system – Turbo generator - Static response – Feedback control – static and dynamic response of ALFC – secondary ALFC loop. Reactive Power – Voltage Control: Excitation systems requirements – Elements of an excitation system – Types of excitation systems – DC, AC, Static and recent developments and future trends – Modeling of exciter, generator – static performance – dynamic performance – AVR root loci

MODULE - III **15**

System Control: P-f control: AGC in isolated power systems – AGC in interconnected power systems – Two area system – modeling of tie line – representation of two area system – static and dynamic response – tie line bias control – Frequency bias tie line control – Basis for selection of bias.

Q-V control: Reactive power and voltage control – Production and absorption of reactive power –
Methods of voltage control – Shunt reactors, Shunt capacitors, Series capacitors, synchronous condensers – Static VAR Systems – Types of SVC – Application of Static VAR compensators and FACTS devices

Computer Control of Power Systems: Energy control centre: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and EMS functions: Security monitoring - Network topology determination, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, in-extremis and restorative.

TOTAL : 45

TEXT BOOKS

1. Elgerd, O.I., "Electrical Energy System Theory: An introduction", Tata McGraw-Hill, New Delhi, 2nd edition 2003.
2. Prabha Kundur, "Power System Stability and Control", EPRI Series, Tata McGraw-Hill Inc., New York, 1st edition 2006.

REFERENCE BOOKS

1. Abhijit Chakrabarti, Halder Sunitha "Power System Analysis-Operation and Control", Prentice-hall Of India Pvt Ltd, 3rd edition 2010
2. Moorthy, P S R, "Operation and Control in power system", BS Publications,2009

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Estimate the load demands for economic operation and optimum control
CO2: Develop suitable model for frequency and voltage control
CO3: Identify the various computer control techniques for power system operation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			3	1							2
CO2	3		2	3								2
CO3	3		2	3	3							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EE012 RENEWABLE ENERGY SOURCES

3 0 0 3

MODULE – I **15**

Introduction: Energy Conservation and Energy Efficiency – Needs and Advantages, Different types of Renewable Energy Sources - Availability of Energy Resources in World –Environmental aspects of energy utilization – Energy Conservation Act 2001 - Statistical Report on Renewable energy scenario in India - Distributed generations. **Solar Energy:** Solar Constant - Solar Flat plate and concentrating collectors – Solar heating and cooling techniques – Solar desalination – Solar Pond – Solar cooker – Solar Drying – Solar pumping Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

MODULE – II **15**

Wind Energy: Wind energy estimation in World and in India – Basic Principles of Wind Energy Conversion-Basic Components of Wind Energy Conversion System-Types of wind Machines – Performance of Wind energy System–Safety Systems and Environmental Aspects- offshore wind mills.

Biomass Energy: Biomass direct combustion – Biomass gasifier – Biomass: Types – Advantages & Drawbacks - Biogas plant – Ethanol production – Bio diesel – Cogeneration: steam turbine cogeneration systems.

MODULE - III **15**

Gas turbine cogeneration systems, reciprocating IC engine cogeneration systems, combined cycle cogeneration systems – Applications of Cogeneration in utility sector – Biomass applications.

Other Renewable Energy Sources: Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – MHD Power Generation -Geothermal energy – Fuel cell systems - Stirling Engines . Introduction to distributed generation.

TOTAL: 45

TEXT BOOKS

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2006.
2. Sukhatme S.P., "Solar Energy", Tata McGraw-Hill, New Delhi, 1997.

REFERENCE BOOK

1. Tiwari. G.N., "Solar Energy: Fundamentals Design, Modelling and Applications", Narosa Publishing House, New Delhi, 2008

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Describe various types of renewable energy based power generation

CO2: Understand the environmental issues related to renewable energy systems

CO3: Apply the cogeneration concepts in utility sector

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3					2						
CO2						3	3					
CO3	3		3			2						

3 – Substantial, 2 – Moderate, 1 – Slight

11EE013 ELECTRIC POWER UTILISATION AND ENERGY AUDITING

(Common to EEE and EIE branches)

3 0 0 3

MODULE - I **15**

Tariff: Tariff calculation - Different types of tariff.

Illumination, Heating and Welding: Nature-of radiation –definition – laws photometry – polar curves – lighting calculations-design of illumination systems (for residential, industrial, commercial and street lightings) – types of lamps-energy efficient lamps. Methods of heating, requirement of heating material-design of heating element - furnaces – Welding generator, welding transformer and their characteristics

MODULE - II **15**

Electric Traction: Introduction – requirements of an ideal traction system – supply systems – mechanics of train movement – tractive effort – Specific energy consumption Traction motors and control – multiple units – braking methods – current collection systems-recent trends in electric traction – Details of Locomotives used in India.

MODULE - III **15**

Electrolytic Process and Storage of Electricity: Electrolysis – Polarization factor – Preparation of work for electroplating – tanks and other equipment – Nickel – iron and Nickel – cadmium batteries – components and materials – Lead acid Batteries - capacity rating of batteries – battery chargers – Method of charging and maintenance

Energy Conservation: Need for electrical energy conservation-methods – energy efficient equipment – energy management – energy auditing.-Features of Energy Conservation act 2001

Economics of power factor improvement – design for improvement of power factor using power capacitors – power quality and energy conservation – DSM techniques.

TOTAL: 45

TEXT BOOKS

1. Taylor. E. Openshaw, “Utilization of Electrical Energy in SI Units” Orient Longman Private Limited, New Delhi, 2003.
2. Gupta. J.B., “Utilization of Electric Power & Electric Traction”, S.K. Kataria & Sons, New Delhi, 2002.

REFERENCE BOOKS

1. Soni, M.L., Gupta, P.V., Bhatnagar, V.S and Chakrabarti A., “A Text Book on Power System Engineering”, Dhanpat Rai & Co., New Delhi, 1998.
2. Uppal, S.L., “Electrical Power”, Khanna Publishers, New Delhi, 1988.
3. BEE reference

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understanding the application of electrical energy for heating, lighting and Welding

CO2: Discuss electric traction systems and their performance

CO3: Discuss about electrolysis , electrical energy conservation, energy auditing and power quality

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3		2	3	3					
CO2	3			2								
CO3			3	3	3	3	3					2

3 – Substantial, 2 – Moderate, 1 – Slight

11EE014 SPECIAL ELECTRICAL MACHINES

3 0 0 3

Prerequisite:
Knowledge of DC and AC Machines

MODULE - I **15**

Permanent Magnet Synchronous Motors and SYCHREL Motors: Permanent Magnet Motors – Classifications – PMSM - Principle of operation – EMF and torque equations – Reactance – Phasor diagram – Power controllers - Converter - Volt-ampere requirements – Locus diagram and torque speed characteristics - Microprocessor based control – Constructional features – Synchrel – Types – Axial and Radial motors – Operating principle – Reluctance torque – Phasor diagram - Characteristics – Introduction to Vernier motor.

MODULE - II **15**

Permanent Magnet Brushless D.C. Motors and Stepper Motors: Principle of operation – Types – Comparison between conventional DC and PMBLDC – Electronic commutation – EMF and torque equations – Sensors for Rotor position – Power controllers – Motor characteristics and control – Constructional features – Stepper motor – Types – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Characteristics – Microprocessor based control.

MODULE - III **15**

Switched Reluctance Motors: Constructional features – Principle of operation – Torque prediction – Inductance profile – Simple Application problem – Analysis – Types of Power controllers and converter topologies used – Current control schemes – Torque Speed Characteristics – Hysteresis and PWM – Phase current analysis for low, Medium and High speed operation – Microprocessor based control.

TOTAL : 45

TEXT BOOKS

1. Miller T.J.E., "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
2. Kenjo T. and Nagamori S., "Permanent Magnet and Brushless DC Motors", Clarendon Press, London, 1988.

REFERENCE BOOKS

1. Aearnley P. P., "Stepping Motors" A Guide to Motor Theory and Practice", Peter Perengrinus, London, 1982.
2. Kenjo T., "Stepping Motors and Their Microprocessor Controls", Clarendon Press, London, 1984.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Categorize the construction, operation and performance of special electrical machines.

CO2: Decide special drives for specific applications.

CO3: Recommend the importance of special drives for enhanced performance

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		1									
CO2	3		3	2								
CO3	1	1	2		2	3						

3 – Substantial, 2 – Moderate, 1 – Slight

11EE015 DESIGN, ESTIMATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT

3 1 0 4

MODULE – I **15**

Equipment Specifications as Basis for Design: General Specifications–Ambient conditions, Accessories, IS; Item specifications and catalogues– Oil /Dry type Transformers; HT and LT Switch gears- Circuit Breaker, Isolator, fuse, MCCB, MCB; Motors –duty, mounting, protection, Cooling, Frame size.; Cables–HT/LT, single / Multi core, Power and control cables, ratings, de ratings.

Introduction to Design and Estimation: Starting documents - Plant Motors and component list; Basic Design for Estimation –voltage, Maximum demand at PCC; SLD, OGA, component list of Plant power circuit; Detailing – Arriving at typical distribution for a medium scale Industry and Large scale Industry.

MODULE – II **15**

Electrical Installation Requirements for Industry: Detailing for Power SLD /Multi line diagrams for PDB-s and MCC-s; Typical detailing of Control circuits for starters of MCCs-DOL / RDOL / Star-delta.

Rules, safety and maintenance of equipment : Indian electricity rules 1956; Earthing – types, Control of Earth resistance, Step / Touch potential in switchyards; Protection against -lightning, Static electricity; Installation testing – Protections, Insulation; Maintenance– daily, weekly, monthly and yearly schedules for Transformers, Switch gears and Motors – Testing of safety gadgets.

MODULE – III **15**

Electrical Installation for Residences: Residential plan and appliances required; Total load; Wiring diagram and layout; Main Switch and fuse or MCB and RCCB, Main distribution – 1 / 3 phase loads; Sub distribution; Requirements for Appliances; Estimation; Regulations - Neutral wire, Earthing , voltage drops, wire sizes, sizing of cables, location of switch boards.

Electrical Equipment for typical Industry: Major application areas and their Electrical Power Requirements in Cement, Sugar ,Pulp and Paper, Industries-Co-generation plants , Iron & Steel Industries- Iron making, Casters and Rolling mills ; Textile industries; Typical plant power distribution diagrams and the special considerations.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS

1. Kamalesh Das , " Electrical Power Systems For Industrial Plants " , Jaico Publishing house , Mumbai, 2007
2. Raina, K.B and Bhattacharya, S.K., "Electrical Design, Estimation and Costing", Wiley Eastern Ltd, New Delhi, 1995.
3. Rao, V.S., "Testing, Commissioning, Operation and Maintenance of Electrical Equipments", Khanna Publishers, New Delhi, 2008.

REFERENCE BOOKS

1. Thompson, F.G., "Electrical Installation and workshop Technology", Volume-I, Fourth Edition, Longman Incorporation, New York, 2002.
2. Surjit Singh., "Electrical Estimating and Costing", Dhanpat Rai and Co, New Delhi, 2001.
3. Gupta. J.B., "Electrical Installation, Estimating and Costing", S.K. Kataria & Sons, New Delhi, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Formulate the estimation and specifications for industries

CO2: Design the layout to meet installation requirements.

CO3: Understand the various rules and maintenance of equipments.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1		2	3	2	1	1						
CO2		2	3	2	1	1						
CO3		2	3	3	1	1						

3 – Substantial, 2 – Moderate, 1 – Slight

11EE016 POWER QUALITY

3 0 0 3

Prerequisite: Knowledge of Power Electronics

MODULE - I **15**

Introduction – Terms and Definitions, Interruptions: Definitions – Power quality, Voltage quality – Power quality issues: Short duration voltage variations, Long duration voltage variations, Transients, Waveform distortion, Voltage imbalance, Voltage fluctuation, Power frequency variations – Sources and Effects of power quality problems – IEEE and IEC Standards.

Short Interruptions: Introduction – Origin of short interruptions: Voltage magnitude events due to re-closing, Voltage during the interruption – Monitoring of short interruptions, Adjustable speed drives, Electronic equipments – Single phase tripping: Voltage during fault and post fault period, Current during fault period.

Long Interruptions: Definition – Failure, Outage, Interruption – Origin of interruptions – Causes of long interruptions – Principles of regulating the voltage – Voltage regulating devices.

MODULE - II **15**

Voltage Sag: Introduction – Definition – Magnitude, Duration – Causes of Voltage Sag –Load influence on voltage sags on Adjustable speed drives, Power electronics loads, Sensitive loads - Overview of mitigation methods.

Transients: Definition – Principles of over voltage protection - Types and causes of transients - Capacitor switching transients –Lightning transients – Transients from load switching.

Wiring and Grounding: Definitions-wiring and grounding problems-solutions to wiring and grounding problems.

MODULE - III **15**

Waveform Distortion: Introduction – Definition and terms – Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage Vs Current distortion – Harmonics Vs Transients – Sources and effects of harmonic distortion – System response characteristics .

Power Quality Solutions: Introduction – Power quality monitoring : Need for power quality monitoring, Evolution of power quality monitoring -Brief introduction to power quality measurement equipments and power conditioning equipments – Mitigation and control techniques – Passive and active Filters for Harmonic Reduction.

TOTAL : 45

TEXT BOOKS

1. Dugan, Roger C., McGranaghan, Mark F. and Beaty, H. Wayne, "Electrical Power Systems Quality", Second Edition, McGraw-Hill, New York, 2002.
2. Sankaran C., "Power Quality", CRC Press, Washington D.C., 2002

REFERENCE BOOKS

1. Kennedy Barry W., “Power Quality Primer”, McGraw-Hill, New York, 2000.
2. Bollen. Math H.J., "Understanding Power Quality Problems: Voltage Sags and Interruptions", IEEE Press, New York, 2000.
3. Arrillaga. J, Watson .N.R and Chen .S, "Power System Quality Assessment", John Wiley & Sons Ltd., England, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Analyze various power quality issues

CO2: Measure the power quality indices using appropriate instruments.

CO3: Select suitable equipments for mitigation of power quality problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			3								
CO2	3	3	2		3		2					
CO3	3	1	3	3	2	1			2			

3 – Substantial, 2 – Moderate, 1 – Slight

11EI018 NEURAL NETWORKS AND FUZZY SYSTEMS

(Common to EEE and EIE branches)

3 0 0 3

MODULE - I **15**

Neural Networks: Introduction – Biological neuron – Artificial neuron – Neuron modeling – Learning rules – Single layer – Multi layer feed forward network – Back propagation – Learning factors. Recurrent Network-Back propagation through Time Algorithm-RBF network.

MODULE - II **15**

Fuzzy Logic Systems: Classical sets – Fuzzy sets – simple operations on fuzzy sets-Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules. Membership function – Knowledge base.Introduction to Neuro Fuzzy system:Fuzzy neural hybrid,Neuro fuzzy hybrid.

MODULE - III **15**

Application of Neural Networks: Applications of artificial neural network-XOR Problem-process identification-classification-inverted pendulum

Application of Fuzzy Logic Systems: Fuzzy logic control – Inverted pendulum – Image processing – Home heating system – Blood pressure during anesthesia – reactor flow control..

TOTAL: 45

TEXT BOOKS

1. S.N.Sivanandam, S. Sumathi, S.N.Deepa, "Introduction to Neural networks using MATLAB 6.0", Tata Mc Graw-Hill,2006
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications',Tata McGraw Hill, 1997

REFERENCE BOOKS

1. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing home, 2002.
2. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992
3. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Develop various algorithm techniques for neural computing.

CO2: Solve the problems using Fuzzy and Neuro - fuzzy techniques.

CO3: Apply knowledge on Neuro fuzzy control to real time systems

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		3									
CO2		3	3	3								
CO3	3		2		3						1	

3 – Substantial, 2 – Moderate, 1 – Slight

11EE017 NANO COMPUTING

3 0 0 3

MODULE – I **16**

Introduction: Overview of Nano technology – Definition – Advantages – Atomic structure – Molecules and Phases – Energy – Molecular and atomic size – Surfaces and dimensional space – Top down and bottom up approach – Applications.

Nano Materials: Types – Preparation of Nano materials – Nano structure – Material properties – Fullerences – Gas phase clusters – Types formation – Cluster growth – Properties – Bonding in clusters – Quantum dots.

MODULE - II **15**

Carbon Nano Tubes: Introduction – Synthesis and purification – Filling of Nano tubes – Mechanism of growth – Electronic structure – Transport properties – Mechanical properties – Physical Properties – Applications – Nano tubes of other materials – Nano Molecular manufacturing.

MODULE - III **14**

Nano Manipulation and Nano Devices: Introduction – Instrumentation systems – Nano manipulation for mechanical properties – Nano particle manipulation by Electrostatic force. Nano sensors – Types – Smart Dust – Nano medicines – Nano machines – Nano robot

TOTAL: 45

REFERENCE BOOKS

1. Pradeep, T., "NANO: The Essentials", Tata McGraw- Hill, New Delhi, 2007.
2. Wilson, Mick Kannangara and Kamali, "Nano Technology: Basic Science and Engineering Technologies", Overseas Press Ltd, New Delhi, 2005.
3. Goddard, William A. Brenner and Donald, W., "Handbook of Nano Science Engineering and Technology", CRC Press, London, 2003.
4. Desai and Lakshman, "Nano Technology", Paragon International Publisher, New Delhi, 2007.
5. Poole, Charles P. Owens and Frank, J., "Introduction to Nano Technology", John Wiley & Sons, New York, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Perceive the properties of carbon nano tubes, characteristics of atomic structures & molecules and nano materials.

CO2: Explain the manufacturing process and different properties of carbon nano tubes.

CO3: Discuss the various types, application of nano devices and nano machines.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3			2							2	1
CO2	3		2		3						2	1
CO3	3	2	1		3	2			1		3	

3 – Substantial, 2 – Moderate, 1 – Slight

11EC021 ANALOG VLSI DESIGN

3 0 0 3

Prerequisite:

- Knowledge of Linear Integrated Circuits and Electronic Circuit

MODULE - I **15**

Device Modeling and Basic Building Blocks: Introduction to Analog Integrated Circuits – Basic MOS semiconductor fabrication process- The MOS transistor – Integrated circuits layout – MOS transistor layout- resistor, capacitor layouts. MOS large signal model – Small signal model of MOS transistor- subthreshold MOS model. Analog CMOS sub circuits: MOS switch – MOS active resistor – Current Sinks and Sources – Current mirrors-Simple, Wilson, and Cascade.

MODULE - II **15**

CMOS Amplifiers: Voltage references – Band gap reference, Inverters –Active load inverters, Current source inverters, push pull inverters-noise analysis of inverters. Differential Amplifiers: small signal analysis, slew rate and noise, current source load differential amplifier. Cascode amplifiers: large signal analysis, small signal analysis, frequency responses, Analog four quadrant Gilbert Multiplier cell.

MODULE - III **15**

Operational Amplifier and Switched Capacitor Circuits: Design of CMOS Op-amps- Compensation of Op-amps: small signal dynamics of a two stage Op Amp, Miller compensation of the two stage Op Amp. Design of two stage op-amps- cascade: single stage, Folded-cascode Op Amp. Introduction to Switched Capacitor filters, Switched Capacitor Amplifier, Continuous time amplifiers Switched Capacitor Integrators.

TOTAL: 45

TEXT BOOKS

1. Allen Phillips E, and Holberg Douglas R., "CMOS Analog Circuit Design", Second Edition, Oxford University Press, Oxford, 2003.
2. Johns David A. and Martin Ken, "Analog Integrated Circuit Design", John Wiley & Sons, New York, 2002.

REFERENCE BOOKS

1. Gray Hurst, Lewis and Meyer, "Analysis and Design of Analog Integrated Circuits", Fourth Edition, John Wiley& Sons, New York, 2001.
2. Jacob Baker R, Harry Li, David E Boyce, "CMOS Circuit Design, Layout and Simulation", IEEE Press, New York, 1998.
3. Razavi. Behzad, "Design of Analog CMOS Integrated Circuits", Firs Edition, Tata McGraw-Hill, New Delhi, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understand and model the MOS Transistor and its building blocks.

CO2: Acquire knowledge of various CMOS inverters and types of amplifiers.

CO3: Analyze & design of Op-Amp and CMOS amplifiers.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2		1				1		2	
CO2	3										1	1
CO3	3	2	3		3				2		3	

3 – Substantial, 2 – Moderate, 1 – Slight

11EI701 PLC, SCADA AND DCS

(Common to EEE and EIE branches)

3 0 0 3

MODULE - I **15**

PLC Programming: PLC: Evolution – Components of PLC – Advantages over relay logic - PLC programming languages – Ladder diagram – Programming timers and counters –PLC Specifications –Timer Functions: Types, programming - Counter Functions: Types, programming. Advanced functions – Arithmetic functions – Logic functions – Comparison functions - Program control instructions, math instructions, and sequencer instructions. Advanced Instructions in PLC – Program control instructions, math instructions, sequencer instructions.

MODULE - II **15**

DCS: DCS: Evolution – Different architectures – local control unit – Operator interface – Displays – Engineering interface.

HART: HART: Introduction – Evolution of signal standards – HART communication protocol – communication modes – HART networks – Control system interface – HART commands – HART field controller implementation – HART and ISO-OSI model.

Field Bus: Field bus: Introduction –Architecture – Basic requirements of field bus standard – Field bus topology – interoperability – interchangeability.

MODULE - III **15**

Applications of PLC: Applications of PLC: Bottle filling system – Material handling system – Spray Painting System – Elevator System.

Applications of DCS: Applications of DCS in Power plants, Iron and Steel plants, Chemical plants, Cement plants and Pulp and Paper plants.

SCADA: Supervisory Control and Data Acquisition (SCADA) – overview – Developer and runtime packages – architecture – Tools – Tag – Internal & External graphics, Alarm logging – Tag logging – structured tags – Trends – history – Report generation

TOTAL: 45

TEXT BOOKS

1. Webb, John W. and Reis Ronald A., "Programmable Logic Controllers", Prentice Hall Publications, New Delhi, 2005.
2. Lukas, Michael P., "Distributed Control Systems", Van Nostrand Reinfold Company, 2002.

REFERENCE BOOKS

1. Petrezeulla, "Programmable Controllers", McGraw Hill, New York, 1989.
2. Popovic D. and Bhatkar V.P, "Distributed Computer Control for Industrial Automation, Marcel Dekkar Inc., New York, 1990.
3. Cimplicity Scada Packages Manual Fanuc India Ltd, 2004.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understand the basic concepts of PLC, and DCS

CO2: Develop ladder logic for various PLC applications and understand HART, SCADA, Field bus concepts.

CO3: Apply PLC and DCS knowledge for Industrial Applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2											
CO2	2	3	1		2	2						1
CO3	2	2	1		2	2	2					1

3 – Substantial, 2 – Moderate, 1 – Slight

11EI021 VIRTUAL INSTRUMENTATION

3 0 0 3

MODULE - I **15**

Introduction to Virtual Instrumentation, Data Acquisition and Interfacing Buses: Historical perspective and traditional instruments - Concept of virtual instruments-Block diagram of virtual instruments- Comparison of virtual instruments over conventional instruments.

Data acquisition system - PC based Data acquisition system- Serial interface - RS232 - RS422-RS485-Parallel interface-GPIB standard bus, serial bus, CAN bus, MOD bus, ISO-OSI models.

MODULE - II **15**

Programming in LabVIEW: Lab VIEW – Graphical user interfaces - Controls and Indicators – 'G' programming – Data types –Data flow programming – Editing Debugging and Running a Virtual Instrument – Graphical programming palettes and tools – Front panel objects – Function and Libraries-Concept of VI and sub VI-Data types - Display types - For loop - While loop - Shift register-Structures – Formula node - Arrays-Clusters - Local and global variables - String handling-Input and output file handling-Math Script tool handling

MODULE -III **15**

Applications: Temperature indicator- tank simulation- On-off controller –PID controller – CRO - Function generator-Real time data acquisition. Generation of HTML page using VI-Transferring data and control from server PC to client PC and vise-versa using web publishing tools. Signal analysis: Fourier transform-Low pass filter-High pass filter-Power spectrum-Windowing and filtering tools-Correlation.

TOTAL : 45

TEXT BOOKS

1. Sanjay Gupta and Joseph John., "Virtual Instrumentation using LabVIEW", Tata McGraw Hill Publishing Company Ltd., 2005.
2. Robert H. Bishop, "Learning with LabVIEW 7 Express", Pearson Education, 2005.

REFERENCE BOOKS

1. Gupta S. and Gupta J.P., "PC Interfacing for Data Acquisition and Process Control", Instrument Society of America, 1994.
2. Rengan. G.S, Sarma. G.R. and Mani. V.S.V., "Instrumentation Devices and Systems", Prentice Hall of India, New Delhi, 1997.
3. Johnson. Gary W. and Jennings. Richard., "Lab VIEW Graphical Programming", McGraw-Hill Professional, New York, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understand the various blocks and functions of Virtual instruments
CO2: Apply the knowledge in programming and data interfacing with the virtual system
CO3: Design a Virtual instrument based system to the industry needs.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	1										1
CO2		1			3							1
CO3	1	1	1		3	2						1

3 – Substantial, 2 – Moderate, 1 – Slight

11EI603 BIOMEDICAL INSTRUMENTATION

(Common to Mechatronics, EEE and EIE branches)

3 0 0 3

MODULE - I **15**

Human Physiology and Measurement: Brief review of Human physiology and anatomy – Cell and its structure – Action and Resting Potential- propagation of action potential – Sodium pump – Nervous system: CNS – PNS – Nerve cell – Synapse. Transducers for body temperature measurements: Piezo–electric, Photoelectric, pressure transducers for physiological measurements, Bio sensors. Basic components of a biomedical system – Electrode-Electrolyte Interface. Electrodes: Micro, needle and surface electrodes.

MODULE - II **15**

Electro-Physiological Measurements: ECG, EEG, EMG, ERG and EOG: Lead systems and recording methods – Typical waveforms. Electrocardiograph measurements, Vectorcardiograph, Phonocardiograph- Blood pressure measurement-Ultrasonic method, Sphygmomanometer – Blood flow measurement by electromagnetic flow meter – Cardiac output measurement by dilution method and Fick's method –Blood pH measurement- Blood Sugar measurement.

MODULE - III **15**

Medical Imaging Systems and Therapeutic Equipments: X-ray machine – Computer tomography – MRI – Ultrasonography – Endoscopy – Different types of biotelemetry systems. Heart lung machine –Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Audio meters – Dializers.

TOTAL : 45

TEXT BOOKS

1. Cromwell, Leslie, Weibell. Fred J. and Pfeiffer. Erich A., "Bio-Medical Instrumentation and Measurements", Second Edition, Pearson Education, New Delhi, 2002.
2. Khandpur R.S., "Handbook of Bio-Medical instrumentation", Tata McGraw-Hill Publishing Co Ltd., New Delhi, 2003.

REFERENCE BOOKS

1. Arumugam M., "Bio-Medical Instrumentation", Anuradha Agencies, Kumbakonam, 2003.
2. Webster J., "Medical Instrumentation", John Wiley & Sons, New York, 1995.
3. Rajarao C. and Guha S.K., "Principles of Medical Electronics and Bio-medical Instrumentation", Universities press (India) Ltd, New Delhi, 2000.
4. Anandanatarajan.R., "Biomedical Instrumentation and Measurements", PHI Learning Private Limited, New Delhi ,2011

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Attain knowledge of human physiology and basics of medical measurements

CO2: Realize the importance of sensing and measurement devices in medical assistance

CO3: Explain the working and constructional features of medical imaging and therapeutic equipment's

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2					3	1					
CO2	3	2			2	1						
CO3	3		2			3						

3 – Substantial, 2 – Moderate, 1 – Slight

11MA601 PROBABILITY AND STATISTICS

(Common to EEE, EIE and Food Technology branches)

3 1 0 4

MODULE – I **15**

Probability and Random Variables: Axioms of probability- Conditional probability – Total probability – Baye's theorem – Random variable – Probability mass function – Probability density function – Moments- Moment generating functions.

MODULE – II **15**

Discrete Distributions: Binomial distribution – Poisson distribution - Geometric distribution.

Continuous Distributions: Uniform distribution – Exponential distribution - Normal distribution and its properties.

MODULE – III **15**

Testing of Hypothesis: Small and large samples – Tests concerning simple means- Comparing means – Proportions – Test for independence - Test for equality of variances- goodness of fit.

Design of Experiments: Analysis of variance- One way classification – Completely Randomized Design - Two way classification – Randomized Block Design – Latin Square Design.

Lecture 45, Tutorial : 15, TOTAL : 60

TEXT BOOKS

1. Gupta, S.C. and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi,Ninth Edition 2011.
2. Miller and Freund's, "Probability and Statistics for Engineers", Eighth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.

REFERENCE BOOKS

1. Kandasamy P., Thilagavathi K. and Gunavathi K., "Probability Statistics and Queuing Theory", S. Chand & Co., New Delhi,Fourth Edition 2010.
2. Veerarajan T., "Probability, Statistics and Random Processes", Tata McGraw-Hill, New Delhi,Third Edition 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Discuss the concepts of basic probability and random variables.
CO2: Decide the appropriate distribution to be applied to solve industrial problems.
CO3: Predict the various tests for handling the large and small samples.
CO4: Test the degree to which two or more groups vary in experimental observations

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3	3		1	2							1
CO2	3	3		1	2							1
CO3	3	3			2							1
CO4	3	3		1	2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11GE011 ENTREPRENEURSHIP DEVELOPMENT

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

3 0 0 3

MODULE – I **15**

Entrepreneurship Concepts: Meaning and Concepts of Entrepreneurship – Definition and Characteristics of an Entrepreneur – Entrepreneurial Process – The scope of Entrepreneurship in India. Entrepreneurial Motivation – Factors creating Entrepreneurship – Classification of Entrepreneurs – Intrapreneurship - Barriers to Entrepreneurship – Creativity, Innovation & Entrepreneurship - Role of Entrepreneurship in Economic Development.

MODULE – II **15**

Business Plan: Business Planning Process – Idea generation, Environmental Scanning, Feasibility Analysis, Drawing Functional Plan - Marketing Plan – Production/Operations Plan –Organizational Plan – Financial Plan – Human Resource Plan – Project Report Preparation , Evaluation, Control and Review.

MODULE – III **15**

Managing a Small Business: Sources of Finance - Institutions Supporting Entrepreneurs - EDPs. Small Scale Industry – The Strengths and Weaknesses of Small Business - Growth strategies – Sickness - Evaluation, Symptoms, Causes and Assessment – Rehabilitation of Sick Industries.

TOTAL :45

TEXT BOOKS

1. Madhurima Lall and Shikha Sahai, " Entrepreneurship", Excel Books, New Delhi, 2006
2. S.S.Khanka, " Entrepreneurial Development", S.Chand & Company Ltd, 2005

REFERENCE BOOKS

1. Robert D Hisrich, Michael P Peters and Dean A Shepherd, "Entrepreneurship", Sixth Edition, Tata McGraw Hill, New Delhi, 2009.
2. Mary Coulter, "Entrepreneurship in Action", Second Edition, Prentice Hall of India, New Delhi, 2005.
3. Jain P.C., "Handbook for New Entrepreneurs", Oxford University Press, Oxford, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: demonstrate knowledge of entrepreneurship concepts

CO2: plan various aspects of business activities

CO3: manage to start and run small business.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1			1		3	3	3		3		
CO2	1			1		3	3	3		3		
CO3	1			1		3	3	3		3		

3 – Substantial, 2 – Moderate, 1 – Slight

11MT012 MICRO ELECTRO MECHANICAL SYSTEMS

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

3 0 0 3

MODULE - I **15**

Microsystems, Microsensors and Actuators: Overview-Microsystems - Working principle of Microsystems - Scaling laws - Scaling in geometry - Scaling in rigid body dynamics - Scaling in electrostatic forces - Scaling in electromagnetic forces - Scaling in electricity - Scaling in fluid mechanics - Scaling in heat transfer - Micro actuation techniques - Micro sensors - Micropump – Micromotors – Microvalves – Microgrippers - Micro accelerometers.

MODULE - II **15**

Micro System Fabrication Process and Manufacturing: Substrates - Single crystal silicon wafer formation – Photolithography - MEMS materials - Ion implantation - Diffusion - Oxidation - CVD - Physical Vapor Deposition - Deposition by epitaxy - Etching process - Bulk Micromanufacturing Surface Micromachining – LIGA - SLIGA

MODULE - III **15**

Micro System Design and Application: Micro system packaging – Materials - Die level - Device level - System level - Packaging techniques - Surface bonding - Wire bonding – Sealing - Design considerations - Process design - Mask layout design - Applications of micro system in – Automotive - Bio medical – Aero space – Telecommunications field. Basic exposure to software for MEMS design - Intellisuite

TOTAL: 45

TEXT BOOKS

1. Gad-el-Hak, Mohamed, "The MEMS Hand book", CRC press, Florida, 2009.
2. Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture", Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS

1. Fatikow, S. and Rembold, U., "Microsystem Technology and Microrobotics", Springer-Verlag, Berlin Heidelberg, 1997.
2. Gardner, Julian W., Varadan, Vijay K. and AwadelKarim Osama, O., "Microsensors MEMS and Smart Devices", John Wiley & sons, New York, 2001.
3. Marc Madou, Fundamentals of Microfabrication, CRC press, New York, 2002
4. W.Trimmer, Editor, Micromechanics and MEMS: Classic and Seminar papers to 1990, IEEE press, 1996.
5. Tay, Francis E.H. and Choong, W.O, "Microfludics and BioMEMS Applications", Springer, Berlin, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Apply the knowledge of micro systems, micro sensors and micro actuators in different applications

CO2: Analyze different micro system fabrication process

CO3: Design and packaging of MEMS devices for industrial applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	1		2	1	1					3	
CO2	1	1		2		1	2				2	2
CO3	1		2	2	1	2	2			1	3	2

3 – Substantial, 2 – Moderate, 1 – Slight

11MT702 ROBOTICS AND MACHINE VISION SYSTEM

(Common to Mechatronics, EEE and EIE branches)

3 0 0 3

MODULE - I **15**

Introduction a**nd End Effectors:** History - Basic components of robot - Laws of robotics – Technical specification of robot- Robot degree of freedom- Types of joints - Work space – Dexterity - Accuracy - Resolution – Repeatability of robot - Robot End Effectors – Singularity – Redundant and parallel manipulator – Economics consideration - Sociological consequence of robot – Robotics application current and future.

MODULE - II **15**

Robot Kinematics: Introduction – Position analysis and finite translations, rotations and transformations – Homogeneous transformations, skews symmetric matrices - Forward & inverse kinematics - Velocity and static force Analysis for serial manipulator.

Robot Dynamics: Acceleration of rigid body, Newton's equation, Euler equation, Newton-Euler dynamic formulation, Lagrangian formulations.

MODULE - III **15**

Trajectory planning and Robot programming: Point to point, continuous path control, Joint trajectory, Cartesian trajectory, trajectory planning – Introduction to robot programming.

Machine Vision: Image acquisition - Digital images - Sampling and quantization - Levels of computation - Feature extraction - Windowing technique – Segmentation – Thresholding - Edge detection - Binary morphology - Grey morphology – 3D vision. Case study: Ball sorting on a conveyor system depending on size.

TOTAL: 45

TEXT BOOKS

1. Groover, M.P., "Industrial Robotics: Technology, Programming and Applications", McGraw-Hill, New York, 2003.
2. Craig, John. J., "Introduction to Robotics: Mechanics and Control", Second Edition, Pearson Education, New Delhi, 2002.

REFERENCE BOOKS

1. Fu, K.S., Gonzalez, R.C. and Lee, C.S.G., "Robotics: Sensing, Vision and Intelligence", Tata McGraw-Hill, New Delhi, 1987.
2. Dair, Gorden M., "Industrial Robotics", Prentice Hall International, New Jersey, 1988.
3. Deb, Sathya Ranjan, "Robotics Technology and Flexible Automation", Sixth Edition, Tata McGraw-Hill, New Delhi, 2003.
4. Niku, Saeed.B "Introduction to Robotics: Analysis, Systems, Applications", New Delhi: Prentice Hall of India Pvt Ltd , 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Understand the fundamental knowledge of components of robotics and its characteristics.

CO2: Realize the kinematics and dynamics of Robots.

CO3: Apply the knowledge in robot programming and machine vision systems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	1	1		3	2	2					1
CO2		1	1			2	2					
CO3	1		1		2							1

3 – Substantial, 2 – Moderate, 1 – Slight

11EI012 ELECTRONIC INSTRUMENTATION

3 0 0 3

MODULE – I **15**

Analog and Digital Instruments: Voltmeters – Ammeters – True RMS meter – Vector impedance meter – Vector voltmeter–Multimeters –Power meter – Q-meter – Component measuring instruments.

Digital method for measuring frequency, period, phase difference, pulse width, time interval, total count – Digital voltmeter: Types – Automatic polarity indication, automatic ranging and auto zeroing – DMM – Microprocessor based Instruments – Digital Panel Meters – IEEE 488 bus.

MODULE - II **15**

Signal Generators, Analyzers and Recording Devices: Sine wave generator – Frequency synthesized sine wave generator – Sweep frequency generator – Pulse and Square wave generator – Function generator – Wave analyzer – Applications – Harmonic distortion analyzer – Spectrum analyzer – Applications – Audio Frequency generator – Noise generator.

Recorders: X-Y recorders and Magnetic tape recorders – Digital recording – Data loggers –Interference and screening – Electrostatic and electromagnetic interference.

MODULE – III **15**

Cathode Ray Oscilloscope and Display Devices: General purpose oscilloscope – CRT – Deflection methods – Screens for CRT – Graticules – Vertical & horizontal deflection systems – Delay line – Multiple trace: Dual beam and dual trace – Probes – Oscilloscope techniques – Special oscilloscopes: Storage oscilloscopes, Sampling oscilloscope – Digital CRO**.**

Displays – Classification: LED & LCD, Bar graph display, Segmental and Dot matrix display.

TOTAL : 45

TEXT BOOKS

1. Kalsi, H.S., "Electronic Instrumentation", Tata McGraw-Hill, New Delhi, 2004.
2. Helfrick, Albert D. and Cooper, William D., "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2002.

REFERENCE BOOKS

1. Rangan, C.S., Sarma, G.R., Mani, V.S.V., "Instrumentation Devices and Systems", Tata McGraw-Hill, New Delhi, 2002.
2. Sawhney, A.K., "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co, New Delhi, 2005.
3. Oliver, B.M. and Cage, J.M., "Electronic Measurements and Instrumentation", McGraw-Hill, New York, 1975.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Identify instruments to measure various electrical parameters

CO2: Analyze the working function of measuring instruments

CO3: Design a measurement system to measure given parameter

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1											
CO2		2	1		2							
CO3	1					2						

3 – Substantial, 2 – Moderate, 1 – Slight