KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 052
(Autonomous)
2014 REGULATIONS

VISION

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

MISSION

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

QUALITY POLICY

We are committed to

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

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION

To become a technically competent centre in the domain of Electronics and Instrumentation Engineering to take care of the national and international needs.

MISSION

MS1: To develop innovative, competent, efficient, disciplined and quality Electronics and Instrumentation Engineers.

MS2: To produce engineers who can participate in technical advancement and social upliftment of the country.

MS3: To excel in academic and research activities by facilitating the students to explore the state-of – the –art techniques to meet the industrial needs

2014 REGULATIONS

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Electronics and Instrumentation Engineering programme should be able to utilize the knowledge gained from their academic programme to:

PEO1: Excel in professional career and higher education using their fundamental knowledge in mathematical and engineering principles.

PEO2: Analyse, design, develop and maintain the instrumentation systems of an industry and also offer solutions that are technically feasible, economically viable and socially relevant.

PEO3: Exhibit Professional and Ethical code of conduct, communication skills, team work and lifelong learning to resolve societal issues

Mapping of Mission Statements (MS) with Program Educational Objectives (PEOs)

MS\PEO	PEO1	PEO2	PEO3
MS1	3	2	1
MS2	2	3	2
MS3	1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

PO2: **Problem Analysis**: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PO5: **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Development and Automation:** Develop an industrial instrumentation system and provide automation by using modern automation tools.
2. **Entrepreneurship:** Become an entrepreneur by inculcating the skills of project management and finance with the knowledge of instrumentation technology,

Mapping of PEOs with POs

PEOs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	2	3	2	1	2	2	2	1	1	2	1	3
PEO2	1	2	3	3	2	3	1	1	1	2	3	3
PEO3	2	3	1	2	3	1	3	3	3	3	2	3

CURRICULUM BREAKDOWN STRUCTURE UNDER REGULATION 2014

Curriculum Breakdown System	Curriculum content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
Basic Science(BS)	20.32	519	37
Engineering Science(ES)	8.24	201	15
Humanities and Social Sciences(HS)	5.49	138	10
Program Core(PC)	44.50	1059	81
Program Electives(PE)	9.89	270	18
Open Electives(OE)	4.94	135	09
Project(s)/Internships(PR)	6.59	432	12
		Total credits	**182**

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B.E. DEGREE IN ELECTRONICS AND INSTRUMENTATION ENGINEERING

CURRICULUM

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

SEMESTER – I

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

CA – Continuous Assessment, ESE – End Semester Examination

CBS – Curriculum Breakdown Structure

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B.E. DEGREE IN ELECTRONICS AND INSTRUMENTATION ENGINEERING

CURRICULUM

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

SEMESTER – II

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

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CURRICULUM

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

SEMESTER – III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14MAT31	Mathematics III	3	1	0	4	40	60	100	BS
14EIT31	Networks, Signals and Systems	3	1	0	4	40	60	100	PC
14EIT32	Electron Devices and Circuits	3	1	0	4	40	60	100	PC
14EIT33	Electrical and Electronics Measuring Instruments	3	1	0	4	40	60	100	PC
14CST35	Object Oriented Programming	3	0	0	3	40	60	100	PC
	PRACTICAL								
14EIL31	Circuits and Networks Laboratory	0	0	3	1	100	0	100	PC
14EIL32	Electron Devices and Circuits Laboratory	0	0	3	1	100	0	100	PC
14CSL34	Object Oriented Programming Laboratory	0	0	3	1	100	0	100	PC
				Total	**22**				

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CBS – Curriculum Breakdown Structure

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CURRICULUM

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

SEMESTER – IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14MAT41	Numerical Methods	3	1	0	4	40	60	100	BS
14EIT41	Transducer Engineering	3	0	0	3	40	60	100	PC
14EIT42	Industrial Instrumentation I	3	1	0	4	40	60	100	PC
14EIT43	Digital Logic Circuits	3	1	0	4	40	60	100	PC
14EET44	Electrical Machines	3	0	0	3	40	60	100	PC
14MET46	Applied Thermodynamics	3	0	0	3	40	60	100	PC
	PRACTICAL								
14EIL41	Transducers and Measurements Laboratory	0	0	3	1	100	0	100	PC
14EEL44	Electrical Machines Laboratory	0	0	3	1	100	0	100	PC
14EGL41	Communication Skills Laboratory	0	0	3	1	100	0	100	BS
				Total	**24**				

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CURRICULUM

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

SEMESTER – V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14EIT51	Industrial Instrumentation II	3	1	0	4	40	60	100	PC
14EIT52	Biomedical Instrumentation	3	0	0	3	40	60	100	PC
14EET52	Microprocessors and Microcontrollers	3	0	0	3	40	60	100	PC
14EET53	Control Systems	3	1	0	4	40	60	100	PC
14ECT52	Linear Integrated Circuits	3	1	0	4	40	60	100	PC
	Elective-I (Professional)	3	0	0	3	40	60	100	PE
	PRACTICAL								
14EIL51	Industrial Instrumentation Laboratory	0	0	3	1	100	0	100	PC
14EIL52	Control and Simulation Laboratory	0	0	3	1	100	0	100	PC
14EIL53	Linear and Digital Integrated Circuits Laboratory	0	0	3	1	100	0	100	PC
				Total	**24**				

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B.E. DEGREE IN ELECTRONICS AND INSTRUMENTATION ENGINEERING

CURRICULUM

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

SEMESTER – VI

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET61	Economics and Management for Engineers	3	0	0	3	40	60	100	HS
14EIT61	Process Control	3	1	0	4	40	60	100	PC
14EIT62	Applied Digital Signal Processing	3	1	0	4	40	60	100	PC
14EIT63	VLSI Systems	3	0	0	3	40	60	100	PC
	Elective-II (Professional)	3	0	0	3	40	60	100	PE
	Elective-III (Open)	3	0	0	3	40	60	100	OE
	PRACTICAL								
14EIL61	Process Control Laboratory	0	0	3	1	100	0	100	PC
14EIL62	Applied Digital Signal Processing Laboratory	0	0	3	1	100	0	100	PC
14EIL63	VLSI and Embedded Systems Laboratory	0	0	3	1	100	0	100	PC
				Total	**23**				

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CBS – Curriculum Breakdown Structure

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CURRICULUM

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

SEMESTER – VII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET71	Total Quality Management	3	0	0	3	40	60	100	HS
14EIT71	PLC, SCADA and DCS	3	0	0	3	40	60	100	PC
14EIT72	Instrumentation System Design	3	1	0	4	40	60	100	PC
	Elective – IV (Professional)	3	0	0	3	40	60	100	PE
	Elective – V (Open)	3	0	0	3	40	60	100	OE
	Elective – VI (Open)	3	0	0	3	40	60	100	OE
	PRACTICAL								
14EIL71	PLC, SCADA and DCS Laboratory	0	0	3	1	100	0	100	PC
14EIL72	Virtual Instrumentation Laboratory	0	0	3	1	100	0	100	PC
14EIP71	Mini Project	0	0	6	3	50	50	100	PR
				Total	**24**				

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B.E. DEGREE IN ELECTRONICS AND INSTRUMENTATION ENGINEERING

CURRICULUM

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

SEMESTER – VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET81	Professional Ethics and Human Values	3	0	0	3	40	60	100	HS
	Elective – VII (Professional)	3	0	0	3	40	60	100	PE
	Elective – VIII (Professional)	3	0	0	3	40	60	100	PE
	Elective – IX (Professional)	3	0	0	3	40	60	100	PE
	PRACTICAL								
14EIP81	Project Work	0	0	18	9	100	100	200	PR
				Total	**21**				

CA – Continuous Assessment, ESE – End Semester Examination

CBS – Curriculum Breakdown Structure

Total Credits : 182

LIST OF PROFESSIONAL ELECTIVES						
Course Code	**Course Title**	**Hours/Week**			**Credit**	**CBS**
		L	**T**	**P**		
SEMESTER V						
14ECT33	Communication Engineering	3	0	0	3	PE
14EIE01	Analytical Instrumentation	3	0	0	3	PE
14EIE02	Environmental Instrumentation	3	0	0	3	PE
SEMESTER VI						
14EET61	Power Electronics	3	0	0	3	PE
14EIE03	Embedded Control	3	0	0	3	PE
14EIE04	Soft Computing Techniques	3	0	0	3	PE
SEMESTER VII						
14MTT71	Micro Electro Mechanical Systems	3	0	0	3	PE
14EET71	Electric Drives and Control	3	0	0	3	PE
14EIE05	Power Plant Instrumentation	3	0	0	3	PE
SEMESTER VIII						
14MAE02	Probability and Statistics	3	1	0	4	PE
14MTE06	Advanced Sensors and Networking	3	0	0	3	PE
14MTE07	Automotive Electronics	3	0	0	3	PE
14MTE12	Nano Technology	3	0	0	3	PE
14ECE22	Embedded Internet of Things	3	0	0	3	PE
14EEE19	Energy Conservation and Management	3	0	0	3	PE
14GEE81	Entrepreneurship Development	3	0	0	3	PE
14EIE06	Instrumentation and Control in Petrochemical Industries	3	0	0	3	PE
14EIE07	Optimal Control	3	0	0	3	PE
14EIE08	Instrumentation in Process Industries	3	0	0	3	PE
14EIE09	Safety in Process Industries	3	0	0	3	PE
14EIE10	Diagnostic and Therapeutic Instruments	3	0	0	3	PE

LIST OF OPEN ELECTIVES						
Course Code	**Course Title**	**Hours/Week**			**Credit**	**CBS**
		L	**T**	**P**		
SEMESTER VI						
14EIO01	Fiber Optics and Laser Instrumentation	3	0	0	3	OE
14EIO02	Non Destructive Testing	3	0	0	3	OE
14EIO03	Wireless Instrumentation	3	0	0	3	OE
SEMESTER VII						
14EIO04	Computer Control of Processes	3	0	0	3	OE
14EIO05	Instrumentation in Aircraft Navigation and Control	3	0	0	3	OE
14EIO06	Industrial Data Communication	3	0	0	3	OE
14EIO07	Adaptive Control	3	0	0	3	OE
14EIO08	Robotics and Machine Vision System	3	0	0	3	OE
14EIO09	Virtual Instrumentation	3	0	0	3	OE

14EGT11 COMMUNICATIVE ENGLISH I

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS :

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

REFERENCE BOOKS :

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

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

CO3: read different genres of texts adopting various reading strategies

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

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT11 MATHEMATICS I

(Common to all Engineering and Technology branches)

3 1 0 4

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

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: solve engineering problems which needs matrix computations
CO2: solve extremal problems which arise in function of several variables
CO3: identify the appropriate method for solving first order ordinary differential equations
CO4: classify and find the solution of ordinary differential equations of higher order
CO5: apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHT11 APPLIED PHYSICS

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CYT11 APPLIED CHEMISTRY

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Get the basic knowledge of water quality parameters and treatment methods
CO2: Obtain the principles of electrochemical cells, EMF series and energy storing devices
CO3: Acquire the knowledge of the types and prevention methods of corrosion
CO4: Know the concepts and developments in combustion and various types of fuels.
CO5: Understand the knowledge about the types of polymers, plastics and moulding methods

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CSC11 PROBLEM SOLVING AND PROGRAMMING

(Common to all Engineering and Technology branches)

3 0 3 4

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

Lecture: 45, Practical: 45, TOTAL: 90

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT- I **9**

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

UNIT - II **9**

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

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

UNIT - III **9**

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

UNIT - IV **9**

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

UNIT - V **9**

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

TOTAL: 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHL11 PHYSICAL SCIENCES LABORATORY I

(Common to all Engineering and Technology branches)

0 0 3 1

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

LIST OF EXPERIMENTS:

1. Determination of Young's modulus of a given material using uniform bending.
2. Determination of thermal conductivity of bad conductor using Lee's disc arrangement.
3. Determination of velocity of ultrasonic waves in liquid and compressibility of liquid using ultrasonic interferometer.
4. (a) Particle size determination using diode laser.

   (b) Determination of wavelength of laser
5. Determination of specific resistance of a given coil of wire using Carey Foster bridge.
6. Determination of wavelength of Hg spectrum using spectrometer and grating.

Demonstration

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

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

LIST OF EXPERIMENTS:

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

Demonstration

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

REFERENCES / MANUALS / SOFTWARE:

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

TOTAL : 45

COURSE OUTCOMES

On completion of the course the students will be able to

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

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

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

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

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

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manuals

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EGT21 COMMUNICATIVE ENGLISH II

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL: 45

TEXT BOOKS :

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

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

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

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

CO5: use functional grammar for improving employment oriented skills

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT21 MATHEMATICS II

(Common to all Engineering and Technology branches)

3 1 0 4

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

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHT21 MATERIALS SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CYT21 ENVIRONMENTAL SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MET11 BASICS OF CIVIL AND MECHANICAL ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

PART-A: CIVIL ENGINEERING

UNIT – I **5**

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

UNIT– II **5**

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

UNIT – III **4**

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

UNIT – IV **4**

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

UNIT – V **4**

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

PART-B: MECHANICAL ENGINEERING

UNIT – I **5**

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

UNIT – II **4**

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

UNIT – III **4**

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

UNIT – IV **5**

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

UNIT – V **5**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

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

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

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

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MEC11 ENGINEERING DRAWING

(Common to all Engineering and Technology branches)

2 0 3 3

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

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14VEC11 VALUE EDUCATION

(Common to all Engineering and Technology branches)

0 2 1 1

UNIT – I **6**

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

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

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

UNIT – II **6**

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

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

UNIT – III **6**

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

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

UNIT – IV **6**

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

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

UNIT – V **6**

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

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

TOTAL : 30

TEXT BOOK:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHL21 PHYSICAL SCIENCES LABORATORY II

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: APPLIED PHYSICS LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

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

Demonstration

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

PART - B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

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

Demonstration

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

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

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

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

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MEL11 BASICS OF CIVIL AND MECHANICAL ENGINEERING LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

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

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

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

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: demonstrate knowledge on safety and adhere to safety features

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

CO3: select methods and tools and execute the given experiments

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

CO5: plan and complete simple and innovative articles

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT31 MATHEMATICS III

(Common to all Engineering and Technology Branches)

3 1 0 4

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics, Volume - III", Reprint Edition, S.Chand & Co., New Delhi, 2014.
2. Veerarajan T., "Transforms and Partial Differential Equations", 3rd Reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Reprint Edition, Narosa Publishing House, New Delhi, 2014.
3. Bali N.P. and Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi Publications, New Delhi, 2014.
4. Ramana B.V., "Higher Engineering Mathematics", 11th Reprint, Tata McGraw Hill Publishing Company, New Delhi, 2010.
5. Erwin Kreyzig, "Advanced Engineering Mathematics", 10th Edition, Wiley & Co, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

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

CO2: model and solve higher order partial differential equations

CO3: apply the methods of solving PDE in practical problems

CO4: gain knowledge on Fourier transforms

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT31 NETWORKS, SIGNALS AND SYSTEMS

3 1 0 4

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I **9**

Network Theorems: DC Circuits**:** Dependent and independent sources-Source transformation-Star delta transformation-Superposition theorem-Thevenin's theorem-Norton's theorem- Maximum power transfer theorem. AC Circuits: Super position theorem.

UNIT – II **9**

Network Analysis: DC response analysis**:** Steady state analysis of RL, RC and RLC circuits, Transient analysis of RL RC and RLC circuits. Resonance Circuits**:** Resonance frequency, current and voltage variations, Bandwidth, Q factor for Series and Parallel resonance circuits.

UNIT – III **9**

Network Parameters and Synthesis: Network Parameters**:** Network functions for one port and two port networks-significance of poles and zeros. Two port networks: Z and Y parameters- Z parameters in terms of Y parameters and Y parameters in terms of Z parameters. Network Synthesis**:** Realisability of one port network-Hurwitz polynomials-Positive Real Functions- Synthesis of RL, RC and LC networks using Foster and Cauer methods.

UNIT – IV **9**

Continuous Time Signals and Systems: Classification - signal representation: exponential, sinusoidal, impulse, step and ramp.odd and even signals-energy and power signals-periodical signals. Signal transformations: scaling, folding. Mathematical representation of systems - classification of systems: static and dynamic-time variant and invariant –linear and nonlinear-stable and unstable-causal and non causal- recursive and non recursive.

UNIT – V **9**

Analysis of Signals and Systems: Trignometric and exponential form of Fourier series of periodical signals: sinusoidal signal. Fourier transform of aperiodical signals: square pulse, triangular pulse decaying exponential signal. Parsevals's theorem-Transfer function of LTI continuous time system using Laplace transform- impulse and step response of LTI system using Laplace transform. Relation between Laplace and Fourier transform.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Sudhakar A and Shyammohan S Palli, "Circuits and Networks Analysis and Synthesis", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
2. Nagoor Kani A., " Signals and Systems", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.

REFERENCE BOOKS:

1. Roy Choudhury D, "Network and Systems", 2nd Edition, New Academic Science, 2009.
2. Thomas. L. Floyd, "Electric Circuits Fundamentals", 8th Edition, Prentice Hall of India, 2009.
3. Gupta B R, "Network Analysis and Synthesis", 3rd Edition, S. Chand & Co., 2009.

www.nptel.ac.in/courses/108105065

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the electric circuit calculations using theorems
CO2: analyze the behavior of RLC circuits in time and frequency domain
CO3: gain knowledge on two port network analysis and synthesis
CO4: analyze continuous time signals and systems in time and frequency domain
CO5: apply Laplace and Fourier transforms in the analysis of signals and systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT32 ELECTRON DEVICES AND CIRCUITS

(Common to EIE & EEE branches)

3 1 0 4

Pre requisite: Basics of Electrical and Electronics Engineering.

UNIT – I **9**

Diodes and Special Devices: Semiconductors – Intrinsic and Extrinsic semiconductor – Theory of PN junction diode – Current equation – Volt-Ampere characteristics – Transition and Diffusion Capacitances – Clipping and Clamping Circuits – Voltage multipliers using diodes – Characteristics of Zener Diode – Tunnel Diode – PIN Diode – Varactor Diode – Photodiodes – LED and LCD – Solar Cell.

UNIT – II **9**

Bipolar Junction Transistor: Construction and operation of a Transistor – Currents in transistor – Input and Output characteristics of a transistor in CE, CB and CC configurations– Current gain in CE, CB and CC configurations – Operating point – Stability and stability factor: Fixed bias circuits and Voltage-divider bias - Hybrid model of BJT.

UNIT – III **9**

FET, MOSFET and UJT: Construction and characteristics of JFET – Parameters of JFET – FET in CS, CD and CG Configurations – Construction, characteristics of MOSFET in Depletion and Enhancement mode – Applications of MOSFET – Construction, theory of operation and characteristics of UJT – UJT as relaxation oscillator.

UNIT – IV **9**

Differential, Tuned and Power Amplifiers: Differential amplifier using BJT– Differential and common mode gain, CMRR – Characteristics of Tuned Amplifiers – Frequency response of single and double tuned amplifier – Classification of power amplifiers – Transformer coupled Class A, Class B and Push Pull amplifiers.

UNIT – V **9**

Feedback Amplifiers and Oscillators: Principle, advantages of negative feedback amplifiers – Types of feedback connections: 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. Multivibrators: Astable and Monostable – Schmitt triggers.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. R.S.Sedha, "A Textbook of Applied Electronics", 4th Edition, S.Chand & Co., Ltd., New Delhi, 2009.
2. Salivahanan. S, Suresh Kumar. N and Vallavaraj A., "Electronic Devices and Circuits", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCE BOOKS:

1. Bell, David A., "Electronic Devices and Circuits", 4th Edition, Prentice Hall of India, New Delhi, 2003.
2. Allen Mottershead, "Electronic Devices and Circuits– An Introduction", 1st Edition, Prentice Hall of India, New Delhi, 1996.
3. Millman Jacob, Christos CHalkias and Satyabrata JIT, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2008.
4. Robert L. Boylestad and Louis Nashelsky, "Electronics Devices and Circuit Theory", 8th Edition, Pearson Education, New Delhi, 2002.
5. B.P.Singh, Rekhasingh, "Electronic Devices and Circuits", 2nd Edition, Pearson Education, 2013.

https://www.youtube.com/watch?v=fOvZKtZogb0
https://www.youtube.com/watch?v=OyC02DWq3mI
https://www.youtube.com/watch?v=mDUTTLCM2K8

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the basic characteristics and applications of diodes
CO2: gain knowledge on the basic characteristics and applications of BJT
CO3: acquire knowledge about the operation and characteristics of FET and UJT
CO4: analyze the characteristics of BJT as amplifier
CO5: know the characteristics of feedback amplifiers and oscillators

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT33 ELECTRICAL AND ELECTRONICS MEASURING INSTRUMENTS

3 1 0 4

UNIT – I **9**

Measurement of Voltage and Current: Introduction to essential requirements of instruments- Three operating forces of analog instruments - Permanent Magnet Moving Coil (PMMC): Construction of PMMC Instruments - Torque Equation- Ammeter Shunts- Voltmeter Multipliers. Moving Iron Instruments: General Torque Equation - Classification – Construction - Comparison between Attraction and Repulsion types of Instruments – Errors, Advantages and Disadvantages of Moving Iron Instruments.

UNIT – II **9**

Measurement of Power and Energy: Introduction to Electrodynamometer type instruments-Electrodynamometer Wattmeter: Construction –Theory- Errors – Power Measurement using Three Phase Wattmeter. Single Phase Induction Type Meters: Construction –Theory and Operation of Single Phase Induction Type Energy Meters – Measurement of VAh using Trivector Meter. Testing of Energy Meters: Phantom loading.

UNIT – III **9**

Potentiometers and Instrument Transformers: D.C.Potentiometers: Introduction - Basic Potentiometer Circuit – Standardisation - Laboratory type (Crompton's) potentiometer - Applications. A.C.Potentiometers: Standardizing A.C.Potentiometers – Drysdale polar type - Applications. Instrument Transformers: use of Instrument Transformers- Ratios- Burden - Current Transformers - Design Features of C.T - Effect of Secondary Open Circuit - Potential Transformers - Difference between C.T and P.T - Construction – Protection. Measurement of Power using Instrument Transformers.

UNIT – IV **9**

Measurement of Resistance and Impedance with Bridges: Classification of Resistances- Measurement of Medium Resistance - Wheat Stone Bridge - Limitations of Wheat Stone Bridge. Low Resistance- Kelvin Double Bridge. High Resistance – Meggar (Earth tester). **A.C.Bridges:** Introduction - Sources and Detectors - Measurement of Self Inductance & Capacitance: Maxwell's Inductance Bridge - Capacitance Bridge - Anderson's Bridge - Schering Bridge - Wien's Bridge- Sources of Errors in Bridge Circuits.

UNIT – V **9**

Electronic Instruments: Introduction - Block diagram of basic digital multi meters - Block diagram of Oscilloscope- Digital Storage Oscilloscope – Function generator. Spectrum Analyzer: Basic spectrum analyzer using swept receiver design. Harmonic Distortion Analyzer: Total Harmonic Distortion. Recorders: X-Y Recorders.LCR meter.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Sawhney, A.K, "Electrical and Electronic Measurements and Instrumentation", 19th Revised Edition, Dhanpath Rai & Co, New Delhi, 2013 (Reprint).
2. Kalsi, H.S., "Electronic Instrumentation", Tata McGraw Hill Publishing Company, New Delhi, 2012.

REFERENCE BOOKS:

1. Anand, M.L, "Electrical Measurements and Measuring Instruments", S.K. Kataria & Sons, Reprint 2012.
2. Gupta, J.B, "A Course in Electronic and Electrical Measurements and Instrumentation", S. K. Kataria & Sons, New Delhi, 2003.
3. Banerjee, G.K, "Electrical and Electronic Measurements", Prentice Hall of India, New Delhi, 2012.
   https://www.youtube.com/watch?v=krz9fABbQzI
   http://www.gate.iisc.ernet.in/2013questions/IN.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret the various instruments for voltage and current measurement
CO2: understand the working principles of meters for measurement of power and energy
CO3: identify the measurement concepts with potentiometers and instrument transformers
CO4: measure the R, L, C components with bridges
CO5: understand the principles of digital meters

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CST35 OBJECT ORIENTED PROGRAMMING

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

3 0 0 3

Pre-requisites: Problem Solving and Programming

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

Constructors and Destructors: Constructors - Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initialization of Objects - Copy and Dynamic Constructors – Destructors. **Overloading:** Defining Operator Overloading - Overloading Unary and Binary Operators – Overloading Binary Operators using Friend Functions.

UNIT – IV **9**

Inheritance: Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance - Multiple Inheritance – Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes – Abstract Classes. **Pointers, Virtual functions and Polymorphism:** Pointers to Objects - this Pointer - Pointers to Derived Classes - Virtual Functions - Pure Virtual Functions.

UNIT – V **9**

Managing Console I/O Operations: Introduction – C++ Streams – C++ Stream Classes – Unformatted I/O Operations- Formatted Console I/O Operations- Managing Output with Manipulators. **Working with Files:** Introduction- Classes for File Stream Operations- Opening and Closing a File- Detecting End-of-File - File Modes- File Pointers and Manipulations- Sequential File- Random Access File- Command line Arguments.

TOTAL: 45

TEXT BOOKS:

1. Balagurusamy E., "Object Oriented Programming with C++", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.

REFERENCE BOOKS:

1. Hubbard John R., "Schaum's Outline Programming with C++", Tata McGraw Hill Publishing Company, New Delhi, 2003.
2. Venugopal.K.R. and Raj Buyya, "Mastering C++", Tata McGraw Hill, Oxford, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL31 CIRCUITS AND NETWORKS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS / EXERCISES:

1. Experimental verification of mesh analysis
2. Experimental verification of Thevenin's and Norton's theorem
3. Experimental verification of Superposition theorem
4. Experimental verification of maximum power transfer theorem
5. Transient response analysis of series RL and RC circuit
6. Frequency response of series and parallel resonant circuit
7. Determination of Z and Y parameters of two-port network
8. Frequency response characteristics of RL and RC network
9. Pole-zero plot and time domain analysis of series RLC circuit
10. Study of classification and analysis of signals and systems

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Sudhakar.A, and Shyam Mohan S.P, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill Publishing Company, New Delhi, 2012.
2. Roy Choudhury.D, "Network and Systems", 2nd Edition, New Academic Science, 2009.
3. Nagoor Kani.A, "Signals and Systems", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
4. Lab Manual
5. MATLAB Software
   https://www.youtube.com/watch?v=kqTX6YZmw70
   https://www.youtube.com/watch?v=w4N9CBc_nkA

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyze the electric circuits using theorems

CO2: understand the behavior of RL and RC circuits

CO3: determine the network parameters, frequency response characteristics and results of time domain analysis

CO4: classify and analyze the signals and systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL32 ELECTRON DEVICES AND CIRCUITS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS / EXERCISES:

1. Characteristics of PN junction diode and Zener diode
2. Characteristics of CE transistor and determination of its hybrid parameters
3. Characteristics of FET
4. Characteristics of UJT and UJT as relaxation oscillator
5. Non linear wave-shaping circuits: clipper and clamper circuits
6. Characteristics of shunt regulators
7. Signal generation using Hartley oscillator and Colpitts oscillator
8. Pulse generation using monostable multivibrator and square wave generation using astable Multivibrator
9. Generation of square waveform using Schmitt trigger
10. Frequency response of CE amplifier circuit

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyze the characteristics of basic electronic devices
CO2: design of various signal generation circuits
CO3: understand the behavior of amplifier circuit

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14CSL34 OBJECT ORIENTED PROGRAMMING LABORATORY

(Common to EEE, EIE & ECE branches)

0 0 3 1

Pre requisites : Object Oriented Programming

LIST OF EXPERIMENTS:

1. Develop C++ functions with default arguments.
2. Implement call by value, call by reference and call by address.
3. Develop a C++ program to demonstrate the use of function overloading.
4. Design C++ classes with data members and member functions.
5. Develop a C++ program to demonstrate the use of friend function.
6. Implement matrix class with dynamic memory allocation and necessary methods.
7. Develop a C++ program using array of objects.
8. Design classes with constructors and destructor.
9. Implement unary and binary operator overloading.
10. Implement multiple and multilevel inheritance.
11. Implement virtual functions.
12. Develop a program to manipulate text file.

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Linux Operating System
2. C ++ Compiler

COURSE OUTCOMES:

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT41 NUMERICAL METHODS

(Common to Civil, EEE, EIE, ECE, CSE, IT, Chemical & Food Technology)

3 1 0 4

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Balagurusamy E., "Numerical Methods", Reprint Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
2. Jain M.K., Iyengar S.R.K. and Jain R.K., "Numerical Methods for Scientific and Engineering Computation", 6^{th} Reprint, New Age International Pvt. Ltd., New Delhi, 2014.
3. Sankara Rao K., "Numerical Methods for Scientists and Engineers", 3^{rd} Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
4. Gerald C.F. and Wheatley P.O., "Applied Numerical Analysis", 7^{th} Edition, Pearson Education, Asia, New Delhi, 2006.
5. Grewal B.S., "Numerical Methods in Engineering and Science", 9^{th} Edition, Khanna Publishers, 2007.

COURSE OUTCOMES:

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT41 TRANSDUCER ENGINEERING

3 0 0 3

UNIT – I **9**

Science of Measurements and Instrumentation of Transducers: Importance of Measurement – Purpose of Measurement – Methods of Measurement – Functional blocks of a Measurement system – Types of Errors – Error Analysis – Units and Standards – Classification of transducers – Selection of transducers.

UNIT – II **9**

Characteristics of Transducers: Static characteristics**:** Accuracy, Precision, Resolution, Sensitivity, Linearity, Hysteresis, Range and Span. Dynamic characteristics: Response of Zero order transducer, First order transducer with Impulse, Step, Ramp and Sinusoidal inputs. Response of Second order transducer with Step and Ramp inputs.

UNIT – III **9**

Variable Resistance Transducers: Resistive Transducers: Resistance Potentiometer: Loading effect– Resolution – Linearity – Nonlinear type – Noise. Resistance Strain gauges: Unbonded and Bonded type strain gauges – Temperature effects on strain gauges – Measurement of strain – Strain gauge circuits. Resistance Thermometers –Hot-wire Anemometer – Humidity sensor.

UNIT – IV **9**

Variable Inductance and Variable Capacitance Transducers: Inductive Transducers**:** Inductive Thickness Transducers – Linear Variable Differential Transformers – Induction Potentiometers – Eddy current type Inductive Transducers – Synchros. Capacitive Transducers: Capacitive Thickness Transducers – Capacitive Displacement Transducers: Proximity Transducer – Capacitive Strain transducer – Variable Area Capacitive Transducer. Capacitive microphone- Capacitive Moisture Transducer – Capacitive Hygrometer.

UNIT – V **9**

Special Transducers: Piezoelectric Transducers - Piezo electric materials – Modes of deformation – Piezo electric acceleration Transducer - Magnetostrictive Transducers –Digital Transducers – Hall Effect Transducers – Fibre Optic Transducers – SQUID Sensors – Film Sensors – Smart Sensors – Introduction to MEMS and Nano sensors.

TOTAL: 45

TEXT BOOKS:

1. Murthy, D.V.S, "Transducers and Instrumentation", 2nd Edition, Prentice Hall of India, New Delhi, 2010.
2. Ranganathan, S., "Transducer Engineering", Allied Publishers, New Delhi, 2003.

REFERENCE BOOKS:

1. Liptak, B.G., "Instrumentation in Process Industries", Butterworth and Heinmann, Oxford, 1995.
2. Doebelin, E. A., "Measurement Systems: Applications and Design", 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2008.
3. Sawhney, A.K., "A Course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai & Co. Pvt. Ltd., New Delhi, 2012.
4. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, New Delhi, 1999.

https://www.youtube.com/watch?v=1uPTyjxZzyo

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the measurement of physical quantities, conversion and classification of transducers
CO2: analyse the static and dynamic characteristics of transducers
CO3: gain knowledge on various types of resistive transducers and applications
CO4: acquire and apply knowledge on inductive and capacitive transducers
CO5: impart knowledge on special transducers

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT42 INDUSTRIAL INSTRUMENTATION I

3 1 0 4

UNIT – I **9**

Force, Torque, Velocity, Acceleration and Vibration: Force(Weight) Measurement – Torque Measurement – Speed and Velocity Measurements: Hand-held tachometer – Capacitor-type Impulse Tachometer – Optical Tachometers – Induction Type Speed Sensor – Magnetic Type Speed Sensor –Velocity measurement as $\Delta x/\Delta t$. Acceleration and Vibration: Seismic-(Absolute-) Acceleration Pickups – Variable Reluctance Accelerometer – Eddy current Proximity Sensor as Vibration Pickups – Mechanical Vibration sensors.

UNIT – II **9**

Temperature Measurement I: Basic Behaviour of Materials to Temperature – Physical Effects utilized to measure Temperature – Temperature Scales – Temperature Measurement: Mechanical Thermometers – Filled system Thermometers – Metallic - Expansion Thermometers – Special Temperature Indicating Devices – Bulb Installations.

UNIT – III **9**

Temperature Measurement II: Electrical Thermometers: Resistance Thermometers – Thermistors – Thermocouples – Radiation Pyrometers. Fiber -optic Temperature measurement systems – Ultrasonic Thermometers.

UNIT – IV **9**

Pressure Measurement I: Units of pressure – Mechanical Pressure Measurement: Manometers – Elastic type pressure gauges: Bourdon type – Metallic Diaphragm – Capsule – Bellows. Electrical Methods of Pressure Measurement: Strain-Gauge – Capacitance – Potentiometric – Resonant Wire – Piezoelectric - Magnetic- Optical.

UNIT – V **9**

Pressure Measurement II: Vacuum sensors: Mechanical Vacuum Gauges – Thermal Vacuum Gauges – Ionisation Vacuum Gauges - Testing and Calibration of Pressure Detectors: Dead weight tester. Force-Balance Pressure Gauges – Bell Type of Pressure Gauge – Pressure Switches.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Krishnaswamy. K, and Vijayachitra. S., "Industrial Instrumentation", 2nd Edition, New Age International Publishers, New Delhi, 2014.
2. Singh S. K., "Industrial Instrumentation and Control", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2009.

REFERENCE BOOKS:

1. Bela G. Liptak, "Instrument Engineers' Handbook, Volume One: Process Measurement and Analysis", 4th Edition, CRC Press, 2003.
2. Patranabis D., "Principles of Industrial Instrumentation", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
3. Ernest O Doebelin and Dhanesh N Manik, "Measurement Systems, Application and Design", 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007.
4. Tattamangalam R. and Padmanabhan, "Industrial Instrumentation Principles and Design", Springer, 2000.

www.nptel.ac.in/courses/112106139/pdf/4_4.pdf
https://web.mst.edu/~cottrell/ME240/Resources/Temperature/Temperature.pdf
http://nptel.ac.in/courses/108105063/pdf/L-04(SS)(IA&C)%20((EE)NPTEL).pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1:understand the construction and working principles of various types of temperature and pressure measuring instruments

CO2:appreciate the usefulness of measuring parameters such as force, torque, velocity, acceleration and vibration for various industrial applications

CO3:infer the design characteristic parameters used in process measuring instruments

CO4:identify the appropriate measuring device for specific applications

CO5:install and interface the process measuring devices in industrial process control system

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT43 DIGITAL LOGIC CIRCUITS

(Common to EIE & EEE branches)

3 1 0 4

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I **9**

Boolean Algebra and Minimization of Boolean Expressions: Axioms and Laws of Boolean Algebra – Reducing Boolean Expressions – Boolean Functions and their representation- Expansion of a Boolean Expression in SOP Form to the standard SOP Form- Expansion of a Boolean Expression in POS Form to standard POS Form- Boolean Expressions and Logic Diagrams- Converting AND/OR/INVERT Logic to NAND/NOR Logic. Minimization of Switching Functions: Two Variable K Map- Three Variable K Map - Four Variable K Map – Implementation of Logic Functions-Quine McCluskey Method: Don't care conditions.

UNIT – II **9**

Combinational Logic Design: Design Procedure: Adders - Subtractors. Code converters: Binary to Gray - Gray to Binary - BCD to Excess 3 - BCD to Gray. Parity bit generators/Checkers - Comparators: 2 bit Magnitude Comparator - Encoders: Octal to Binary Encoder - Decoders: 3 Line to 8 Line Decoder - 2 Line to 4 Line Decoder with NAND Gates- Multiplexers – Demultiplexers

UNIT – III **9**

Synchronous Sequential Circuits: Latches and Flipflops: Triggering and Characteristics equations of Flipflops. Race around condition- Master slave J-K Flipflop - Flipflop Excitation Tables –Conversion of Flipflops - Synchronous Sequential Logic: Analysis of Clocked Sequential Circuits-State Reduction and Assignment – Design Procedure. Synchronous Counters: Design of Synchronous counters – Design of a Synchronous 3-bit Up-down Counter Using J-K FFs- Ring counter. Registers: Universal shift registers.

UNIT – IV **9**

Asynchronous Sequential Logic: Analysis Procedure- Design Procedure – Reduction of State and Flow Tables- State Assignments – Hazards and Hazard Free Realizations: Static Hazards- Dynamic Hazards – Hazard free Realization- Essential Hazards.

UNIT – V **9**

Logic Families and Memory: Digital IC Specification Terminology: Propagation Delay - Noise Margin –Speed Power Product. Transistor Transistor Logic (TTL): Two-input TTL NAND Gate – Three-input TTL NAND Gate. Emitter Coupled Logic (ECL): Inverter. Complementary Metal Oxide Semiconductor (CMOS) Logic: CMOS Inverter- CMOS NAND Gate- CMOS NOR Gate. Memory Types and Terminology: Memory Organization and operation - Semiconductor RAMs: Static RAMs (SRAMs)- Dynamic RAMs(DRAMs). Read-Only Memory (ROM)-ROM organization – Types of ROMs- Programmable ROM (PROM)

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Anand Kumar A., 'Fundamentals of Digital Circuits', 2nd Edition, Prentice Hall of India, 2013.
2. Morris Mano M., 'Digital Design with an Introduction to the Verilog', 5th Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Salivahanan, S and Arivazhagan, "Digital Circuits and Design", 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.
2. Donald Leach, Albert Malvino and Goutam Saha, "Digital Principles and Applications", 8th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.
3. Charles H.Roth,Jr and Lizy Kurian John, "Digital System Design using VHDL", 2nd Edition, Cengage Learning, 2012.
4. http://nptel.ac.in/courses/117106086/1
5. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: simplify the boolean expressions
CO2: design and implement the combinational circuits
CO3: implement circuits using synchronous techniques
CO4: implement circuits using asynchronous techniques
CO5: identify the logic families and memory devices

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET44 ELECTRICAL MACHINES

(Common to Mechatronics, ECE & EIE branches)

3 0 0 3

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL: 45

TEXT BOOK:

1. Mehta V.K. and Rohit Mehta, "Principles of Electrical Machines", 2nd Edition, S.Chand & Co. Ltd., India, 2002.

REFERENCE BOOKS:

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

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: develop knowledge on construction and working of DC and AC machines
CO2: examine the construction and working of Transformers
CO3: determine the performance characteristics of the electrical machine
CO4: select electrical machines for various applications
CO5: explain the various tests, starting and speed control techniques

Mapping of COs with POs and PSOs

CO with PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3								2		2	
CO2	3			3										
CO3	3			2	3						1			
CO4	3						1				2		3	1
CO5	3			1						2				

1 – Slight, 2 – Moderate, 3 – Substantial

14MET46 APPLIED THERMODYNAMICS

(Common to EEE & EIE branches)

(Use of Steam Table with Mollier Diagram and Psychrometric Chart are Permitted)

3 0 0 3

Pre-requisites: Basics of Mechanical Engineering.

UNIT – I **9**

Laws of Thermodynamics: Thermodynamic Systems – Macroscopic and Microscopic - Boundary –- Control Volume – System and Surroundings – Properties – State - Process – Cycle - Point and Path Functions – Equilibrium – Zeroth Law of Thermodynamics. Work and Heat Transfer - First Law of Thermodynamics for Open and Closed Systems – Steady Flow Energy Equation (SFEE). Second Law of Thermodynamics– Kelvin-Planck and Clausius Statements – Heat Engine, Refrigerator, Heat Pump.

UNIT – II **9**

Internal Combustion Engines: Classification - Components of Internal Combustion Engines - Two Stroke and Four Stroke Engines, Valve Timing and Port Timing Diagrams, Comparison of Petrol and Diesel Engines. Ignition System – Types. Cooling System – Types. Lubricating System – Types. **Fuels and Combustion:** Introduction to Fuels – Physical and Chemical Properties of Liquid, Solid and Gaseous Fuels. Combustion: Principle of Combustion – Combustion of Oil, Coal, Gas.

UNIT – III **9**

Boiler and Furnaces: Introduction – Formation of Steam – Thermodynamic Properties of Steam, Use of Steam Tables and Charts. Basic Steam Power Cycle (Simple Rankine Cycle). **Boiler:** Boiler - Classifications: Fire Tube, Water Tube and Packaged Boiler – Boiler Efficiency Calculation: Direct Method and Indirect Method – Boiler Blowdown and Boiler Water Treatment – Boiler Mountings and Accessories. Elements of Pulverised Fuel System and Fluidized Bed Combustion. **Furnaces:** Types and Classification of Different Furnaces – Various Losses in Furnaces – Furnace Efficiency Calculation.

UNIT – IV **9**

Air Compressors: Positive Displacement Compressors – Classifications - Reciprocating Compressors –Indicated Power – With and Without Clearance Volume – Various Efficiencies – Multi Stage with Inter-Cooling, Conditions for Perfect and Imperfect Inter-Cooling. Rotary Compressor - Types - Roots Blower, Sliding Vane, Centrifugal Compressor.

UNIT – V **9**

Refrigeration and Air-Conditioning: Unit of Refrigeration – Components of Refrigeration System- Vapour Compression Refrigeration Cycle with (p-h) and (T-s) Diagrams – Subcooling and Superheating. Working of Vapour Absorption Refrigeration System, Air-Conditioning Systems. Basic Psychrometric Terms and Psychrometric Processes. Types of Air-Conditioning Systems – Summer, Winter and Year Round Air-Conditioning Systems.

TOTAL: 45

TEXT BOOKS:

1. Rajput R.K., "Thermal Engineering", 9th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2013.
2. Nag P.K., "Power Plant Engineering", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

REFERENCE BOOKS:

1. Nag P.K., "Basic and Applied Engineering Thermodynamics", Tata McGraw Hill Publishing Company, New Delhi, 2012.
2. Ballaney P.L., "Thermal Engineering", 24th Edition, Khanna Publishers, New Delhi, 2012.
3. Cengel Y., "Thermodynamics: An Engineering Approach", 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply the laws of thermodynamics in various thermal equipments
CO2: recognize the various components of internal combustion engines and concept of fuels and combustion
CO3: identify the different types of boilers and furnaces
CO4: get the working principle of air compressor with their different types
CO5: familiarize the concept of refrigeration and air-conditioning systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL41 TRANSDUCERS AND MEASUREMENTS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS / EXERCISES:

1. Measurement of temperature using thermocouple, thermistor and resistance temperature detector
2. (a) Measurement of displacement using LVDT
   (b) Characteristics of vibration analyzer, Hall effect transducers and Piezoelectric transducers
3. Measurement of strain using strain gauge and load cell
4. Measurement of speed using photoelectric tachometer and proximity sensor
5. Range extension for DC ammeter and voltmeter
6. Calibration of energy meter using direct loading
7. Measurement of current and voltage using CT and PT
8. Measurement of real, reactive powers and power factor using trivector meter
9. Measurement of resistance and capacitance using Kelvin double bridge and Schering bridge
10. Measurement of unknown resistance and voltage using DC potentiometer

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual

   https://www.youtube.com/watch?v=EWTPvrJQG_4

   https://www.youtube.com/watch?v=luugrqmoy7e

   https://www.youtube.com/watch?v=nkCeEM1H2gA

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: perform the measurements of different physical parameters
CO2: analyze the characteristics of electrical quantities
CO3: determine the unknown resistance, capacitance and inductance using various bridge circuits

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL44 ELECTRICAL MACHINES LABORATORY

(Common to Mechatronics & EIE branches)

0 0 3 1

LIST OF EXPERIMENTS / EXERCISES:

1. Open circuit and load characteristics of separately excited DC shunt generator.
2. Load characteristics of DC series motor.
3. Swinburne's Test.
4. Speed control of DC shunt motor.
5. Open circuit and short circuit tests on single phase transformer.
6. Load test on three-phase alternator.
7. Regulation of three phase alternator by EMF method.
8. Load test on three phase squirrel cage induction motor.
9. Load test on three phase slip ring induction motor.
10. V and inverted V curves of three phase synchronous motor.

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Nagrath I.J. and Kothari D.P., "Electrical Machines", Tata McGraw Hill, 2010.
2. Lab Manual

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: analyze the characteristics of DC and AC machines
CO2: test the speed control techniques of DC machines
CO3: predetermine the regulation and efficiency of various machines
CO4: analyze the characteristics of synchronous motor
CO5: estimate the performance of rotating machines by conducting suitable load tests

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EGL41 COMMUNICATION SKILLS LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

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

Audio Visual Lab: Activity based learning

2. Activity based Reading Skills: Reading for getting information and understanding; scanning, skimming and identifying topic sentences – Reading for gaining knowledge-Group activity.
3. Activity based Writing Skills: Preparing a draft – Word editing features, editing and proof reading; Writing a short essay using the draft prepared - Group activity.
4. Speaking Skills: Verbal and Non-Verbal Communication; Introducing oneself -Describing a place, Expressing views and opinions; Giving a presentation on a Topic - eye contact, speaking audibly, clearly and with confidence; Group discussion.Conversations – Face-to-Face conversation – Simulated Telephonic Conversation.

Career Lab

5. Interview Skills: Introducing oneself – Answering other FAQ's. Presentation Skills: Elements and structure of effective presentation – Presentation Tools – Voice modulation – Body language –Video samples. Group Discussion: Structure of Group Discussion – Strategies in group discussion - Team work – Video Samples. Soft Skills: Fundamentals of Soft Skills – Work Place Culture and Inter-Personal Relationships.

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Orell Digital Language Lab Software

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: communicate efficiently in real life and career related situations
CO2: demonstrate good Presentation skills and team skills
CO3: familiarize in using modern communication software packages to enhance their soft skills

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO_1									3	3		2		
CO_2									2	3		1		
CO3									1	3		2		

3- Substantial, 2- Moderate, 1- slight

14EIT51 INDUSTRIAL INSTRUMENTATION II

3 1 0 4

Pre-requisites: Transducer Engineering and Industrial Instrumentation I

UNIT – I **9**

Flow Measurement I: Mechanical Flow Meters – Orifice Flow Meter – Venturi Tubes – Flow Nozzle – Dall Tube – Installation of Head Flow Meters – Pitot Tube – Differential Pressure Transmitters - Quantity Meters - Inferential Flow Meters.

UNIT – II **9**

Flow Measurement II: Mass Flow Meters: Angular Momentum Type Flow Meters – Impeller-Turbine Mass Flow Meters. Electrical Flow Meters: Electromagnetic Flow meter – Ultrasonic Flow Meters. Other Types of Flow Meters: Vortex Shedding Flow Meter – Flow Switches – Flow Meter Calibration – Flow Meter Selection.

UNIT – III **9**

Level Measurement: Float Type Level Indication: Float Level Switch. Level Measurement Using Displacer and Torque Tube - Boiler Drum Level Measurement: Hydrostatic Pressure Method - Differential Pressure Method. Level Measurement by Electrical Methods - Level Measurement Using Resistance Tapes - Capacitance Level Detection and Level Measurement - Radiometric Level Detection and Measurement - Level Measurement using Ultrasonic Sensors - Level Switches.

UNIT – IV **9**

Density and Viscosity: Measurement of Density: Displacement and Float Type Densitometers (For Liquid Density) – Hydrostatic Densitometer (Pressure Head Type). Measurement of Viscosity: Capillary Viscometers (Laboratory Type) - Efflux Cup Viscometers (Saybolt Viscometer) - Capillary Viscometer (Industrial Type) - Plastometer.

UNIT – V **9**

Humidity and Moisture: Measurement of Humidity: Dry and Wet bulb Psychrometers - Hair Hygrometers – Dew point Hygrometers - Electrolytic Hygrometers. Measurement of Moisture in Gases and Liquids: Piezoelectric Hygrometer - Infrared Absorption Hygrometer - Measurement of Moisture in Solids.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1. Krishnaswamy K. and Vijayachitra S., "Industrial Instrumentation", 2nd Edition, New Age International Publishers, New Delhi, 2014.
2. Ernest O. Doebelin and Dhanesh N. Manik, "Measurement Systems, Application and Design", 5th Edition, Tata McGraw-Hill, New Delhi, 2008.
3. Singh S.K., "Industrial Instrumentation and Control", 3rd Edition, Tata McGraw-Hill, New Delhi, 2009.

REFERENCE BOOKS:

1. Liptak B.G., "Instrument Engineers Handbook (Measurement)", Butterworth-Heinemann Ltd., 4th Edition, Oxford, 2003.
2. Jain R.K., "Mechanical and Industrial Measurements", 11th Edition, Khanna Publishers, New Delhi, 2013.
3. Tattamangalam R. Padmanabhan, "Industrial Instrumentation Principles and Design", Springer, London, 2000.
4. Alan S. Morris, "Measurement and Instrumentation Principles", 3rd Edition, Butterworth-Heinemann, New Delhi, 2001.
5. William C. Dunn, "Fundamentals of Industrial Instrumentation and Process Control", 1st Edition, Tata McGraw Hill, New Delhi, 2009. - https://ay12-14.moodle.wisc.edu/prod/pluginfile.../426-Flow_measurement.pptx
6. http://www.indumart.com/Level-measurement-4.pdf -
7. www.omega.com/literature/transactions/transactions_vol_iv.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the construction and working principles of various types of flow and level measuring instruments
CO2: interpret the usefulness of measuring parameters such as density, viscosity, humidity and moisture for various industrial applications
CO3: infer the design characteristic parameters used in process measuring instruments
CO4: identify the appropriate measuring device for specific applications
CO5: implement and interface the process measuring devices in industrial process control system

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT52 BIOMEDICAL INSTRUMENTATION

(Common to EIE & Mechatronics branches)

3 0 0 3

UNIT – I **9**

Human Physiological Systems: Cell and its structure-Resting and action potentials-Different systems of human body: Skeletal system-Circulatory system-Respiratory system-Excretory system-Central nervous system-Peripheral nervous system. **Physiological Transducers:** Introduction-Classification of transducers-Displacement, position and motion transducers: Piezo electric transducers-Ultrasonic transducers-Transducers for body temperature measurements: Thermocouples-Electrical resistance Thermometer-Thermistors. Optical fibre sensors.

UNIT – II **9**

Bio Potential Electrodes and Bio signal Acquisition: Components of the Bio medical instrument system-Electrodes: Micro electrode-depth and needle electrode-surface electrodes. Amplifiers: Medical preamplifiers-Chopper amplifiers-Isolation amplifier. **Biomedical Recorders and Patient Safety:** ECG-EEG-EMG-EOG-ERG: Lead systems, recording methods and typical waveforms. Patient safety: Electrical shock hazards-leakage currents-Safety codes for electro medical equipment-Electrical safety analyzer.

UNIT – III **9**

Non Electrical Parameters Measurement and Diagnostic Procedures: Patient monitoring systems: Measurement of heart rate-Blood pressure Measurement- Cardiac output. Pulmonary function analysers:Pulmonary function measurements - Spirometry. Blood gas analyzers: Blood pH measurement-Measurement of blood pCO2-Blood pO2 measurement.Oximeters: Pulse oximeter.

UNIT – IV **9**

Modern Medical Imaging Systems: Radiography and fluoroscopy-X-ray machine-Endoscopes-Computer tomography-Thermography-Ultrasonic imaging systems-Magnetic resonance imaging–Positron emission tomography–Single photon emission computed tomography.

UNIT – V **9**

Applications of Bio medical Devices: Physiological assist devices: Pacemakers: Ventricular asynchronous pacemaker-Ventricular synchronous pacemaker. Defibrillators:A.C.Debrillator- D.C.Defibrillator - Synchronised d.c defibrillator. Heart lung machine-Kidney machine. **Operation Theatre Equipment**:Surgical diathermy-Short wave diathermy-Micro wave diathermy. Ventilators– Lithotriptors: The stone disease problem-First lithotriptor machine.

TOTAL : 45

TEXT BOOKS:

1. M.Arumugam, "Bio-Medical Instrumentation", , 2nd Edition, Anuradha Agencies, 2014.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", 2nd Edition, Tata McGraw-Hill, New Delhi, 2012.
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", 2nd Edition, Prentice hall of India, New Delhi, 2007.

REFERENCE BOOKS:

1. John G. Webster, "Medical Instrumentation Application and Design", 4th Edition,John Wiley and Sons, NewYork, 2015.
2. Dr.O.N.Pandey, "Fundamentals of Biomedical Instrumentation", 4th Edition, S.K.Kataria & Sons, New Delhi, 2013.
3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4th Edition, Pearson Education, 2002.
4. R.Ananda Natarajan, "Bio Medical Instrumentation and Measurements", 1st Edition, PHI Learning Pvt Ltd., New Delhi, 2011.
5. Myer Hutz, "Standard Hand Book of Biomedical Engineering and design", 1st Edition, Tata McGraw-Hill, New Delhi, 2003.
6. https://www.goodreads.com/author/show/2815598.R_S_Khandpur
7. http://www.freeengineeringbooks.com/BioMedical/BioMedical-Instrumentation.php
8. https://www.amazon.in/BIOMEDICAL-INSTRUMENTATION-MEASUREMENTS-R-Anandanatarajan-ebook/dp/B00K7YFVUS

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand and analyze biomedical instrumentation systems and their applications to various industries
CO2: analyze the acquisition concepts in the bio potential recorders
CO3: identify the various electrical parameters of the human system
CO4: understand various imaging modalities in hospitals
CO5: apply the familiarized therapeutic concepts in the recend trends of biomedical devices

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET52 MICROPROCESSORS AND MICROCONTROLLERS

(Common to EEE & EIE branches)

3 0 0 3

Pre-requisites: Digital Logic Circuits

UNIT – I **9**

8085 Microprocessor: History and Evolution of 8085 Microprocessor-Architecture-Pin configuration-Registers-Timing Diagrams-Interrupts-Memory Mapping- Instruction Set-Addressing Modes- Assembly Language Programs.

UNIT – II **9**

Peripheral Interfaces: Serial Communication Interface-Parallel communication Interface-Timer Interface-DMA controller Interface-Keyboard/Display Interface.

UNIT – III **9**

8051 Microcontroller: History and Evolution of 8051 Microcontroller- Functional block diagram- Memory Organization-Special function registers – Program Counter – PSW register –Stack - Instruction set-Addressing modes.

UNIT – IV **9**

8051 Programming: I/O Ports – Timer – Interrupt – Serial Port -I/O port programming- Timer programming-counter programming-Serial Communication-Interrupt programming.

UNIT – V **9**

Peripheral Interfacing: Keypad-LCD -Sensors- A/D and D/A converters- DC Motor speed control-stepper motor control – Washing Machine Control.

TOTAL: 45

TEXT BOOKS:

1. Krishna Kant, "Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086,8051,8096", 8th Edition, PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Soumitra Kumar Mandal, "Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086 and 8051", 8th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013.

REFERENCE BOOKS:

1. Senthil Kumar N., Saravanan M., Jeevananthan S., "Microprocessor and Microcontroller", 12th Impression, Oxford University Press, 2015.
2. Mazidi Muhammad Ali, Mazidi Janice Gillispie and McKinlay Rolin, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Prentice Hall of India, New Delhi, 2012.
3. Ayala Kenneth J., "The 8051 Microcontroller", 3rd Edition, Thomson Delmer Learning, Singapore, 2004.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: demonstrate knowledge on the architectural functions of 8085
CO2: classify the different addressing modes and instruction sets
CO3: develop basic and advanced programs for 8085 and 8051
CO4: utilize the on chip peripherals for the specific applications
CO5: integrate the input/output devices in real time using 8051

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET53 CONTROL SYSTEMS

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

3 1 0 4

UNIT – I **9**

Mathematical Modeling: History of Control Systems - Classification of Control Systems - Basic Structure: Open Loop and Closed Loop Systems - Transfer Function and State Space Models (Physical and Phase Variable Model): Electrical Systems, Mechanical Systems, Electromechanical Systems: Gear Trains and DC Motor - Electrical Analogy of Mechanical Systems - Reduction of Multiple Subsystems: Block Diagram Reduction, Signal Flow Graphs.

UNIT – II **9**

Time Response of Systems: Poles, Zeros and System Response -Type and Order of System - Significance of Test Signals - First Order System - Second Order System: Classification and Nature of Response - Step Response of Second Order Underdamped System - Time Domain Specifications - Steady State Error and Error Constant - Generalized Error Series.

UNIT – III **9**

Stability Analysis: Concepts of Stability - Pole Location and Stability - Routh Hurwitz Criterion - Root Locus Technique - Effect of Addition of Poles and Zeros on Stability.

UNIT – IV **9**

Frequency Response of Systems: Concept of Frequency Response - Frequency Response Analysis: Bode Plot and Polar Plot - Stability Analysis in Frequency Domain: Nyquist Stability Criterion - Frequency Domain Specifications.

UNIT – V **9**

Compensator and Controller: Need for Compensator - Types of Compensation - Cascade Compensators: Types, Transfer Function and Physical Realization - Effect of Ideal Compensation on Time Response: P, PI, PD and PID - Design of Lag and Lead Compensator via Root Locus.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Gopal M., "Control Systems; Principles and Design", 4th Edition, Tata McGraw-Hill, New Delhi, 2012.
2. Kuo B.C., "Automatic Control Systems", 9th Edition, John Wiley and Sons, New York, 2009.
3. Ogata K.,"Modern Control Engineering", 5th Edition, Pearson Education/ PHI, New Delhi, 2010.

COURSE OUTCOMES:

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT52 LINEAR INTEGRATED CIRCUITS

(Common to ECE, EEE & EIE branches)

3 1 0 4

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Gaykwad, Ramakant A., "OP-AMP and Linear IC's", 4th Edition, PHI Learning, New Delhi, 2009.
2. Salivahanan S. and Kanchana Bhaaskaran V.S., "Linear Integrated Circuits", 2nd Edition, McGraw Hill Education Pvt. Ltd., India, 2014.
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, McGraw-Hill, New York, 2008.
4. Coughlin Robert and Driscoll F., "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, Pearson Education Asia, 2001.

COURSE OUTCOMES:

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL51 INDUSTRIAL INSTRUMENTATION LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Measurement of flow using
   a) Orifice b) Venturi tube c) Electro Magnetic flow meters

2. Characteristics of Converters
   a) I/V b) V/I c) P/I d) I/P

3. Pressure Measurement and Calibration
   a) Pressure gauge b) Vacuum gauge

4. a) Measurement of Torque and Angle
   b) Measurement of pH, Conductivity, Turbidity and TDS in water

5. Measurement of Level using
   a) Ultrasonic level measurement
   b) Differential pressure transmitter

6. Analysis of Concentration and Absorbance using UV- Visible Spectrophotometer and IR analyzer

7. Dew point measurement by sling psychrometer

8. Measurement of Bio potential parameters ECG, EEG, EOG

9. Measurement of
   a) Respiration rate
   b) Blood glucose
   c) Blood flow
   d) Strain

10. Measurement of high temperature with pyrometer

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Krishnaswamy K. and Vijayachitra S., "Industrial Instrumentation", 2nd Edition, New age International Publishers, New Delhi, 2014.
2. Lab Manual

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: measure the physical quantities like flow, level, pressure, viscosity and pH by selecting the suitable sensing element

CO2: analyze the concentration and absorbance for various samples using suitable analyzer

CO3: assess the blood pH, strain measurement, respiration and heart rate using biomedical instruments

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL52 CONTROL AND SIMULATION LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Simple MATLAB programs using loops and plot commands
2. Transfer function of DC servomotor in a) Armature Controlled mode b) Field Controlled mode
3. Transfer function of AC servomotor
4. Time response analysis of second order systems using MATLAB and Simulink
5. Effect of P,PI,PID controllers on time response of system using MATLAB
6. Analysis of the stability via Root Locus using MATLAB
7. Effect of addition of poles and zeros on system response and stability using MATLAB
8. Frequency domain analysis with bode plot using MATLAB
9. Effect of dead time on time and frequency response of system using MATLAB
10. Design and implementation of compensators

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. MATLAB software
2. Lab Manual
   http://www.nvistech.com/technical-training/instrumentation-control-lab/control-system-lab

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: derive the models of the linear systems
CO2: determine the time and frequency domain specifications
CO3: analyze the stability in time and frequency domains

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL53 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Design and Verification of JK Flip flop, D Flip flop, Full adder and Full Subtractor circuits
2. Design and implementation of Binary to Gray and Gray to Binary code converters
3. Design and implementation of Encoder, Decoder and Multiplexers
4. Design and implementation of 4 – bit modulo counters
5. Design and implementation of 4-bit shift registers
6. Design and implementation of inverting and non-inverting amplifiers using operational amplifier
7. Design and implementation of Adder & Comparator circuits using operational amplifier
8. Design and implementation of Integrator and Differentiator circuits using operational amplifier
9. Design and implementation of instrumentation amplifier circuit using operational amplifier
10. Implementation of NE/SE 555 timer in Astable and Monostable modes

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: design combinational and sequential circuits with digital ICs
CO2: design circuits using operational amplifier
CO3: understand the applications of IC 555

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GET61 ECONOMICS AND MANAGEMENT FOR ENGINEERS

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOK:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

On completion of the course the students will be able to

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

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

CO3: appraise marketing management decisions

CO4: apply appropriate operation management concept in business situations

CO5: interpret financial and accounting statements

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT61 PROCESS CONTROL

3 1 0 4

Pre-requisites: Control Systems

UNIT – I **9**

Process Control Introduction: Process Control - Automatic Process Control - Need for Automatic Process Control in industry - Mathematical modeling of processes - First order process systems - Second order process systems (Interacting and Non-Interacting Systems) - Dynamic behavior of First-order and Second-order systems - Batch and Continuous process - Self Regulation - Servo and Regulator operation.

UNIT – II **9**

Development of Empirical Dynamic Models from Step Response Data: Development of models by Linear and Nonlinear Regression – Graphical fitting of First-Order models using Step tests – Fitting Second-Order models using Step tests. Dynamic response characteristics of more complicated systems: Poles and Zeros and their effect on system response – Time delays - Approximation of Higher-Order Systems.

UNIT – III **9**

Control Characteristics and Controller Tuning: The Automatic Controller - Process characteristics - Control system parameters - Discontinuous controller modes - Continuous controller modes - Composite control modes. Controller Tuning: Evaluation criteria: Performance criteria - Simple performance criteria - Time integral performance criteria - Selection of feedback controller. Controller tuning: Process reaction curve method - Ziegler-Nichols method - Damped oscillation method - Frequency response method of tuning - Self tuning controllers.

UNIT – IV **9**

Control Systems with Multiple Loops: Advanced control systems - Feed Forward control -Cascade control - Ratio control - Selective control systems - Split-Range control - Adaptive control - Inferential control - Control of systems with 'Large Dead Time' - Interacting control systems - Multi variable control.

UNIT – V **9**

Selected Unit Operations: Introduction - Boiler - Reactor - Mixing controls - Heat exchanger -Distillation process(column)

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1. Krishnaswamy. K, "Process Control", 2nd Edition, New Age International (P) Ltd. Publishers, New Delhi, 2013.
2. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III, "Process Dynamics and Control", 3rd Edition, JohnWiley and Sons, Inc., 2010.

REFERENCE BOOKS:

1. George Stephanopoulos, "Chemical Process Control-An Introduction to Theory and Practice", 1st Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
2. Wayne Bequette B., "Process Control: Modeling, Design and Simulation", PHI Learning Pvt. Ltd., New Delhi, 2012.
3. Singh S. K. ,"Process Control: Concepts, Dynamics and Applications", PHI Learning Pvt. Ltd., New Delhi, 2009.
4. Surekha Bhanot, "Process Control Principles and Applications", 1st Edition, Oxford University Press, 2008.
   http://www.pacontrol.com/download/Process%20Control%20Fundamentals.pdf
   http://nptel.ac.in/courses/108105063/pdf/L-11%28SS%29%20%28IA%26C%29%20%28%28EE%29NPTEL%29.pdf
   https://canteach.candu.org/Content%20Library/20030407.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: develop mathematical model for first order and higher order processes
CO2: obtain empirical models from the real time process
CO3: identify, design and tune suitable controllers for process applications
CO4: build the suitable advanced controller tuning strategy for process applications
CO5: analyze the theory and concept of the selected unit operations

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT62 APPLIED DIGITAL SIGNAL PROCESSING

3 1 0 4

Pre-requisites: Engineering Mathematics III

UNIT – I **9**

Introduction to Discrete Signals, Systems and Signal Processing: Need and advantages of digital signal processing - Classification of discrete signals: Deterministic, Periodic, Symmetric, Causal, energy and power - Signal representation by singularity functions: unit impulse, step, ramp and exponential. Simple manipulation of Discrete Time Signals: Shifting, Folding and Time Scaling. Classification of discrete systems: Static, Linear, Time variance, Causal, Stable and Invertible. Analog to digital signal conversion: Sampling – The sampling theorem - Aliasing Effect - Quantization.

UNIT – II **9**

z-Transform: Definition and Region of Convergence (RoC), Properties of z-transform – Evaluation of inverse z-transform - difference equation- Solution of difference equation using z-transform - Stability of LTI system – Linear and Circular convolutions - Convolution using z-transform

UNIT – III **9**

Discrete Fourier Transform and Computation: Introduction and limitation of DTFT – Discrete Fourier Transform (DFT) of discrete time signals – Properties of DFT – Fast Fourier Transform (FFT) – Decimation in time radix-2 FFT – Decimation in frequency radix-2 FFT – Computation of inverse DFT using FFT.

UNIT – IV **9**

FIR Filter Design (Low pass filters): Introduction – Magnitude response and phase response of digital filters – Windowing technique for design of linear phase filters: Rectangular, Hamming and Hanning – Basic FIR digital filter structures: Direct forms, Cascade, Polyphase and Linear - phase structure realizations.

UNIT – V **9**

IIR Filter Design (Low pass filters) and DSP Processor: Analog filter design – Butterworth approximations - digital filter design using Impulse invariant and Bilinear transformation - pre-warping. Structure realization of IIR filters: Direct form-I, Direct form-II, Cascade form and Parallel form realization. Architecture and features of TMS 320C54X signal processor. Application: Sub-band coding of speech signals.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Pearson Prentice Hall, 2012.
2. S.Salivahanan, "Digital Signal Processing", 3rd Edition,Tata McGraw Hill, 2013.

REFERENCE BOOKS:

1. A. Nagoor Kani, "Signals and Systems" ,Tata McGraw Hill, 2010.
2. Ashok Ambardar, "Digital Signal Processing: A Modern Introduction", Thomson, 2007.
3. Avatar Sing, S. Srinivasan, "Digital Signal Processing- Implementation using DSP Microprocessors with Examples from TMS320C54xx", Thomson India, 2004.
4. B.Venkataramani, M.Basker, "Digital Signal Processors", 2nd Edition, Tata McGraw Hill, 2010.

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: exhibit knowledge in digital signal processing and its applications
CO5: gain knowledge about DSP processor

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT63 VLSI SYSTEMS

(Common to EIE & EEE branches)

3 0 0 3

Pre-requisites: Digital Logic Circuits

UNIT – I **9**

MOS Transistor Theory: NMOS enhancement transistor – PMOS enhancement transistor – Threshold voltage – Body effect. MOS transistor switches. Basic D.C. equations – Second order effects: Threshold voltage – Body effect – Sub threshold region – Channel length modulation – Mobility variation – Fowler-Nordheim tunneling – Drain punch through – Hot electron effect. MOS models – Small signal A.C characteristics.

UNIT – II **9**

CMOS Logic and Circuit Design: CMOS Logic: Inverter – Combinational logic – NAND gate – NOR gate – Compound gates – Multiplexers – Memory – Latches and registers. Complementary CMOS inverter - DC characteristics – βn/βp ratio, Noise margin. Switching characteristics: Fall time – Rise time – Delay time. Power dissipation for CMOS logic: Static dissipation – Dynamic dissipation – Short circuit dissipation. Layout design rules and Stick diagram for inverter, NAND and NOR.

UNIT – III **9**

CMOS Fabrication Technology: Silicon semiconductor technology: Wafer processing – Oxidation – Epitaxy, Deposition, Ion implantation and Diffusion. Basic CMOS technology: N-Well CMOS process – P-Well process – Twin tub process – Silicon on Insulator. Latchup: Physical origin of latchup – Latchup triggering – Latchup prevention – Internal latchup prevention techniques – I/O latchup prevention.

UNIT – IV **9**

CMOS Chip Design Options: Types of ASICs: Full custom ASICs – Standard cell based ASICs – Gate array based ASICs: Channeled Gate Array – Channelless Gate Array – Structured Gate Arrays – Programmable Logic Devices. FPGA: Programmable Logic – Programmable Logic structures – Programmable Interconnect – Xilinx Programmable Gate Arrays – Design flow.

UNIT – V **9**

Verilog HDL: Typical design flow, Basic concepts: Lexical conventions – Data types, Modules and Ports, Gate level modeling, Dataflow modeling: Continuous assignment, Behavioral modeling: Structured procedure – Procedural assignments. Switch level modeling: MOS switches – CMOS switches – Bidirectional switches. Implementation of logic using Verilog HDL: Multiplexer, Comparator, D-Flip-Flop, Half Adder, Full Adder, Ripple Carry Adder, Arithmetic Logic Unit, Multiply and Accumulator Unit.

TOTAL: 45

TEXT BOOKS:

1. Neil H.E.Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design - A systems Perspective", 2nd Edition, Pearson Education, New Delhi, 2002.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 3rd Edition, Pearson Education, New Delhi, 2006.

REFERENCE BOOKS:

1. Debaprasad Das, "VLSI Design", 1st Edition, Oxford University Press, 2011.
2. Smith M.J.S., "Application Specific Integrated Circuits", 1st Edition, Pearson Education, New Delhi, 2009.
3. Bhaskar J., "Verilog HDL Primer", 3rd Edition, BS Publications, Hyderabad, 2004.
4. http://nptel.ac.in/courses/117106092/
5. http://www.nptelvideos.in/2012/12/vlsi-design.html
6. http://freevideolectures.com/Course/2328/VLSI-Technology/3

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: know the basic characteristics and the second order effects in designing MOSFET
CO2: understand the basic CMOS technology
CO3: carry out MOSFET level design in digital CMOS circuits
CO4: gain knowledge on different types of ASICs and FPGA structure
CO5: apply the programming skills to create digital structures

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL61 PROCESS CONTROL LABORATORY

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES:

1. Mathematical modelling of interacting second order system
2. PID controller tuning for temperature process
3. Closed loop response of flow process with servo and regulatory control
4. Closed loop response for pressure process with servo and regulatory control
5. Closed loop response for temperature process with servo and regulatory control
6. Characteristics of pneumatic control valve
7. Analysis of feedback and feedback + feed forward control schemes in level control process
8. Response of ratio control system and cascade control system
9. Mathematical modelling of single conical tank system
10. Control of multivariable process

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Krishnaswamy. K, "Process Control", 2nd Edition, New Age International (P) Ltd. Publishers, New Delhi, 2013.
2. Lab Manual

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: model interacting second order system and single conical tank system
CO2: design, execute and analyze the performance of controllers with servo and regulatory control
CO3: demonstrate the ratio, cascade, feedback and feedback + feed forward control schemes in process applications
CO4: disseminate the characteristics of control valves

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL62 APPLIED DIGITAL SIGNAL PROCESSING LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. a) Generation and characteristic analysis of Continuous and Discrete Time Signals
   b) Verification of sampling theorem
2. Shifting, Scaling and Folding of signals
3. Response of various systems
4. Spectral analysis of simulated and real time signals using Fourier transform
5. Biomedical signal acquisition and analysis
6. Design and analysis of FIR lowpass filters using various windows and realization of its structures
7. Design and analysis of IIR lowpass filters using BLT and IIT techniques and realization of its structures
8. Harmonic analysis
9. Total Variation Analysis on signals
10. Signal generation and Convolution using DSP Processor

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Scilab, MATLAB 7.1 and LabVIEW 8.6
2. TMS320C54X Simulator

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: develop programs using Scilab, MATLAB and LabVIEW for processing the signals
CO2: design and implement filters
CO3: analyze the signal using frequency transform
CO4: demonstrate their abilities towards DSP processor based implementation of DSP systems
CO5: generate signals using TMS320C54X processor

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL63 VLSI AND EMBEDDED SYSTEMS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

Experiments using 8085 Microprocessor

1. Arithmetic operations
2. Code conversion
3. A/D and D/A conversions
4. Arithmetic series and Geometrical series

Experiments using 8051 Microcontroller

5. Sorting of number series
6. Interfacing temperature sensor and seven segment display
7. Stepper motor control
8. Hex code conversion using Keil compiler and burning into the microcontroller

Simulation and implementation using Verilog HDL

9. Design and simulation of Multiplexer, ALU, Up-down counter, MAC
10. Design and implementation in FPGA: ALU, Up-down counter

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Xilinx ISE, QUARTUS II
2. Keil C Software

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: perform simple basic programs using microprocessor and microcontroller
CO2: develop Verilog HDL programming for digital structures
CO3: implement programming skills in interfacing and develop real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GET71 TOTAL QUALITY MANAGEMENT

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the meaning of quality and its importance
CO2: know the principles of total quality management and peculiarities of their implementation
CO3: develop in-depth knowledge on various tools and techniques of quality management
CO4: learn the applications of quality tools and techniques in both manufacturing and service industry
CO5: develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT71 PLC, SCADA and DCS

(Common to EIE & EEE branches)

3 0 0 3

Pre-requisites: Control Systems, Digital Logic Circuits

UNIT – I **9**

Programmable Logic Controllers (PLCs): An overview and PLC hardware components**:** Programmable Logic Controllers - Parts of a PLC - Principles of operation - PLCs versus Computers - PLC size and application – The I/O section – Discrete I/O modules – Analog I/O modules – Special I/O modules – The CPU – Memory design – Memory types – Programming devices – Recording and retrieving data – PLC workstations.

UNIT – II **9**

PLC Programming: Basics of PLC programming: Processor memory organization – Program scan – PLC programming languages – Relay type instructions – Instruction addressing – Internal relay instructions – Programming EXAMINE IF CLOSED and EXAMINE IF OPEN instructions – Entering the ladder diagram – Modes of operation. Programming timers: Mechanical timing relay – Timer instructions – On delay timer instruction – Off delay timer instruction – Retentive timers - Cascading timers. Programming counters: Counter instructions – Up counter – Down counter – Cascading counters – Combining counter and timer functions.

UNIT – III **9**

Advanced PLC Programming and Applications: Program control instructions: Master control reset instruction – Jump instruction and subroutines. Data manipulation instructions: Data manipulation – Data compare instructions. Math instructions. Sequencer and shift register instructions. Process control and Data Acquisition systems: Closed loop container filling process - ON/OFF liquid heating system- PLC control of a PID loop. **SCADA:** Introduction to SCADA – A brief history of SCADA –Real-time systems – Remote control – Communications – Applications: Real time Revisited – Scanning and communications – Automatic control

UNIT – IV **9**

Distributed Control Systems: Evolution of Distributed Control Systems: Emergence of the Distributed Control System architecture. Local control unit architecture: Basic elements of a microprocessor based controller – Functional blocks: An introduction. Local control unit languages: Functional blocks. Local control unit process interfacing issues - Security design issues for the local control unit: Redundant controller designs.

UNIT – V **9**

DCS Operator Interfaces and Applications: Operator interfaces: Introduction – Low level operator interface – High level operator interface: Architectural alternatives, Hardware elements in the operator interface, Operator displays. Engineering interfaces: Engineering interface requirements. DCS applications: Cement plants – Pulp and Paper plants – Water and waste water treatment plants

TOTAL: 45

TEXT BOOKS:

1. Frank D. Petruzella, "Programmable Logic Controllers", 3rd Edition, TataMcGraw Hill, New Delhi, 2010.
2. Michael P.Lukas, "Distributed Control System", Van Nostrand Reinhold Co., Canada 1986.
3. Stuart A. Boyer, "SCADA: Supervisory Control and Data Acquisition", 4th Edition, ISA Press, USA, 2009.

REFERENCE BOOKS:

1. John W.Webb, Ronald A.Reis. "Programmable Logic Controllers: Principles and Applications", 5th Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.
2. Popovic D. and Bhatkar V.P., "Distributed Computer Control for Industrial Automation, Marcel Dekkar Inc., New York, 1990.
3. Hughes T., "Programmable Logic Controllers", ISA Press, USA, 1989.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: gain knowledge on the basics of automation system
CO2: analyze theory of operation of PLC and SCADA
CO3: develop programming with PLC, SCADA and DCS
CO4: impart the knowledge of centralized monitoring and distributed control
CO5: apply PLC, SCADA and DCS in industrial process control

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT72 INSTRUMENTATION SYSTEM DESIGN

3 1 0 4

Pre-requisites: Industrial Instrumentation

UNIT – I **9**

Design of Transmitters: Design of temperature transmitters: RTD –Thermocouple. Design of Orifice: Liquid - Steam – Gas. Design of Rotameter - Design of level transmitters.

UNIT – II **9**

Analog Signal Conditioning: General features - Electronic controllers: Error detectors - Single mode - Composite controller modes. Pneumatic controllers: General features - Mode implementation - Design considerations. Introduction to relays: Electromechanical - Solid state relays.

UNIT – III **9**

Final Control Elements: Final control operation: Signal conversions - Analog electrical signals - Digital electrical signals-Pneumatic signals. Power electronics: Switching device - Controlling device. Actuators: Electrical actuators - Pneumatic actuators - Hydraulic actuators. Control element: Mechanical – Electrical - Fluid valves.

UNIT – IV **9**

Computer Based Control: Introduction - Digital applications: Alarms - Two position control. Computer based controller: Hardware configurations - Software requirements. Computer applications: Data logging - Supervisory control.

UNIT – V **9**

P&I Diagrams and Instrument Installation: Flow sheet symbols and P&I diagrams: Instrument index - Loop identification number - Identification letter tables - Instrument line symbols - Field bus P&ID examples: Device net – Multipoint - Multifunction - Multivariable devices and tools. Instrument installation: Installation documentation - Safety in design: Pipe and tube materials -Electrical installation in potentially explosive locations - Process industries practices.

Lecture:45, Tutorial :15, TOTAL: 60

TEXT BOOKS:

1. Johnson, C.D., "Process Control Instrumentation Technology", 8th Edition, Prentice Hall of India, New Delhi, 2006.
2. Thomas Mcavinew, Raymond Mulley, "Control System Documentation: Applying Symbols and Identification", 2nd Edition, ISA: The Instrumentation, Systems and Automation Society, 2004.

REFERENCE BOOKS:

1. Anderson N.A., "Instrumentation for Process Measurements", 3rd Edition, Chilton Book Company, Pennsylvania,1980.
2. Doebelin E.O., "Measurement Systems: Application & Design", 5th Edition, TataMcGraw Hill, New Delhi, , 2007.
3. Sheingold D.H., "Transducer Interfacing Handbook: The guide to analog signal conditioning", 1st Edition, Analog devices Inc., 1980.
4. Liptak B.G., "Instrument Engineers' Handbook Process Control and Optimization", 4th Edition, CRC Press, 2006. nptel.ac.in/courses/112103174/24

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the instrumentation behind flow, level and temperature transmitters
CO2: interpret the design concept of pneumatic and analog controllers
CO3: select suitable final control elements and actuators for process control system
CO4: implement computer based digital control schemes
CO5: develop and design the process flow diagram, piping and instrumentation diagram for a typical industrial process control system

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL71 PLC, SCADA AND DCS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS/EXERCISES:

1. Simulation of logical programming, timer and counter functions of PLC
2. Alarm control and bottle filling system control with PLC
3. Material handling system control using forward and reverse action of motor with PLC
4. Two cylinder and three cylinder piston control with PLC
5. Development of HMI using SCADA and development of functional block diagram using DCS
6. Control of level in the cylindrical tank system using DCS
7. Control of pressure process using DCS
8. Control of flow process using DCS
9. Control of cascade control process using DCS
10. Control of level in the conical tank system with DCS

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: develop, complie and debug basic and advanced PLC programs
CO2: write, compile and debug programs to mimic control panels using SCADA and DCS
CO3: design, develop and execute PLC programs for various process applications
CO4: demonstrate automation of plant operations with DCS

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIL72 VIRTUAL INSTRUMENTATION LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Introduction to LabVIEW – Front panel, Block diagram, Control palette, Function palette and Tool palette.
2. Simple program using different data types: Numeric, Boolean and Strings.
3. Programming with Loops and Structures.
4. Programming with Shift registers, Feedback node, Timing, Local and Global variables.
5. Programming with Arrays and Clusters.
6. Measurement of temperature in real time using DAQ card.
7. Programming and applications of virtual function generator using NI-ELVIS.
8. ECG signal acquisition and analysis using NI-ELVIS.
9. Real time image acquisition using NI-EVS.
10. Development of Web Publishing tool to display a HTML page.

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
2. Lab Manual http://soaneemrana.org/onewebmedia/ELECTRONICS%20COMMUNICATION%20SYSTEM%20BY%20GEORGE%20KENNEDY.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: perform programming using LabVIEW.
CO2: implement the concepts of loops, structures, arrays, clusters in LabVIEW programming
CO3: acquire real time data using DAQ cards
CO4: implement the concept of web publishing tool and data acquisition system for real time applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GET81 PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

Moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – Models of Professional Roles – theories about right action – Self-interest – customs and religion- uses of ethical theories. Meaning of Engineering experimentation - engineers as responsible experimenters.

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT33 COMMUNICATION ENGINEERING

(Common to EEE, EIE, CSE & IT branches)

3 0 0 3

UNIT – I **9**

Amplitude Modulation: 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 transmitter - AM receivers – Superheterodyne receivers

UNIT – II **9**

Angle Modulation: Angle Modulation – FM and PM waveforms - Phase deviation and modulation index - Frequency deviation - Direct FM and PM demodulators - Frequency spectrum of angle modulated waves - Bandwidth requirement - Narrowband FM and Broadband FM - Average power - FM and PM modulators, Direct FM transmitter - Angle modulation vs. amplitude modulation - Double conversion FM receivers - PLL FM demodulator.

UNIT – III **9**

Digital Modulation: Sampling - Time Division Multiplexing - Digital T-carrier System – Pulse code modulation – Amplitude shift keying - Frequency and phase shift keying – Modulator and demodulator - bit error rate calculation

UNIT – IV **9**

Data Communication: Data communication codes: ASCII - BAR codes - Error Control - Error Detection - Redundancy checking - Error Correction - Hamming – Line coding : AMI – NRZ - RZ - Serial interfaces : RS232 - RS485 - Data communication circuits - Data communication modems - Public Switched Telephone Network(PSTN) – ISDN

UNIT – V **9**

Wireless Technologies: Cellular telephone systems – Cellular concepts – Second generation (2G) Third generation (3G) and (4G) cell phone systems – PANs and Bluetooth - Zigbee and Mesh wireless networks - Infrared wireless networks

TOTAL: 45

TEXT BOOKS:

1. Wayne Tomasi, "Electronic Communications Systems: Fundamentals Through Advanced", 5th Edition, Pearson Education, 2008.

REFERENCE BOOKS:

1. Michael Moher and Simon Haykin, "Communication System", 5th Edition, Wiley India Pvt. Ltd., 2011.
2. Frenzel and Louis E., "Principles of Electronic Communication Systems", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2008.
3. Anokh Singh, "Principles of Communication Engineering", S. Chand & Co., New Delhi, 2006.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: paraphrase amplitude and angle modulation techniques
CO2: learn the concepts of digital modulation techniques
CO3: summarize the concepts in data communication and network protocol
CO4: identify the cellular telephone systems and concepts
CO5: identify the next generation wireless technologies

Mapping of Cos with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE01 ANALYTICAL INSTRUMENTATION

3 0 0 3

UNIT – I **9**

Colorimetry and Spectrophotometry: Electromagnetic spectrum – Laws relating to absorption of radiation– Colorimeters: Single and double beam photometers – Spectrophotometers: Single- beam Null type and double-beam Ratio- recording types. IR spectrophotometer: Basic components – Types – FTIR spectrophotometers – Attenuated total reflectance spectrophotometers – Flame Photometers: Principle – Construction and types.

UNIT – II **9**

Chromatography: Basic definitions – Gas chromatography – Liquid chromatography and its types – High Pressure Liquid Chromatography (HPLC). **pH measurement:** Principle – Electrodes for pH measurement: Hydrogen electrodes – Glass electrodes – Reference electrodes – Combination electrode – Selective ion electrodes.

UNIT – III **9**

Industrial Gas Analyzers: Types of gas analyzers – Paramagnetic oxygen analyzer – Electrochemical methods – Infrared gas analyzers – Thermal conductivity analyzers – Analyzers based on gas density – Method based on ionization of gases.

UNIT – IV **9**

Radio Chemical Techniques: Fundamentals of radiochemical methods – Radiation detectors: Ionization chamber – Geiger-Muller counter – Proportional counter – Scintillation counter – Semiconductor detectors. **Magnetic Resonance Techniques:** Mass spectrometers: Different types– Applications. NMR Spectrometer: Basic principle – Types.

UNIT – V **9**

Industrial Process Analytical Techniques: Electrochemical Methods: Voltammetry – Potentiometry. Thermo analytical instruments: Thermo Gravimetric Analysis (TGA) – Differential Thermal Analysis (DTA) – Differential Scanning Calorimetry (DSC). Chemical analysis techniques: Segmented flow analysis, Flow injection analysis. Capillary electrophoresis.

TOTAL: 45

TEXT BOOKS:

1. Khandpur R.S., "Handbook of Analytical Instruments", 2nd Edition, Tata McGraw-Hill, New Delhi, 2010.
2. Willard H.H., Merritt L.L., Dean J.A., and Settle F.A., "Instrumental Methods of Analysis", 7th Edition, CBS Publishing & Distribution, New Delhi, 1988.

REFERENCE BOOKS:

1. Liptak B.G., "Instrumentation Engineers Handbook (Process Measurement and Analysis)", 4th Edition, CRC Press, Volume I, 2005.
2. Ewing G.W., "Instrumental Methods of Chemical Analysis", 6th Edition, McGraw-Hill, New York, 2007.
3. Douglas A.Skoog, F.James Holler, Stanley R.Crouh, "Principles of Instrumental Analysis", 6th Edition, Thomson Brooks/ Cole, 2007.
4. https://www.youtube.com/watch?v=Jc1uC6EbMCs
5. https://www.youtube.com/watch?v=FR9DFkenWUU
6. https://www.youtube.com/watch?v=r18Gi8lSkfM

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: gain knowledge on analytical instruments which utilize various regions of the electromagnetic spectrum as source
CO2: enhance knowledge in the nuclear & radio chemical techniques, chromatographic methods and pH measurement
CO3: acquire knowledge on various analysis methods of industrial gases and liquids
CO4: analyse various radio chemical techniques and spectrometry
CO5: impart awareness on analytical techniques for various industrial applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE02 ENVIRONMENTAL INSTRUMENTATION

3 0 0 3

UNIT – I **9**

Introduction to Environmental Pollution: Necessity of Instrumentation and Control for environment – Sensor requirement for environment – Environmental carcinogens – Control of pollution. Modern methods of pollution analysis: Methods of quantitative analysis – Gravimetric methods – Volumetric methods. Toxic pollutants and their analysis: Types of toxic pollutants – Common toxic manifestations – Biological sampling – Threshold Limiting Value (TLV) – Toxic metal pollutants and their characterization – Toxic minerals and dust – Toxic organic compounds.

UNIT – II **9**

Air Pollution Analysis: Effects of air pollutants on man and material – Greenhouse effect – Classification of air pollutants – Analysis of major air pollutants – Analysis of minor air pollutants– Monitoring of hydrocarbons and ozone – Trace metal pollutants – Suspended particular matter– Sources of sampling – Air sampling equipment – Sampling gaseous pollutants.

UNIT – III **9**

Water Pollution Analysis: Physical examination – Chemical characterization – Biological investigations – Stages involved in water treatment: Coagulation – Sedimentation – Filtration – Disinfection – Removal of iron and manganese in water – Corrosion and scale prevention – Taste and odour removal from water – Fluoridation of water. **Soil Pollution:** Agricultural pollution – Role of micronutrients in soil – Trace element analysis – Classification of pesticides.

UNIT – IV **9**

Analysis of Effluents: Analysis of industrial effluents: Quality of industrial effluents – Physical methods of characterization – Analysis of organic pollutants. Analysis of domestic effluents: Treatment and analysis. **Noise Pollution:** Sources – Types and measurement – Environment and noise measurements.

UNIT – V **9**

Environmental Instrumentation for Society-Case Studies: Rain water harvesting: Need – methods – components. Noise pollution and control: Noise management strategy – Application in EIA studies. E-waste management and control: Clarification of E-waste – Environmentally sound management for E-waste – E-waste treatment technologies – Integrated E-waste recycling and treatment. Waste water treatment: Waste minimization – Pre-treatment requirements – Treatability – Modes of disposal and cost analysis – Hazards and concerns in wastewater treatment facilities.

TOTAL: 45

TEXT BOOKS:

1. Khopkar S.M., "Environmental Pollution Analysis", 2nd Edition, New Age International Pvt. Ltd., Publishers, New Delhi, 2012.
2. Campbell M., "Sensor System for Environmental Monitoring", Blackie Academic and Professional, London, 1997.

REFERENCE BOOKS:

1. Khopkar S.M., "Basic Concepts of Analytical Chemistry", 2nd Edition, New Age International Pvt. Ltd., Publishers, New Delhi, 2004.
2. Peavey, Howard S., Rowe. Donald R and Tchobanoglous George, "Environmental Engineering", 1st Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2013.
3. "Pollution Control Acts, Rules and Notifications issued thereunder", 6th Edition, Manual of the PCL series of Central Pollution Control Board, 2010.
   http://nptel.ac.in/courses/Environmental Engineering

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the environmental pollution and the methods of analysis
CO2: analyze the technical facts for air pollution
CO3: analyze the technical facts for water pollution
CO4: do treatment of effluents and analysis of noise pollution
CO5: implement the analytical concepts to various case-studies

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET61 POWER ELECTRONICS

(Common to EEE & EIE branches)

3 0 0 3

Pre-requisites: Electron Devices and Circuits, Electrical Machines

UNIT – I **9**

Power Semi-Conductor Devices: History, Evolution and Symbols of Power Electronic devices - Construction, Principle of Operation**,** Static and Dynamic Characteristics of SCR, TRIAC, MOSFET, IGBT and GTO – Safe Operating Area, Two transistor analogy of thyristor- Thyristor Protection – Series and Parallel Connections of thyristors- Loss calculations and data sheet specification of MOSFET (Quantitative analysis only)

UNIT – II **9**

Phase Controlled 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 – Gating Circuits for Single Phase Converters

UNIT – III **9**

DC to DC Converters: DC Choppers using devices other than Thyristors – Chopper Control Strategy – Time Ratio Control – Current Limit Control – Principle of Step Up and Step Down Operation – Single Quadrant DC Chopper, Two Quadrant and Four Quadrant DC Choppers – Voltage and Current Commutated Choppers – Introduction To Buck, Boost, Cuk, Buck–Boost Regulators

UNIT – IV **9**

Inverters: Inverters – Types – Single Phase Bridge Inverters – Three Phase Bridge Inverters – 180^o and 120^o Mode – PWM Inverters – Sinusoidal PWM, Multiple PWM and Space Vector PWM– Voltage Control of Single Phase Inverters – Harmonic Reduction – Single Phase Current Source Inverters – Basic Series Inverter

UNIT – V **9**

AC to AC Converters: Single Phase and Three Phase AC voltage Controllers – Control Strategy , Single Phase Transformer Tap Changers – Cycloconverter –Step up and Step down – Single Phase to Single Phase Cycloconverter – Three Phase to Single Phase Cycloconverter, Applications: UPS,

TOTAL: 45

TEXT BOOKS:

1. Rashid M.H., "Power Electronics: Circuits Devices and Applications", 3rd Edition, Pearson Education, New Delhi, 2014.
2. Bimbra P.S., "Power Electronics", 5th Edition, Khanna Publishers, 2012.

REFERENCE BOOKS:

1. Singh M.D. and Kanchandani, "Power Electronics", 2nd Edition, Tata McGraw-Hill, New Delhi, 2013.
2. Ned Mohan, Undeland and Robbins, " Power Electronics: Converters, Applications and Design", 3rd Edition, John Wiley and Sons, Wiley India Limited, 2007.
3. Joseph Vithayathil, "Power Electronics - Principles and Applications", 1st Edition, McGraw Hill Education (India) Pvt. Ltd., 2010.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: choose various power semiconductor devices based on their construction and characteristics
CO2: categorize and explain the working principle of rectifiers
CO3: determine the principle of operation of DC to DC converters
CO4: analyze the different types of inverters and their working principle
CO5: interpret the principle of operation of cycloconverter and ac voltage controllers

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE03 EMBEDDED CONTROL

(Common to EIE & EEE branches)

3 0 0 3

Pre-requisites: Microprocessors and Microcontrollers

UNIT – I **9**

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.

UNIT – II **9**

PIC 18 Timer Programming and Memory Interfacing: Interfacing and Assembly Language Programming of I/O Ports – Timers – Counters – Capture/Compare Mode – PWM – External Hardware Interrupts – Interfacing Memory.

UNIT – III **9**

Interfacing Peripherals with PIC 18 Microcontroller: Interfacing and Assembly Language Programming of ADC – DAC – Temperature Sensor – LCD – Keyboard – Motor Control: DC motor and Stepper motor.

UNIT – IV **9**

Introduction to Embedded Systems: Definition – Classification of Embedded Systems – Characteristics – Quality Attributes – Fundamental issues in Hardware Software Co-Design – Embedded Product Development. Life Cycle: Objectives – Different Phases – Approaches. Trends in the Embedded Industry: Processor Trends – Embedded OS Trends – Open Standards, Frameworks and Alliances – Bottlenecks.

UNIT – V **9**

RTOS Concepts and Case Study: Basics of OS – Types of OS – Tasks – Process – Task scheduling – Task communication – Priority Inversion Problem – Micro C / OS-II. Case Study: Automatic Chocolate Vending Machine – Smart Card Reader – Automated Meter Reading System.

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", 1st Edition, Pearson Education Asia, 2009.
2. Shibu.K.V, "Introduction to Embedded Systems", 4th Reprint, Tata McGraw Hill Education Pvt. Ltd., 2011.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014.

REFERENCE BOOKS:

1. Valvano Jonathan W., "Embedded Microcomputer Systems - Real Time Interfacing", 3rd Edition, Cengage Learning, 2011.
2. Labrosse, Jean J., "Micro C / OS –II : The real-time Kernel", Illustrated and Revised Edition, Taylor & Francis, 2002.
3. Microchip: PIC Microcontroller Data manuals.

nptel.ac.in/courses/.../IIT%20Kharagpur/Embedded%20systems/Pdf/Lesson-2.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the basic concepts of PIC Microcontroller
CO2: gain knowledge in the interfacing concepts of PIC Microcontroller
CO3: apply the programming skills to interface peripherals with PIC Microcontroller
CO4: acquire adequate knowledge in objectives, attributes and trends of embedded systems
CO5: perform case studies using RTOS

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE04 SOFT COMPUTING TECHNIQUES

(Common to EIE, ECE & CSE branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

Learning Networks: Adaptive linear neuron - Radial Basis Function Network (RBFN), Associative memory networks: Discrete Hop field network. Fixed weight competitive nets, Kohonen Self Organising Feature Maps (KSOM).

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL: 45

TEXT BOOKS:

1. S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", 2nd Edition, Wiley, 2014.
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications", PHI, 2003.
3. J.S.R.Jang, C.T.Sun, E.Mizutani, "Neuro – Fuzzy and Soft Computing", PHI Learning Pvt. Ltd., 2012.
   https://www.youtube.com/watch?v=kHyNqSnzP8Y
   http://nptel.ac.in/courses/112106064/38

REFERENCE BOOKS:

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Wiley, 2010.
2. Samir Roy, Udit Chakraborty, "Introduction to Soft Computing – Neuro Fuzzy and Genetic Algorithms", Pearson, 2013.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the concepts of neural network
CO2: develop a rule based fuzzy systems
CO3: apply neural network and fuzzy logic control to real time systems
CO4: effectively incorporate genetic algorithm in problem solving
CO5: develop a hybrid neuro – fuzzy model

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MTT71 MICRO ELECTRO MECHANICAL SYSTEMS

(Common to Mechatronics & EIE branches)

3 0 0 3

Pre-requisites: Applied physics, Engineering Mechanics, Sensors and Transducers

UNIT – I **9**

Microsystems: 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.

UNIT – II **9**

Microsensors and Actuators: Micro sensors - Micro actuation techniques - Micropump – Micromotors – Microvalves – Microgrippers - Micro accelerometers.

UNIT – III **9**

Micro System Fabrication: Substrates - Single crystal silicon wafer formation - MEMS materials - Photolithography - Ion implantation - Diffusion - Oxidation - CVD - Physical Vapor Deposition - Deposition by epitaxy – Etching process.

UNIT – IV **9**

Micro System Manufacturing and Design: Bulk Micromanufacturing - Surface Micromachining – LIGA – SLIGA. Micro system packaging – Materials - Die level - Device level - System level - Packaging techniques - Surface bonding - Wire bonding – Sealing - Design considerations.

UNIT – V **9**

Micro System Applications: 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. Mohamed Gad-el-Hak, "The MEMS Hand Book", CRC Press, Florida, 2005.
2. Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture", 2nd Edition, John Wiley and Sons, New York, 2008.

REFERENCE BOOKS:

1. Fatikow S. and Rembold U., "Microsystem Technology and Microrobotics", Springer-Verlag, Berlin Heidelberg, 2014.
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", 2nd Edition, CRC press, New York, 2011.
4. Trimmer W., "Micromechanics and MEMS: Classic and Seminar papers to 1990", IEEE Press, 1997.
5. Tay Francis E.H. and Choong W.O, "Microfludics and BioMEMS Applications", Springer- Science+Business Media B.V., 2013.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: assess the scaling laws in microsystems
CO2: select suitable micro sensors and actuators
CO3: fabricate microsystems for specific applications
CO4: design and develop microsystem manufacturing process and packaging
CO5: develop a design procedure for microproducts

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EET71 ELECTRIC DRIVES AND CONTROL

(Common to EEE & EIE branches)

3 0 0 3

Pre-requisites: Electrical Machines, Power Electronics

UNIT – I **9**

DC Drives: Fundamentals of Electrical Drives-Block Diagram, Elements– Classes of Motors Duty - Speed Control Of DC Motors – Ward–Leonard Scheme – Drawbacks – Thyristorized Converter Fed Dc Drives: - Single, Two And Four Quadrant Operations – Chopper Fed DC Drives: Single, Two and Four Quadrant Operations – Effect Of Ripples- Closed Loop Control Of DC Drive

UNIT – II **9**

Induction Motor Drives: Speed Control Of three Phase Induction Motors – 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 – Effect Of Harmonics- Closed Loop Control Of Induction Motor Drive .

UNIT – III **9**

Synchronous Machine Drives: Speed control of three phase Synchronous Motors – True synchronous and self controlled modes of operations – Voltage source Inverter fed Synchronous Motor drive - Current source Inverter fed Synchronous Motor – cycloconverter fed Synchronous Motor –Closed loop control of synchronous motor drive- Effect of harmonics.

UNIT – IV **9**

PMSM Drives and Variable Reluctance Motor Drive: Characteristics of permanent magnet synchronous machines - Drive characteristics and control principles- Variable Reluctance motor drives- Torque production -Drive characteristics and control principles -Microprocessor based control of PMSM & variable reluctance motor.

UNIT – V **9**

Vector Control: Basic Principle of Vector Control–Direct and Quadrature-Axis Transformation-Indirect Vector control and Direct Vector Control of Induction motor- vector control of PMSM -Advantages and limitations- PLC based control schemes, Selection of drives for Steel rolling mills, Paper mills.

TOTAL: 45

TEXT BOOKS:

1. Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2013.
2. Bose B.K., "Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS:

1. Vedam Subramanian, "Electric Drives: Concepts and Applications", Tata McGraw-Hill, New Delhi, 2007.
2. Bose B.K., "Power Electronics and Variable Frequency Drives: Technology and Applications", Wiley India Pvt. Ltd., 2010.
3. Sen P.K., "Electrical Drives",Prentice Hall of India Pvt. Ltd., New Delhi, 2006.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: evaluate the performance of D.C. drives
CO2: understand the operation and control of AC drives
CO3: choose the various control techniques employed for synchronous motor drives
CO4: identify modern control technique for industrial drives
CO5: analyze the equations governing the vector control

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE05 POWER PLANT INSTRUMENTATION

3 0 0 3

Pre-requisites: Industrial Instrumentation, Process Control

UNIT – I **9**

Overview of Power Generation: Brief survey of Hydro, Thermal, Nuclear, Gas and non-conventional methods of power generation – Thermal power plant: Functional block diagram. Importance of instrumentation in power generation – Piping and instrumentation diagram – Control rooms: Thermal and Electrical.

UNIT – II **9**

Instrumentation and Control in Water Circuit: Raw water – Boiler feed water – Makeup water – Steam – Condensed water – Circulation systems – Drum level measurement and control: Single, double and three element controls – Super heater temperature controls – Analysis of impurities in steam and water – Dissolved oxygen analyzer.

UNIT – III **9**

Instrumentation and Control in Air-Fuel Circuit: Combustion control – Air/Fuel ratio control – Atomization control – Furnace draft control – Primary air and secondary air controls –Pollution monitoring - Calculation of efficiency of boilers – Input / Output method - Heat loss method – Master control and distribution of loads to different boilers.

UNIT – IV **9**

Turbine–Monitoring and Control: Inlet steam pressure and flow – Measurement and control. Speed, vibration, shell temperature and expansion monitoring and control – Bearing temperature and alarms – Lubricant oil temperature – Alternator cooling system. Distributed control systems and interlocks applicable to thermal power plant – Supervisory Control and Data Acquisition – Maintenance and calibration of instruments.

UNIT – V **9**

Nuclear Power Plant Instrumentation: Instrumentation and control – Important components – Sensors and measurement system – Reactor control – Digital architectures in nuclear power plants – Radiation protection and monitoring – Nuclear safety.

TOTAL: 45

TEXT BOOKS:

1. Krishnaswamy K. and Ponni Bala M., "Power Plant Instrumentation", 2nd Edition, Prentice Hall Pvt. Ltd., 2013.
2. Dukelow, Sam G., "The Control of Boilers", Instrument Society of America, 1991.

REFERENCE BOOKS:

1. Liptak B.G., "Instrumentation in process industries", Butterworth and Heinmann, Oxford, 1995.
2. Elonka, S.M. and Kohal, A.L., "Standard Boiler Operations", Tata Mc Graw Hill, New Delhi 1994.
3. Morse, Frederic T., "Power Plant Engineering", East West Press, New Delhi.
   www.ignou.ac.in/upload/Unit-2-58.pdf
   onlinevideolecture.com/?course_id=518&lecture_no=11

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: gain knowledge about the basics of power plants and various methods of power generation.
CO2: acquire knowledge on measurements and control involved in water circuit and boiler.
CO3: apply knowledge on measurements and control involved in air-fuel circuit.
CO4: analyse the turbine control, DCS, SCADA and interlock circuits in power plant.
CO5: understand about safety and radiation measures in nuclear power plant.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3											1	3	
CO2			3			2	3					1	3	
CO3			3			2	3					1	3	
CO4			3			2	3					1	3	
CO5			3			2	3					1	3	

1 – Slight, 2 – Moderate, 3 – Substantial

14MAE02 PROBABILITY AND STATISTICS

3 1 0 4

UNIT – I **9**

Probability and Random Variables: Axioms of Probability- Conditional probability – Total probability – Baye's theorem - Random variable – Discrete and Continuous random variables – Probability mass function, probability density function and cumulative distribution functions – Mathematical expectation and variance – Moments – Moment generating functions.

UNIT – II **9**

Standard Distributions: Discrete Probability distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous distributions: Uniform distribution – Exponential distribution and Normal distribution.

UNIT – III **9**

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

UNIT – IV **9**

Testing of Hypothesis: Sampling Distributions – Large Sample Tests – Z-test for single mean and difference of means, single proportion and difference of proportions – Small Sample Tests – Student's t-test for significance of means – F-test for comparison of variances – Chi-square test for goodness of fit and independence of attributes.

UNIT – V **9**

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

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Veerarajan T., "Probability, Statistics and Random Processes", Reprint Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.
2. Miller and Freund's, "Probability and Statistics for Engineers", 8th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.

REFERENCE BOOKS:

1. Trivedi K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
2. Devore J.L., "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, New Delhi, 2012.
3. Walpole R.E., Myers R.H., Myers S.L. and Ye K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
4. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", 9th Edition, Sultan Chand & Sons, New Delhi, 2011.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: classify random variables and apply suitably in practical problems
CO2: understand different types of distributions and their uses
CO3: apply effectively the concepts of two dimensional random variables
CO4: identify large and small samples and apply suitable tests for getting required results
CO5: know the concepts of analysis of variance and its applications in engineering

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MTE06 ADVANCED SENSORS AND NETWORKING

(Common to Mechatronics and EIE branches)

3 0 0 3

Pre-requisites: Sensors and Transducers

UNIT – I **9**

Introduction to Sensors: Introduction –Sensor Classification – Sensor Characteristics and Terminology – Physical Effects Employed for Signal Transduction – Mathematical Model of Transducer – Zero, I and II order transducers – Choice of Sensor – New Sensor Materials and Technologies – Standards, Temperature Scales and Units and relations of physical quantities.

UNIT – II **9**

Chemical Sensors: Molecular Recognition – Signal Transduction – Electrochemical Sensors: Amperometric and Voltammetric Sensors – Potentiometric Sensors – Evanescent wave Sensors – Multisensory Arrays – Biosensors – Humidity Sensors.

UNIT – III **9**

Optic Sensors: Fundamentals of light – Electromagnetic Optics Spectrum – Propagation of light Lambert – Beer Law – Interactions of Light: Absorption, Scattering, Dispersion, Polarization, Diffraction and Interference – Optical Sources – Optical Detectors – Optical Components – Fiber Optic Sensors: Intensity Modulated Sensors – Diffraction Grating Sensors – Interferometric Sensors.

UNIT – IV **9**

Fundamentals of Wireless Communication: Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel - wireless sensor networks (WSNs): concepts and architectures. Design Challenges in Sensor Networks.

UNIT – V **9**

Wireless Sensor Networks (WSNs): Single node architecture: hardware and software components of a sensor node - WSN Network architecture: - data relaying and aggregation strategies - Issues in WSN routing–OLSR–Localization– Indoor and Sensor Network Localization-absolute and relative localization. QOS in WSN – Energy Efficient Design.

TOTAL: 45

TEXT BOOKS :

1. John Vetelino and Aravind Reghu, "Introduction to Sensors", CRC Press, 2010.
2. Francis To So Yu and Shizhuo Yin, "Fiber Optic Sensors", CRC Press, 2008.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005.

REFERENCE BOOKS:

1. Jacob Fraden, "Handbook of Modern Sensors", Springer, 2010
2. Jirı Janata, "Principles of Chemical Sensors", Springer, 2009.
3. Pavel Ripka and Alois Tipek, "Modern Sensors Handbook", ISTE Ltd, 2007
4. Jon S. Wilson, "Sensor Technology Handbook", Newnes, 2005.
5. Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret the basic concepts of sensors and its characteristics
CO2: demonstrate the advanced concepts of chemical sensors
CO3: analyze the characteristics of optic sensor measurement system
CO4: explain the concepts, network architectures and applications of wireless sensor networks
CO5: analyze the protocol design issues of wireless sensor networks

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MTE07 AUTOMOTIVE ELECTRONICS

(Common to Mechatronics, ECE and EIE branches)

3 0 0 3

Pre-requisites: Sensors and Transducers

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL: 45

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Hollembeak, Barry, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, New York, 2002.
2. Tim, Gilles, "Automotive Engines: Diagnosis, Repair, Rebuilding", 7th Edition, Delmar Publishers, New York, 2015.
3. Donald Christiansen and Charles K. Alexander, "Standard Handbook Of Electronic Engineering", 5th Edition, McGraw-Hill, 2005.
4. Robert Bosch GmbH, "Automotive Hand Book", 9th Edition, Wiley, 2014.

COURSE OUTCOMES:

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14MTE12 NANOTECHNOLOGY

(Common to Mechatronics and EIE branches)

3 0 0 3

Pre-requisites: Applied Physics, Applied Chemistry, Material Science

UNIT – I **9**

Nanomaterials: Introduction to nanomaterials - Scientific revolutions of nanotechnology - Evolution of band structure and Fermi surface - Bonding in solids: Ionic bonding, Covalent bond, Metallic bond, Intermolecular bonds, Dispersion bonds, Dipole bonds, Hydrogen bonds.

UNIT – II **9**

Nanostructures: Classification of nanostructures - zero, one, two and three dimensional nanostructures. Size effects in nanostructures. Chemistry of nanoshapes - Surface to volume ratio. Smart materials - Shape Memory Alloys: shape memory effects.

UNIT – III **9**

Synthesis of Nanomaterials: Methods of nanomaterial preparation - Top down and bottom up approach: mechanical grinding, wet chemical synthesis, gas phase synthesis, Chemical vapour deposition. Film Deposition Method - Lithography - Material removing techniques: Etching, Chemical and Mechanical Polishing.

UNIT – IV **9**

Properties of Nanoparticles: Surface properties of nanoparticles - Mechanical, electronic, optical, magnetic, thermal and chemical properties. Size dependent properties.

UNIT – V **9**

Fields of Nanotechnology: Quantum dots - properties and applications. Carbon nanotubes - physical properties and applications. Magnetic materials: Dia and Paramagnetic materials - Quantum theory of paramagnetic materials – Nanodevices: Electronic, magnetic, photonic, mechanical, fluidic, and biomedical Nanodevices.

TOTAL: 45

TEXT BOOKS:

1. Charles P. Poole and Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2007.
2. Mark A. Ratner and Daniel Ratner, "Nanotechnology: A gentle introduction to the next Big Idea", Prentice Hall, P7R, 1st Edition, 2003.
3. T. Pradeep, "Nano the Essential Nanoscience and Nanotechnology", Tata McGraw hill, 2008.

REFERENCE BOOKS:

1. Mick Wilson, Kamali Kannargare and Geoff Smith, "Nano technology: Basic Science and Emerging Technologies", Overseas Press, 2005.
2. Dutta J. and Hoffmann H., "Nanomaterials", Top Nano, 2004.
3. Rajendran V., "Material Science", Tata McGraw Hill, New Delhi, 2011.

COURSE OUTCOMES:

On completion of the course students will be able to

CO1: infer the basic concepts of nanomaterials
CO2: classify the different nanostructures
CO3: investigate the different methods in synthesis of nanomaterials
CO4: determine the properties of different nanomaterials
CO5: recommend the nanostructured materials for real time engineering applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE22 EMBEDDED INTERNET OF THINGS

(Common to ECE & EIE branches)

3 0 0 3

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL: 45

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Donald Norris, "Raspberry Pi Projects for the Evil Genius", McGraw Hill Professional, 2014.
2. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", 1st Edition, John Wiley and Sons, 2014.
3. Cuno Pfister, "Getting started with the Internet of Things", 1st Edition, O'Reilly Media Inc., 2011.

COURSE OUTCOMES:

On completion of the course the students will be able to

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE19 ENERGY CONSERVATION AND MANAGEMENT

(Common to EEE & EIE branches)

3 0 0 3

UNIT – I **9**

Introduction: Classification of Energy - Energy Scenario - Energy Needs of Growing Economy - Energy Pricing in India – Energy and Environment - Energy Conservation Act . Energy Audit: Types and Methodology - Energy Audit Instruments - Role of energy managers and auditors - Introduction to Fuels - Properties of fuels - Proximate and Ultimate Analysis

UNIT – II **9**

Thermal Utilities: Steam – Introduction, Properties of steam, Steam distribution systems - Boilers- Types and Classification- Performance Evaluation of Boilers – Boiler Efficiency- Direct and Indirect methods – Energy Conservation opportunities in boilers- Principle of cogeneration – Technical options for cogeneration- Waste heat recovery - Classification and benefits

UNIT – III **9**

Electrical and Lighting System: Introduction to Electric Power Supply Systems - Electricity Billing – Electrical Load Management and Maximum Demand Control- Power factor improvement and its benefit - Factors involved in determination of motor efficiency- Energy efficient motors- Basic Parameters and Terms in Lighting systems, Luminous performance Characteristics of commonly used luminaries and Energy saving opportunities in lighting systems

UNIT – IV **9**

Fans, Blowers and Pumps: Fan Types - Blower Types- Fan Performance evaluation- Fan Laws- Flow control strategies- Pumps- Types – Factors affecting pump performance- System characteristics- Efficient Pumping system operation- Flow Control Strategies- Energy conservation opportunities in pumping systems

UNIT – V **9**

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracting and role of ESCOs.

TOTAL: 45

TEXT BOOKS:

1. Bureau of Energy Efficiency Exam Materials Volume I and II, III and IV.
2. Umesh Rathore, "Energy Management", 2nd Edition, S.K. Kataria and Sons, 2014.

REFERENCE BOOKS:

1. Hamies, "Energy Auditing and Conservation; Methods, Measurements, Management & Case Study", Hemisphere, Washington, 1980.
2. Smith C.B., "Energy Management Principles", Pergamon Press, New York, 1981.
3. Write Larry C., "Industrial Energy Management and Utilization", Hemisphere Publishers, Washington, 1998.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: interpret the importance of energy, energy conservation and energy audit
CO2: appraise the energy saving opportunities in thermal systems
CO3: predict the energy saving opportunities in motors and lighting systems
CO4: appraise the energy saving opportunities in fan , blowers and pumps
CO5: analyze the different financial management techniques

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14GEE81 ENTREPRENEURSHIP DEVELOPMENT

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

3 0 0 3

Unit-I **9**

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

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

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

UNIT – V **9**

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

TOTAL : 45

TEXT BOOK:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the concepts of entrepreneurship and its importance

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

CO3: understand the components of a business plan

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

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

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE06 INSTRUMENTATION AND CONTROL IN PETROCHEMICAL INDUSTRIES

3 0 0 3

Pre-requisites: Industrial Instrumentation and Process Control

UNIT – I **9**

Petroleum Processing and Operations: Petroleum Exploration – Drilling – Recovery techniques – Well completion methods – Crude oil composition – Refining of crude oil – Feed stocks – Thermal cracking – Catalytic reforming – Catalytic cracking – Polymerization – Alkylation – Isomerisation.

UNIT – II **9**

Reactors and Evaporators: Reactors – Basic operation and fundamentals. Temperature control – Once through – Recirculated cooling – Cascade control – Split range controls with multiple coolants – Pressure control – Evaporators – Terminology – Types – Product concentration control – Feedback control – Cascade control – Selective control – Feed forward control.

UNIT – III **9**

Heat Exchangers and Dryers: Degrees of freedom – Liquid to Liquid heat exchangers – Three-way valve control – Steam Heaters – Different controls – Drying Curves – Different Dryers – Control of dryers – Batch: Atmospheric, vacuum and fluid bed dryers – Continuous: Double drum, Rotary, turbo, spray and fluid bed dryers.

UNIT – IV **9**

Distillation Columns: Distillation equipment – Column variables – Control configurations – Product Quality Control: Inferring composition from Temperature – Analyser controls – Pressure control – Feed control: Temperature and Flow.

UNIT – V **9**

Pumps and water treatment: Different pumps: Centrifugal, Rotary and Reciprocating – Pump Controls: ON-OFF, Throttling. Variable speed and stroke adjustment – Water treatment controls – Oxidation, Reduction, Neutralization, Precipitation and Biological.

TOTAL: 45

TEXT BOOKS:

1. Liptak B.G., "Instrumentation in Process Industries", Butterworth and Heinmann Ltd., Oxford,1995.
2. Krishnaswamy K., "Process Control", New Age International Publishers, New Delhi, 2006.

REFERENCE BOOKS:

1. Dr.Ram Prasad, "Petroleum Refining Technology", Khanna Pbulishers, New Delhi, 2007.
2. Austin G.T. Shreeves, "Chemical Process Industries", McGrawHill International School Edition, Singapore, 1985.
3. Considine D.M., "Handbook of Applied Instrumentation", McGrawHill, 1964.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the basics of Petroleum exploration, refining and basic operations in petroleum industry
CO2: erect, operate and maintain instrumentation and control system in chemical reactors and evaporators
CO3: erect, operate and maintain instrumentation and control system in heat exchangers and dryers
CO4: erect, operate and maintain instrumentation and control system in distillation columns
CO5: erect, operate and maintain instrumentation and control system in pumps and water treatment plants

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3											1	3	
CO2			3			2	3					1	3	
CO3			3			2	3					1	3	
CO4			3			2	3					1	3	
CO5			3			2	3					1	3	

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE07 OPTIMAL CONTROL

3 0 0 3

Pre-requisites: Engineering Mathematics –III and Control Systems

UNIT – I **9**

Introduction: Static optimization with and without constraints -Matrix properties and definitions – Quadratic forms and definiteness – State space form for continuous systems and discrete system. Calculus of variations**:** Functionals of a single function, necessary and sufficient conditions: Fixed initial and final boundary conditions

UNIT– II **9**

Optimal Control Formulation: The performance measure: Performance measures for optimal control problems, selecting a performance measure. Constraints – Variational approach to optimal control problems: Necessary conditions for optimal control

UNIT– III **9**

Linear Quadratic Optimal Control Systems: Problem formulation – Linear regulator problem **-**Infinite time linear quadratic regulator – Meaningful interpretation of Riccati coefficient – Analytical solution of algebraic Riccati equation – Equivalence of open loop and closed loop. Design of LQR: Inverted pendulum, DC motor speed control

UNIT - IV **9**

Dynamic Programming: The Optimal control law -Principle of optimality – Dynamic programming applied to routing problem – An optimal control system - Recurrence relation of dynamic programming – Computational procedure for solving control problems- Characteristics of dynamic programming solutions.

UNIT-V **9**

Pontryagin's Minimum Principle: Minimum time problems – Relation between dynamic programming and the minimum principle -Two point boundary value problems –Quasi linearization.

TOTAL: 45

TEXT BOOKS:

1. Kirk, Donald E., "Optimal Control Theory: An Introduction", Dover Publications, 2004.
2. Desineni Subburam Naidu, "Optimal Control Systems", CRC Press, 2003.
   https://onlinecourses.nptel.ac.in/noc17_ee11
   https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-323-principles-of-optimal-control-spring-2008/lecture-notes

REFERENCE BOOKS:

1. Gopal M., "Modern Control System Theory", Wiley Eastern Limited, 1993.
2. Anderson B.D.O. and Moore J.B., "Optimal Control: Linear Quadratic Methods", Prentice Hall, New Jersey, 1979.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the basic concepts of optimal control
CO2: formulate optimal control problems
CO3: design optimal controller using LQR concepts
CO4: determine optimal control solution for discrete systems using dynamic programming
CO5: design optimal controller with control constraints

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE08 INSTRUMENTATION IN PROCESS INDUSTRIES

3 0 0 3

Pre-requisites: Process Control

UNIT – I **9**

Basics of Process Measurements: Continuous vs. discrete measurement – Continuous vs. sampled measurement – In-line, On-line and Off-line – Measurement uncertainty – Measurement decision risk – Calibration – Measurement device components – Current loop – Power supply and Wiring –Serial communications – Smart transmitters – Environmental issues – Explosive atmospheres –Measurement device dynamics – Filtering and smoothing.

UNIT – II **9**

Instrumentation in Paper Industries: Process description in diagrammatic and functional block details – Digester blow tank controls – Digester liquor feed pump control – Brown stock washer level control – Stock chest level control – Dissolving tank density control – White liquor classifier density control – White liquor flow control – Condensate conductivity control – Dryer temperature control – Web moisture control.

UNIT – III **9**

Instrumentation in Steel Industries: Process description in diagrammatic and functional block details – Raw materials preparation – Operation of Blast Furnace (BF) and auxiliary units including stoves– Basic Oxygen Furnace (BOF) – Electric Furnace (EF) – Open Hearth Furnace (OHF) – Stove combustion control system – Gas and water control system in Basic oxygen furnace (BoF) – Mould level control system in strand casting operations.

UNIT – IV **9**

Instrumentation in Cement Industries: Process description in diagrammatic and functional block details – Conveyor belt instrumentation – Automatic bagging and bottling – Preheater – Kiln feed control – Kiln speed control – Kiln draught control – Combustion control – Cooler control.

UNIT – V **9**

Instrumentation in Pharmaceutical and Fermentation Industries: Description of the process – flow measurement – Level measurement – Pressure measurement – Temperature measurement – Smoke detector – Analyzers – Fermentation control system – Continuous fermentation – pH control – Temperature control – Distillation control systems – Centrifuge purging controls.

TOTAL: 45

TEXT BOOKS:

1. Liptak B.G., "Instrumentation in Process Industries", Chilton Book Company, 2003.
2. Andrews and William, "Applied Instrumentation in Process Industries", Gulf Publishing Company, Tokyo, 1979.

REFERENCE BOOKS:

1. Cecil Smith, "Basic Process Measurements", Wiley, 2009.
2. Considine D. M., "Hand book of Applied Instrumentation", Tata McGraw-Hill, New Delhi, 1993.
3. Douglas O.J.Desá, "Applied Technology and Instrumentation for Process control", 1st Edition, CRC Press., 2004.

http://w3.siemens.com/mcms/sensor-systems/en/process-instrumentation/pages/process-instrumentation.aspx

https://www.goodreads.com/book/show/4599131-instrumentation-in-the-processing-industries

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: acquire knowledge about the basics of process measurements

CO2: understand about instrumentation and control in paper industry

CO3: gain knowledge about instrumentation and control involved in iron and steel industry

CO4: acquire knowledge about instrumentation and control involved in cement kilns

CO5: understand instrumentation and controls involved in pharmaceutical and fermentation industries

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE09 SAFETY IN PROCESS INDUSTRIES

3 0 0 3

UNIT – I **9**

Safety: Background - Development of safety movement – Growth of safety movement – Safety movement nowadays – Safety responsibility and organization – Occupational health and safety programme – Safety principles – Safety policy - Safety inspection – Safety planning – Safety measures in manufacturing industry – Employee participation in safety – Safety and productivity – Relationship of safety with plant design, Equipment design and work environment – Safety economics – Safety legislation.

UNIT – II **9**

Industrial Hazards and Industrial Accidents: Industrial hazards: Introduction – Classification of hazards – Hazard management programme – Hazard control – Major industrial hazards – List of industries involving hazardous processes. Industrial Accidents: Introduction – Types of accidents – Nature/Effects of accidents – Causes – Cost calculation of accident – Accident prevention – Accident reporting – Accident investigation and analysis – Typical accidents in chemical and other industries – Machine guarding

UNIT – III **9**

Environmental Factors in Industry: Environment – Environmental control – Environmental factors in industry – Effect of environmental factors on human body and mind: Temperature – Illumination – Noise – Vibration – Housekeeping – Plant layout – Colour – Humidity and air conditioning.

UNIT – IV **9**

Personal Protective Equipment: Introduction – Legal requirements – Need for Personal Protective Equipment (PPE) – Assessing suitable PPE – Choice and use of Personal Protective Equipment – Types of Personal Protective Equipment – Non-Respiratory Protective Equipment: Head protection – Face and eye protection – Hand and arm protection – Foot and leg protection – Body protection – Hearing protection. Respiratory Protective Equipment: Respirator selection – Types of Respiratory Protective Equipment. Training in the use of PPE – Maintenance of PPE.

UNIT – V **9**

Safety Symbols and Handling Emergencies: Safety Signs and Color used in industry – Sign categories – Sign types – Safety colours – Training – Maintenance – Some commonly used safety signs. Handling Emergencies: Introduction – Work place emergency – Emergency planning – Need for emergency planning – Emergency planning concepts – Objectives of emergency planning – Emergency planning process – Development of emergency action plan – On-site and off-site emergency planning.

TOTAL: 45

TEXT BOOKS:

1. Amit Gupta, "Industrial Safety and Environment", Laxmi Publication (P) Ltd., New Delhi, 2006.
2. Bob Skelton, "Process Safety Analysis- An Introduction", Institution of Chemical Engineers, U.K., 1997.

REFERENCE BOOKS:

1. Rao, CS, "Environmental Pollution Engineering", Wiley Eastern Ltd., New Delhi, 1992.
2. Lees F.P., "Loss Prevention in Process Industries: Hazard identification, Assessment and Control", Vol. 1-3, Butterwort-Heinemann, Oxford, 1996.
3. Ralph King, "Safety in the Process Industries", Butterworth-Heinemann Ltd., London, 1990.

https://onlinecourses.nptel.ac.in/noc16_ee02/preview

https://www.industry.siemens.com.cn/industrysolutions/cn/zh/electrification/automation_it/safety-services/process/solution/Documents/Safety-process-industry-en.pdf.

https://library.e.abb.com/public/3aea41bdd7bee93dc1257288005051b2/85-87%20SRAS25_72dpi.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: gain knowledge on safety in process industries
CO2: know about industrial hazards and industrial accidents
CO3: analyse the environmental factors to be considered in process industries
CO4: understand the various personal protective equipment
CO5: know about safety symbols, emergency planning and handling procedures

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE10 DIAGNOSTIC AND THERAPEUTIC INSTRUMENTS

3 0 0 3

Pre-requisite: Biomedical Instrumentation

UNIT – I **9**

Respiratory Measurements Systems: Pulmonary function measurements - Basic spirometer- Ultrasonic spirometer - Fleisch Pneumotachometer - Pulmonary function analyzers - Respiratory gas analyzers - Whole body plethysmography - Intra-alveolar and thoracic pressure measurements - Apnea monitor. Types of ventilators – Ventilator terms - Pressure volume flow diagram – Microprocessor controlled ventilator.

UNIT – II **9**

Ultrasonic Imaging Systems: Diagnostic ultrasound - Physics of ultrasonic waves - Medical ultrasound - Basic pulse-echo apparatus - Imaging modes - Real-time ultrasonic imaging systems - Duplex scanner - Modern ultrasound imaging systems - Area array systems - Three-dimensional ultrasound imaging systems - Intravascular imaging - Tissue harmonic imaging - Portable ultrasound systems - Biological effects of ultrasound.

UNIT – III **9**

Arrhythmia and Ambulatory Monitoring Instruments: Cardiac Arrhythmias - Arrhythmia monitor - QRS detection techniques - Ambulatory monitoring instruments - Data recording – Data replay and analysis. Foetal monitoring instruments**:** Cardiotocograph - Abdominal foetal Electrocardiogram – Foetal Phonocardiogram.

UNIT – IV **9**

Blood Cell Counters: Types of blood cells – Cell counting: Microscopic method – Automatic optical method - Electrical conductivity method. Anaesthetic system: Need of anaesthesia – Anaesthesia machine. Audiometers: Mechanism of hearing -Measurement of sound – Bekesy audiometery.

UNIT – V **9**

Role of Lasers in Health Care: Types of lasers- Laser interaction with tissue and surgical procedure- Lasers for eye surgery- Laser Lithotripsy- Lasers in dentistry –Lasers in dermatology. Case study on applications of Laser in healthcare.

TOTAL: 45

TEXT BOOKS:

1. Khandpur R.S., "Handbook of Biomedical Instrumentation", 2nd Edition, Tata McGraw-Hill, New Delhi, 2012.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2003.

https://www.youtube.com/watch?v=PQVfG6fkhyU

www.biomed.mtu.edu/~osoykan/classes/be3600/note2003/note2003.htm

www.eeeuniversity.com/2013/08/ei2311-biomedical-instrumentation.html

REFERENCE BOOKS:

1. John G. Webster, "Medical Instrumentation Application and Design", 4th Edition, John Wiley and Sons, NewYork, 2015.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", 2nd Edition, Prentice Hall of India, New Delhi, 2007.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the various measurement techniques related to respiratory system
CO2: analyze the ultrasound imaging techniques and its usefulness in diagnosis
CO3: identify and analyse the various monitoring instruments
CO4: understand the mechanisms of special assist devices
CO5: apply the knowledge of lasers in health care

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO01 FIBER OPTICS AND LASER INSTRUMENTATION

3 0 0 3

UNIT – I **9**

Optical Fibers and their Properties: Principles of light propagation through a fiber – Different types of fibers and their properties – Fiber fabrication – Transmission characteristics of optical fiber: Absorption losses, scattering losses and dispersion – Optical sources: LED and LD – Optical detectors: PIN and APD.

UNIT – II **9**

Industrial Application of Optical Fibers: Fiber optic sensors – Fiber optic instrumentation system – Different types of modulators – Different types of interferometers – Interferometric method of measurement of length – Moiré fringes – Fiber optic gyroscope – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT – III **9**

Laser Fundamentals: Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Resonator configuration – Q-switching and mode locking – Types of lasers: Gas lasers, solid lasers, liquid lasers and semi conductor lasers. Laser safety: Biological effects – Safety standards – Risk of exposure – Laser hazard classification and assessment – Laser safety system.

UNIT – IV **9**

Industrial Application of Lasers: Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect – Material processing – Laser heating, welding, melting and trimming of materials – Removal and vaporization – Laser telemeters.

UNIT – V **9**

Hologram and Medical Applications of Laser: Holography – Basic principle –methods – Holographic interferometry and applications – Holography for non-destructive testing – Medical applications of lasers – Laser and tissue interaction – Laser instruments for surgery – Removal of tumors of vocal cords – Brain surgery – Plastic surgery – Gynecology and Oncology.

TOTAL: 45

TEXT BOOKS:

1. Arumugam M., " Optical Fibre Communication and Sensors", Anuradha Agencies, 2002.
2. Ghatak A.K. and Thiagarajar K., "Optical Electronics Foundation Book", Tata McGraw-Hill, New Delhi, 1991.

REFERENCE BOOKS:

1. John and Harry, "Industrial Lasers and their Applications", McGraw Hill, New York, 1974.
2. Senior J.M., "Optical Fiber Communication: Principles and Practice", Prentice Hall, New Jersey, 1985.
3. R.P. Khare, "Fiber Optics and Optoelectronics", Oxford University Press, 2008.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: acquire knowledge about the basics of optical fibers
CO2: interpret the fiber optic sensors for various industrial applications
CO3: understand the working of various types of laser sources and laser safety
CO4: gain knowledge about laser based instrumentation systems and their applications to various industries
CO5: understand the applications of lasers in medical field and holography

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO02 NON DESTRUCTIVE TESTING

3 0 0 3

UNIT – I **9**

Introduction: Fundamentals of NDT – Comparison with Destructive Testing – Visual inspection – Liquid penetrant testing: Methods, effect of surface tension, applications – Selection of penetrant method - Solvent removable, water washable, post emulsifiable – Control and measurement of penetrant process variables – Interpretation and evaluation of test results – Codes, standards and specifications

UNIT – II **9**

Electromagnetic Testing: Magnetic flux leakage testing principles, Inductive coils probe, Hall effect probe applications. Magnetic particle testing: Principles, types of magnetization, equipment used, demagnetization, applications – Eddy Current Testing: Principles, properties, sensing elements, probes arrangement, absolute and differential, pulsed eddy current technique – Applications: Inspection of tubes, pipes, cylinders, steel bars, welds, welded tubes and pipes – applicable codes and standards.

UNIT – III **9**

Radiography and Fluoroscopy: Gamma rays and X-Rays: Physics, properties, generation – Radiography: Principle, sensitivity, image quality indicators-Wire type and step hole type, Radiographic imaging, Inspection techniques – Single wall single image, Double and multiwall penetration, -Film Radiography: X-Ray film; Structure and types; Exposure time; Intensity of X-Rays; Film handling, storage and processing – Fluoroscopy: Real time Radioscopy, Image intensifier tubes, CCTV display – Radiation safety – Applications – Applicable codes, standards and specifications.

UNIT – IV **9**

Ultrasonic Testing: Physics, principles and properties of ultrasonic waves **–** Transmission of ultrasonic waves – Pulse – echo, through transmission and resonance techniques – Probes: Types, construction – Flaw detection – Thickness measurement – Automated ultrasonic testing and inspection – Calibration and comparison with reference blocks – Applications – Applicable codes, standards and specifications.

UNIT – V **9**

Other NDT techniques and Applications: Under water NDT – Optical inspection probes – Acoustic emission testing – Thermal imaging – Neutron radiography – Holography – Industrial Computed Tomography – Magnetic Resonance Imaging – Certification of personnel for inspection.

TOTAL: 45

TEXT BOOKS:

1. Baldev Raj, Jeyakumar T., Thavasimuthu M., "Practical Non-Destructive Testing", Narosa Publishing House, New Delhi, 2002.
2. Barry Hull, Vernon John, "Non-Destructive Testing" English Language Book Soceity / Macmillan [ELBS], 1988.

REFERENCE BOOKS:

1. B.E. Noltingk, "Instrumentation Reference Book", Butterworth International Editions.
2. A.S.M. Handbook, "Non-Destructive Evaluation and Quality Control" Volume-11, Volume-17, Volume-19 ASM International, Metals park, Ohio, USA.
3. Hanstock R.F., "Non-Destructive Testing of Metals", London: Institute of Metals, 1951.
4. web.itu.edu.tr/~arana/ndt.pdf
5. https://pdfs.semanticscholar.org/c125/05f08e12199ee99d89f23c324eae7376dd5d.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: use the fundamental concepts of visual inspection and liquid penetrant testing

CO2: carryout various types of electromagnetic testing including eddy current, magnetic flux leakage and magnetic particle testing

CO3: apply the concepts of radiography and fluoroscopy

CO4: apply the concept of ultrasonic testing

CO5: carryout other types of testing techniques like thermal imaging, holography, Computer Tomography and Magnetic Resonance Imaging

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO03 WIRELESS INSTRUMENTATION

3 0 0 3

UNIT – I **9**

Wireless Instrumentation Technology: Introduction – Instruments and Instrumentation: Measurement systems – Multiplexing structures – Wireless instruments and communication protocols – RF Interfaces and examples – Networks of Wireless instruments – Sensor node components: Computing subsystem – Communication subsystem – Power systems.

UNIT – II **9**

Powering Autonomous Sensors: Autonomous sensors – Ambient energy sources and transducers – Energy storage units – Power consumption – Power considerations of wireless instruments – Energy harvesting: RF energy harvesting – Energy harvesting from vibration – Thermal energy harvesting – Energy management techniques – Calculation for battery selection.

UNIT – III **9**

Wireless Systems and Standards for Automation: Wireless HART: Protocol stack – Network components – Addressing control – Coexistence techniques – ISA100.11a: Introduction – Scope –Working group of ISA 100 – Features – Sensor classes – Architecture of WHART – Comparison between ISA100.11a and WHART protocol stacks.

UNIT – IV **9**

Wireless Instrument and Sensor Networks: Wireless sensor architecture and network design – Wireless instrument architecture and network design – Wireless sensor and instrument network design – Wireless integrated network sensors – Plug-and-Play sensors and networks – Industrial wireless networks and automation.

UNIT – V **9**

Wireless Sensor and Instrument Applications: Application specific wireless sensors and instruments – Commercial wireless sensors and instruments – Wireless instruments and sensor networks in research and development – Industrial wireless sensor and instrument networks – Wireless human health monitoring and environmental applications – Radio Frequency Identification – Consumer products and other applications.

TOTAL: 45

TEXT BOOKS:

1. John G. Webster, Halit Eren, "Measurement, Instrumentation and Sensors Handbook", 2nd Edition, CRC Press - Taylor & Francis Group, 2014.
2. Subhas Chandra Mukhopadhyay, "Smart Sensors, Measurement and Instrumentation", 2nd Edition, Springer Heidelberg, New York, Dordrecht London, 2013.
3. Halit Eren, "Wireless Sensors and Instruments: Networks, Design, and Applications", 1st Edition, CRC Press, 2006.

REFERENCE BOOKS:

1. Sunit Kumar Sen, "Fieldbus and Networking in Process Automation", 1st Edition, Taylor & Francis Group, LLC, 2014.
2. Robert B. Northrop, "Introduction to Instrumentation and Measurements", 3rd Edition, CRC Press 2014.
3. Bela G. Liptak, "Instrument Engineers Handbook - Process Control and Optimization", 4th Edition - Volume II, CRC Press - Taylor & Francis Group, 2006.
4. Feng Zhao, Leonidas J. Guibas, "Wireless Sensor Networks: An Information Processing Approach", 1st Edition, Elsevier, 2004.
5. http://www.nptelvideos.in/2012/12/wireless-communication.html
6. http://www.nptelvideos.in/2012/11/advanced-3g-and-4g-wireless-mobile.html

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the fundamentals of wireless technology
CO2: anlayze various power sources for wireless instruments
CO3: attain knowledge on different wireless protocols and network standards
CO4: carry out the design of wireless sensor instrument and networks
CO5: explore towards various applications of wireless sensor, instrument systems and networks

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO04 COMPUTER CONTROL OF PROCESSES

3 0 0 3

Pre-requisites: Control Systems

UNIT – I **9**

Computer Aided Process Control: Introduction- Role of computers in process control - Classification of computer aided process control system - batch and sequential control processes - supervisory computer control processes - Direct Digital Control processes-Computer aided process control architecture- Centralized computer control systems - Distributed computer control systems - Hierarchical computer control systems-Man Machine Interface-Economics of computer aided process control

UNIT – II **9**

Sampled Data Control Systems: Conventional control Vs Computer control– Mathematical representation of the sampling Process – Sampling frequency considerations - Selection of optimum sampling period – Data Hold: Zero Order Hold-Pulse transfer function- Complex series representation of the sampler - Development of the Pulse transfer Function - Modified z Transform

UNIT – III **9**

Stability Analysis and Design of Controllers: Definitions of stability-Stable z-domain pole locations- Asymptotic stability - BIBO stability - Internal stability-Jury test .Digital equivalent of conventional controller -Deadbeat algorithm - Dahlin algorithm - Ringing effect- Kalman algorithm - Smith Predictor algorithm -Internal Model Control.

UNIT – IV **9**

Computer Hardware and Software for Process Control: Introduction- Bus interface –Process related interfaces: Analog interfaces - Digital interfaces - Pulse interfaces - RTC - Standard interfaces-industrial communication systems-Field buses. Types of computer control process software - System software - Application software - System support software - Features of process control computer software-Real Time Operating System - Single task operating system-Multitask operating . Case studies - Stirred tank temperature control system – Thickness and flatness control system for metal rolling mill.

UNIT – V **9**

Model Predictive Control: Introduction – conventional control Vs Model Predictive Control (MPC) – control objective – prediction models in MPC: state space models, FIR and step response models. Optimization techniques: linear programming and Quadratic programming .Basic MPC algorithm – Case study: Double integrator problem.

TOTAL: 45

TEXT BOOKS:

1. Deshpande, P.B. and Ash R.H., "Computer Process Control", ISA Publications, USA, 1995.
2. Singh S.K. "Process Control: Concepts, Dynamics and Applications", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS:

1. James B. Rawlings, and David Q. Mayne, "Model predictive control: Theory and design" , 2nd Edition, Nob Hill Publishing, LLC, USA, 2015
2. Karl J. Astrom, and Bjorn Wittenmark , "Computer Controlled Systems: Theory and design ", 3rd Edition, Prentice Hall, 1996.
3. www.skct.edu.in/SKCT-ICE/pdf/faculty/Website%20Resume%20-%20shanthi.pdf
4. www.edibon.com/fr/files/equipment/UCP/catalog
5. srmuniv.ac.in/sites/default/files/files/ICO403-ccp-4.pdf
6. https://auceipi.files.wordpress.com/2010/01/computer-control-of-process.ppt

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the impact of computers in process control
CO2: analyze the performance of discrete time systems
CO3: design basic digital controllers and analyze the stability of the closed loop discrete systems
CO4: understand the significance of interfacing and operating systems in process control
CO5: gain basic knowledge on model predictive control

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO05 INSTRUMENTATION IN AIRCRAFT NAVIGATION AND CONTROL

3 0 0 3

UNIT – I **9**

Basics of Aircraft and Aircraft Instruments: Introduction – Control Surfaces – Forces – Moments and Angle of Attack – Engines – Avionics – Modern Aircraft System. Aircraft Instruments and their Layout – Aircraft Display Types – Quantitative and Display Colour – Instrument Grouping – Basic T Grouping, Glass Cockpits of Modern Aircraft, Electronic Flight Instrument System.

UNIT – II **9**

Air Data Instruments and Directional Systems: Introduction to Air Data Instruments – Types of Air Data Instruments – Pneumatic Air Data Instruments, Air Data Computer – International Standard Atmosphere – Air Data Instruments – Directional Systems: Magnetic Compass – Earth Magnetic Field.

UNIT – III **9**

Gyroscopic and Advanced Flight Instruments: Introduction – Types of Gyro – Conventional Mechanical, Vibrating Gyros, RLG, FOG – Basic Mechanical Gyro and its Properties – Directional Gyro – Gyro Horizon – Turn and Bank Indicator – Turn Coordinator – Standby Attitude Director Indicator – Gyro Stabilised Direction Indicating Systems – Advanced Direction Indicators.

UNIT – IV **9**

Engine Instruments and Indicators: Introduction – Engine Speed Measurements – Electrical Tacho Generator/Indicator, Servo Type, Non-Contact Type, Optical Tachometer, Hall Effect Sensor – Torque Measurements – Pressure Measurements. Engine Fuel Indicators: Fuel Quantity Indicator – Fuel Flow Rate Indicator – Rotating Vane, Integrated Flow Meter.

UNIT – V **9**

Aircraft Navigation Systems: Introduction – Radio Navigation Aids – Radio Navigation Systems – VHF Omni Directional Range System DME/ILS/INS/GPS – Distance Measuring Equipment, Instrument Landing Systems – Inertial Navigation System – Attitude and Heading Reference System – Strap Down INS – Doppler Navigation System, Area Navigation, Global Positioning System.

TOTAL: 45

TEXT BOOKS:

1. S. Nagabhushana and Sudha L.K., "Aircraft Instrumentation and Systems", 2nd Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2013.
2. Federal Aviation Administration (FAA), "Instrument Flying Handbook", 1st Edition, Aviation Supplies and Academics, 2013.

REFERENCE BOOKS:

1. Megson T.M.G. "Aircraft Structures for Engineering Students", 4th Edition, Elsevier Science and Technology, 2007.
2. Pallett E.B.J., "Aircraft Instruments and Integrated Systems", 3rd Edition, Prentice Hall, 1992.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the basics of aircraft and aircraft instruments
CO2: gain knowledge on air data instruments and directional systems
CO3: analyse the types of gyroscope and advanced flight instruments
CO4: know the fundamentals of engine instruments and indicators
CO5: understand the concepts of aircraft navigation systems

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO06 INDUSTRIAL DATA COMMUNICATION

3 0 0 3

UNIT – I **9**

Open System Interconnection (OSI) Model and Cables: Overview – OSI Reference model – Systems Engineering Approach – State Transition Structure – Detailed Design – Media – Physical connections – Protocols – Noise – Cable spacing – Ingress protection. Copper Cable: Cable Characteristics – Cable Selection – Coaxial Cables – Twisted-pair cable – Distribution/installation Standards – Connector Standards – Earthing/grounding – Termination – Transient protection.

UNIT – II **9**

RS-232 and RS-485 Standards: RS-232 overview: RS-232 Interface Standard (CCITT V.24 Interface Standard)– Half-duplex Operation of the RS-232 interface– Summary of EIA/TIA-232 Revisions – Limitations. RS-485 Overview –The RS-485 Interface Standard. RS-485 Troubleshooting: Introduction – RS-485 vs RS-422 – RS-485 Installation – Noise Problems – Test equipment. Current loop and RS-485 converters overview: The 20 mA currentloop – Serial Interface Converters.

UNIT – III **9**

TCP/IP and Industrial Ethernet: TCP/IP overview: Introduction – Internet Layer Protocols (Packet Transport) – Host-to-host layer: end to end reliability. TCP/IP troubleshooting: Introduction – Common problems – Tools of the trade – Typical network layer problems – Transport layer problems. Industrial Ethernet overview: Introduction – 10 Mbps Ethernet – 100 Mbps Ethernet – Gigabit Ethernet – Industrial Ethernet.

UNIT – IV **9**

Profibus, Field Bus and HART: Profibus PA/DP/FMS overview: Introduction – Profibus Protocol Stack – The Profibus communication model – Relationship between application process and communication – Communication objects – Performance – System operation. Foundation Fieldbus overview: Introduction to Foundation Field bus – The Physical layer and Wiring Rules – The data-link layer – The Application layer – The user layer – Error detection and diagnostics – High-speed Ethernet (HSE). HART overview: Introduction to HART and Smart Instrumentation – HART protocol – Physical layer – Data-link layer – Application layer.

UNIT – V **9**

Wireless Technology and System Design: Wireless Technologies: Satellite Systems – Wireless LANs (WLANs) – Radio and wireless communications. System design methodology: Introduction – Point-to-point links – networked Systems. Installation, commissioning, troubleshooting: Introduction – Methodology – Common problems.

TOTAL: 45

TEXT BOOKS:

1. Deon Reynders, Steve Mackay, Edwin Wright, "Practical Industrial Data Communications", 1st Edition, Elsevier, 2005.
2. Forouzan, Behrouz A., "Data communication and Networking", 4th Edition, Tata McGraw-Hill, New Delhi, 2007.

REFERENCE BOOKS:

1. Michael P. Fitz, "Fundamentals of Communications Systems", 1st Edition, Tata McGraw-Hill, 2007.
2. Bernard Sklar, Pabitra Kumar Ray, "Digital Communications: Fundamentals & Applications", 2nd Edition, Pearson Education Asia, Singapore, 2009.
3. Douglas E. Comer, M. S. Narayanan, "Computer Networks and Internets", 5th Edition, Pearson Education Asia, 2008.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the concepts, terminologies and technologies used in modern data communication in industrial networking

CO2: gain knowledge about the cable standards and its characteristics

CO3: identify the suitable protocol for industrial data communication

CO4: design and ensure the installation, commissioning and troubleshooting methods in data communications

CO5: integrate different industrial communication protocols and standards into a complete working system

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO07 ADAPTIVE CONTROL

3 0 0 3

Pre-requisites: Control systems

UNIT – I **9**

Introduction to Adaptive Control and System Models: Adaptive control versus conventional feedback control-Basic adaptive control schemes: Open loop direct and indirect adaptive control. Classification of models - Nonparametric models: Frequency response function, Transfer function, Correlation functions. Parametric models: ARX, ARMAX, FIR. Input signal design.

UNIT – II **9**

Parameter Estimation: Least square estimation- Recursive least square estimation-Prediction Error method- estimation of delays - Model order determination and validation

UNIT – III **9**

Self Tuning Regulator: Pole placement design- Direct and indirect self tuning regulators- Continuous time self tuners- Minimum variance and moving average controllers- Stochastic direct and indirect self tuning regulators- Linear quadratic self tuning regulators

UNIT – IV **9**

Model Reference Adaptive Controller: The MIT rule- Lyapunov theory - Design of model reference adaptive controller using MIT rule and Lyapunov theory - Relation between MRAS and STR, Introduction to adaptive back stepping.

UNIT – V **9**

Auto tuning and Gain Scheduling: PID control-Auto tuning techniques-Transient response methods- Methods based on relay feedback- Relay oscillations. Design of gain scheduling controllers- Nonlinear transformations-Applications of gain scheduling. Case study: Temperature control in a distillation column, CSTR.

TOTAL: 45

TEXT BOOKS:

1. Astrom K., "Adaptive Control", 2nd Edition, Dover Publications, 2008.
2. Landau I.D., Lozano R.M., Saad M. and Karimi A., " Adaptive control Algorithms, Analysis and Applications", 2nd Edition,Springer,2011.

REFERENCE BOOKS:

1. Arun K Tangirala,"Principles of system identification theory and practice", 1st Edition, CRC press Taylor & Francis Group, 2015.
2. Sastry S. and Bodson M. "Adaptive control Stability, Convergence and Robustness", Dover Publications, Reprint, 2011.
3. Gang Tao, "Adaptive control design and Analysis", John Wiley & Sons Inc. Publication, 2003.
4. aaclab.mit.edu/material/lect
5. iberzon.csl.illinois.edu/teaching/13ece517notes.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the basic concepts and methods of system identification techniques
CO2: develop dynamic models from experimental data
CO3: gain knowledge about self-tuning regulator for closed loop systems
CO4: design model reference adaptive controller for simple systems
CO5: know the concept of controller tuning methods

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO08 ROBOTICS AND MACHINE VISION SYSTEM

3 0 0 3

UNIT – I **9**

Robotics and Robotic Drives: History, Present status and future trends in robotics and automation – Laws of robotics – Robot definitions – Robot anatomy – Work volume – Robot drive systems: Hydraulic, Electric, Pneumatic drives – Servomotor – Stepper motor – Precision of movement – Robot applications.

UNIT – II **9**

Mechanical Power Transmission Systems: Gear transmission – Belt drives – Cables – Roller chains – Link – Motion conversion: Rotary-to-Rotary motion conversion: Ideal gears – Harmonic drives – Belt and pulley systems; Rotary-to-linear motion conversion: Lead screws – Rack and pinion systems – Belt and pulley driving a linear load – Slider cranks – Cams – Kinematic chains.

UNIT – III **9**

Robot Kinematics: Introduction – Robots as mechanisms – Matrix representation – Homogeneous transformation matrices – Representation of transformations – Forward and inverse kinematics of robots – Denavit – Harten berg representation – Degeneracy and dexterity.

UNIT – IV **9**

End Effectors and Sensors: Types of end effectors: Mechanical gripper – Other types of gripper; Magnetic gripper – Vaccum gripper – Adhesive gripper – Hooks – Scoops – Tools as end effectors. Position sensor – Velocity sensor – Proximity sensor – Tactile sensor – Slip sensor – Range sensor.

UNIT – V **9**

Vision Systems for Robotics: Introduction to machine vision – The sensing and digitizing function in machine vision – Image processing and analysis: Image data reduction – Segmentation – Feature extraction – Object recognition – Image representation – Gray scale and colour images.

TOTAL : 45

TEXT BOOKS:

1. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Tata McGraw Hill Education Private Limited, New Delhi, Ninth Reprint, 2011.
2. Klafter, Richard D., Chmielewski, Thomas A, and Negin, Michael, "Robotics Engineering: An Integrated Approach", Prentice Hall of India, New Delhi, 2009.

REFERENCE BOOKS:

1. Niku, Saeed.B "Introduction to Robotics: Analysis, Systems, Applications", New Delhi: Prentice Hall of India Pvt. Ltd., 2009.
2. Fu, K.S., Gonzalez, R.C., and Lee C.S.G., "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill, New York, 2008.
3. S K Saha, "Introduction to Robotics", Tata McGraw Hill, 2010.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the concept of robotics
CO2: design power circuit for robots
CO3: gain knowledge on kinematics and dynamics in robotics
CO4: learn various types of sensors and end effectors used in robotics
CO5: design automatic manufacturing cells with robotic control

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIO09 VIRTUAL INSTRUMENTATION

3 0 0 3

UNIT – I **9**

Introduction to Virtual Instrumentation: General Functional description of a digital instrument - Physical quantities and analog interfaces - User interfaces - Need for VI - Architecture of Virtual Instrumentation – Graphical System Design Model - Virtual Instrument and Traditional Instrument - Hardware and Software in Virtual Instrumentation – Dataflow Programming – Graphical and Text based Programming.

UNIT – II **9**

Introduction to LabVIEW: Software Environment–Creating and Saving a VI - Front panel tool bar – Block diagram tool bar - Palettes – Controls and Indicators –Editing, Debugging and running a VI– Waveform Graph, Chart and XY- Plot – SubVI.

UNIT – III **9**

Programming in LabVIEW: FOR Loop – WHILE Loop- Shift Register – Feedback Node – Local and Global Variables – CASE Structures – Sequential Structures – Formula Node – Arrays – Array Functions – Auto Indexing – Clusters – Cluster Operations. Strings and File IOs: Strings - String Functions – Editing, Formatting and Parsing Strings – File IOs – High level File IOs.

UNIT – IV **9**

Instrument Control and Data Acquisition: GPIB Communication – Instrument I/O Assistant – Instrument Drivers – Serial Port Standards - TCP/IP –PCI- PXI - DAQ Hardware and Software – DAQ Hardware Configuration – DAQ Assistant - DAQ Software – Installing the DAQ Card - USB based DAQ Card.

UNIT – V **9**

Applications: Signal measurement using general purpose DAQ Card - Temperature measurement using DAQ Card - IMAQ Vision: Vision Basics – Image Processing and Analysis – Particle Analysis – Machine Vision – Machine Vision Hardware and Software.

TOTAL: 45

TEXT BOOKS:

1. Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
2. S.Sumathi, P.Surekha, "LabVIEW based Advanced Instrumentation Systems", Springer Science & Business Media, 2007.

REFERENCE BOOKS:

1. Sanjay Gupta, Joseph, John, "Virtual Instrumentation using LabVIEW", 2nd edition, Tata McGraw Hill, 2010.
2. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", 1st Edition, Newnes, 2000.
3. Gary W. Johnson, Richard Jennings, 'LabVIEW Graphical Programming', 4th Edition, McGraw-Hill, 2000.
4. http://s1.nonlinear.ir/epublish/book/VIRTUAL_INSTRUMENTATION_USING_LabVIEW_B00K7YGYW2.pdf
5. http://www.ni.com/white-paper/4752/en/
6. http://obren.info/papers/VirtualInstrumentation.pdf

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: understand the basic concepts in Virtual Instrumentation
CO2: acquire knowledge on the elements of LabVIEW
CO3: perform programs using LabVIEW
CO4: understand the data acquisition techniques and the interfacing methods
CO5: apply DAQ card for image acquisition and other applications

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial