PSN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)

Melathediyoor, Tirunelveli - 627 152

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM AND SYLLABUS

(Regulation-2018)

I semester to VIII semester

PSN COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)
MELATHEDIYOOR, TIRUNELVELI – 627152.
AFFILIATED TO ANNA UNIVERSITY, CHENNAI
REGULATIONS- R2018 (Full Time)
B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT VISION	DEPARTMENT MISSION
The department aims at imparting high quality education to Electrical and Electronics Engineering students with active learning, critical thinking with ethical values to meet the global challenges.	**DM1:** To provide advanced knowledge and skills for Learning under congenial environment for global placement and entrepreneurship. **DM2:** To stimulate the process of critical thinking and solving the problems with focus on research capabilities. **DM3:** To enhance professional ethics and standards to meet the demands of society

Program Educational Objectives (PEOs):

S. No	Objective	PEOs
PEO1	Basic Knowledge	To impart fundamental knowledge in the field of Electrical and Electronics Engineering and enabling them to occupy responsible positions in their career.
PEO2	Problem Solving Skill	To enhance the analytical skills of the students by learning process and making themselves to identify, apprehend and solve problems using modern tools.
PEO3	Societal Response	To make use of their technical expertise for Socially beneficial activities and transform them in responsible positions.

Program Outcomes (POs):

PO's No	KNOWLEDGE	STATEMENTS	APPLIANCE
1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Theory/ Practical / Project work
2	Problem Analysis	Identify, formulate, research literature, and analyse complex engineering problems	Theory / Practical / Projects

		reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	
3	Design / Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	Theory / Practical / Projects
4	Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Theory / Practical
5	Modern Tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	Theory / Practical / Project work
6	The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	Theory / Industrial visit / In plant training
7	Environment and Sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	Theory / Industrial Visit/ In plant Training
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	Theory / Industrial visit / In plant training
9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	Projects

10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	Projects/ Seminar/ Mini Project
11	Project Management and Finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Projects
12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Projects / Higher Studies

Program Specific Outcomes [PSOs]:

PSO 1: Ability to work professionally in the field of Power System, Control system and Power Electronics with the knowledge of operation and Maintenance.
PSO 2: Ability to solve complex real time problems in Electrical and Electronics Engineering field using modern tools.

PSN COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)
MELATHEDIYOOR, TIRUNELVELI - 627152
AFFILIATED TO ANNA UNIVERSITY, CHENNAI.

CURRICULUM - B.E. / EEE - I TO VIII SEMESTER
(Applicable to students those who are admitted from AY 2018-19)

SEMESTER I

S. No	Course Code	Course Title	L	T	P	C
THEORY						
1	501001	Technical English	3	0	0	3
2	501002	Elementary Mathematics for Engineers	3	0	0	3
3	501003	Applied Physics I	3	0	0	3
4	501004	Applied Chemistry I	3	0	0	3
5	501005	Engineering Graphics	2	0	2	3
6	501006	Fundamentals of Computers and Python Programming	3	0	0	3
PRACTICAL						
7	501101	Applied Physics & Chemistry Lab - I	0	0	3	2
8	501102	Computer Lab	0	0	3	2
9	501103	Workshop Practice	0	0	3	2
		TOTAL	17	0	11	24

SEMESTER II

S. No	Course Code	Course Title	L	T	P	C
THEORY						
1	501007	Business Communication and Presentation Skills	3	0	0	3
2	501008	Engineering Mathematics – I	3	0	0	3
3	501009	Applied Physics II	3	0	0	3
4	501010	Applied Chemistry II	3	0	0	3
5	501011	Engineering Mechanics	3	0	0	3

6	501012	Programming in C	2	0	0	2
7	501013	Basic Engineering (Coming under EEE Board)	2	0	0	2
PRACTICAL						
8	501104	Applied Physics & Chemistry Lab II	0	0	3	2
9	501105	C Programming Lab	0	0	2	1
10	501106	Basic Electrical and Electronics Lab	0	0	3	2
		TOTAL	19	0	8	24

SEMESTER III

S. No	Course code	Course title	L	T	P	C
THEORY						
1	501014	Engineering Mathematics II	3	1	0	4
2	504001	Electric circuits and Networks (Practical Component)	3	0	2	4
3	504002	Electrical Machines –I	3	0	0	3
4	504003	Electromagnetic Field theory	3	0	0	3
5	504004	Electronic Devices and circuits	3	0	0	3
6	504005	Measurements & Instrumentation	3	0	0	3
PRACTICAL						
7	504101	Electrical Machines - I Laboratory	0	0	3	2
8	504102	Electronic Devices and Circuits Laboratory	0	0	3	2
9	504103	Measurements and Instrumentation Laboratory	0	0	2	1
10	501109	Career Skill Development Training – I	0	0	2	1
		TOTAL	18	1	12	26
MANDATORY COURSE						
11	501801	Environmental studies	2	0	0	0

SEMESTER IV

S. No	Course code	Course title	L	T	P	C
THEORY						
1	501020	Engineering Mathematics – III	3	1	0	4

2	504006	Electrical Machines –II	3	0	0	3
3	504007	Control System (Practical Component)	3	0	2	4
4	504008	Transmission and Distribution	3	0	0	3
5	504009	Conventional and Non-conventional Energy Sources	3	0	0	3
6	504010	Linear Integrated and Digital logic Circuits	3	0	0	3
PRACTICAL						
7	504104	Electrical Machines - II Laboratory	0	0	3	2
8	504105	Linear Integrated and Digital Circuits Laboratory	0	0	3	2
9	501113	Career Skill Development Training – II	0	0	2	1
		TOTAL	18	1	10	25
MANDATORY COURSE						
INDUSTRIAL VISIT						

SEMESTER V

S.No	**Course code**	**Course title**	**L**	**T**	**P**	**C**
THEORY						
1	504011	Power System Analysis	3	1	0	4
2	504012	Power Electronics	3	0	0	3
3	504013	Design of Electrical Machines	3	1	0	4
4	504014	Object Oriented Programming	2	0	0	2
5	503015	Digital Signal Processing	3	1	0	4
6		Open Elective –I	3	0	0	3
PRACTICAL						
7	504106	Object Oriented Programming Laboratory	0	0	3	2
8	504107	Power Electronics Laboratory	0	0	3	2
9	501115	Career Skill Development Training – III	0	0	2	1
		TOTAL	17	3	8	25
MANDATORY COURSE						
10	501802	Value Education and Human Rights	2	0	0	2
	Inplant Training					

SEMESTER VI

S. No	**Course code**	**Course title**	**L**	**T**	**P**	**C**
THEORY						
1	504015	Industrial Automation	3	0	0	3
2	504016	Power system operation and control	3	1	0	4

3	504017	Microprocessor and Microcontroller	3	0	0	3
4	504018	Solid State Drives	3	0	0	3
5		Open Elective –II	3	0	0	3
6		Elective – I	3	0	0	3
7		Elective – II	3	0	0	3
PRACTICAL						
8	504108	Micro Processor and Micro Controller Laboratory	0	0	3	2
9	504109	English Language Lab for Engineers	0	0	3	2
10	504110	Power system Simulation Laboratory – I (Internal Evaluation only)	0	0	2	1
11	501116	Career Skill Development Training – IV	0	0	2	1
		TOTAL	21	1	9	28
MANDATORY COURSE						
Mini Project / Seminar (Internal Evaluation only)						

SEMESTER VII

S. No	**Course code**	**Course title**	**L**	**T**	**P**	**C**
THEORY						
1	504019	Power system Transients	3	0	0	3
2	504020	Conservation and Utilization of Electrical energy	3	0	0	3
3	504021	Special Electrical Machines	3	0	0	3
4	504022	Protection and switch gear	3	0	0	3
5	504023	Electric Vehicles	3	0	0	3
6		Elective – III	3	0	0	3
7		Elective – IV	3	0	0	3
PRACTICAL						
8	504111	Power System Simulation Laboratory – II	0	0	3	2
9	504112	Electrical Estimation, Costing and power wiring Laboratory (Internal Evaluation only)	0	0	2	1
10	504113	Embedded and Intel system lab (Internal Evaluation only)	0	0	2	1
		TOTAL	21	0	9	25
MANDATORY COURSE						
	Internship Training					

SEMESTER VIII

S.No	Course code	Course title	L	T	P	C
1	504301	Project Work	0	0	15	6
		TOTAL	0	0	15	6

TOTAL CREDITS: 185

LIST OF ELECTIVE – I

S. No	Course code	Course title	L	T	P	C
1	504201	Principles of Management	3	0	0	3
2	504202	Professional Ethics in Engineering	3	0	0	3
3	504203	Computer networks	3	0	0	3
4	504204	Fundamentals of NANO Technology	3	0	0	3
5	504205	Power Quality	3	0	0	3

LIST OF ELECTIVE – II

S. No	Course code	Course title	L	T	P	C
1	504206	Bio medical Instrumentation	3	0	0	3
2	504207	Total Quality Management	3	0	0	3
3	504208	Microcontroller based system design	3	0	0	3
4	504209	Power system dynamics	3	0	0	3
5	504210	Flexible AC Transmission Systems	3	0	0	3

LIST OF ELECTIVE – III

S. No	Course code	Course title	L	T	P	C
THEORY						
1	504211	Power System Deregulation	3	0	0	3
2	504212	Photonics	3	0	0	3
3	504213	Modern Control System	3	0	0	3
4	504214	Smart grid	3	0	0	3
5	504215	Solar Photovoltaic Systems	3	0	0	3

LIST OF ELECTIVE – IV

S. No	Course code	Course title	L	T	P	C
THEORY						
1	504216	Soft Computing Techniques	3	0	0	3
2	504217	Sensors and Transducers	3	0	0	3
3	504218	Power Electronic applications in power system	3	0	0	3
4	504219	Vehicular Power Systems	3	0	0	3
5	504220	MEMS and NEMS	3	0	0	3

LIST OF OPEN ELECTIVES

S. No	Course code	Course title	L	T	P	C
THEORY						
1	504901	Automotive Electrical System	3	0	0	3

2	504902	Energy Management	3	0	0	3
3	504903	PLC and SCADA	3	0	0	3

SEMESTER I

501001 **TECHNICAL ENGLISH** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

To equip the students of Engineering and Technology to acquire the basic communication skills in English

To empower the learners of Engineering and Technology to attain the key employability skill-English

To inculcate in the minds of students to accomplish the accessibility to get acquainted with the latest scientific and technological terminology through electronic media.

To install in the minds of the students the skills of LSRW to achieve excel.

CO-PO MAPPING:

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

UNIT I LANGUAGE FOCUS 10

Communication skills for Engineers- General English (EGP) Vs Technical English(ESP) - Parts of speech-Types of sentences- Subject- Verb Concord –Functional usage of Tenses-Conjunction-Prepositions -Articles - Adverbs- Phrasal verbs and idioms- - Clauses– Relative Clauses-Imperative and Infinitive Structures- Question patterns- - Numerical adjectives-Numerical expressions- Adverbial clauses of time, place and manner- If clauses.

UNIT II LISTENING 10

Listening Skills – Listening to Audio CDs for Correct Pronunciation --Poor Listening vs. Effective Listening – Barriers to Effective Listening -Listening Comprehension – Listening telephonic conversation- Listening to announcements -Listening and Note-Taking.—Listening to Lectures, seminars, workshops, News in TIMES NOW, REPUBLIC, CNBC TV18 BBC, CNN TV Channels- Writing a brief summary or answering questions on the material listened.

UNIT III SPEAKING 10

Pronunciation- Stress and Intonation- -Use of Language for Various Communicative Functions – Greeting —Introducing –Complaining--thanking –Congratulating –Inviting - apologizing etc - Framing different types of questions and answers-slangs-Indianism in English communication-Accepting others views and ideas-, Arguing against others views and ideas- Interrupting others

talks- Addressing higher officials, colleagues, subordinates, a public gathering, and a video conferencing, Listening TED talks

UNIT IV READING 10

Developing Efficient Reading Skills – Types – Skimming, Scanning, Extensive reading, Intensive reading–Reading short stories-Preparing Quiz questions- Predicting content—Interpretation - Inference from text– Implications- Critical reading-Reading technical articles, brief notes, advertisements and editorial of newspapers.

UNIT V WRITING 10

Paragraph writing (Argumentative)- Essay writing - Precis-writing-Synopsis–writing-Biographical writing- Autobiographical writing- Word- formation- Prefixes and Suffixes – Synonyms, Antonyms, Homonymous, Homophones and Eponyms-Collocation-Punctuation Intensifiers-checklists-recommendations-connectives-Writing instructions- Words often Confused-One-Word Substitution-Developing hints-Purpose Expressions-Developing Technical Vocabulary. Definitions-single sentence, Extended- Spotting the errors

Language Lab (Not for Exam) 10

1. Learning of phonetic sounds (vowels, consonants and diphthongs)
2. Listening to CDs for correct pronunciation
3. Learning various expressions
4. Learning different types of conversations (formal and informal)
5. Stress and intonation practice

Resource materials- 1. Ebek language lab. Chennai, 2. Foundation- Bangalore

Extensive Reader; The Guide by R.K. Narayan

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Write cohesively and coherently and flawlessly avoiding grammatical errors

CO2: Listen/view and comprehend different Spoken discourses/excerpts in different accents

CO3: Communicate with one or many listeners' using appropriate communicative strategies

CO4: Read different genres of texts adopting various reading strategies

CO5: Enable writing skills to write comprehend passages, report and paragraph.

TEXT BOOKS:

1. K.R.Lakshminarayan, Effective Technical communication, SCITECH Publications, 1999.

2. Listening and Note-taking, Department of English, PSN College of Engineering and Technology, Tirunelveli, 2014.

3. G.Radhakrisnapillai, Spoken English for You, Emerald publications, 1999

4. K.R.Lakshminarayan, English for Technical communication. SCITECH Publications, 2006

5. Ashraf Rizvi, M., Effective Technical Communication, Tata McGraw Hill Publication, New Delhi, 2008

6. Web sources; www.pearsonlongman.com/technicalenglish/

REFERENCE BOOKS:

1. Kiranmai Dutt, P. et al, A Course on Communication Skills, Edition Foundation Books, New Delhi, 2007.
2. Ashraf Rizvi, M., Effective Technical Communication, Tata McGraw Hill Publication, New Delhi, 2008.

501002 ELEMENTARY MATHEMATICS FOR ENGINEERS L T P C

3 0 0 3

COURSE OBJECTIVES:

To familiarize the students with basic elements of mathematics.

To acquaint the students with standard concepts and tools that will serve as building blocks towards tackling more advanced level of mathematics that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector.

CO-PO MAPPING:

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

UNIT I MATRICES 9

Matrices – types of matrices and operations including elementary row and column operations -Rank of matrix – Echelon Form – inverse of a matrix – Determinants (rules of computation) – System of linear Equations - Rank method - Cramer's rule– Cayley Hamilton theorem– Finding Inverse of a matrix using Cayley Hamilton theorem - Eigen values and Eigen vectors.

UNIT II ELEMENTS OF LOGIC 9

Sets and Functions – elementary set theoretic operations –De Morgan's law – Convex sets– Relations and Correspondences – Number systems – Divisibility in integers – Congruence's – Modulus function (distance) – sequences and series – convergence- Test for Convergence.

UNIT III DIFFERENTIAL AND INTEGRAL CALCULUS 9

Limits and Continuity - Concept of a derivative – standard rules of differentiation (including elementary trigonometric and transcendental functions) – Rolle's Theorem, Mean value Theorem – Integration - basic concept – definite and indefinite integral – standard rules of Integration – Integration by parts – Beta and Gamma Functions and their properties.

UNIT IV QUANTITATIVE TECHNIQUES 9

Linear programming –Formation of LPP– Graphical method of solution – Standard form of LPP –Theory of Simplex method–Artificial variable technique –The Big M method– The two phase method – Solution of simultaneous equations by simplex method – Unique optimal solution – Transportation Problems.

UNIT V THREE DIMENSIONAL ANALYTICAL GEOMETRY 9

Equation of the plane –Intersection of three planes – Equation of a straight line – coplanar lines – Shortest distance between two lines - Equation of a sphere – Plane section of a sphere – Equations of a tangent plane – Equation of a cone– Right circular cone.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Find the Eigen values and Eigen vectors by matrix methods.

CO2: Understand different types of sequences of series and their convergence.

CO3: Know the concepts of differentiation and integration and applications of indefinite integral.

CO4: Form and solve the inequalities by LPP and solve transportation problems.

CO5: Understand the concepts of three dimension and form the equations of tangent plane, cone.

TEXT BOOKS:

1. B.S.Grawel, Higher Engineering Mathematics, Khanna publishers, 47th edition, 2016.

2. Premkumar Kupta and D.S.Hira, Operations Research, S.Chand & Company Ltd, New Delhi,5th edition, 2008.

3. Dr.S.Arumugam and Prof.A.Thangapandi Isaac, Modern algebra, New Gamma Publishing house, 2013.

4. Dr.S.Arumugam and Prof.A.Thangapandi Isaac, Sequences & Series and Trigonometry, New Gamma Publishing house, 2012.

5. Dr.S.Arumugam and Prof.A.Thangapandi Isaac, Set theory, Number system and Theory of equations, New Gamma Publishing house, 2012.

REFERENCE BOOKS:

1. N.P.Bali and Dr.ManishGoyal, A text book of Engineering Mathematics, Lakshmi publications, New Delhi, 8th edition, 2011.

2. Ron Larson, Bruce H.Edwards, Text Book of calculus, 3rd edition, Indian reprint 2011, Cengage learning India (p) Ltd, Delhi.

3. Andrew Simpson, Discrete Mathematics, Tata McGraw Hill, 2010.

501003 **APPLIED PHYSICS – I** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

To provide an adequate exposure and develop insight about the basic principles of Physics along with the possible applications.

To create awareness about the vital role played by Physics in the development of new technologies.

CO-PO MAPPING:

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

UNIT I ELASTIC PROPERTIES OF MATTER 9

Elasticity – Hooke's law – stress-strain diagram – elastic modulus – Poisson's ratio – torsional stress and deformations – twisting couple – torsion pendulum (theory and experiment) – bending of beams – bending moment – cantilever (theory and experiment) – determination of Young's modulus by uniform and non-uniform bending (qualitative).

UNIT II ELECTROSTATICS AND CURRENT ELECTRICITY 9

Electrical potential, electric fields and electric dipoles (concepts only) – Gauss' law in electrostatics – application of Gauss' law to spherical and flat surface with uniform charge distribution – Vande-Graaf generator – induced electric fields in dielectric materials – capacitance – energy stored in a parallel plate capacitor – Ohm's and Kirchoff's laws – drift velocity and current density (concepts only) – resistance – power transmission and losses (problems) – batteries – Internal resistance – series and parallel connection of batteries

UNIT III ELECTROMAGNETISM 9

Magnetic dipole – cork screw rule – force acting on a current carrying conductor – Lorentz force – Ampere's circuital law – Biot –Savart's law – solenoids and toroids (construction and expression for induced magnetic field) – motion of a charged particle in combined electric and magnetic fields – cyclotron – electromagnetic induction – magnetic flux – Lenz's law.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Characteristics of musical sound – pitch – quality – intensity – Weber Fechner law – reverberation – reverberation time – Sabine's formula (no derivation) – conditions for good acoustics of buildings. Ultrasonics – production of ultrasonics by piezoelectric and magnetostriction methods – detection of ultrasonics – engineering applications.

UNIT V OPTICS AND LASERS 9

Interference: Principle – Coherence (spatial and temporal) – Interference in thin film of uniform thickness (derivation) – Diffraction: Principle. Lasers – absorption and spontaneous emission of light – stimulated emission – population inversion – Einstein's A and B coefficients – types of lasers: solid state lasers – Nd-YAG lasers – gas lasers – He-Ne laser – laser welding – laser cutting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to,

CO1: Understand the properties of different types of metals

CO2: Gain knowledge about conductivity of different types of materials

CO3: Study about magnetism property of the materials

CO4: Know the applications of sound waves in engineering & medicine

CO5: Understand the application of laser in engineering & medicine

TEXT BOOKS:

1. R.K. Gaur, S.L. Gupta, Engineering Physics, Dhanpat Rai Publications, 2001.

2. E. Clark, Electricity, Magnetism & waves, CBS Publications & Distributors, 2005.

3. Applied Physcis – I, School of Basic Engineering and Sciences, PSN College of Engineering

and Technology.

REFERENCE BOOKS:

1. S.L. Kakani, Shubra Kakani, Engineering Physics, CBS Publications & Distributors, Second Edition, 2008.
2. DattuprasadRamanlal Joshi, Engineering Physics, Tata McGraw Hill Education Private Limited, 2010.
3. Fundamentals of Physics, Alan Giambattista, Betty McCarthy Richardson, Robert C Richardson, Tata McGraw Hill Education Private Limited, 2008.
4. Physics in 30 Days, B.M. Sharma, Cengage Learning, 2010.

501004 APPLIED CHEMISTRY – I

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To study water and its treatment for domestic and industrial purposes
To study the applications of different kinds of polymers, composites and engineering materials
To study the thermodynamic principles for application in their work place

CO-PO MAPPING:

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

UNIT 1 WATER AND ITS TREATMENT 9

Drinking water specifications (BIS and WHO standards) – Water hardness, types, units, estimation by EDTA method – boiler feed water – requirements – boiler troubles – scale and sludge formation, caustic embrittlement, boiler corrosion, priming and foaming – boiler feed water treatment – internal treatment – phosphate, calgon and carbonate conditioning – external treatment – zeolite process, reverse osmosis process – domestic water treatment – chlorination.

UNIT II POLYMERS AND COMPOSITES 9

Polymers – definition, classifications (based on the origin and structure) – polymerization – degree of polymerization. Types of polymerization – addition and condensation – mechanism of free radical polymerization – thermoplastics and thermosets – rubber – properties, applications, vulcanization – synthesis, properties and uses of PE, PVC, nylon-6,6, PET. Composites – definition, advantages – fibre reinforced polymer composites – preparation, types and uses.

UNIT III ENGINEERING MATERIALS 9

Refractories – classification – acidic, basic and neutral refractories – properties(refractoriness, refractoriness under load, dimensional stability, porosity, thermalspalling) – Abrasives – properties - natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, siliconcarbide and boron carbide. Lubricants – mechanism of lubrication, liquid lubricants, -

properties – (viscosity index, flash and fire points, cloud and pour points, oilyness) –solid lubricants – graphite and molybdenum sulphide.

UNIT IV THERMODYNAMICS 9

Terminology of thermodynamics –First law and its limitations – Work-done in an isothermal expansion of an ideal gas (derivation only)- Second law: Entropy - reversible and irreversible processes - Free energy and workfunction: Helmholtz and Gibbs free energy functions; Gibbs-Helmholtz equation (derivation only) -Clausius-Clapeyron equation (derivation only) – Van't Hoff isothermand isochore(derivation only).

UNIT V NANOMATERIALS 9

Nanomaterials – definition – size dependent properties – synthesis: top down approach – photolithography and electron beam lithography – bottom up approach – chemical vapour deposition and electro-deposition method. Structure, preparation and properties of fullerenes and carbon nanotubes. Applications of nanomaterials – catalysis, electronics & telecommunications, medicine, composites and energy sciences.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Do water Treatment for domestic & industrial purpose

CO2: Study different kinds of advanced materials and their applications

CO3: Study different kinds of polymers & their applications

CO4: Basics of thermo dynamics and its concept

CO5: Familiar with name materials & their applications in different fields

TEXT BOOKS:

1. S.S.Dara, Engineering Chemistry, Chand & Co., 2006
2. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishing Co., 2006

REFERENCE BOOKS:

1. Puri, Sharma, Pathania, Principles of Physical Chemistry, Vishal publishing Co., 2008
2. Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai Publishing Co.,2004

501005 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings

CO-PO MAPPING:

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

UNIT I PLANE CURVES AND FREEHAND SKETCHING 10

Basic Geometrical constructions, Curves used in engineering practices: Conics. Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle. Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 10

Projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 10

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by change position method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 10

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

UNIT V- ISOMETRIC AND PERSPECTIVE PROJECTIONS 10

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions – Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1. Perform free hand sketching of basic geometrical shapes and multiple views of objects.

CO2. Draw orthographic projections of lines, planes and solids

CO3. Obtain development of surfaces.

CO4. Prepare isometric and perspective views of simple solids.

CO5: Perform free hand sketching of isometric projection

TEXT BOOKS:

1. Natarajan, K.V, "A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2011.

REFERENCES:

1. Bhatt. N.D, "Engineering Drawing", Charotar Publishing House, 2009.

2. Gopalakrishnan.K.R, "Engineering Drawing I & II", Subhas Publications 2008.

3. Venugopal. K and Prabhu Raja. V, "Engineering Graphics", New Age International (P) Ltd., 2011.

4. Shah. M.B and Rana. B.C "Engineering Drawing", Pearson Education, 2009.
5. Dhananjay. A.J. "Engineering Drawing with Introduction to AutoCAD", Tata McGraw Hill Publishing Company Ltd., 2010.

501006	FUNDAMENTALS OF COMPUTERS AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To learn the organization of a digital computer.
To learn the basic operations of MS-Office
To learn the concepts of the fundamentals in Python
To study with the concepts of Controls and Decision making in Python.

CO-PO MAPPING:

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

UNIT I FUNDAMENTALS OF COMPUTERS 9

Introduction – Overview of computers – Applications – Characteristics – Evolution – Generations – Classification – Basic computer organization – Number system and computer codes: Decimal, Binary, Octal, Hexadecimal – Conversion of numbers - Computer Software: Overview – Types – System management programs – system development programs – Standard Application programs – Basic Internet Terminologies – Browsing – Using a Search Engine

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Introduction – Planning the computer program – Problem Solving – Structuring the logic – Office Packages – MS Word: Accessing MS Word – Basic Operations in MS Word – MS Excel: Accessing MS Excel – Basic operations performed in MS Excel – MS PowerPoint: Accessing MS PowerPoint

UNIT III PYTHON FUNDAMENTALS 9

Introduction – Features – Setup – Fundamental modes – Values and Data types – Variables – Keywords – Identifiers – Comments – Quotations – Indentation – Multiline statements – Input-Output and import functions – Expressions – Statements – Operators – Operator Precedence – Built-in functions – Advantages and Disadvantages of Python

UNIT IV CONTROL FLOW AND FUNCTIONS 9

Control for Decision making – Iterations / Loops – Nested Loops – Control statements – Looping Techniques – Functions: Defining a function – Function call – Types of functions – Function Arguments – Recursion

UNIT V STRINGS AND COMPOUND DATA 9

Strings: Initialization – Accessing string variable – Slicing Strings – Concatenation – Replication operator – String functions and methods

Lists: Introduction – Creating and Accessing elements on a list– Tuples: Introduction – Creating a tuple – Accessing tuple items – Dictionary: Introduction – Creating and Accessing elements

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Know fundamental knowledge on basics of computers and Number System

CO2: Work on MS-Office

CO3: Write, compile and debug simple programs in Python

CO4: Understand the concept of functions in Python

CO5: Use different Compound data types in Python.

TEXT BOOKS:

1. E. Balagurusamy, Fundamentals of Computer Programming, Second Edition, Tata McGraw Hill Edu. Pvt. Ltd., 2012.

2. Dr. A. Kannan, Dr. L. Sai Ramesh, Problem Solving and Python Programming, United Global Publishers Ltd., 2017.

Reference Books:

1. E. Balagurusamy, Fundamentals of Computers, Tata McGraw Hill Edu. Pvt. Ltd., 2009

2. Allen B. Downey, Think Python, O'Reilly Publications, 2017.

501101 APPLIED PHYSICS AND CHEMISTRY LABORATORY – I

L	T	P	C
0	0	3	2

COURSE OBJECTIVE:

To earn practical knowledge by applying the experimental methods to correlate with physics and chemistry theory.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Air wedge – determination of thickness of thin wire.
2. Cantilever – Pin and Microscope – determination of Young's Modulus.
3. Laser and OFC – determination of particle size, wavelength of laser and acceptance angle.
4. Torsion Pendulum – determination of rigidity modulus.
5. Ultrasonic Interferometer – determination ultrasonic velocity and compressibility of liquids.
6. Compound Pendulum – measurement of acceleration due to gravity.

7. Determination of total hardness of water by EDTA method.
8. Estimation of carbonate and non-carbonate hardness of water
9. Determination of alkalinity of Water sample
10. Estimation of chloride content in water sample (Argentometric)
11. Determination of molecular weight and degree of polymerization of polymer solution using viscometer.
12. (a) Determination of DO in water (Winkler's method)
    (b) Determination of COD (Demonstration only)
    (c) Determination of BOD (Demonstration only)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Gain practical knowledge by applying the experimental methods to correlate with physics and chemistry theory.

CO2: Gain working knowledge of fundamental Physics and chemistry.

CO3: Apply the design process to engineering application.

CO4: Use modern engineering techniques and tools, including software and laboratory instrumentation.

CO5: Gain knowledge about polymerization

TEXT BOOKS:

1. Applied Physics Laboratory – I, Department of Physics, PSN College of Engineering and Technology, Tirunelveli, 2014.
2. Lab Manual for Applied Chemistry I – Department of Chemistry, School of Basic Engineering & Sciences, PSN CET.

501102 COMPUTER LAB L T P C

0 0 3 2

COURSE OBJECTIVE:

To learn how to work on MS-Office

To solve problems using Python

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Create a document in MS Word and perform basic formatting
2. Create a MS Excel sheet and illustrate the use of formulas, functions and chart
3. Create a presentation for any topic of interest using MS PowerPoint and slideshow

4. Write a Python script to perform Temperature conversion
5. Write a Python script to find the Factorial of a number
6. Write a Python script to generate the Fibonacci series up to 'N' terms
7. Write a Python script to print the first 'N' prime numbers
8. Write a Python script using functions to perform Binary search
9. Write a Python script to count the occurrences of each word in a given sentence
10. Write a Python script to find the maximum of a list of numbers
11. Write a Python script to find the sum of n numbers in a List
12. Write a Python script to perform Matrix addition

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Create and edit their own documents

CO2: Create and edit sheets and presentations

CO3: Understand the functions of Python

CO4: Write their own programs to solve problems by using python

CO5: Write a python script to perform matrix addition

501103 **WORKSHOP PRACTICE LAB** **L T P C**

0 0 3 2

COURSE OBJECTIVES:

To provide hands on practice to the students in basic engineering practices in civil and mechanical engineering.

CO-PO MAPPING:

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

CIVIL ENGINEERING PRACTICE

Plumbing Practices:

a. Study of pipeline joints, its location and functions: Valves, Taps, Couplings, Unions, Reducers, Elbows in Household Fittings.
b. Study of pipe connections - requirements for pumps and turbines.
c. Preparation of plumbing line sketches for water supply and sewage works.
d. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
e. Demonstration of plumbing requirements of high-rise buildings.

Carpentry Practices using Power Tools:

a) Study of joints in doors, windows and furniture

b) Hands on exercise: sawing, planning, and cutting
c) Preparation of T-tap, dovetail and mortise joints.

MECHANICAL ENGINEERING PRACTICES

Welding practice:

Preparation of arc welding of butt joints, lap joints and Tee joints.

Sheet metal practice:

a. Forming & Bending:
b. Model making – Trays, Funnels, etc.
c. Different types of joint

Foundry:

Mold preparation for gear and step cone pulley.

Fitting:

Fitting – Exercises – preparation of square fitting and Vee – fitting models.

Demonstration on:

Smithy operations, upsetting, swaging, setting down and bending.

REFERENCES:

1. K.Jeyachandran, S.Natarajan & S, Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2009.
2. T.Jeyapoovan, M.Saravanapandian & S.Pranitha, "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, 2010.
3. H.S. Bawa, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2010.
4. A. Rajendra Prasad & P.M.M.S. Sarma, "Workshop Practice", Sree Sai Publication, 2009.
5. P.Kannaiah & K.L.Narayana, "Manual on Workshop Practice", Scitech Publications, 2009.

TOTAL: 45 PERIODS

SEMESTER II

501007 BUSINESS COMMUNICATION AND PRESENTATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To develop communication competence in prospective engineers so that they are able to communicate information as well as their thoughts and ideas with clarity and precision.

To make the students aware of the new developments in technical communication those have become part of business organizations today.

To facilitate the potential engineers acquire the technical writing skills for print and media

CO-PO MAPPING:

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

UNIT I BUSINESS COMMUNICATION 10

Concept and meaning of communication- Role of communication in information age- - skills necessary for technical communication- Communication Flows in an Organization - Communications in a technical organization- Barriers to the process of communication- Using e-mail and social media for business communication- Standard e-mail practices- Language in e-mail- E-mail etiquette

UNIT II STYLE AND ORGANIZATION IN TECHNICAL COMMUNICATION 10

Objectivity, clarity, precision as defining features of technical communication-Various types of business writing: Letters, notices, circulars, reports, notes, memos- Language and format of various types of business letters-Language and style of reports- Report writing strategies-Analysis of a sample report.

UNIT III COMMUNICATION AND PERSONALITY DEVELOPMENT 10

Psychological aspects of communication- - Emotional Intelligence- Politeness and Etiquette in communication- Cultural factors that influence communication- Mannerisms to be avoided in communication- Language and persuasion- Language and conflict resolution.

UNIT IV ORAL PRESENTATION AND PROFESSIONAL SPEAKING 10

Elements of effective presentation- Body Language and use of voice during presentation-Connecting with the audience during presentation- Projecting a positive image while speaking-Planning and preparing a model presentation- Organizing the presentation to suit the audience and context- Basics of public speaking- Preparing for a speech-

UNIT V CAREER ORIENTAL COMMUNICATION 10

Resume and CV-Design & style-Applying for a job-Language and format of job application-Job Interviews- purpose and process- How to prepare for interviews- Language and style to be used in interviews- Types of Interview questions and how to answer them Interview through telephone/video-conferencing. Behavioural interviews.-Group Discussion- structure and dynamics- Techniques of effective participation in group discussion-.

Language Lab (Not for Exam) 10

- Sound Structure of English and intonation patterns
- Learning interview techniques
- Different models of GD
- Learning presentation skills
- Listening to various accents of English

Resource materials; FOUNDATION, Bangalore, Extensive Reader—The Old Man and the Sea by Ernest Hemingway

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Communicate with one or many listeners' by using effective business communication.

CO2: Create formal reports and proposals cohesively and creatively and flawlessly.
CO3: Understand basic communicative mannerisms, cultural factors and emotional intelligence.
CO4: Develop and deliver powerful presentation and confidence in public speaking.
CO5: Produce resumes and cover letters.

TEXT BOOKS:

1. William sanbourn, Technical communication. Pearson education 2007
2. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill publication, New Delhi, 2008.
3. Dr.Mousumi, Emotional Intelligence. Excel books. New Delhi, 2007
4. Web sources: http//templeok.wwebs.com/BussCommA-FullText.pdf.

REFERENCE BOOKS:

1. Hartman Lemay, Presentation Success, Thomson Learning
2. Malcolm Goodale, Professional Presentations
3. Farhathullah, T. M. Communication skills for Technical Students
4. Michael Muckian, John Woods, The Business letters Handbook

501008 ENGINEERING MATHEMATICS I L T P C

3 0 0 3

COURSE OBJECTIVES:

To develop the skill of the students in the areas of real, complex and vector integrations.
To acquaint the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications, in which they would find useful in their profession.

CO-PO MAPPING:

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

UNIT I MULTIVARIATE FUNCTIONS AND MULTIPLE INTEGRALS 9

Partial derivative – Problems based on partial derivative – maximum-minimum problems – Lagrangians – Chain rule – Double integrals –Area as double integrals – iterated integrals – triple integrals – Volume as triple integrals.

UNIT II VECTOR ALGEBRA 9

Laws of vector algebra – operations – definition of dot, cross, triple product – Vector function – geometric interpretation – Gradient, divergence and curl – Directional derivatives – formulae – Orthogonal curvilinear coordinates – Jacobians – gradient, divergence, curl and laplacian in curvilinear coordinates – Special curvilinear coordinates.

UNIT III VECTOR CALCULUS 9

Line integrals – simply connected region – Green's theorem (statement only) – Problems based on Green's theorem – Path independence – surface integrals – Stokes theorem (statement only) – Problems based on Stoke's theorem.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 9

First order Ordinary Differential Equations – Different types – Second order Ordinary Differential equations with constant coefficients and with variable coefficients – Method of variation of parameters.

UNIT V ANALYTIC FUNCTIONS 9

Differentiation, Cauchy Riemann Equations – Analytic Functions, Necessary and sufficient conditions - Harmonic Functions, Harmonic Conjugate Construction of Analytic Function, Elementary Analytic Function (Exponential, Trignometric, Logorithm) and their properties – Conformal mapping ($z+c$, z^2, $1/z$), Bilinear transformation, Fixed Points – Bilinear transformation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Find the optimal value o by partial differentiation and to find area and volume by integrals

CO2: Apply Jacobian, divergence, curl in Engineering.

CO3: Solve line, path and surface integrals.

CO4: Solve ordinary differential equations by various methods.

CO5: Distinguish analytic functions and their properties.

TEXT BOOKS:

1. B.S.Grawel, Higher Engineering Mathematics, Khanna publishers, 47th edition, 2016.

2. Manickavasagam Pillai and Narayanan, Differential Equations, S. V. Publications, new edition, 2009.

REFERENCE BOOKS:

1. N.P.Bali and Dr.ManishGoyal, A text book of Engineering Mathematics, Lakshmi publications, New Delhi, 8th edition, 2011.

2. Ron Larson, Bruce H.Edwards, Text Book of calculus, 3rd edition, Indian reprint 2011, Cengage learning India (p) Ltd, Delhi.

3. Dr.S.Arumugam and Prof.A.Thangapandi Isaac, Complex analysis, New Gamma Publishing house, 2013.

501009 APPLIED PHYSICS – II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To provide an adequate exposure and develop insight about the basic principles of Physics along with the possible applications.

To create awareness about the vital role played by Physics in the development of new technologies.

CO-PO MAPPING:

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

UNIT I QUANTUM MECHANICS 9

Concept of de Broglie's Matter waves – Derivation of wavelength of matter waves in different forms – Heisenberg's Uncertainty principle, Concept of Phase velocity and Group velocity (qualitative); Schrodinger's Time independent and dependent equation (derivation), Applications of Schrodinger's equation (qualitative treatment) – a) Particle in one dimensional rigid box b) Potential Barrier.

UNIT II CRYSTAL STRUCTURE 9

Lattice – unit cell – space lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for simple cubic (SC), Body Centred cubic (BCC), Face centred cubic (FCC) and Hexagonal closed packed (HCP) structures – polymorphism and allotropy – crystal defects: point, line and surface defects.

UNIT III WAVES AND FIBRE OPTICS 9

Oscillatory motion – Damped vibration – differential equation and its solution, critical damping, Logarithmic decrement and Quality factor – Forced vibration – differential equation. Fiber Optics – Introduction - total internal reflection – critical angle - Numerical aperture and acceptance angle (derivation), step index and graded index fibers, losses associated with optical fibers, application of optical fibers.

UNIT IV THERMAL PHYSICS 9

Concept of Heat: Lattice vibrations – Phonons – Einstein's & Debye's theory of specific heat of solids – Maxwell - Boltzmann's distribution (derivation) – Concept of entropy, specific heat – Transfer of heat by conduction, convection and radiation – Radiation - Stefan's law (statement and equation) – Thermal diffusivity– Glass Dewar Thermos flask – Thermal conductivity – Lee's disc (derivation).

UNIT V MAGNETIC MATERIALS AND ALTERNATING CURRENT 9

Classification of magnetic materials: Dia, Para, ferro, Antiferro and ferri magnetism – Hard and soft magnetic materials. Alternating currents: Amplitude – cycle – Time period – Frequency – Phase – Generation of alternating currents and voltages – AC circuit containing resistance only – AC circuit containing inductance only – AC circuit containing capacitance only – Resistance and inductance in series AC circuit – Resistance, inductance and capacitance in series AC circuit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Find the energy of small particle

CO2: Find the structure of different material in different temperature

CO3: Study different types of fiber optics used in communication systems
CO4: Gain knowledge on the thermal properties of different types of materials
CO5: Study the engineering applications of magnetic materials

TEXT BOOKS:

1. R.K. Gaur, S.L. Gupta, Engineering Physics, DhanpatRai Publications, 2001.
2. E. Clark, Electricity, Magnetism & waves, CBS Publications & Distributors, 2005.
3. Applied Physcis – II, School of Basic Engineering and Sciences, PSN College of Engineering and Technology.

REFERENCE BOOKS:

1. S.L. Kakani, Shubra Kakani, Engineering Physics, CBS Publications & Distributors, Second Edition, 2008.
2. DattuprasadRamanlal Joshi, Engineering Physics, Tata McGraw Hill Education Private Limited, 2010.
3. Fundamentals of Physics, Alan Giambattista, Betty McCarthy Richardson, Robert C Richardson, Tata McGraw Hill Education Private Limited, 2008.
4. Physics in 30 Days, B.M. Sharma, Cengage Learning, 2010.

501010 APPLIED CHEMISTRY – II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To study the principles of electrochemistry and corrosion control.
To study the application of phase rule and nature of alloys.
To study the analytical techniques and their importance.

CO-PO MAPPING:

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

UNIT I ELECTROCHEMISTRY

Conductance, Cell constant and its determination; Single electrode potentials, Electrolytic and Galvanic cells, EMF series and its applications, Nernst equation (Derivation only), Cell emf measurement, Reversible and irreversible cells. Reference electrodes – Primary (Standard Hydrogen Electrode) and Secondary (Standard Calomel Electrode). Conductometric titration-Neutralisation reaction, Potentiometric titration-Redox titration.

UNIT II CORROSION

Definition and scope of corrosion, Direct chemical corrosion, Electrochemical corrosion and its mechanisms; Types of electrochemical corrosion, (differential aeration, galvanic). Typical Electrochemical corrosion like Pitting, Inter - granular, Soil, Waterline; Factors affecting corrosion. Protection of corrosion – Sacrificial Anodic Protection (SAP) and Impressed current cathodic Protection method (ICCP). Protective coatings - Paints-constituents and function

UNIT III ENERGY SCIENCES

Nuclear Energy - Nuclear reactor – working principle. Battery technology – Fundamentals of primary cells, Rechargeable batteries, Ni - Cd, battery; Fuel cells – Hydrogen –Oxygen Fuel cell - principles, applications, advantages/disadvantages. Fuels [Conventional] – Types of fuels, Calorific value, Processing and refining of Petroleum, Liquid fuels - synthetic Petrol - synthesis by Bergius process only- Knocking and anti - knock agents, Octane and Cetane values, Cracking of crude oil - Catalytic cracking; Limitations of fossil fuels, Non - conventional sources of energy - Solar, Wind, and biomass.

UNIT IV PHASE RULE AND ALLOYS

Phase Rule, phase rule applications to one component - water system and multiple component systems – lead silver phase equilibrium diagram; Alloys - importance of making alloys, types of Alloys - ferrous and nonferrous alloys, Nichrome, Carbon steel, Alloy steel, Alloys of Cu - Brass and bronze . Heat treatment of alloys.

UNIT V INSTRUMENTAL TECHNIQUES

Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Know the Principles & applications of electro chemistry

CO2: Understand about corrosion & its protection techniques

CO3: Gain Knowledge about materials used in energy production

CO4: To study the properties of different kinds of alloys & its application

CO5: Understand various instrumental techniques for sample processing

TEXT BOOKS:

1. S.S.Dara, Engineering Chemistry, Chand & Co., 2006

2. Jain and Jain, Engineering Chemistry, DhanpatRai Publishing Co., 2006

REFERENCE BOOKS:

1. Puri, Sharma, Pathania, Principles of Physical Chemistry, Vishal publishing Co., 2008

2. Shashi Chawla, A Text Book of Engineering Chemistry, DhanpatRai Publishing Co., 2004.

501011	**ENGINEERING MECHANICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To explain the importance of mechanics in the context of engineering and conservation equations, to introduce the techniques for analyzing the forces in the bodies, to explain the significance of

centroid, centre of gravity and moment of inertia and to apply the different principles to study the motion of a body, and concept of relative velocity and acceleration.

CO-PO MAPPING:

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

UNIT 1 FUNDAMENTALS & STATICS 9

Mechanics and its relevance – Rigid Bodies –Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces - Principle of transmissibility – Coplanar Forces – Resolution and Composition of forces – Equivalent systems of forces – Single equivalent– force Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Vectorial representation of forces - Varignon's theorem

UNIT 2 PROPERTIES OF SURFACES AND SOLIDS 9

Significance of properties of Sections - First moment of area and the Centroid of Simple sections – Rectangle, circle, triangle from integration method– T section, I section, – Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem - Second and product moments of plane area – Rectangle, triangle, circle from integration method – T section, I section, Angle section, Hollow section by using standard formula.

UNIT 3 KINEMATICS OF PARTICLES 9

Types of plane motion – Characteristics of kinematics – Mathematical expression for velocity and acceleration – Rectilinear motion and its types – Rectilinear motion with uniform acceleration - Motion of a particle under gravity - Rectilinear motion with variable acceleration - Application of general equations - Relative motion - Concept of relative velocity - Curvilinear motion – Velocity and acceleration components – Projectile motion

UNIT 4 FRICTION 9

Role of fictional force – Types of friction – Limiting friction - Laws of friction - static friction - Application of laws of friction - Ladder friction - Wedge friction - Screw friction and belt friction - Rolling resistance.

UNIT 5 KINETICS OF PARTICLES 9

Laws of motion – Newton's second law – D' Alembert's principle: Motion of a lift, motion on an inclined surface, motion of connected bodies, motion of two bodies connected by a string and passing over smooth pulley - Work Energy Equation of particles: Motion of connected bodies, conservation of energy, work done by a spring – Impulse and Momentum; Motion of connected bodies, conservation of linear momentum, motion of bullet and gun– Impact of elastic bodies: Types of impact, impact of a body with fixed plane, Kinetic energy lost at impact.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the student would be able to

CO1: Illustrate the vectorial and scalar representation of forces and moments
CO2: Evaluate the properties of surfaces and solids
CO3: Analyze the different type of motion
CO4: Determine the friction and the effects by the laws of friction
CO5: Calculate dynamic forces exerted in rigid body

TEXT BOOKS:

1. Vector Mechanics for Engineers, Beer, F.P and Johnson Jr. E.R., Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 2010.
2. Engineering Mechanics, Hibbeller, R.C., Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.

REFERENCES:

1. Engineering Mechanics, R.K. Bansal, Laxmi Publications, 2015.
2. Engineering Mechanics, SS Bhavikatti, New age Publications, 2015.
3. Engineering Mechanics, Kumar, K. L., Kumar, V. Pub., Tata McGraw Hill, 2011.
4. Engineering Mechanics Statics and Dynamics by A K Tayal, Umesh Publications, 2011.

501012 PROGRAMMING IN C L T P C

2 0 0 2

COURSE OBJECTIVES:

To understand the basic concepts in C Programming
To study the concepts of control structures in C
To learn the function concepts in C
To learn the array concepts in C

CO-PO MAPPING:

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

UNIT I INTRODUCTION 6

Computer Languages and its types: Machine languages, Assembly Languages and High Level Languages; Program Development in C, Structured Programming - Algorithm, Pseudo code; Data types in C, Operators, Formatted input-output statements, Simple C programming examples

UNIT II DESIGNING STRUCTURED PROGRAMS IN C 6

Control Structures – Decision making statements – Simple if, if-else, nested if, else if ladder; Looping Statements: while, do-while, for statements; Multi branching statement: switch statement, use of break and continue statements;

UNIT III FUNCTIONS 6

Introduction, Types of function, Library Functions, User defined function, Function definition, Function declaration, Prototypes, Function Calling, Parameter passing, Call by value and Call by

reference, Recursive functions,

UNIT IV ARRAYS 6

Declaring arrays in C, Array applications, Two – dimensional arrays, Multidimensional arrays, C program examples; Pointer variable declaration and Initialization. Pointer operators, Pointer expressions and Arithmetic,

UNIT V STORAGE CLASSES IN C 6

Auto-Static-Extern-Register storages classes Derived types: Structures – Declaration, definition and initialization of structures, accessing structures, unions

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Have fundamental knowledge on C language

CO2: Design programs involving decision structures, loops and functions.

CO3: Define small functions for solving complex applications

CO4: Write, compile and debug programs in C language using Arrays.

CO5: Understand the concept of Structure and Union

TEXT BOOKS:

1. E. Balagurusamy, "Programming in ANSI C" McGraw Hill, 4th Edition, 2008

REFERENCE BOOKS:

1. Dietel & Dietel, "C – How to Program", 6th edition, Pearson Education, 2010
2. M.T. Somasekhara, "Problem Solving with C", Eastern Economy Edition, PHI, 2009
3. E. Balagurusamy, "Data Structures using C", McGraw Hill, 2013

Prof. Hari Mohan Pandey, "Data Structure and Algorithm", University Science Press, 1st edition, 2009.

501013 BASIC ENGINEERING L T P C

2 0 0 2

COURSE OBJECTIVES:

To study the basic construction materials, surveying & special structure

To study the sources of Energy and Power Generation

To study the manufacturing processes and machining operations.

To study the fundamentals of DC & AC circuits

To study the fundamentals of semiconductor Devices and Digital Electronics.

CO-PO MAPPING:

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

A – CIVIL ENGINEERING

UNIT I CONSTRUCTION MATERIALS AND SURVEYING 6

Construction Materials – Properties, Types and uses of Stone, Bricks, Sand, Cement, Steel. Stone Masonry - Brick Masonry – Types. Types and Uses of Beam, Column, Lintels, Flooring, Roofing. Foundation – Footings – Types. Basic Requirements of Building – Planning – Criteria. Surveying - Object of Surveying – Classification of Surveying – Instruments used for Chain surveying – Calculation of Areas. Leveling – Principle of leveling – Types – Plane Table Surveying.

B – MECHANICAL ENGINEERING

UNIT II ENERGY 6

Renewable and non-renewable energy sources - types, characteristics - advantages/disadvantages. Hydro, thermal and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications).

UNIT III: MANUFACTURING PROCESS AND MACHINING OPERATIONS 6

Metal forming processes – Rolling, forging, drawing, extrusion and sheet metal operations-fundamentals only. Metal Joining processes – Welding - arc and gas welding, Soldering and Brazing. Casting process – Patterns -Moulding tools - Types of moulding – fundamentals of machining processes.

C - ELECTRICAL ENGINEERING

UNIT IV FUNDAMENTALS OF ELECTRIC CIRCUITS 6

Introduction to DC and AC circuits : Active and Passive elements - Electrical quantities - Ohm's Law - Resistors - Series and parallel combinations - Kirchoff's laws – Ideal Sources - Source Transformation – Magnetic circuits : Faraday's laws – Induced EMF and inductances - Sinusoidal functions – RMS (effective) and Average values - Phasor representation - sinusoidal excitation applied to purely resistive, inductive and capacitive circuits - power and power factor (Derivative part only) - Megger.

D - ELECTRONICS ENGINEERING

UNIT V SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS 6

PN Junction Diode and its characteristics – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers -Binary Number System: Decimal to binary conversion - Binary arithmetic – Addition - Subtraction-Multiplication-Boolean algebra – Logic Gates: AND, OR, NAND, NOR, NOT, XOR and XNOR gates.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to,

CO1: Explain the usage of construction material and proper selection of construction materials and also measure distances and area by surveying.

CO2: Understand the basics of Energy Sources and Power Generation

CO3: Acquire the knowledge about various manufacturing processes.

CO4: Solve simple circuits and express the concept of fundamentals of circuits

CO5: Express the function of semiconductor devices and develop the truth tables of logic gates.

TEXT BOOKS:

1. B.L.Theraja, “Fundamentals of Electrical Engineering and Electronics”, S.Chand Publications, 28th edition, reprint 2013.
2. K. Venugopal & Dr.V. PrabhuRaja, G.Sreekanjana “Basic Civil & Mechanical Engineering”, Anuradha Publishers, (2010).
3. Shetty, M.S, "Concrete Technology", S. Chand and Company Ltd, New Delhi, 2015

REFERENCES:

1. D.P. Kothari and I.J. Nagrath, “Basic Electrical and Electronics Engineering”, Tata Mcgraw hill, First edition 2014.
2. V.K. Metha,”Principles of Electronics” S. Chand & Company Ltd, 10 th Edition, 2014
3. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, 2005.
4. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., Elements of Workshop Technology, Vol. I & II, Indian Book Distributing Company Calcutta, 2007.
5. Nag, P.K., Power Plant Engineering, Tata McGraw-Hill, New Delhi, 2008.

501104 **APPLIED PHYSICS AND CHEMISTRY LABORATORY II**

L	T	P	C
0	0	3	2

COURSE OBJECTIVE:

To gain practical knowledge by applying the experimental methods to correlate with physics and chemistry theory.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Diffraction Grating – determination of wavelength of Hg spectrum
2. Potentiometer – Specific resistance of a wire.
3. Lee’s disc – determination of thermal conductivity of bad conductor.
4. Wheat stone’s bridge – determination of band gap of semiconductor.
5. Magnetometer – determination of hysteresis loss of ferromagnetic material.
6. Non-uniform bending – determination of depression and unknown weight.
7. Conductometric acid/base titration
8. Conductometric precipitation titration
9. Potentiometric titration/Redox titration
10. Determination of pH of water sample by pH metry.
11. Estimation of copper in brass by EDTA method
12. Estimation of ferrous iron by spectrophotometry

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Gain practical knowledge by applying the experimental methods to correlate with physics and chemistry theory.

CO2: Apply the various procedures and techniques for the experiments.

CO3: Apply the various procedures and techniques for the experiments.

CO4: Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

CO5: Use the different measuring devices and meters to record the data with precision.

TEXT BOOKS:

1. Applied Physics Laboratory – II, Department of Physics, PSN College of Engineering and Technology, Tirunelveli, 2014.
2. Lab Manual for Applied Chemistry II – Department of Chemistry, School of Basic Engineering & Sciences, PSN CET

501105 **C PROGRAMMING LAB** **L T P C**

0 0 2 1

COURSE OBJECTIVES:

To learn and execute the simple programs in C' language

To be familiar with looping and branching concepts in C' Programming

To be familiar with array in C' Programming

To learn the concept of functions in C' Language

To study about the concept of Structures and Unions

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Write a C Program to generate first 'n' terms of the Fibonacci sequence
2. Write a C Program to generate prime numbers between 1 and 'n'
3. Write a C Program to find the Factorial using recursion and non-recursion
4. Write a C Program to find the GCD of two given positive numbers
5. Write a C Program to perform the arithmetic operations on two numbers using switch statement
6. Write a C Program to find the sum of series ($1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$)
7. Write a C Program to implement the addition of 'n' numbers in an array
8. Write a C program to find both the largest and smallest number in a list of integers after arranging them in ascending order

9. Write a C Program to merge two sorted arrays
10. Write a C Program to find the given string is Palindrome or not.
11. Write a C Program that uses the concept of function

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Solve simple problems using C Language

CO2: Execute programs using control statements

CO3: Handle arrays in C' Programs

CO4: Write functions and to solve some complicated problems in C.

CO5: Study about the concept of Structures and Unions

501106 BASIC ELECTRICAL AND ELECTRONICS LABORATORY

L	T	P	C
0	0	3	2

COURSE OBJECTIVES:

To impart practical knowledge on House wiring system, Measurement of Electrical Quantities, Handling electrical equipment, Semiconductor devices operation and Functioning of Logic Gates

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Residential House wiring using switches, fuse, indicator , lamp and Energy meter
2. Different Types of wiring (Staircase and Fluorescent Lamp wiring)
3. Verification of Ohm's law
4. Measurement of Electrical quantities (Voltage, current, power and power factor in RLC series circuit)
5. Calculation of Magnetic flux in an electrical circuit.
6. Measurement of earth resistance using megger
7. V-I Characteristics of PN Junction diode
8. V-I Characteristics of Zener diode
9. Voltage regulation using Zener Diode
10. Verification of basic gates operation
11. Verification of Half wave and Full wave rectifier operation
12. Study of
    (i) Active and passive components
    (ii) Signal generation and measurement using AFO and CRO

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end the course the students can able to,

CO1: Design House wiring system

CO2: Measure the various Electrical Quantities in a circuit

CO3: Perform the troubleshooting of electrical equipment

CO4: Check the status of Semiconductor devices

CO5: Check the Functioning of Logic Gates

SEMESTER III

501014	**ENGINEERING MATHEMATICS II**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

COURSE OBJECTIVES:

To strengthen the innovative knowledge of the students on application of mathematics familiarizing on standard concepts and tools that are useful in their profession in industrial sector, corporate sector and multinational companies.

CO-PO MAPPING:

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

UNIT I FOURIER SERIES 12

Fourier series – Dirichlet's conditions – General Fourier series –Fourier series of periodic functions with different periods - Fourier series of Odd functions – Fourier series of even functions – Half range Fourier sine series – Half range Fourier cosine series – Root mean square value - Parseval's identity.

UNIT II PARTIAL DIFFERENTIAL EQUATIONS I 12

Concept of dependent and independent variables - Formation of partial differential equations – solution of partial differential equations – the four standard forms – Equations of the form f(p,q) = 0 – Clairaut's equation – Equation solvable for x – Equation solvable for y – Solution of Lagrange's linear partial differential equations Pp+Qq = R.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS II 12

Linear homogeneous partial differential equation of n^{th} order with constant coefficients – Non homogeneous linear partial differential equation with constant coefficients – Equations reducible to linear partial differential equations with constant coefficients-Classification of PDE- Canonical forms.

UNIT IV COMPLEX INTEGRATION 15

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues– Residue theorem

– Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V THEORY OF EQUATIONS 12

Relation between roots and coefficient of an algebraic equations-symmetric function of the roots-Transformation of equations-Reciprocal equations – standard reciprocal equations – multiple methods –Horner's method.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Find the Fourier series for a function defined on closed interval.

CO2: Formulate and solve PDE of first order.

CO3: Formulate and solve PDE of higher order.

CO4: Choose an appropriate method to solve complex integration.

CO5: Identify problem evaluation techniques in theory of equation.

TEXT BOOKS:

1. Sudhir, K Pundir and Rimple Pundir, Advanced Partial Differential Equations (with boundary value problems), Pragati Prakashan publications, 3rd edition, 2010.

2. George F.Simmons, Differential Equation and its applications with Historical Notes, Tata McGraw Hill publications 3rd edition, 2006.

3. B.S.Grawel, Higher Engineering Mathematics, Khanna publishers, 47th edition, 2016.

REFERENCE BOOKS:

1. N.P.Bali and Dr.ManishGoyal, A text book of Engineering Mathematics, Lakshmi publications, New Delhi, 8th edition, 2011.

2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 40th edition, 2007.

3. H.K.Dass, Engineering Mathematics, S.Chand and Company Limited, Seventh Revised Edition, 1998.

4. Theory of equations by Dr.Arumugam and Issac

5. Applied mathematics by R.D.Sharma (vol 2), Dhanpat Rai publications

504001	**ELECTRIC CIRCUITS AND NETWORKS (PRACTICAL COMPONENT)**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

COURSE OBJECTIVES:

To enable the students to acquire knowledge about the basics of circuit elements, network theorems, single phase and three phase AC circuits.

CO-PO MAPPING:

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

UNIT I BASICS OF CIRCUIT ANALYSIS 9

Classification of Circuit Elements - Kirchoff's laws - Formation of mesh equations - analysis of complex circuits using mesh and nodal analysis (DC and AC circuits) - Star _Delta transformation.

UNIT II NETWORK THEOREMS 9

Statement, illustration and application to DC circuits - Thevenin's Theorem - Norton's Theorem - Superposition theorem - Maximum power transfer theorem - Reciprocity theorem.

UNIT III STEADY STATE AND TRANSIENT ANALYSIS 9

Steady state Analysis: Voltage, Current relationship of RL series - RC series - RLC series and Parallel circuits – power and power factor.

Transient Analysis: Transients in RC, RL and RLC circuit with DC Excitation.

UNIT IV RESONANCE AND COUPLED CIRCUITS 9

Series resonance - Parallel resonance – Resonant frequency - Q factor - Self Inductance– Mutual Inductance – Coefficient of coupling.

UNIT V THREE PHASE CIRCUITS 9

Phase sequence – Balanced star and Delta connected load – Unbalanced star and Delta connected load – power measurement in 3 phase circuits.

PRACTICAL COMPONENTS (Not included for End semester Theory Examination)

- Verification of Kirchoff's laws
- Verification of Maximum power transfer theorem
- Verification of Thevenin's Theroem
- Verification of Superposition Theroem
- Verification of Norton's Theroem
- Characteristics of parallel RLC Circuit
- Characteristics of RLC Series Circuit
- Measurement of Series Resonance Frequency

LECTURES: 45 PRACTICAL: 30 TOTAL: 75 PERIODS

COURSE OUTCOMES:

At the end of course, the students will able to

CO1: Analyze the complex circuits using mesh current and nodal voltage method.

CO2: Solve the complex circuits using network theorems.

CO3: Derive the steady state and transient response of RL, RC and RLC circuits.

CO4: Illustrate the concept of Resonance and coupled circuits.

CO5: Solve the balance and unbalanced load condition in three phase circuits.

TEXT BOOKS:

1. Sudhakar, A. and Shyam Mohan.S.P, Circuits and Networks Analysis and Synthesis, 5th edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi 2015.
2. Nagewara Rao. T, Electric Circuit Analysis, 10th edition, A.R.Publications, Chennai 2010

REFERENCES:

1. Arumugam and Premkumar, Electric Circuit Theory, Khanna Publishers.2012.
2. Abhijit Chakrabarti., Circuit Theory Analysis and Synthesis, 7th Revised Edition paper back 2018.
3. M Nahvi, Joseph Edminister and K Uma Rao, Electric circuits, Schaum's outline series, 5th edition, 2010

504002 ELECTRICAL MACHINES – I

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To expose the students to the basic principles of Electro mechanical Energy Conversion in DC Machines and Transformers.

CO-PO MAPPING:

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

UNIT I INTRODUCTION 9

Electrical machine types – Energy balance – Magnetic field system – Simple electro mechanical system – Inductance – Statically induced EMF and dynamically induced EMF – Torque.

UNIT II DC GENERATOR 9

Constructional detail-principle of operation – EMF equation-Methods of excitation –Types of generator –Characteristics of generator- Armature reaction – commutation- parallel operation-Voltage regulation of DC Generators - Applications.

UNIT III DC MOTOR 9

Principle of operation – back EMF and torque equation – Condition for maximum power - Types of DC Motors – DC shunt Motor – DC Series motor - characteristics of Motor – necessity of starter – types of starters – 3 point starter – 4 point starter.

UNIT IV SPEED CONTROL METHODS & TESTING OF DC MACHINES 9

Factors controlling motor speed – speed control of DC shunt motor and series motor- armature control method and field control method – testing of DC machines – Brake test – Swinburne's test – Hopkinson's test – Retardation test.

UNIT V TRANSFORMERS 9

Construction – principle of operation- hysteresis – core losses – EMF equation – Transformer on no load – Transformer on load - equivalent circuit – Open circuit and short test on transformer - efficiency and voltage regulation – auto transformer – 3 phase transformer – Testing of transformer

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will able to

CO1: Recite and describe the basic principles of Electro mechanical Energy Conversion

CO2: Interpret the concept of DC generators and their characteristics

CO3: Discuss the concept of DC motor and their characteristics

CO4: Categorize the methods of testing and speed control of DC motor

CO5: Describe the working of transformer and classify the transformer and also evaluate the efficiency of transformer by solving problems.

TEXT BOOKS:

1. Theraja, B.L., "A Text book of Electrical Technology", Vol. II, S.C Chand and Co., New Delhi, Reprint 2014.

2. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 4th edition, 2010.

REFERENCES:

1. Fitzgerald.A.E., Charles KingselyJr, Stephen D.Umans, 'Electric Machinery', McGraw Hill Books Company, 6th edition, 2005.

2. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', John Wiley&Sons, 2007.

3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 1st edition,2010.

504003 ELECTROMAGNETIC FIELD THEORY L T P C

3 0 0 3

COURSE OBJECTIVES:

To study the concept of electrostatics, electrical potential, energy density.

To study the concept of magneto statics, magnetic flux density, scalar and vector potential.

To study the concept of Electric and Magnetic fields in material

CO-PO MAPPING:

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

UNIT I VECTOR ANALYSIS 9

Vector fields – Different Co-ordinate systems-Rectangular, Cylindrical and Spherical coordinate systems. Gradient - Divergence – Curl - Line Integral-Surface Integral-Divergence theorem-Stoke's theorem

UNIT II ELECTROSTATICS 9

Coulomb's Law in Vector Form – Definition of Electric Field Intensity – Electric Field due to discrete charges – Electric field due to continuous charge distribution - Electric Field due to

charges distributed uniformly on an infinite line – Electric Field on the axis of a uniformly charged circular disc-Electric Scalar Potential – Relationship between potential and electric field - Potential due to infinite uniformly charged line – Potential due to electrical dipole - Electric Flux Density – Gauss Law – Proof of Gauss Law.

UNIT III MAGNETOSTATICS 9

Theories of magnetic field- Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I – Magnetic field intensity on the axis of a circular loop– Ampere's circuital law. Magnetic flux density – Lorentz Law of force – Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential.

UNIT IV ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9

Poisson's and Laplace's equation – Electric field in free space, conductors, dielectric -Dielectric polarization – Capacitance- Dielectric strength - Electric field in multiple dielectrics – Electrostatic energy and energy density – Boundary conditions for electric fields. Definition of Inductance – Inductance of loops and solenoids – Definition of mutual inductance – simple examples. Energy density in magnetic fields – magnetic boundary conditions.

UNIT-V ELECTRODYNAMIC FIELDS AND ELECTROMAGNETIC WAVES 9

Displacement current - Maxwell's equations (differential and integral forms) –.Electro Magnetic Wave equations – Uniform plane waves - Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors-skin depth, Poynting Theorem.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will able to

CO1: Recite and discuss the fundamentals of vector fields

CO2: Illustrate the concept of Electric field and solve the problems

CO3 : Define laws of magnetic field and calculate its parameters

CO4 : Discuss the behavior of electric and magnetic fields in materials

CO5: Derive Maxwell's, Electromagnetic waves equation and illustrate the behavior of electromagnetic waves.

TEXT BOOKS:

1. Mathew N.O. Sadiku, 'Principles of Electromagnetics', Oxford press, 6th edition, 2015.

2. William H.Hayt, 'Engineering Electromagnetics', Tata McGraw Hill edition, 8th edition, 2013.

REFERENCES:

1. Joseph. A.Edminister, 'Theory and Problems of Electromagnetics', Third edition, Schaum Series, Tata McGraw Hill, 2011.

2. AshutoshPramanik, 'Electromagnetism – Theory and Applications', Prentice-Hall of India Private Limited, New Delhi, 2009.

3. Kraus and Fleish, 'Electromagnetics with Applications', Tata McGraw Hill International Editions, Fifth Edition, 2010.

504004 ELECTRONICS DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To acquaint the students with the construction, theory, and operation of the basic electronic devices such as PN junction diode, Field Effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices.

CO-PO MAPPING:

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

UNIT I PN JUNCTION DIODES SEMICONDUCTORS 9

Energy bands in intrinsic and extrinsic silicon; – Carrier transport: diffusion current, drift current, mobility and resistivity – Generation and recombination of carriers – PN junction – Capacitive Effects in PN junction – Ideal Diode – Characteristics of Junction Diode – Diode Model: Exponential Model, Small-signal Model – Load line analysis – Series, Parallel Configurations – Mechanism of avalanche and Zener breakdown – Zener Diodes – Light Emitting Diodes: Direct and Indirect Bandgap materials, Homojunction and Heterojunction structure

UNIT II BIPOLAR JUNCTION TRANSISTORS BJT 9

Structure and Physical Operation (Modes and Configuration) – Current-Voltage Characteristics – Early Effect – Non-ideal Effects: Transistor Breakdown, Temperature effects – Transistor as Amplifier, Switch – DC operating point and Load Line-Q-Point-Bias Stability – Ebers-Moll Model – Hybrid-Pi Model – BJT biasing methods – Bias compensation methods, thermal runaway, thermal stability

UNIT III FIELD EFFECT TRANSISTORS JFET 9

Construction, Characteristics – Transfer Characteristics MOSFET: Structure and Working of n-Channel MOSFET (enhancement) – p-Channel MOSFET, CMOS – MOSFET Current-Voltage Characteristics – Non-ideal Effects: Body effect, Channel Length Modulation, Velocity Saturation – Depletion mode MOSFET FET, MOSFET Configurations and Biasing Methods Introduction to Bi-CMOS

UNIT IV POWER AMPLIFIER AND TUNED AMPLIFIER 9

Power Amplifiers, Tuned Amplifiers Classification of Amplifiers – Class A, B, C, D, S and class AB amplifiers, Class B Push-Pull – Transformer coupled amplifier design – LM380 IC Power Amplifier – MOSFET power amplifiers – Tuned Amplifiers: Single, Double and Stagger Tuned Amplifiers

UNIT V WAVESHAPING CIRCUITS AND BLOCKING OSCILLATOR 9

Pulse Generators, Shapers Multivibrators – Waveform shaping circuits – Schmitt trigger – Blocking Oscillator – Time Base Circuits – UJT as Relaxation Oscillator, Sawtooth generator

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the student will be able to:

CO1: Analyze the characteristics of the p-n junction diodes

CO2: Analyze the characteristics of transistors

CO3: Explain their understanding about the behavior of power control devices

CO4: Explain the functioning of optoelectronic devices

CO5: Design diode based circuits for the given specifications

TEXT BOOKS:

1. Adel S. Sedra, Kenneth C. Smith – Microelectronic Circuits – Oxford University Press, U.S. – 2015 (11th Edition - American Edition) – ISBN: 9780199339136

2. Jacob Millman, Christos C. Halkias and SatyabrataJit – Millman's Electronic Devices and Circuits – McGraw Hill, India – 2015 (4th Edition) – ISBN: 9789339219543

REFERENCES:

1. Anil K. Maini, Varsha Agrawal, "Electronic Devices and Circuits" Wiley, kindle edition 2009, ISBN: 9788126518951

2. David A. Bell – Electronic Devices and Circuits – Oxford University Press, India – 2008(5th Edition) – ISBN: 9780195693409

3. Donald A Neamen and Dhrubes Biswas – Electronic Circuits: Analysis and Design (SIE) – McGraw Hill, India – 2006(3rd Edition) – ISBN: 9780071070102

4. L. Boylestad – Electronic Devices and Circuit Theory – Pearson, India – 2015 (11th Edition) – ISBN: 9789332542600

5. S Salivahanan and N Suresh Kumar – Electronic Devices and Circuits – McGraw Hill, India – 2016(4th Edition) – ISBN: 9789339219505

504005 MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.

To Introduce about general instrument system, error, calibration etc.

CO-PO MAPPING:

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

UNIT I INTRODUCTION 9

Significance of Measurements-Methods of Measurements- Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of

measurement- Types of instruments: Indicating, recording, integrating, etc. – Calibration of instruments.

UNIT II ELECTRICAL MEASURING INSTRUMENTS 9

Basic requirement of measuring instrument-Principles of indicating instrument- Torque existing in instrument -Principle of D'arsonval Galvanometer – Principle and types of analog voltmeters – ammeters – PMMC- Moving Iron – ohmmeter - multimeters- Megger – Single and three phase wattmeters and energy meters

UNIT III MAGNETIC MEASUREMENTS 9

Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – current transformer – potential transformer - Instruments for measurement of frequency and phase - A.C potentiometers-Measurement of air gap flux-Testing of Permanent magnet.

UNIT IV DC AND AC BRIDGES 9

D.C Bridges - Wheatstone's Bridge – Kelvin's Bridge - A.C bridges– Maxwell's Bridge- Anderson Bridge-De Sauty's bridge- Schering Bridge – Heaviside bridge – Campell's bridge – Wien's bridge - transformer ratio bridges- self-balancing bridges.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive- capacitive & inductive transducers – Piezoelectric transducers – Photoelectric transducer – Measurement of speed- Introduction to data acquisition system - An Introduction to Computer –Digital recording system - Controlled Test Systems. IEEE - 488 GPIB Bus

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course student will able to:

CO1: Compare different types of instruments-their working principles, advantages and disadvantages.

CO2: Explain the operating principles of various analog meters.

CO3: Classify the transformer and compare their performance and also discuss about magnetic measurements

CO4: Identify different Bridge circuits and categorize the uses and summarize their functions

CO5. Identify the transducers, describe their operating principle and discuss about data acquisition system

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', DhanpatRai and Co, 20 th edition, Reprint 2015.

2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 3rd Edition, Reprint 2012.

3. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, Reprint 2013.

REFERENCES:

1. A.J. Bkouwens, 'Digital Instrumentation', Tata McGraw Hill, 2010.

2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2011.
3. Golding E.W.and Widdis, "Electrical Measurements & Measuring Instruments", Reem Publication, 2011.

504101 ELECTRICAL MACHINES – I LABORATORY L T P C
0 0 3 2

COURSE OBJECTIVE:

To provide strong background in different types of excitation for D.C. Machines and Transformer.
To gain knowledge on various lab experiments connected with D.C. Machines and Transformer and there by achieve the design concepts.
To attain knowledge on application of D.C. Machines and Transformer concepts with respect to the performance characteristics.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Study about various starters used for DC Machines.
2. Open circuit and load characteristics of DC shunt generators.
3. Load characteristics of DC compound generator.
4. Brake test on DC shunt motor.
5. Brake test on DC compound motor.
6. Brake test on DC series motor.
7. Swinburne's test
8. Speed control of DC shunt motor.
9. Retardation Test on D.C. Shunt Motor
10. Hopkinson's test on DC motor – generator set.
11. Load test on single-phase transformer
12. Open circuit and short circuit tests on single phase transformer.
13. Sumpner's test on transformers.
14. Case study on Electrical equipment (Fan, Lamp, Iron box and motor)

Additional Experiments:

1. Using MATLAB simulate the following tests
    a. Load characteristics of DC shunt motor.
    b. Swinburne's test.
    c. Separation of Losses in a D.C. Shunt Motor.
    d. Open circuit characteristics of DC shunt generator.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Justify the characteristics of various generators depending on their type of field excitation.

CO2: Perform the experiment for speed control of different types of DC Motors.

CO3: Perform test on Motor-Generator Set.

CO4: Demonstrate different types of testing in transformer.

CO5: Develop the Simulation Model of dc machines

TEXT BOOKS:

1. Bimbra P. S., Electrical Machinery, 7/e, Khanna Publishers, 2011.

2. Theraja B. L., A Textbook of Electrical Technology, S. Chand & Company, New Delhi, 2008.

REFERENCES:

1. Kothari D. P. Laboratory Manual for Electrical Machines, I K International Publishing House Pvt. Ltd.

2. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.

504102	**ELECTRONIC DEVICES AND CIRCUITS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

COURSE OBJECTIVE:

To introduce the various electronic components and tools.

To introduce design, construct and evaluate electronic circuits using them.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Characteristics of Diodes (PN Junction and Zener)
2. Bridge Rectifier (With and without filters)
3. Characteristics of BJT in CE Configuration
4. Characteristics of UJT
5. Biasing Circuit and Bias Compensation
6. Characteristics of LDR, Photodiode
7. Two Stage RC Coupled Amplifier Frequency Response
8. Cascode Amplifier Frequency Response
9. Darlington Pair Amplifier Frequency Response
10. Phase Shift Oscillator, Colpitts and Hartley Oscillator
11. Multivibrator using BJT
12. UJT as Relaxation Oscillator

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the student will be able to:

CO1: Operate electronic test equipment and hardware/software tools to create transistor based circuits by applying the knowledge on them with an understanding of their limitations and impact on society, environment

CO2: Troubleshoot transistor based circuits by applying the knowledge on them

CO3: Work as part of a team and as individual effectively in designing simple circuits

CO4: Communicate the technical information related to designed electronic circuits by means of oral and written reports

CO5: Follow the safety procedures and ethics in designing simple circuits.

504103 MEASUREMENTS AND INSTRUMENTATION LAB L T P C

0 0 2 1

COURSE OBJECTIVE:

To offer strong background in different types of sensors and measuring devices.

To provide mathematical foundation and there by the relative analysis of measuring calculations.

To provide knowledge on various lab experiments connected with sensors and measuring instrument and there by achieve the design concepts.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Displacement Measurement using LVDT and obtain its characteristics
2. Measurement of temperature using thermo couple and obtain its characteristics curve
3. Measure torque of a rotating shaft using torsion meter/strain gauge torque transducer
4. Measurement of Capacitance using Schering bridge
5. Measurement of Inductance using Maxwell's Inductance capacitance bridge
6. Measurement of Inductance using Anderson's bridge.
7. Measurement of Resistance using Wheatstone bridge
8. Measurement of Resistance using Kelvin Double bridge method
9. Calibration of Single phase energy meter using direct & phantom loading.
10. Measurement of three phase power and power factor
11. Measurement of Pressure using Bourdan tube.
12. Measurement of Iron Loss.
13. Study of Current Transformer and clamp meter.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will able to,

CO1: Justify the operating principle and characteristics of various sensors.

CO2: Apply the procedure to measure the electrical quantities using measuring instruments.

CO3: Determine the electrical parameters using different types of Bridges

CO4: Demonstrate the function of Transducers and wattmeter.

CO5: Perform the calibration test for various meters.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', DhanpatRai and Co, 20 th edition, Reprint 2015.

2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 3rd Edition, Reprint 2012.

REFERENCES:

1. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2011.

2. Golding E.W and Widdis, "Electrical Measurements & Measuring Instruments", Reem Publication, 2011.

501109 CAREER SKILL DEVELOPMENT – I L T P C

0 0 2 1

COURSE OBJECTIVE:

To empower the students with skill sets required for their overall personality development

To improve the standard of students for their employability.

CO-PO MAPPING:

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

UNIT I LINGUISTICS SKILLS – 1 6

1. Reporting people's words and thoughts, Reporting statement, reporting orders, offers, suggestions, intentions, etc.

2.Linking verbs

3.Forming questions

4.Organising information

UNIT II LINGUISTICS SKILLS –2 6

1.Spoken English Vs Written English

2.Varities of English Language

3.Conversational skills – In Various situations a) Shopping Malls b) Airport c) Principal's Office d) Hospital e) Telephonic orders (Swiggy, Zomato)

UNIT III QUANTITATIVE ABILITY- I 6

Shortcuts, Number theory- History of numbers – HCF & LCM – Divisibility rule – Finding the unit place, Percentage, Average, Probability

UNIT IV QUANTITATIVE ABILITY - II 6

Clocks, calendars, Profit, loss and discount, Simple and compound interest, Ratio &Proportions, Mixtures and allegation, Probability, Permutation and combination.

UNIT V AGGRANDIZING STAGE SKILLS 6

Listening and making motivational speeches, Goal setting – Academic, Impromptu Speech, Extempore speech

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will able to,

CO1: Acquire knowledge on English Grammar,

CO2: Attain knowledge about analytical skills

CO3: Gain knowledge on logical reasoning.

CO4: Facilitate to set their career goals.

CO5: Make motivational speeches

TEXT BOOKS:

1. John Eastwood, "Oxford Practice Grammar", Oxford.
2. Rajesh Verma, "Fast Track Objective Arithmetic", Arihant Publications.

REFERENCE BOOKS:

1. V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
2. R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Ltd.

MANDATORY COURSE

501801 ENVIRONMENTAL STUDIES L T P C

2 0 0 2

COURSE OBJECTIVES:

To study about the dynamic processes and understand the features of the earth's interior and surface conditions.

CO-PO MAPPING:

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

UNIT I ENVIRONMENTAL SYSTEMS 6

Definition scope and importance of environment. Need for public awareness. Concept of an ecosystem. Structure and function of an ecosystem - producers, consumers and decomposers. Energy flow in the ecosystem. Ecology succession – food chains, food webs and ecological pyramids. Introduction, types, characteristic feature, structure and function of the (a) forest

ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, rivers)

UNIT II BIODIVERSITY 6

Introduction to biodiversity definition: genetic, species and ecosystem diversity, Biogeographically classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values, Biodiversity at local levels – Global level, Kalakad and Mundanthurai Tiger Reserve (KMTR). India as a mega diversity nation. Hot – spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife confects. Endangered and endemic species of India. Field study of common plats, insects, birds, field study of simple ecosystems – pond, river, hill slopes, etc.,

UNIT III ENVIRONMENTAL POLLUTION 6

Definition. Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Radiation Hazards. (h) Use and throw plastic (j) Agrochemicals Management and prevention of municipal solid wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslide, Tsunami. Filed study of local polluted site – Urban/Rural/Industrial/Agricultural.

UNIT IV NATURAL RESOURCES 6

Forest resources: Use and over – exploitation, deforestation. Water resources: use and over – utilization of surface and ground water, dams – benefits and problems, sand mining. Food resources – changes caused agriculture and overgrazing, effects of modern agriculture. Energy resources: growing energy needs. Renewable and non-renewable energy sources. Role of an Individual in conservation of natural resources.

UNIT V SOCIAL ISSUES AND ENVIRONMENT 6

Population explosion. From unsustainable to sustainable development. Water conservation rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain. Environment protection act. Air (Prevention and control of pollution) act. Water (Prevention and control of pollution) act. Wildlife protection act (1972). Forest conservation act. Role of State and Central pollution control boards. Family welfare program-HIV/AIDS, child welfare, women welfare.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will able to,

CO1: Understand the different environmental systems.

CO2: Know about biodiversity.

CO3: Understand different environmental pollution.

CO4: Study and understand the natural resources.

CO5: Understand social issues.

TEXT BOOK:

1. Dr A. Ravikrishnan “Environment Science and Engineering” Sri krishnahi tech publication

Chennai, Revised Edition June 2013.

REFERENCE BOOKS:

1. Dharmendra S. Sengar, 'Environmental law', prentice hall of India Pvt Ltd, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt, Ltd, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

SEMESTER IV

501020 ENGINEERING MATHEMATICS III

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

To develop the skills of the students in the areas of transforms and partial differential equations. To serve as a prerequisite for post graduate and specialized studies and research.

CO-PO MAPPING:

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

UNIT I LAPLACE TRANSFORM 12

Laplace transform – Conditions for existence – Transform of elementary functions –Basic properties – Transform of derivatives and integrals – Transform of unit step 1function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems.

UNIT II FOURIER TRANSFORMS 12

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's identity.

UNIT III Z -TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded).

UNIT V PROPOSITIONAL 12

Propositions- Logical connectives -Compound propositions-Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalence and implications – Demorgan's laws – Normal forms – Principal conjunctive & disjunctive Normal forms – Rules of Inference – arguments – validity of arguments.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to o

CO1: Apply Laplace transform in Engineering.

CO2: Evaluate the Fourier transform of continuous functions.

CO3: Solve difference equation by Z- Transform.

CO4: Apply PDE in Engineering.

CO5: Understand the concept of logics.

TEXT BOOKS:

1. Grewal, B.S, 'Higher Engineering Mathematics' 47th Edition, Khanna publishers, Delhi, 2016.
2. Bali.N.P and Manish Goyal 'Transforms and partial differential Equations', Second Edition, Laxmi Publications(P) Ltd. (2011)(For units 2,3,4,5)

REFERENCES:

1. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi, 2007.
2. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education, 2007.
3. Erwin Kreyszig 'Advanced Engineering Mathematics', 8th edition-Wiley India, 2007.
4. T.Veerarajan, "Engineering Mathematics", Tata-McGraw Hill Publishing Pvt. Ltd., New Delhi, 2008.

504006 ELECTRICAL MACHINES – II L T P C

3 0 0 3

COURSE OBJECTIVES:

To study the operation and performance characteristics of Alternators.

To study the operation and performance characteristics of Induction machines.

To study the operation and performance characteristics of Synchronous machines.

To acquire knowledge in starting and speed control of induction motors.

To study the operation and performance characteristics of special machines.

CO-PO MAPPING:

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

UNIT I ALTERNATORS 9

Constructional details –Principle of operation– EMF equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF, ZPF and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque –Effect of unequal voltage – Distribution of load –

Maximum power output - Applications

UNIT II THREE PHASE INDUCTION MOTOR 9

Classification of AC Motors - Constructional details – Types of rotors – Principle of operation – Slip – Torque equation, Slip torque characteristics – Equivalent circuit – Losses and efficiency – Load test - No load and blocked rotor tests – Circle diagram – Synchronous induction motor – Linear induction motor - Induction generator- Applications.

UNIT III STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9

Need for starting – Types of starters – Rotor resistance, Autotransformer, DOL and Star, delta starters — Direct switching of Induction motor – Crawling – Cogging - Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT IV SYNCHRONOUS MOTOR 9

Principle of operation – Starting methods - Torque equation –Equivalent circuit of synchronous motor - power developed – Types of excitation -Effect of Change in excitation - V and inverted V curves – Hunting –Method of starting - Applications.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Starting methods of single phase induction motors -Shaded pole induction motor- Linear reluctance motor –Linear induction motor Repulsion motor -Hysteresis motor - AC series motor - Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the working principle and characteristics of alternators.

CO2: Classify AC motors and describe the characteristics and Tests on Induction motor.

CO3: List the starters and discuss the starting and speed control methods of 3 phase induction motor.

CO4: Explain the operating principle and starting methods of Synchronous motor.

CO5: List the types and discuss the principle and testing of Single phase induction motor.

TEXT BOOKS:

1. Theraja, B.L., "A Text book of Electrical Technology", Vol. II, S.C Chand and Co., New Delhi, 23rd edition, Reprint 2014.

2. D.P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 5th edition, 2017.

REFERENCES:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, "Electric Machinery", Tata McGraw Hill publishing Company Ltd, 6th edition, 2005.

2. J.B. Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, First edition, 2013.

3. M.G.Say, "Performance and Design of AC Machines", CBS Publishers, 3rd edition, 2005

504007 CONTROL SYSTEMS (PRACTICAL COMPONENT) **L T P C**

3 0 2 4

COURSE OBJECTIVES:

To understand the basic components of control systems.

To Gain knowledge in various time domain and frequency domain tools for analysis and design of linear control systems.

To understand the methods and analyze the stability of systems

To Gain knowledge in designing compensators.

To understand the concepts of state variables

CO-PO MAPPING:

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

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Introduction and classification of control systems - Transfer function – Mathematical models of systems – signal flow graphs using Mason's gain formula - Control hardware and their models: Servo motors- tacho generators - gear train.

UNIT II TIME RESPONSE ANALYSIS 9

Mathematical expression for standard test signals – Type and order of systems – Time response of first order and second order systems - Time domain specifications – Steady state error analysis - Generalized error series – Introduction to PID controller- PID Controller tuning using Ziegler Nichols's method.

UNIT III FREQUENCY DOMAIN ANALYSIS 9

Frequency response analysis – frequency domain specifications of second order systems – Correlation between time domain and frequency domain specifications– polar plots, bode plots – Determination of Gain margin and phase margin.

UNIT IV DESIGN OF COMPENSATORS AND STABILITY ANALYSIS 9

Need for Compensation – Compensation Techniques - Design of Lead Compensator using bode plot – Design of lag compensator using bode plot – Stability Analysis: Root locus – Routh's stability

UNIT V STATE SPACE ANALYSIS 9

Introduction to multiple input multiple output systems - State variables - State equation - State transition matrix - Controllability - Observability

PRACTICAL COMPONENTS

1. Introduction to simulation software like MATLAB/LABVIEW
2. Modeling of DC Motor using simulation software
3. Digital simulation of first and second order systems for different inputs

4. Given a system transfer function, plot the location of the system zeros and poles using simulation software
5. Stability analysis by root locus plot using MATLAB program.
6. Stability analysis of linear systems using Bode plot.
7. Design of PID controller using Ziegler Nichol's method
8. Speed control of DC Motor using PID Controller

LECTURES: 45 PRACTICALS: 30 TOTAL: 75 PERIODS

TEXT BOOKS:

1. J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 5th edition, Multicolour edition, 2018.
2. M. Gopal, "Control Systems, Principles & Design", Tata McGraw Hill, 5th edition New Delhi, 2012.

REFERENCES:

1. B.C. Kuo, "Automatic Control Systems", Prentice Hall of India Ltd., 9th edition New Delhi, 2009.
2. M.N. Bandyopadhyay, "Control Engineering Theory and Practice", Prentice Hall of India, 2004.
3. S. Salivahanan, R. Rengaraj & G. R. Venkatakrishnan, "Control Systems Engineering", Pearson publications., Chennai, 2015

504008 TRANSMISSION AND DISTRIBUTION L T P C

3 0 0 3

COURSE OBJECTIVES:

To give basic knowledge in structure of power system
To derive the expressions for the computation of transmission line parameters.
To acquire knowledge in modeling and performance of transmission lines
To understand the function of insulators and cables
To understand the operation of the different distribution schemes.

CO-PO MAPPING:

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

UNIT I BASICS OF AC AND DC TRANSMISSION SYSTEM 9

Structure of electric power system – Extra High Voltage AC (EHVAC) Transmission – need, advantages, limitations –Effect of high voltage on volume of conductor and on efficiency -High Voltage Direct current Transmission (HVDC) – principle – classifications- advantages and limitations – Comparison between EHVAC and HVDC transmission -Examples of EHVAC and

HVDC links. Mechanical design of transmission line between towers – sag and tension calculations using approximate equations taking into account the effect of ice and wind.

UNIT II TRANSMISSION LINE PARAMETERS 9

Parameters of resistance- inductance and capacitance calculations - single and three phase transmission lines - single and double circuits - solid- stranded and bundled conductors - symmetrical and unsymmetrical spacing – transposition of lines - concepts of GMR and GMD.- (Simple diagrams of typical towers and conductors for 400, 220 and 110 KV operations)

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Transmission line classification - short line- medium line and long line – equivalent circuits – Ferranti effect - surge impedance- attenuation constant and phase constant - voltage regulation and transmission efficiency - real and reactive power flow in lines – power circle diagrams – shunt and series compensation.

UNIT IV INSULATORS AND CABLES 9

Classification of insulators for transmission and distribution purpose – voltage distribution in insulator string and grading - improvement of string efficiency. Underground cables - constructional features of LT and HT cables – types of cables - insulation resistance- capacitance- dielectric stress and grading.

UNIT V DISTRIBUTION SYSTEM 9

Feeders - distributors and service mains- DC 2-wire distributor – radial and ring main distribution. AC distribution – single phase (with concentrated and distributed loads) and three phase 3-wire and 4-wire distribution with balanced and unbalanced loads.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course the students will able to,

CO1: Explain the fundamentals of transmission system
CO2: Calculate the value of Transmission line parameters
CO3: Design and analyze the performance of Transmission lines
CO4: Discuss the functions of insulators and cables.
CO5: Explain the features of Distribution Systems

TEXT BOOKS:

1. V.K.Mehta, Rohit Mehta, "Principles of power system", S. Chand, New Delhi, 4 th revised edition, 2008.
2. S.L. Uppal, "Electrical Power" Khanna Publishers, 13 th edition, 2014.

REFERENCES:

1. Hadi Saadat, "Power System Analysis," Tata McGraw Hill Publishing Company", 2nd edition, 2008.
2. S.N. Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd, New Delhi, fourth printing 2005.
3. C.L.Wadhwa, "Electrical power system", New age international, first Edition, 2016.

504009 CONVENTIONAL AND NON-CONVENTIONAL ENERGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To impart knowledge on the various energy resources and their applications.

To impart knowledge on the construction and operation of various conventional power generation.

To impart knowledge on the construction and operation of various non-conventional power generation.

CO-PO MAPPING:

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

UNIT I THERMAL AND HYDRO POWER PLANTS 9

Basic thermodynamic cycles- Various components of steam power plant-layout - pulverized coal burners- Fluidized bed combustion - coal handling systems-ash handling systems - Forced draft and induced draft fans- Boilers - feed pumps-super heater –regenerator – condenser- deaearators - cooling tower - Electro static precipitator.

Site selection for hydroelectric power plant - Layout - dams - selection of water turbines-types of hydro turbine - Classification of hydroelectric power plant- pumped storage hydro plants-Advantages

UNIT-II NUCLEAR AND GAS POWER PLANTS 9

Various components of nuclear power plant - layout - Principles of nuclear energy - Types of Nuclear reactions - nuclear reactor - Types of Reactor - Nuclear waste &its disposal-Case study.

Types of gas power plants - open and closed cycle gas turbine- work output & thermal efficiency - methods to improve performance - reheating – inter coolings – regeneration - advantage and disadvantages – applications

UNIT III WIND AND OCEAN ENERGY 9

Basic principles of wind energy conversion- wind data and energy estimation-site selection considerations - Basic components of WECS- Classification of WEC systems - Types of Wind machines - Performance of wind machines - Generating systems-energy storage - Applications of wind energy

Ocean thermal energy conversion - types of OTEC power generation- open and closed cycle OTEC systems –generation of tidal energy – tidal power generation methods – barrage tidal power – Applications

UNIT IV SOLAR AND GEOTHERMAL ENERGY 9

Introduction-Solar constant-Solar radiation on the earth's surface-solar energy conversion into heat, Flat plate and concentrating collectors - Energy balance equation and collector efficiency - Solar energy storage system - Applications of solar energy: solar photo-voltaic, agricultural and industrial process heating, solar cooking, solar production of hydrogen.

Geothermal energy sources – Geothermal power plants technology – other applications of geothermal energy.

UNIT V BIO MASS AND OTHER RENEWABLE ENERGY 9

Bio mass conversion technologies - classification of Bio mass plants- Constructional details of some main digesters -Site selection- Thermal gasification of Biomass - Advantages and disadvantages of Biological conversion of solar energy.

Design and Principle operations of Fuel Cell- classification of fuel cells-Advantages and disadvantages of fuel cells - MHD power generation-Voltage and power output of MHD generator - Thermo electric power generation

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe the operation of thermal and hydro power plant and its application

CO2: Explain the operation of nuclear and gas power plant and its application

CO3: Explain the function of wind and ocean based power generation and its application

CO4: Discuss the importance and function of solar and geothermal based power generation

CO5: Describe the operation of Biomass and other renewable power generation and its application

TEXT BOOKS:

1. A Course in Power Plant Engineering by Arora and Domkundwar, S Chand Publications, 8th edition, 2016.
2. G.D.Rai., "Non-Conventional Energy Sources" Khanna Publications, Fourth Edition 2010, 29th Reprint.

REFERENCE BOOKS:

1. P.K.Nag, Power Plant Engineering, McGraw Hill, 4th edition, 2010.
2. R.K.Rajput, A Text book on Power Plant Engineering, Laxmi Publications, 5th edition, 2016.
3. Samsher Gautam "Power Plant Engineering" Vikas Publications, 2016.

504010 LINER INTEGRATED AND DIGITAL LOGIC CIRCUITS L T P C

3 0 0 3

COURSE OBJECTIVES:

To impart knowledge on the Signal analysis using Op-amp based circuits and Applications of Op-amp. To study various number systems and simplify the logical expressions

CO-PO MAPPING:

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

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

UNIT III SPECIAL ICs& APPLICATIONS OF OPAMP 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using op amps.

UNIT IV NUMBER SYSTEMS & COMBINATIONAL CIRCUITS 9

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders

UNIT V SYNCHRONOUS SEQUENTIAL CIRCUITS& ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment. Asynchronous sequential logic circuits-Transition tability, flow tability-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Acquire knowledge in IC fabrication procedure

CO2: Understand and acquire knowledge on the Applications of Op-amp.

CO3: Understand Functional blocks and the applications of special ICs

CO4: Study various number systems and simplify the logical expressions

CO5: Design combinational and sequential Circuits.

TEXT BOOKS:

1. David A. Bell, ‘Op-amp & Linear ICs’, Oxford, 2013
2. D. Roy Choudhary, Sheil B. Jani, ‘Linear Integrated Circuits’, II edition, New Age, 2003.
3. Ramakant A.Gayakward, ‘Op-amps and Linear Integrated Circuits’, IV edition, Pearson Education, 2003 / PHI. 2000.
4. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007

5. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
6. Comer "Digital Logic & State Machine Design, Oxford, 2012.

504104 ELECTRICAL MACHINES – I LABORATORY **L T P C**
0 0 3 2

COURSE OBJECTIVE:

To offer basic knowledge of alternators.
To estimate the regulation of alternator.
To determine the performance characteristics of induction motor

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Study of AC starters and Modeling of AC machines.
2. Regulation of three phase alternator by EMF and MMF methods.
3. Regulation of three phase alternator by ZPF and ASA methods.
4. Regulation of three phase salient pole alternator by slip test.
5. Synchronization of alternator to Infinite Bus bar.
6. V and Inverted V curves of Three Phase Synchronous Motor.
7. Load test on single phase induction motor.
8. No load and blocked rotor test on single phase induction motor.
9. Load test on three - phase induction motor.
10. Circle Diagram of three phase squirrel cage induction motor.
11. Equivalent circuit of three phase squirrel cage induction motor.
12. Separation of No -load losses of three - phase squirrel cage induction motor.
13. Speed control of three - phase induction motor by pole changing method.

Additional Experiments:

1. Modeling and Analysis of Induction Motor using Labview.
2. Speed control of 3- ϕ slip ring induction motor using PLC
3. Star - delta starter using PLC

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will able to,
CO1: Identify various parts of an electrical machine.
CO2: Calculate the equivalent circuit parameters of induction motor.
CO3: Conduct experiments on Ac Machines to draw the characteristics.

CO4: Determine the regulation of Alternators and compare their performance.
CO5: Perform test on synchronous Machine and determine the Direct and quadrature axis

TEXT BOOKS:

1. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.
2. Electrical Machines Laboratory Manual by Nagrath IJ&M.R. Poonkuzhali (EDD Notes), 2007.

REFERENCES:

1. M.G. Say – Performance and Design of AC machines –Pitman, 2005
2. P.S. Bimbhra, Electrical Machinery, Schand Publishers, 7th edition, 2011

504105	LINER INTEGRATED AND DIGITAL LOGIC CIRCUITS LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVE:

To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Application of Op-Amp: inverting and non-inverting amplifier,
2. Adder, comparator, Integrator and Differentiator.
3. Voltage to frequency characteristics of NE/ SE 555 IC
4. Variability Voltage Regulator using IC
5. Implementation of Boolean Functions, Adder and Subtractor circuits
6. Parity generator and parity checking
7. Encoders and Decoders
8. Design of multiplexer and de multiplexer
9. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the student will be able to:
CO1: Understand the integrator and differentiator.
CO2: Understand the characteristics of IC 555
CO3: Design and implement 4-bit shift registers
CO4: Design and implement counters using specific counter IC.

CO5: Design and implement the Mux and De-Mux

501113	CAREER SKILL DEVELOPMENT – II	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE:

To excel the talents of students to face their career challenges and built confidence.

To become familiar with the theoretical and practical framework of career development.

CO-PO MAPPING:

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

UNIT I COMMUNICATION SKILLS / COMMUNICATION WITH OTHERS 6

Art of listening, Art of writing-Art of writing e-mails-email etiquette, Art of speaking

UNIT II CORPORATE SKILLS / WORKING WITH OTHERS 6

Developing body language- Practising etiquette and mannerism-Time management-Stress management

UNIT III INTERPERSONAL SKILLS/ UNDERSTANDING OTHERS 6

Developing interpersonal relationship-Team building-group dynamics-Networking- Improved work relationship

UNIT IV VERBAL & NON VERBAL REASONING 6

Analogy, Classification, Puzzles, Inserting the missing character, Figure series, Data Sufficiency, Data Interpretation, Assertion & Reason.

UNIT V ENHANCING JOB SKILLS 6

Group Discussion, Online language tests, Mock Interview

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will able to,

CO1: Increase their skill of listening, writing and speaking.

CO2: Increase their personality development, mannerisms Skill and Attitude.

CO3: Increase their interpersonal relationship.

CO4: Increase their knowledge of verbal and nonverbal reasoning.

CO5: Increase their experience of group discussion and mock interviews.

TEXT BOOKS:

1. Meena.K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills: A Road Map to Success), P.R. Publishers & Distributors, No, B-20 & 21, V.M.M. Complex, Chatiram Bus Stand, Tiruchirappalli- 620 002.
2. Alex K. (2012) Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi- 110 055.

SEMESTER V

501011 **POWER SYSTEM ANALYSIS** **L T P C**

3 1 0 4

COURSE OBJECTIVES:

To model the power system under steady state operating condition.

To apply efficient numerical methods to solve the power flow problem.

To model and analyses the power systems under abnormal (or) fault conditions.

To model and analyses the transient behavior of power system when it is subjected to a fault.

CO-PO MAPPING:

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

UNIT I INTRODUCTION **9+3**

Modern power system (or) electric energy system, Analysis for system planning and operational studies – basic components of a power system. Generator models – transformer model – transmission system model, load representation. Single line diagram – per phase and per unit representation – change of base. Network graph, Bus incidence matrix, Primitive parameters and bus admittance matrix from primitive parameters

UNIT II POWER FLOW ANALYSIS **9+3**

Bus classification, Formulation of power flow problems – Power flow solution using Gauss, Seidel method and Newton Raphson method. Development of Fast Decoupled Power Flow (FDPF) model and iterative solution – algorithm and flowchart - Comparison between these methods.

UNIT III SYMMETRICAL FAULT ANALYSIS **9+3**

Formation of Bus impedance matrix by Z bus building algorithm. Types of faults in power systems, symmetrical fault analysis. – fault analysis using Z bus matrix – algorithm and flow chart, Short circuit capacity, symmetrical fault analysis through bus impedance matrix **-** Post fault bus voltages **-** Fault level – Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS **9+3**

Symmetrical components, sequence impedance, sequence networks, Introduction to unsymmetrical faults. Single line to ground, line to line and double line to ground fault, Unbalanced fault analysis, problem formulation – analysis using Z bus impedance matrix – (algorithm and flow chart) - computation of post fault currents in symmetrical component and phasor domains.

UNIT V POWER SYSTEM STABILITY ANALYSIS **9+3**

Introduction to stability studies – classification of stability, Transient stability, Development of swing equation, Equal area criterion – critical clearing angle and time, factors affecting transient

stability - Numerical integration method: Euler's method, modified Euler's method, Fourth order Runge Kutta method.

LECTURES: 45 TUTORIALS: 15 TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will able

CO1: Model the power system under steady state operating condition.

CO2: Understand and apply iterative techniques for power flow analysis.

CO3: Model and carry out short circuit studies on power system

CO4: Acquire knowledge on Fault analysis.

CO5: Model and understand various power system components and carry out power flow, short circuit and stability studies.

TEXT BOOKS:

1. John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.

2. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010

REFERENCE BOOKS:

1. John.J.Grainger, William D. Stevenson, "Power System Analysis", Tata McGraw Hill, New Delhi 2008.

2. Pai M A, 'Computer Techniques in Power System Analysis', Tata McGraw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.

3. J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, 'Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.

504012 POWER ELECTRONICS L T P C

3 0 0 3

COURSE OBJECTIVES:

To understand the importance and the functioning of electronic devices for conversion, control, applications and conditioning of electronic power.

CO-PO MAPPING:

	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	-	-	-	-	2	1	1
CO3	3	3	-	-	1	-	-	-	-	-	-	-	2	1
CO4	3	3	-	-	1	1	-	-	1	2	-	-	-	1
CO5	3	3	-	-	1	1	-	-	1	-	1	2	-	2

UNIT I POWER SEMI - CONDUCTOR DEVICES 9

Operation and characteristics - power transistor- power diode - SCR- TRIAC- power MOSFET- Power IGBT- GTO – IGCT-turn-on and turn-off methods- two transistor model of SCR- switching

characteristics of MOSFET - IGBT-Introduction to Driver and Snubber circuits.

UNITII AC TO DC CONVERTERS 9

Introduction to half wave- full wave and bridge rectifiers- Single phase half controlled and Fully controlled converters (R-RL-RLE Load with and without freewheeling diode)-Three phase(semi and full converter)– twelve pulse converter- Effect of source impedance – performance parameters – Dual converters – Applications-Battery charger

UNIT III CHOPPERS 9

Thyristor commutation techniques - natural and forced commutation – Principle of chopper operation – Step up and Step down choppers – Chopper Classification –Chopper Configuration Control Strategies- Switching mode regulators-Buck-Boost-Buck-Boost converter- Applications-Switching Mode Power Supplies- Battery operated vehicles.

UNIT IV INVERTERS & UPS 9

Single phase and three phase (both 120^0 mode and 180^0 mode) Voltage Source inverters - Current source inverter - Voltage and harmonic control- PWM techniques: Sinusoidal PWM- modified sinusoidal PWM - multiple PWM – Introduction to Space vector Modulation – Applications-Induction heating, UPS.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three Phase AC voltage controllers – Multistage sequence control - single and three phase cyclo converters –Introduction to Integral cycle control- Power factor control and Matrix converters- Application- light dimmers.

LECTURES: 45 TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will have the able to

CO1: Understand the different types of power semi-conductor devices and their switching characteristics.

CO2: Study the operation- characteristics and performance parameters of controlled rectifiers and their real time applications.

CO3: Learn the operation- switching techniques, the real time applications and basic topologies of DC-DC switching regulators.

CO4: Study the different modulation techniques of pulse width modulated inverters and the harmonic reduction methods and the inverters real time applications.

CO5: Attain the knowledge about the operation of AC voltage controller, real time application and Matrix converters.

TEXT BOOK

1. Muhammad H. Rashid., "Power Electronics: Circuits, Devices and Applications", Prentice Hall of India, Pearson education, 4rd edition, 2014
2. P.S. Bimbhra, "Power Electronics", Khanna Publishers, 5rd Edition, 2017.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, India, reprint, 2013.

REFERENCE BOOKS

1. Singh.M.D and Kanchandani, "Power Electronics", Tata McGraw Hill publication Company Ltd, New Delhi, 2014 Third edition.
2. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2012.
3. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2015.

504013 DESIGN OF ELECTRICAL MACHINES **L T P C**

3 1 0 4

COURSE OBJECTIVES:

To understand the design and applications of DC &AC machines

To introduce the basic design concepts and cooling arrangement of transformers.

To understand the computer aided design.

CO-PO MAPPING:

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

UNIT I FUNDAMENTALS OF ELECTRICAL MACHINE DESIGN 9+3

Major considerations in Electrical Machine Design , Electrical Engineering Materials - Choice of Specific Electrical and Magnetic loadings - Rating of machines- Standard specifications –Thermal design aspects - Heating and cooling of electrical machines.

UNIT II DESIGN OF DC MACHINES 9+3

Output equation – main dimensions- Magnetic circuit calculations – Carter"s Coefficient – Net length of Iron –Real & Apparent flux densities-choice of number of poles- armature design – design of field poles and field coils – design of commutator and brushes – Computer aided design of dc machines.

UNIT III DESIGN OF TRANSFORMERS 9+3

KVA output for single and three phase transformers – optimum design of transformers - design of yoke- core and winding for core and shell type transformers- Window space factor – Overall dimensions - leakage reactance calculation -Temperature rise in Transformers- Design of tank and cooling tubes of transformers - Methods of cooling of Transformers - Computer aided design of single phase core transformer

UNIT IV DESIGN OF INDUCTION MOTORS 9+3

Output equation – main dimensions- –design of stator – design of squirrel cage and slip ring rotor - Magnetic leakage calculations – Leakage reactance of poly phase machines- Operating characteristics : Magnetizing current - Short circuit current- Circle diagram - Computer program: Design of slip-ring rotor.

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9+3

Output equations – choice of loadings- Short circuit ratio- Estimation of air gap length -Design of

salient pole machines: Armature design- Design rotor- design of field coil- Design of damper winding - Design of turbo alternators- Rotor design-Introduction to Computer aided design - Computer program: Design of Stator main dimensions

LECTURES: 45 TUTORIALS: 15 TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the Students can able to

CO1: Understand basics of design considerations for rotating and static electrical machines

CO2: Design single and three phase transformer.

CO3: Design armature and field of DC machines.

CO4: Design stator and rotor of induction motor.

CO5: Design and analyze synchronous machines.

TEXT BOOKS:

1. A.K.Sawhney , "A course in Electrical Machine Design" , Dhanpat Rai and sons, New Delhi, 6th Edition, Reprint 2018.
2. S.K. Sen, "Principles of Electrical Machine Design with Computer Programme", Oxford and IBH publishing Co., New Delhi, 2nd edition, 2006.

REFERENCE BOOKS:

1. R.K Agarwal, "Principles of Electrical Machine Design", S.K.Kataria sons, New Delhi, Revised edition, 2010
2. V.N Mittle and A.Mittle, "Design of Electrical Machines", Standard Publications and Distributors, New Delhi, 2002.
3. M.G.Say "Performance and Design of AC machines" CBS Publishers and distributors, New Delhi, 3rd Edition, 2002.

504014 OBJECT ORIENTED PROGRAMMING L T P C

2 0 0 2

COURSE OBJECTIVES:

To understand Object Oriented Programming concepts and basic characteristics of Java

To know the principles of packages, inheritance and interfaces

To define exceptions and use I/O streams

To develop a java application with threads and generics classes

To design and build simple Graphical User Interfaces

CO-PO MAPPING:

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

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 6

Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java – Characteristics of Java – The Java Environment – Java Source File Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers – static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages – JavaDoc comments.

UNIT II INHERITANCE AND INTERFACES 6

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning -inner classes, Array Lists – Strings

UNIT III EXCEPTION HANDLING AND I/O 6

Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 6

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V EVENT DRIVEN PROGRAMMING 6

Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Develop Java programs using OOP principles

CO2: Develop Java programs with the concepts inheritance and interfaces

CO3: Build Java applications using exceptions and I/O streams

CO4: Develop Java applications with threads and generics classes

CO5: Develop interactive Java programs using swings

TEXT BOOKS:

1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2011.

2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2013.

REFERENCE BOOKS:

1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers‖, 3rd Edition, Pearson, 2015.

2. Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2011.

3. Timothy Budd, ―Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education, 2000.

504015 DIGITAL SIGNAL PROCESSING L T P C

3 1 0 4

COURSE OBJECTIVES:

To introduce discrete Fourier transform and its applications.

To teach the design of infinite and finite impulse response filters for filtering undesired signals.

To introduce signal processing concepts in systems having more than one sampling frequency.

CO-PO MAPPING:

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

UNIT I SIGNALS AND SYSTEMS 12

Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution-Correlation.

UNIT II FREQUENCY TRANSFORMATIONS 12

Introduction to DFT – Properties of DFT – Circular Convolution – Filtering methods based on DFT – FFT Algorithms – Decimation – in – time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering – DCT – Use and Application of DCT.

UNIT III IIR FILTER DESIGN 12

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

UNIT IV FIR FILTER DESIGN 12

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

UNIT V FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS 12

Binary fixed point and floating point number representations – Comparison – Quantization noise – truncation and rounding – quantization noise power- input quantization error- coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling.

LECTURES: 45 TUTORIALS: 15 TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand about signals and systems

CO2: Perform frequency transforms for the signals.

CO3: Design IIR filters.
CO4: Design FIR filters.
CO5: Design finite word length effects in digital filters

TEXT BOOKS:

1. John G. Proakis and Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education, Prentice Hall, 2007.
2. Emmanuel C, Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second edition, Pearson Education Prentice Hall, 2002.

REFERENCE BOOK:

1. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Third Edition, Tata Mc Graw Hill, 2007.
2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
3. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2006.
4.

504106 OBJECT ORIENTED PROGRAMMING LAB

L	T	P	C
0	0	3	2

COURSE OBJECTIVE:

To get a clear understanding of object-oriented concepts.
To understand object oriented programming through C++ & JAVA.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

C++:

1. Program using functions
• functions with default arguments
• implementation of call by value, address, reference
2. Simple classes for understanding objects, member functions & constructors
• classes with primitive data members,
• classes with arrays as data members
• classes with pointers as data members
• classes with constant data members
• classes with static member functions
3. Compile time polymorphism
• operator overloading
• function overloading

4. Run time polymorphism
• inheritance
• virtual functions
• virtual base classes
• templates
5. File handling
• sequential access
• random access

JAVA:

6. Simple java applications
• for understanding references to an instant of a class
• handling strings in JAVA
7. Simple package creation
• developing user defined packages in java
8. Interfaces
• developing user defined interfaces
• use predefined interfaces
9. Threading
• creation of threading in java applications
• multi threading
10. Exception handling mechanism in java
• handling predefined exceptions
• handling user defined exceptions

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:
CO1: Gain the basic knowledge on Object Oriented concepts.
CO2: Develop applications using Object Oriented Programming Concepts.
CO3: Implement features of object oriented programming to solve real world problems.
CO4: Learn simple applications of java
CO5: Study exception handling mechanism in java

504107	**POWER ELECTRONICS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

COURSE OBJECTIVE:

To provide practical knowledge in the operation of switching devices
To provide hands on training in the applications of power electronic devices

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	1	1	-	-	-	-	2	-	-	-	-	2		
CO2	1	1	1	1	-	-	-	-	1	-	1	1		
CO3	1	1	1	-	-	-	-	-	2	-	-	2		
CO4	1	1	1	-	2	-	1	-	1	-	-	2		
CO5	1	1	1	-	-	-	-	-	1	-	2	2		

LIST OF EXPERIMENTS

1. VI Characteristics of SCR
2. VI Characteristics of TRIAC
3. Characteristics of MOSFET & IGBT
4. Switching characteristics of SCR
5. Transient characteristics of MOSFET
6. AC to DC fully controlled converter
7. AC to DC half controlled converter
8. Step down and step up MOSFET based choppers
9. IGBT based single phase PWM inverter
10. Characteristics of GTO & IGCT.
11. Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters).
12. Resonant dc - dc converter by zero voltage switching
13. Resonant dc to dc converter by zero current switching

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the student will be able to:

CO1: Attain practical knowledge in the operation of switching devices

CO2: Able to study the characteristics of power electronics devices.

CO3: Measure the various waveform of AC-DC half and full converters.

CO4: Acquire the knowledge on simulation software.

CO5: Understand the concept of DC-DC converter and chopper

501115 CAREER SKILL DEVELOPMENT – III

L	T	P	C
0	0	2	1

COURSE OBJECTIVE:

To empower the students with skill sets required for their overall personality development

To improve the standard of students for their employability.

CO-PO MAPPING:

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

UNIT I LINGUISTICS SKILLS **6**

Logical sequence of words, higher level Reading Comprehension, Paragraph writing, Jumbled words, Sentence Rearrangement, Error Spotting, Idioms & Phrases, Word Substitution, and Synonyms & Antonyms.

UNIT II QUANTITATIVE ABILITY **6**

Number theory, Percentage, Profit loss and discount, Simple and compound interest, Problems on Average & Ages, Ratio &Proportions, Mixtures and allegation, Time speed and distance-Train problems-boats and streams, Time and work -Pipes and cisterns, Probability, Permutation and combination, Mensuration, Clocks, Calendars,

UNIT III REASONING ABILITY **6**

Analytical reasoning– Linear and circular arrangement, Blood relation, Direction Problems Logical reasoning – Number and Alpha series, coding and decoding, syllogisms, cubes, Ranking & Ordering.

UNIT IV VERBAL & NON VERBAL REASONING **6**

Analogy, Classification, Puzzles, , Inserting the missing character, Figure series, Data Sufficiency, Data Interpretation, Assertion & Reason, Statement – Arguments & assumptions, Cause & effect, Courses of Action.

UNIT V: PRACTICALS **6**

Impromptu Speech, Group Discussion.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: To excel the talents of students to face their career challenges and built confidence.

CO2: To enable the students to speak and write in English without making any mistakes

CO3: Students will examine the world of work, assess their interests and abilities, and make realistic career decisions.

CO4: Students acquire knowledge on English Grammar, Analytical & Logical reasoning.

CO5: Students will be facilitated to set their career goals.

TEXT BOOKS:

1. Edgar Thorpe & Showick Thorpe, "Winning Interviews", Pearson Publications.
2. John Eastwood, "Oxford Practice Grammar", Oxford.

MANDATORY COURSE

501802	**VALUE EDUCATION AND HUMAN RIGHTS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES:

To know about the various laws regarding to the business.

CO-PO MAPPING:

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

UNIT I: INTRODUCTION VALUE EDUCATION 6

purpose and significance in the present world – Value system – The role of culture and civilization-Holistic living – Balancing the outer and inner – Body, Mind and Intellectual level-Duties and responsibilities

UNIT II: SALIENT VALUES FOR LIFE 6

Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity , and inclusiveness, Self-esteem and self-confidence, punctuality – Time, task and resource management – Problem solving and decision making skills- Interpersonal and Intra personal relationship – Team work – Positive and creative thinking

UNIT III: EVOLUTION OF THE CONCEPT OF HUMAN RIGHTS 6

Journey from Magna Carta to the Universal Declaration of Human Rights (Magna carta; The united States Declaration of Independence; The French Declaration of the Rights of Man and the Citizen; United States Bill of Rights; Geneva Convention of 1864; Universal Declaration of Human Rights, 1948. International Bill of Rights (Significance of Universal Declaration of Human Rights, International Covenant on Civil and Political Rights; and the International Covenant on Economic, Social and Cultural Rights)

UNIT IV: THEORIES AND CLASSIFICATION OF HUMAN RIGHTS AND RULE OF LAW 6

Three Generation of Human Rights, Theory of Natural Rights, Legal/Positive Theory of Rights, Marxist Theory of Rights, Feminist Perspectives of Human Rights. Human Rights Concept, Origin, Historical Development in Greek and English Civilization and its Contribution to the Development of Rights

UNIT-V: LEGISLATIVE PROCEDURE 6

Salient Features of the Indian Constitution, Preamble, Citizenship, Fundamental Rights. Directive Principles of State Policy, Fundamental Duties, Parliamentary Government, Bicameralism, Legislative Process, Privileges, Council of Ministers, President of India, Governor. Judicial process under the Constitution, Nature of Judicial Review, Judicial, Court system in India, Judges-Appointments, conditions of service, etc., Advisory Jurisdiction of the Supreme Court, Public Interest Litigation

TOTAL: 30 PERIODS

COURSE OUTCOME:

On successful completion on this course the student will be able to

CO1: Understand duties and responsibilities

CO2: Recognize the salient values for life

CO3: Study about the concept of human rights

CO4: Study the history of human rights and rule of law

CO5: Gain good knowledge about the about the Indian business legislation.

TEXT BOOKS

1. Baxi, Upendra, (2002), The Future of Human Rights, New Delhi: Oxford University Press.
2. Dube, M.P. and Neeta Bora, (ed.), (2000), Perspective on Human Rights, New Delhi: Anamika Publishers.

REFERENCE BOOKS

1. Freeman, Michael, (2003), Human Rights: An Interdisciplinary Approach, Cambridge: Polity Press.
2. Jain M.P. - Indian Constitutional Law.

SEMESTER VI

501015 INDUSTRIAL AUTOMATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To become familiar with the fundamentals of PLC and its applications in the electrical engineering discipline

To write PLC programs using ladder diagrams

To acquire a good knowledge about SCADA system fundamentals and applications

To become familiar with the fundamentals of Distributed Control Systems

CO-PO MAPPING:

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

UNIT I INTRODUCTION TO PLC PROGRAMMING **9**

History of PLC- Principle of operation- Architecture of PLCs- Advantages & disadvantages of PLCs. Selection criteria for PLC - Program Scan- PLC programming languages- Fundamentals of Ladder diagram- basic components and symbols, Systematic approach in designing an process control system.

UNIT II ADVANCED PLC FUNCTIONS **9**

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs – Sinking-Sourcing Concept - Programming Timers- Counters –Data Manipulation and Math instructions - Closed loop systems using PLC - Industrial processes: Bottle filling system- AC Motor starter - Program development - Safe systems

UNIT III SCADA ARCHITECTURE **9**

Evolution and Definition of SCADA- Fundamentals of modern SCADA systems - SCADA system desirable properties - Basic SCADA Architecture: Human Machine Interface- Master Terminal

Unit- Remote Terminal Unit – Light, Thermal Sensors, actuators and wiring - SCADA Communication in an electrical power system- SCADA server- SCADA functions.

UNIT IV SCADA APPLICATIONS **9**

Intelligent Electronic Devices - Operation and control of interconnected power system- Automatic substation control- SCADA configuration- Energy management system- system operating states- system security- State estimation - SCADA system security issues- SCADA systems in Electric Power Generation – SCADA economics

UNIT V DISTRIBUTED CONTROL SYSTEM (DCS) **9**

Evolution – Advantages – DCS Architectures –Local control unit - Operator interfaces - Low level and high level operator interfaces – Operator displays - Engineering interfaces – Low level and high level engineering interfaces – Key issues of DCS - General purpose computers in DCS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students can able to

CO1: Understand the fundamentals of PLC and its applications in the electrical engineering discipline

CO2: Write PLC programs using ladder diagrams

CO3: Understand about SCADA system fundamentals

CO4: Understand about SCADA system applications

CO5: Learn the fundamentals of Distributed Control Systems

TEXT BOOKS:

1. Frank D. Petruzella, "Programmable Logic Controllers", 3rd Edition, Tata McGraw,Hill Education, 2005.
2. Stuart A Boyer, "SCADA, Supervisory Control and Data Acquisition", 4th Edition, International Society of Automation, 2010.
3. Michael P. Lukas, "Distributed Control System", Van Nostrand Reinhold Co., Canada, 1986.

REFERENCE BOOKS:

1. Gary Dunning, "Introduction to Programmable Logic Controllers", 2nd Edition, Delmar Thomson Learning, 2001
2. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", P, 2004
3. W.Bolton, "Programmable Logic Controllers", 5th Edition, Newnes Publications, 2009.

504016	**POWER SYSTEM OPERATION AND CONTROL**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

COURSE OBJECTIVES:

To acquire knowledge in power system operation and control.

To understand the system load variations and handling methods.

To acquire knowledge in unit commitment and scheduling problems.

To understand the concept of AGC, reactive power control and functioning of control centers

CO-PO MAPPING:

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

UNIT-I INTRODUCTION 9+3

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - System load variations: system load characteristics- load curves- daily-weekly and annual load duration curves - load factor - Reserve requirements: installed reserve - spinning reserve - cold reserve - hot reserve – Methods of forecasting.

UNIT-II UNIT COMMITMENT & HYDROTHERMAL SCHEDULING 9+3

Unit commitment-constraints in unit commitment–unit commitment solution methods– Priority list methods – Forward dynamic programming approach

Hydro-thermal co-ordination- Long range Hydro scheduling – Short range hydro scheduling-Hydroelectric plant models – Scheduling Energy.

UNIT-III AUTOMATIC GENERATION CONTROL 9+3

Generator model- Load Model- Prime mover Model – Governor Model – Tie line Model – Generation control – Tie-line Control – Tie-line bias control - AGC implementation – AGC features – Static and Transient Response of two area system. – State variability model - integration of economic dispatch control with LFC.

UNIT-IV REACTIVE POWER AND VOLTAGE CONTROL 9+3

Generation and absorption of reactive power: Relation between voltage- power and reactive power at a node-Analysis of Reactive power absorbed and generated by Transmission line - numerical problems - methods of voltage control- Tap-changing transformer - Tap setting of OLTC transformer – SVC (TCR + TSC) and STATCOM for voltage control.

UNIT-V COMPUTER CONTROL OF POWER SYSTEM 9+3

Energy control centre– Functions- data acquisition and control - SCADA and EMS functions - state estimation - security analysis and control - State transition diagram showing various state transitions and control strategies. state estimation problem – measurements and errors - weighted least square estimation

LECTURES: 45 TUTORIALS: 15 TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will have the

CO1: Ability to understand the day-to-day operation of electric power system.

CO2: Ability to analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand.

CO3: Ability to understand the significance of power system operation and control.

CO4: Ability to acquire knowledge on real power-frequency interaction

CO5: Ability to design SCADA and its application for real time operation.

TEXT BOOKS:

1. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.

REFERENCE BOOKS:

1. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
2. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.

504017 MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To understand the architecture of µP8085 & µC 8051

To learn addressing modes & instruction set of 8085 & 8051.

To study use of Interrupt structure 8085 & 8051.

CO-PO MAPPING:

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

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.66

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor stepper motor control- Application to automation systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students can able to

CO1: Acquire knowledge in Addressing modes & instruction set of 8085 & 8051.

CO2: Study the need & use of Interrupt structure 8085 & 8051.

CO3: Understand the importance of Interfacing

CO4: Explain the architecture of Microprocessor and Microcontroller.

CO5: Develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.

2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.

3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCE BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.

2. B.RAM," Computer Fundamentals Architecture and Organization" Newage International Private Limited, Fifth edition, 2017.

3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

4. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu, 2016

5. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu, 2016.

504018	**SOLID STATE DRIVES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To understand the stable steady - state operation and transient dynamics of a motor, load system.

To study and analyze the operation of the converter / chopper fed DC drive and to solve simple problems.

To study and understand the operation of both classical and modern induction motor drives.

To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

To learn characteristics and control of solid state DC motors drives, induction motor drives & synchronous motor drives.

CO-PO MAPPING:

CO/PO	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	-	2	-	-	2		
CO3	3	3	-	1	1	-	-	-	-	-	-	-		
CO4	3	3	-	-	1	1	-	-	1	2	-	-		
CO5	3	3	-	-	1	1	-	-	1	-	1	2		

UNIT I DRIVE CHARACTERISTICS 9

Electric Drives- Advantages of Electric Drives- selection of Motor power rating-Equations governing motor load dynamics - steady state stability - Multi quadrant dynamics – Modes of operation - load torque characteristics of various drives.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phases fully controlled converter fed separately excited D.C motor drive - Continuous and discontinuous conduction - Time ratio and current limit control - Constant torque and constant power region - 4 quadrant operation of converter.

UNIT III DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function of armature voltage control of DC motor and load – Closed loop speed and current control for field weakening mode - Design of controllers - Current controller and speed controller - Converter selection and characteristics.

UNIT IV SOLID STATE CONTROL OF INDUCTION MOTOR 9

Induction Motor Drives-Stator control - Stator voltage and frequency control – v/f control-AC chopper- Inverter and cyclo converter fed induction motor drives – Rotor control – Rotor resistance control -rotor resistance control using DC chopper-.slip power recovery scheme.

UNIT V SOLID STATE CONTROL OF SYNCHRONOUS MOTOR 9

Synchronous Motor Drives-Speed control of three phase synchronous motors- Variable frequency control of three phase synchronous motors - Voltage and current source fed synchronous motor - Cyclo converter fed synchronous motors – Constant Margin control and Power factor control-Permanent magnet synchronous motor drive

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the Students can able to

CO1: Express the stable steady, state operation and transient dynamics of a motor, load system.

CO2: Express the operation of the converter / chopper fed DC drive and to solve simple problems.

CO3: Express the operation of both classical and modern induction motor drives.

CO4: Design current and speed controllers for a closed loop solid state DC motor drive.

CO5: Express the function of solid state DC motors drives, induction motor drives & synchronous motor drives.

TEXT BOOKS:

1. Dubey.G.K, “Fundamental of Electrical Drives”, CRC press, Second Edition, 2005.
2. Gopal K Dubey “Power Semi-Conductor Controlled Drives”, Prentice Hall Inc New Jersey, Reprint 2014.

REFERENCE BOOKS:

1. Bimal K. Bose. “Modern Power Electronics and AC Drives”, PHI / Pearson Education, 2012.
2. R. Krishnan “Electric Motor & Drives Modelling, Analysis and Control”, Prentice Hall of India, 2001.
3. Murphy J.M.D. and Turnbull “Thyristor control of AC Motor”, Pergamon Press Oxford, First edition, 2001.

504108 **MICROPROCESSOR AND MICROCONTROLLER LABORATORY**

L	T	P	C
0	0	3	2

COURSE OBJECTIVE:

To introduce ALP concepts and features
To write ALP for arithmetic and logical operations in 8086 and 8051
To differentiate Serial and Parallel Interface
To interface different I/Os with Microprocessors
To be familiar with MASM

CO-PO MAPPING:

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

LIST OF EXPERIMENTS:

8086 Programs using kits and MASM
1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay Peripherals and Interfacing Experiments
7. Traffic light control
8. Stepper motor control
9. Digital clock 10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation 8051 Experiments using kits and MASM
14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2‟s complement of a number
16. Unpacked BCD to ASCII

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:
CO1: Write ALP Programmes for fixed and Floating Point and Arithmetic
CO2: Interface different I/Os with processor
CO3: Generate waveforms using Microprocessors
CO4: Execute Programs in 8051
CO5: Explain the difference between simulator and Emulator

504109 ENGLISH LANGUAGE LAB FOR ENGINEERS L T P C

0 0 3 2

COURSE OBJECTIVE:

To equip the Students of Engineering and Technology to acquire the basic communication skills in English.

To ensure the students of Engineering and Technology to acquire presentation skills.

To empower the learners of Engineering and Technology to attain the key employability skill-English

To inculcate in the minds of students to accomplish the accessibility to get acquainted with the latest scientific and technological terminology through electronic media.

To install in the minds of the students the skills of LSRW to achieve excel.

CO-PO MAPPING:

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

I. REVISING ENGLISH PHONETICS 9

1.1. Vowels, consonants, diphthongs.
1.2. Sounds
1.3. Stress and intonation
1.4. Understanding various accents of English
1.5. English Pronunciation Test

II. LISTENING COMPREHENSION 9

2.1. Gap filling
2.2. True or false
2.3. Multiple choice questions

III. READING COMPREHENSION 9

3.1. Word Formation Test
3.2. Cloze Test
3.3. Testing in Divergent Thinking
3.4. Transcoding Test

IV. CAREER LAB 9

4.1. Resume preparation-Types of resume
4.2. Presentation skills. (Technical)
4.3. Group Discussion (Technical)
4.4. Interview techniques-Mock interview

V. VERBAL AND NON-VERBAL COMMUNICATION 9

5.1. Body language and communication
5.2. Dyadic communication exercises
5.3. Soft skills (Work place)
5.4. Technical Report preparation

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to
CO1: Communicate using right pronunciation.
CO2: Communicate with one or many listeners' using appropriate communicative strategies.
CO3: Write cohesively and coherently and flawlessly avoiding grammatical errors
CO4: To acquire through knowledge in Technical writing skills.
CO5: To acquire knowledge to enhance communication skills.

TEXT BOOK:

1. Lab Manual Prepared by English Department. PSNCET

REFERENCE BOOKS:

1. Dr.R.Senapathi Communication Skills Lakshmi Publications, Chennai, 2012
2. Lesikar ,Raymond V.John Pettit ,and Mary E Flatly Lesikar's,Basie Business Communication,10th ed.Tata McGraw-Hill, New Delhi, 2007.
3. Bovee, Courtland and John V Thill, Business Communication Today, 8 th ed., Pearson Education, New Delhi, 2008.
4. William Sanborn, Technical Communications Pearson education, 2006

504110 POWER SYSTEM SIMULATION LABORATORY – I L T P C
0 0 2 1

COURSE OBJECTIVE:

To develop simple Matlab programs for the basic power system formulation.
To acquire experience in the usage of standard packages for power transmission and Distribution/ Simulation / control functions.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS:

1. Formation of Bus Admittance Matrix for given networks
2. Formation of Bus Impedance Matrix for given networks
3. Computation parameters of single Phase two wire transmission system
4. Computation parameters of three Phase symmetrical and unsymmetrical transmission system
5. Computation parameters of three Phase horizontal conductors of transmission system
6. Computation parameters of three Phase bundled conductors of transmission system
7. Symmetrical fault analysis
8. Unsymmetrical fault analysis
9. Transient fault Analysis
10. Attainment of the swing equation curve when fault is cleared
11. Attainment of the critical clearing angle and time for swing equation under sustained fault

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Explain the fundamentals of transmission system

CO2: Calculate the value of Transmission line parameters

CO3: Ability to model and carry out short circuit studies on power system

CO4: Ability to acquire knowledge on Fault analysis.

CO5: Ability to model and understand various power system components and carry out power flow, short circuit and stability studies.

501116 CAREER SKILL DEVELOPMENT – IV L T P C

0 0 2 1

COURSE OBJECTIVE:

To excel the talents of students to face their career challenges and built confidence.

To enable the students to speak and write in English without making any mistakes

CO-PO MAPPING:

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

UNIT I BODY LANGUAGE 6

Introduction, Grooming, Body Language – Body Language exhibited during professional interactions, Emotions displayed by Body Language, Postures and Gestures, Handshake, Eyes, Dressing Etiquettes, Hygiene & Cleanliness, Time Management.

UNIT II INTERVIEW ETIQUETTES 6

Meaning, Purpose, Personality traits and improvement, Interview process and types, checklist – do's and don'ts, Dress code, Importance of Body language in interviews, Self-Introduction.

UNIT III RESUME BUILDING 6

Introduction, Difference between Resume and CV, Strategy of Resume Writing from Employees Perspective, Favorable first impression, Body of the resume, clarity and crispness, format and content

UNIT IV GROUP DISCUSSION 6

Types, Key steps to succeed in Group Discussion, Responsibility of the first speaker, Guidelines – Do's and Don'ts during Group Discussion, The technique of summing up.

UNIT V PRACTICALS 6

Extempore speech, online typing, Mock Interview

TOTAL: 30 PERIODS

TEXT BOOKS

1. Edgar Thorpe & Showick Thorpe, "Winning Interviews", Pearson Publications.
2. John Eastwood, "Oxford Practice Grammar", Oxford.
3. Rajesh "Verma, Fast Track Objective Arithmetic", Arihant Publications.
4. K.Panday, "Analytical Reasoning", Magical Series.
5. P.Bakshi, "Objective English" Arihant Publications.

REFERENCE BOOKS

1. V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
2. R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited.

SEMESTER VII

504019 POWER SYSTEM TRANSIENTS L T P C

3 0 0 3

COURSE OBJECTIVES:

To study the generation of switching transients and their control using circuit – theoretical concept.
To study the mechanism of lighting strokes and the production of lighting surges.

CO-PO MAPPING:

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

UNIT I INTRODUCTION AND SURVEY 9

Review and importance of the study of transients – causes for transients. RL circuit transient with sine wave excitation – double frequency transients – basic transforms of the RLC circuit transients. Different types of power system transients – effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients – resistance switching and the equivalent circuit for interrupting the resistor current – load switching and equivalent circuit – waveforms for transient voltage across the load and the switch – normal and abnormal switching transients. Current suppression – current chopping – effective equivalent circuit. Capacitance switching – effect of source regulation – capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients – ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation – rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke – factors contributing to good line design – protection using ground wires – tower footing resistance – Interaction between lightning and power system.

UNIT IVTRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault – distribution of voltages in a power system – Line dropping and load rejection – voltage transients on closing and reclosing lines – over voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation.

UNIT V PROTECTION AGAINST TRANSIENTS 9

Protection of power systems against transient over-voltage due to switching and lightning, Lightning arrestors, Surge diverters, Surge capacitors and reactors, Overhead ground wires, Insulation coordination, Computer aids to calculate transient (EMTP).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Understand and analyze switching and lightning transients.

CO2: Acquire knowledge on generation of switching transients and their control.

CO3: Analyze the mechanism of lighting strokes.

CO4: Understand the importance of propagation, reflection and refraction of travelling waves.

CO5: Find the voltage transients caused by faults.

TEXT BOOKS:

1. Allan Greenwood, Electrical Transients in Power Systems, Wiley Inter Science, New York, 2nd Edition, 1991, Reprint 2011.

2. Pritindra Chowdhari, Electromagnetic transients in Power System, John Wiley and Sons Inc., Second Edition, 2009.

3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, Power System Transients – A statistical approach, PHI Learning Private Limited, Second Edition, 2010.

REFERENCE BOOKS:

1. M.S.Naidu and V.Kamaraju, High Voltage Engineering, McGraw Hill, Fifth Edition, 2013.

2. Juan A. Martinez-Velasco, "Transient Analysis of Power Systems: Solution Techniques, Tools and Applications", Wiley, United Kingdom, 2015.

3. Y.Hase, Handbook of Power System Engineering, Wiley India, 2012.

504020	CONSERVATION AND UTILISATION OF ELECTRICAL ENERGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To impart knowledge on Electrical energy conservation, energy auditing

To impart knowledge on Principle and design of illumination systems

To impart the concepts of Electric heating and welding.

CO-PO MAPPING:

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

UNIT I CONSERVATION **9**

Economics of generation – definitions- load and load duration curves- Need for electrical energy conservation – Energy conservation Techniques – energy efficient equipment –energy management – Energy conservation at home- Introduction to energy auditing - Energy audit at industries

UNIT II ILLUMINATION **9**

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps – design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED and its advantages over conventional lightings.

UNIT III HEATING AND WELDING **9**

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating - resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types - resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV ELECTRIC TRACTION **9**

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

UNIT V REFRIGERATION AND AIR CONDITIONING **9**

Introduction – Refrigeration cycle – Refrigeration system – Types of refrigerants –Domestic refrigerator – Equipment: Type of Compressors, Condensers, Expansion devices, Evaporators. Water coolers – Air conditioning systems – Air conditioning cycle– Classification of air conditioning systems – Central system – Unitary systems – Load estimation – Heating of building.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the limitations of energy conservation and get the knowledge of energy consumption tariff.

CO2: Analyze the various types of lighting loads.

CO3: Apply the electrical technology for heating and welding

CO4: Evaluate the requirements of ideal traction system and to know about the working principle of traction system

CO5: Create fervor to understand the process of refrigeration and air conditioner.

TEXT BOOKS:

1. R.K.Rajput, "Utilization of Electrical Power", Laxmi publications (P) Ltd., Fifth edition, Reprint 2019.

2. C.L.Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd. 2010.

REFERENCE BOOKS:

1. Dr.N.V.Suryanarayana, "Utilisation of Electric power", Wiley Eastern Limited, New Age International Limited, Reprint 2005.

2. J.B.Gupta, "Utilization Electric power and Electric Traction", S.K.Kataria and Sons, 2012.

3. Arora, C.P., "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010.

504021 SPECIAL ELECTRICAL MACHINES L T P C

3 0 0 3

COURSE OBJECTIVES:

To impart knowledge on Construction, principle of operation, control and performance of stepping motors, switched reluctance motors, permanent magnet brushless D.C. motors and permanent magnet synchronous motors.

CO-PO MAPPING:

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

UNIT I STEPPING MOTORS 9

Stepper motors – Basic principle – different types – variable reluctance- permanent magnet – hybrid type – comparison – theory of operation – monofilar and bifilar windings – modes of excitation – drive circuits – static and dynamic characteristics – applications

UNIT II SWITCHED RELUCTANCE MOTORS 9

Constructional features - Principle of Operation-Torque equation -Power Semi-Conductor

Switching Circuits –Torque – Speed Characteristics - Microprocessor based control of SRM Drive – Sensorless operation - Applications.

UNIT III PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Commutation in DC motors - Electronic Commutation - Difference between mechanical and electronic commutators - Construction and principle of Permanent Magnet Brushless DC Motor - trapezoidal type-sinusoidal type – comparison – applications - Torque and Emf equation -Torque-speed characteristics - Power Controllers-Drive Circuits

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Permanent magnet materials-Magnetic characteristics-Construction and types - Principle of operation –EMF equation – Torque equation –Armature reaction EMF-Synchronous reactance-phasor diagram-Torque Speed Characteristics -Power controllers - Self-control - vector control - Microprocessor based Control -– Sensorless operation - Applications

UNIT V OTHER SPECIAL MACHINES 9

Constructional features – Principle of operation and Characteristics of Hysteresis motor-Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

LECTURES: 45

COURSE OUTCOMES:

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

CO1: Acquire the knowledge on construction and operation of stepper motor.

CO2: Acquire the knowledge on construction and operation of stepper switched reluctance motors.

CO3: Acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.

CO4: Acquire the knowledge on construction and operation of permanent magnet synchronous motors.

CO5: Select a special Machine for a particular application.

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008, Reprint 2015.

2. Melkebeek, Jan A. "Electrical Machines and Drives: Fundamentals and Advanced Modelling", Germany, Springer International Publishing, 2018.

3. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCES

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2017.

2. R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013

504022	**PROTECTION AND SWITCHGEAR**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To educate the causes of abnormal operating conditions (faults, lightning and switching surges) of

the apparatus and system.

To introduce the characteristics and functions of relays and protection schemes.

To impart knowledge on apparatus protection

To introduce static and numerical relays

To impart knowledge on functioning of circuit breakers

CO-PO MAPPING:

CO/PO	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	-	2	-	-	2		
CO3	3	3	-	1	1	-	-	-	-	-	-	-		
CO4	3	3	-	-	1	1	-	-	1	2	-	-		
CO5	3	3	-	-	1	1	-	-	1	-	1	2		

UNIT I PROTECTION SCHEMES **9**

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Methods of Neutral grounding – Zones of protection and essential qualities of protection – Protection schemes

UNIT II ELECTROMAGNETIC RELAYS **9**

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III TRANSFORMER PROTECTION **9**

Types of Faults, Over Current Protection, Percentage Differential Protection, Inrush Phenomenon, High Resistance Ground Faults in Transformers, Inter-turn Faults, Incipient Faults, Over-fluxing Phenomenon

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION **9**

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Introduction, block diagram of numerical relay, numerical over current protection, numerical transformer protection, numerical distance protection of transmission line

UNIT V CIRCUIT BREAKERS **9**

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers - D.C. circuit breaker, auto-reclosing - definitions & features.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After learning the course the students should be able to:

CO1: Explain the purposes of protection, in relation to major types of apparatus, protection principle, dangers and criteria.

CO2: Choose and justify a suitable protection system for a specified application.

CO3: Analyze and compare specified protection systems

CO4: Compare merits of various principles, relay hardware and interrupting devices.

CO5: Compare the different type of circuit breakers performance based on which selection of circuit breaker can be made for a given application

TEXT BOOKS:

1. Badri Ram, B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition, 2011.
2. Y. G. Parithankar & S. R. Bhide, "Fundamentals of Power System Protection", 2nd edition, PHI, 2010
3. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.

REFERENCES:

1. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
2. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
3. Ravindra P.Singh, 'Switchgear and Power System Protection', PHI Learning Private Ltd., New Delhi, 2009.

504023 **ELECTRIC VEHICLES** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

To introduce the fundamental concepts, principles, analysis and design of hybrid, electric and fuel cell vehicles.

CO-PO MAPPING:

CO/PO	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	-	2	-	-	2		
CO3	3	3	-	1	1	-	-	-	-	-	-	-		
CO4	3	3	-	-	1	1	-	-	1	2	-	-		
CO5	3	3	-	-	1	1	-	-	1	-	1	2		

UNIT I INTRODUCTION **9**

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II BATTERY **9**

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries, operating features of Li-ion battery.

UNIT III DC & AC ELECTRICAL MACHINES **9**

Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN **9**

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking,

motor sizing.

UNIT V HYBRID ELECTRIC VEHICLES 9

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After learning the course the students should be able to:

CO1: Understand the working of different configurations of electric vehicles.

CO2: Understand the hybrid vehicle configuration and its components, performance analysis

CO3: Understand the properties of batteries and its types

CO4: Understand the electric vehicle drive systems

CO5: Understand the hybrid electric vehicles

TEXT BOOKS

1. Larminie, James, and Lowry, John. Electric Vehicle Technology Explained. Germany, Wiley, 2012.

2. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.

3. Muneer, Tariq, Electric Vehicles: Prospects and Challenges. Netherlands, Elsevier Science, 2017.

REFERENCES:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.

2. Hybrid Electric Vehicles. Croatia, IntechOpen, 2017.

504111 POWER SYSTEM SIMULATION LABORATORY – II L T P C

0 0 2 1

COURSE OBJECTIVE:

To provide better understanding of power system analysis through digital simulation.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS:

1. Formation of Bus Admittance and Impedance Matrices and Solution of Networks
2. Power Flow Analysis using Gauss-Seidel Method
3. Power Flow Analysis using Newton Raphson Method
4. Economic Dispatch in Power Systems

5. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
6. State estimation: Weighted least square estimation
7. Electromagnetic Transients in Power Systems: Transmission Line Energization
8. Contingency analysis: Generator shift factors and line outage distribution factors
9. Simulation and Implementation of Voltage Source Inverter
10. Computation of harmonic indices generated by a rectifier feeding a R-L load

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: To acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.

CO2: To analyze the power flow using GS and NR method

CO3: To find Symmetric and Unsymmetrical fault

CO4: To understand the economic dispatch.

CO5: To analyze the electromagnetic transients.

504112	**ELECTRICAL ESTIMATION, COSTING AND POWER WIRING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OBJECTIVE:

To become familiar in estimation of electrical wiring and IE rules

To get the training on usage of electrical standards and symbols

To acquire knowledge in the field of costing for LT & HT wiring.

To acquire knowledge in earthing and testing of installation.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS:

1. Study on Conventional Symbols for various Wiring Items and Accessories.
2. Estimate the costing and quantity of materials required for residential single bedroom flat (1 BHK).
3. Estimate the costing and quantity of materials required for Industrial power wiring having 4 or 5 machines.
4. Estimate the costing and quantity of materials required for Erection of one no. 15 hp induction motor in saw mill/flour mill.

5. Estimate the costing and quantity of materials required for Irrigation Pump motor (5hp) wiring.
6. Estimate the costing and quantity of materials required for Computer centre having 10 computers, a/c unit, UPS, light and fan.
7. Estimate the costing and quantity of materials required for Street Light service having 12 lamp light fitting.
8. Estimate the costing and quantity of materials required for a residential solar PV system
9. Study on Earthing and testing of installation.
10. Estimate the costing and quantity of materials required for a pipe and plate earthing as per IS 3043, 1966.
11. Study on testing of Wiring Installation.
12. Estimate the costing and quantity of materials required for installing a distribution transformer.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: To understand usage of electrical standards and symbols

CO2: To learn the differences between the theoretical and practical usage of accessories.

CO3: To have adequate knowledge in the field of cost estimation of power wiring and installation.

CO4: To study the market strategy and live with real world.

CO5: To know about Earthing and Testing of installation.

504113 EMBEDDED AND INTEL SYSTEM LAB L T P C

0 0 2 1

COURSE OBJECTIVES:

To learn the working of ARM processor

To understand the Building Blocks of Embedded Systems

To learn the concept of memory map and memory interface

To know the characteristics of Real Time Systems

To write programs to interface memory, I/Os with processor

CO-PO MAPPING:

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

LIST OF EXPERIMENTS:

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.

3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Interrupt performance characteristics of ARM and FPGA.
8. Flashing of LEDS.
9. Interfacing stepper motor and temperature sensor.
10. Implementing zigbee protocol with ARM.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to
To write programs in ARM for a specific Application
To interface memory and Write programs related to memory operations
To interface A/D and D/A convertors with ARM system
To analyze the performance of interrupt
To write programmes for interfacing keyboard, display, motor and sensor.

SEMESTER - VIII

		L	T	P	C
504301	**PROJECT WORK**	**0**	**0**	**15**	**6**

COURSE OBJECTIVE:

Final year projects represent the culmination of study towards the bachelor of engineering degree. Projects offer the opportunity to apply and extend material learned throughout the program. Assessment is by means of a seminar presentation, submission of a thesis, and a public demonstration of work undertaken.

CO-PO MAPPING:

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

COURSE CONTENT:

This course will be conducted largely as an individual or small group project under the direct supervision of a member of academic staff. The specific project topic undertaken will reflect the common interests and expertise of the student(s) and supervisor. Students will be required to:

1) Perform a literature search to review current knowledge and developments in the chosen technical area;

2) Undertake detailed technical work in the chosen area using one or more of theoretical studies, computer simulations and hardware construction.

3) Produce progress reports or maintain a professional journal to establish work completed, and to schedule additional work within the time frame specified for the project;
4) Deliver a seminar on the general area of work being undertaken and specific contributions to that field;
5) Prepare an interim report describing the work undertaken and results obtained so far; and
6) Present the work in a forum involving poster presentations and demonstrations of operational hardware and software.

COURSE OUTCOMES:

On successful completion of the course students will be able to:
CO1: Demonstrate a sound technical knowledge of their selected project topic.
CO2: Undertake problem identification, formulation and solution.
CO3: Design engineering solutions to complex problems utilizing a systems approach.
CO4: Conduct an engineering project
CO5: Communicate with engineers and the community at large in written an oral forms.

ELECTIVE – I

504201 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To expose the students to the basic concepts of management in order to aid in understanding how an organization functions, and in understanding the complexity and wide variety of issues managers face in today's business firms.

CO-PO MAPPING:

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

UNIT I - INTRODUCTION **9**

Management – Evolution of Management Thought -Principles of Management – Functions of Management - Social Responsibility of Management. Definition, Characteristics, Levels of Management, Process of Management, Contribution made by Frederick Taylor- Scientific management, Henri Fayol –Modern management. Prof. C.K. Pralad -Pyramid concept, Peter Drucker- MBO.

UNIT II - DEVELOPMENT OF MANAGEMENT **9**

Development of Management Theory **:** Dynamic Engagement Approach -Six different themes in management theory -New organizational environment, Ethics and social responsibility, Globalization and management, Inventing and reinventing organizations, Culture and multiculturalism.

UNIT III - PLANNING OF MANAGEMENT **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT IV - ORGANISING OF MANAGEMENT **9**

Organizing- Definition, Importance, Design of organization structure - concept, Span of management, Forms of organization structure -Functional, flat, Project-amoebic, Matrix etc. Work from home, Outsourcing, Virtual Organizations. Power and Authority - Concept, Delegation of authority, Centralization and decentralization, Conflict and Co-ordination.

UNIT V - DESIGN OF MANAGEMENT **9**

Staffing-Staffing as a Management function. Directing – Directing as a function of management, Direction and supervision. Motivation-Concept, Theories of motivation -Maslow theory of human needs, Mc Gregor's theory X & theory Y,William Ouchi- Theory Z and Edwin A. Locke- Goal setting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Study the evolution of Management, to study the functions and principles of management

CO2: Learn the organizational environment, Ethics and social responsibility

CO3: Study the vital framework namely planning of the management

CO4: Identify and apply appropriate management techniques for managing contemporary organizations

CO5: Learn the design theory to include the new concepts and practices of design entrepreneurship and organizational change.

TEXTBOOKS:

1.Stephen P. Robbins & Mary Coulter, ―Management, Prentice Hall (India) Pvt. Ltd., 10th Edition, Reprint 2016.

2.JAF Stoner, Freeman R.E and Daniel R Gilbert ―Management, Pearson Education, 6th Edition, 2004.

REFERENCE BOOKS:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, ―Fundamentals of Management‖ Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, ― Management, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich ―Essentials of management Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, ―Principles of Management, Tata McGraw Hill, 1999

504202	**PROFESSIONAL ETHICS IN ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

To know about the various activities and behaviour of the authorities in the business.

CO-PO MAPPING:

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

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to,

CO1: Study the awareness on Engineering Ethics providing basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues

CO2: Get the basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards

CO3: Inculcate knowledge and exposure on Safety and Risk, Risk Benefit Analysis

CO4: Get an idea about the Collective Bargaining, Confidentiality, Professional, Employee, Intellectual Property Rights

CO5: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts

and Cases", Thompson Learning, 2000

REFERENCE BOOKS:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.

504203 COMPUTER NETWORKS L T P C

3 0 0 3

COURSE OBJECTIVE:

Understand the division of network functionalities into layers.
Be familiar with the components required to build different types of networks.
Be exposed to the required functionality at each layer.
Learn the flow control and congestion control algorithms

CO-PO MAPPING:

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

UNIT I FUNDAMENTALS & LINK LAYER 9

Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance ; Link layer Services – Framing – Error Detection – Flow control

UNIT II MEDIA ACCESS & INTERNETWORKING 9

Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)

UNIT III ROUTING 9

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

UNIT IV TRANSPORT LAYER 9

Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V APPLICATION LAYER 9

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Identify the components required to build different types of networks

CO2: Choose the required functionality at each layer for given application

CO3: Identify solution for each functionality at each layer

CO4: Trace the flow of information from one node to another node in the network

CO5: Learn about the application layer

TEXT BOOKS:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

2. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.

REFERENCE BOOKS:

1. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.

2. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.

3. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

504204 FUNDAMENTALS OF NANO TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To learn about basis of nanomaterial science, preparation method, types and application.

CO-PO MAPPING:

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

UNIT I BACKGROUND TO NANOSCIENCE 9

Defination of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challenges of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties.

UNIT II TYPES OF NANOSTRUCTURE AND PROPERTIES OF NANOMATERIALS 9

One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

UNIT III APPLICATION OF NANOMATERIAL 9

Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application.

UNIT IV OPTICAL PROPERTIES 9

Photoconductivity, Optical absorption & transmission, Photoluminescence, Fluorescence, Phosphorescence, Electroluminescence.

UNIT V MAGNETIC MATERIALS 9

Basic Magnetic Phenomena; Diamagnetism, Paramagnetism, Ferromagnetism, Ferrimagnetism, Anti-ferromagnetism, Some examples of these materials and their applications, RKKY Interactions, Ferrofluids, Introduction to superconductivity; London Equation and Josephson effect.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion on this course the student will be able to

CO1: Familiarize about the science of nanomaterials

CO2: Demonstrate the preparation of nanomaterials

CO3: Develop knowledge in applications of nanomaterial

CO4: Study the optical properties of nanomaterial

CO5: Learn the magnetic properties of nanomaterial

TEXT BOOKS:

1. Gabor L. Hornyak, Joydeep Dutta, Harry F. Tibbals, Anil K. Rao, "Introduction to Nanoscience", CRC Press, 2008.

2. M.H. Fulekar, "Nanotechnology: Importance and Application", IK International, 2010.

REFERENCE BOOKS:

1. Challa Kumar, "Nanosystem characterization tools in the life sciences", Wiley VCH, 2006.

2. Gary Wiederrcht, "Handbook of Nanofabrication", Elsevier, 2010.

504205 POWER QUALITY L T P C

3 0 0 3

COURSE OBJECTIVES:

To study the production of voltages sags, swell and harmonics and methods of control.

To study various methods of power quality monitoring.

CO-PO MAPPING:

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

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients – short duration variations such as interruption - long duration variation such as sustained interruption.

Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations - International standards of power quality - Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and interruptions - estimating voltage sag performance - Thevenin"s equivalent source - analysis and calculation of various faulted condition - Voltage sag due to induction motor starting - Estimation of the sag severity - mitigation of voltage sags - active series compensators - Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES AND INTERRUPTIONS 9

Sources of over voltages - Capacitor switching – ferro resonance - Mitigation of voltage swells - surge arresters - low pass filters - power conditioners - Lightning protection – Origin of Long & Short interruption -influence on various equipment- monitoring and mitigation of interruption.

UNIT IV HARMONICS 9

Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quantities under Non-sinusoidal Conditions, Harmonic Indices, Harmonic Sources from Commercial Loads, Locating Harmonic Sources, System Response Characteristics, Effects of Harmonic Distortion, Inter-harmonics – IEEE standards.

UNIT V POWER QUALITY MONITORING 9

Monitoring Considerations, Historical Perspective of Power Quality Measuring Instruments, Power Quality Measurement Equipment, Assessment of Power Quality Measurement Data, Application of Intelligent Systems, Power Quality Monitoring Standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will able to

CO1: Learn the basic concepts to measure the quality of power supply

CO2: Express the concept of voltages sags, swell and harmonics

CO3: Get knowledge in over voltages and protection scheme applied

CO4: Express the effect of harmonic and harmonic reduction techniques.

CO5: Express the necessity of power quality monitoring

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.WayneBeaty, "Electrical Power Systems Quality" McGraw Hill, 3RD Edition, 2012.
2. G.T. Heydt, "Electric Power Quality", 2nd Edition, West Lafayette IN Stars in a Circle Publications, 1994.

REFERENCE BOOKS:

1. M.H.J.Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", New York: IEEE Press, 1999.
2. J. Arrillaga, N.R. Watson, S. Chen, "Power System Quality Assessment" (New York: Wiley, 1999.

ELECTIVE – II

504206 BIO MEDICAL INSTRUMENTATION L T P C

3 0 0 3

COURSE OBJECTIVE:

To Introduce Fundamentals of Biomedical Engineering

To study the communication mechanics in a biomedical system with few examples

To study measurement of certain important electrical and non-electrical parameters

To understand the basic principles in imaging techniques

To have a basic knowledge in life assisting and therapeutic devices

CO-PO MAPPING:

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

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals – Basic components of a biomedical system- ardiovascular systems- Respiratory systems -Kidney and blood flow – Biomechanics of bone – Biomechanics of soft tissues -Physiological signals and transducers – Transducers – selection criteria – Piezo electric, ultrasonic transducers – Temperature measurements – Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound – Pulmonary function measurements – spirometer – Photo lethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter – ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes – Micro, needle and surface electrodes – Amplifiers, reamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier – ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms – Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems – Retinal Imaging – Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart –

Lung machine – Audio meters – Dialysers – Lithotripsy – ICCU patient monitoring system – Nano Robots – Robotic surgery –Orthopedic prostheses fixation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Understand the philosophy of the heart, lung, blood circulation and respiration system.

CO2: Provide latest ideas on devices of non-electrical devices.

CO3: Gain knowledge on various sensing and measurement devices of electrical origin.

CO4: Understand the analysis systems of various organ types.

CO5: Bring out the important and modern methods of imaging techniques and their analysis.

TEXT BOOKS

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2nd edition, 2003

3. Joseph J Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th edition, 2012

REFERENCE BOOKS

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.

2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.

3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.

504207 TOTAL QUALITY MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVE:

To facilitate the understanding of Quality Management principles and process.

CO-PO MAPPING:

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

UNIT I INTRODUCTION 9

Definition of Quality Management and System, Evolution of Quality, ISO and its structure. Concepts of Quality Control, Quality Assurance, Total Quality Management, Total Quality Control and Quality Management System. Relevance of Quality Management in Shipping

UNIT II TQM PRINCIPLES 9

Leadership – Quality Statements, Strategic quality planning, Quality Councils – Employee

involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal -Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

Unit III TQM Tools and Techniques 9

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

UNIT IV APPLICATIONS OF QMS IN SHIPPING 9

Initiatives of ISMA in improving shipping management through QMS. Co-relation between Quality management and ISM Code. Application of QMS in Maritime Industry. Total quality, & Total Quality Management, Principles of TQM, Core concepts of TQM, Approaches to TQM. TQM Tools and techniques. Barriers and advantages of TQM. Overview of environmental management system and ISO14000.

UNIT V STATISTICAL PROCESS CONTROL 9

Statistical Process Control history & development. Averages & measures of dispersion. Process variation, variable & attribute data. Use of statistical problem solving tools such as check sheets, histograms, Pareto diagrams, stratification graph, scatter plots, cause & effect diagram

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Increase of the flexibility and profitability,

CO2: Capture and conversion of the customer's needs,

CO3: Offer contented position of the customers.

CO4: Develop the organizational, competitive and economic potential of quality.

CO5: Integrate biblical principles with the practice of total quality management.

TEXT BOOKS

1. Dale H.Besterfiled, Carol B.Michna, Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCE BOOKS

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 8th Edition, First Indian Edition, Cengage Learning, 2012.

2. Janakiraman. B and Gopal .R.K., “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

3. Suganthi.L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006.

504208 MICROCONTROLLER BASED SYSTEM DESIGN L T P C

3 0 0 3

COURSE OBJECTIVE:

To introduce the architecture of PIC microcontroller

To educate on use of interrupts and timers

CO-PO MAPPING:

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

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx–-Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING 9

I2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Expose the fundamentals of microcontroller based system design.

CO2: Study I/O and RTOS role on microcontroller.

CO3: Impart knowledge on PIC Microcontroller based system design.

CO4: Learn microchip PIC 8 bit peripheral system Design

CO5: Gain case study experiences for microcontroller based applications.

TEXT BOOKS

1. Peatman,J.B., "Design with PIC Micro Controllers" Pearson Education, 3rdEdition, 2004.

2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE BOOKS

1. Rajkamal, "Microcontrollers-Architecture, Programming, Interfacing & System Design", 2ed, Pearson, 2012.
2. I Scott Mackenzie and Raphael C.W. Phan, "The Micro controller", Pearson, Fourth edition 2012.

504209 POWER SYSTEM DYNAMICS L T P C

3 0 0 3

COURSE OBJECTIVES:

To understand and analyze power system operation, stability, control and protection.

CO-PO MAPPING:

CO/PO	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	-	2	-	-	2		
CO3	3	3	-	1	1	-	-	-	-	-	-	-		
CO4	3	3	-	-	1	1	-	-	1	2	-	-		
CO5	3	3	-	-	1	1	-	-	1	-	1	2		

UNIT I INTRODUCTION 9

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design – distinction between transient and dynamic stability – complexity of stability problem in large system – necessity for reduced models – stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING 9

Synchronous machine – flux linkage equations – Park's transformation – per unit conversion – normalizing the equations – equivalent circuit – current space model – flux linkage state space model. Sub-transient and transient inductances – time constants. Simplified models (one axis and constant flux linkage) – steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators – function and types of excitation systems – typical excitation system configuration – block diagram and state space representation of IEEE type 1 excitation system – saturation function – stabilizing circuit. Function of speed governing systems – block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY 9

State equation for multimachine simulation with one axis model, transient stability simulation of multimachine power system with one axis machine model including excitation system and speed governing system using R-K method of fourth order (Gill's technique), power system stabilizer.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances: Linear model of the unregulated synchronous machine and its modes of oscillation, regulated synchronous machine, distribution of power impact, linearization of the load equation for the one machine problem – Simplified linear model, effect of

excitation on dynamic stability

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Learn the basics of dynamics and stability problems

CO2: Study on modeling of synchronous machines

CO3: Learn the excitation system and speed-governing controllers.

CO4: Study small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.

CO5: Learn the transient stability simulation of multi machine power system.

TEXT BOOKS

1. P.M. Anderson and A.A.Fouad, 'Power System Control and Stability', Galgotia Publications, New Delhi, 2003.

2. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc., USA, 1994.

3. R.Ramanujam, "Power System Dynamics – Analysis and Simulation", PHI, 2009.

REFERENCE BOOKS

1. C.A.Gross, "Power System Analysis," Wiley India, 2011.

2. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac," Electric Power Systems", Wiley India, 2013.

3. K.Umarao, "Computer Techniques and Models in Power System," I.K. International, 2007.

504210 FLEXIBLE AC TRANSMISSION SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

To understand the fundamentals of FACTS Controllers, Importance of controllable parameters and types of FACTS controllers & their benefits

To recall the objectives of Shunt and Series compensation

To explain control of STATCOM and SVC and their comparison and the regulation of STATCOM

CO-PO MAPPING:

CO/PO	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	-	2	-	-	2		
CO3	3	3	-	1	1	-	-	-	-	-	-	-		
CO4	3	3	-	-	1	1	-	-	1	2	-	-		
CO5	3	3	-	-	1	1	-	-	1	-	1	2		

UNIT I FACTS CONCEPTS 9

Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

UNIT II VOLTAGE SOURCE CONVERTERS 9

Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and

48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

UNIT III STATIC SHUNT COMPENSATION 9

Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable VAR generation, variable impedance type static VAR generators switching converter type VAR generators hybrid VAR generators.

UNIT IV SVC AND STATCOM 9

The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT V STATIC SERIES COMPENSATORS 9

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC) Control schemes for GSC TSSC and TCSC.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Choose proper controller for the specific application based on system requirements

CO2: Understand various systems thoroughly and their requirements

CO3: Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping

CO4: Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

CO5: Analyze the functioning and control of GCSC, TSSC and TCSC

TEXT BOOKS:

1 Hingorani H G and Gyugyi. L "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems" New York, IEEE Press, 2000.

2. Padiyar.K.R, "FACTS Controllers in Power Transmission and Distribution" New Age Int. Publishers, 2007

REFERENCE BOOKS

1. Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modeling and Control", Springer, 2012

2. Yong-Hua Song, Allan Johns, "Flexible AC Transmission Systems", IET, 1999

ELECTIVE – III

		L	T	P	C
504211	**POWER SYSTEM DEREGULATION**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE:

To provide in-depth understanding of operation of deregulated electricity market systems.

To examine typical issues in electricity markets and how these are handled world-wide in various markets.

CO-PO MAPPING:

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

UNIT I INTRODUCTION **9**

Deregulation, Reconfiguring Power systems, unbundling of electric utilities, Background to deregulation and the current situation around the world, benefits from a competitive electricity market after effects of deregulation

UNIT II INDEPENDENT SYSTEM OPERATOR **9**

Role of the independent system operator, Operational planning activities of ISO: ISO in Pool markets, ISO in Bilateral markets, Operational planning activities of a GENCO: Genco in Pool and Bilateral markets, market participation issues, competitive bidding

UNIT III DEREGULATION IN TRANSMISSION SYSTEM **9**

Power wheeling, Transmission open access, pricing of power transactions, security management in deregulated environment, and congestion management in deregulation

UNIT IV ANCILLARY SERVICES **9**

General description of some ancillary services, ancillary services management in various countries, and reactive power management in some deregulated electricity markets.

UNIT V RELIABILITY ANALYSIS **9**

Interruption criterion, stochastic components, component models, Calculation methods, Network model: stochastic networks, series and parallel connections, minimum cut sets, reliability cost. Generation, transmission and distribution reliability, Reliability and deregulation: conflict, reliability analysis, effects on the actual reliability, regulation of the market

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Understand the operation of deregulated electricity market systems

CO2: Solve typical issues in electricity markets

CO3: analyze various types of electricity market operational and control issues using new mathematical models.

CO4: Understand ancillary services management

CO5: Understand the reliability analysis

TEXT BOOKS

1. K. Bhattacharya, MHT Bollen and J.C Doolder, “Operation of Restructured Power Systems”,

Kluwer Academic Publishers, USA, 2001.
2. Bollen, Math H.J., et al. Operation of Restructured Power Systems. United States, Springer US, 2012.
3. Alomoush, M., and Shahidehpour, Mohammad. Restructured Electrical Power Systems: Operation: Trading, and Volatility. United States, CRC Press, 2017.

REFERENCE BOOKS

1. Sheblé, Gerald B. Computational Auction Mechanisms for Restructured Power Industry Operation. United States, Springer US, 2012.
2. Restructured Electric Power Systems: Analysis of Electricity Markets with Equilibrium Models. Ukraine, Wiley, 2010.

504212 PHOTONICS L T P C

3 0 0 3

COURSE OBJECTIVE:

To describe and illustrate with examples the concept of coherence, estimate the coherence of light sources.

To explain properties of Gaussian beams, calculate propagation of Gaussian beams in free-space and through thin lenses.

CO-PO MAPPING:

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

UNIT I MODERN OPTICS 9

Light, Light-material interaction, Electrodynamics: Maxwell's equations, Electromagnetic wave in different media, Polarization of light, Interference, Absorption, Dispersion and modulation of light Plasmons Quantum optics, Fiber optics and their applications, Lasers and their applications.

UNIT II OPTOELECTRONICS 9

Optical processes in semiconductors, Semiconductor optoelectronic Devices, Application of optoelectronic devices, Optoelectronic tweezers.

UNIT III PHOTONIC MATERIALS AND DEVICES 9

Photonic crystals, Luminescence, Photorefractive materials Photonic devices: LEDs, Solar cells, photodiodes, photodetectors, photoconductors, Laser diodes, Electro-optic and Magneto-optic devices

UNIT IV NANOPHOTONICS 9

Nanophotonics and its nature, Device operation: nanophotonic AND gate & OR gate, Adiabatic nanofabrication and Nonadiabatic nanofabrications: near-field optical CVD and near field photolithography, A phototransistor, Charge coupled device.

UNIT V NANO BIOPHOTONICS 9

Photobiology, Photosynthesis, Photo excitation, Optical fiber delivery system, Optical Biosensors, Laser activated therapy, laser surgery

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Calculate diffraction for simple physical systems, interpret limitations of Fresnel and Frauenhofer diffraction;

CO2: Explain and illustrate light guiding, calculate wave propagation in waveguide systems;

CO3: Explain the principles of operation of quantum lasers, calculate characteristics of optical resonators;

CO4: Estimate output characteristics of photon sources;

CO5: Conduct an independent study within the field of photonics and make a presentation of the results.

TEXT BOOKS

1. Saleh, Bahaa E. A., and Teich, Malvin Carl. Fundamentals of Photonics. United States, Wiley, 2020.

2. Photonics, Volume 1: Fundamentals of Photonics and Physics. Germany, Wiley, 2015.

REFERENCE BOOKS

1. Nanoimprint Lithography - Next Generation Nanopatterning Methods for Nanophotonics Fabrication. Croatia, INTECH Open Access Publisher, 2010.

2. Sze, Simon M., and Ng, Kwok K.. Physics of Semiconductor Devices. Germany, Wiley, 2006.

504213 MODERN CONTROL SYSTEM L T P C

3 0 0 3

COURSE OBJECTIVE:

To explain the concepts of basic and modern control system for the real time analysis and design of control systems.

To explain and apply concepts of state variables analysis.

To study and analyze nonlinear systems.

CO-PO MAPPING:

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

UNIT I MATHEMATICAL PRELIMINARIES 9

Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-

Time State models.

UNIT II STATE VARIABLE ANALYSIS 9

Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems – Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT III NON LINEAR SYSTEMS 9

Introduction – Non Linear Systems – Types of Non-Linearities – Saturation – Dead-Zone – Backlash – Jump Phenomenon – Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT IV STABILITY ANALYSIS 9

Stability in the sense of Lyapunov, Lyapunov's stability, and Lypanov's instability theorems – Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

UNIT V OPTIMAL CONTROL 9

Introduction to optimal control – Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Understand the concepts of state variable analysis

CO2: Apply the knowledge of basic and modern control system for the real time analysis a design of control systems.

CO3: Analyze the concept of stability of nonlinear systems and optimal control

CO4: Analyze the concept of stability of nonlinear systems and categorization.

CO5: Apply the comprehensive knowledge of optimal theory for Control Systems.

TEXT BOOKS

1. Ogata, Katsuhiko. Modern Control Engineering. United Kingdom, Prentice Hall, 2010.

2. Paraskevopoulos, P.N. Modern Control Engineering. United Kingdom, CRC Press, 2017.

REFERENCE BOOKS

1. CHOUDHURY, D. ROY. MODERN CONTROL ENGINEERING. India, PHI Learning, 2005.
2. Dorf, Richard C., and Bishop, Robert H. Modern Control Systems. United Kingdom, Pearson, 2011.
3. Roth, Zvi S., and Bai, Ying. Classical and Modern Controls with Microcontrollers: Design, Implementation and Applications. Germany, Springer International Publishing, 2018.

504214 SMART GRID L T P C

3 0 0 3

COURSE OBJECTIVES:

To understand how electricity is priced in a transmission network.

To evaluate the trade-off between economics and reliability of an electric power system.

To understand the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid.

CO-PO MAPPING:

CO/PO	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	-	2	-	-	2		
CO3	3	3	-	1	1	-	-	-	-	-	-	-		
CO4	3	3	-	-	1	1	-	-	1	2	-	-		
CO5	3	3	-	-	1	1	-	-	1	-	1	2		

UNIT I INTRODUCTION 9

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Smart Substations, Substation Automation, Feeder Automation, Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU), PMUs application to monitoring & control of power system.

UNIT III RENEWABLE INTEGRATION AND INVESTMENT VALUATION 9

Renewable integration: dealing with short-term variation - Renewable integration: impacts on long-term reliability - Demand-side participation and dynamic pricing - Impacts of Smart Grid on reliability - Impacts of Smart Grid on air pollutant emissions reduction

UNIT IVSECURITY AND PRIVACY 9

Cyber Security Challenges in Smart Grid - Load Altering Attacks - False Data Injection Attacks - Defense Mechanisms - Privacy Challenges - Economics and Market Operations - Energy and Reserve Markets - Market Power - Generation Firms - Locational Marginal Prices - Financial Transmission Rights

UNIT V MICROGRIDS AND DISTRIBUTED ENERGY RESOURCES 9

Concept of microgrid, need & application of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid, Plastic & Organic solar cells, thin flim solar cells, Variable speed wind generators, fuel cells, microturbines, Captive power plants, Integration of renewable energy sources.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Explain various aspects of the smart grid, including, Technologies, Components, Architectures and Applications.

CO2: Explain communication infrastructure of smart grid.

CO3: Explain various integration aspects of conventional and non-conventional energy sources.

CO4: Explain distributed generation coordination including monitoring of smart grid using modern communication infrastructure.

CO5: Analyze microgrid as a hybrid power system with advantages and challenges in future.

TEXT BOOKS

1. Ali Keyhani, Mohammad N. Marwali, Min Dai, Integration of Green and Renewable Energy in Electric Power Systems, Wiley, 2017.

2. Clark W. Gellings, The Smart Grid: Enabling Energy Efficiency and Demand Response, CRC Press, 2014.

3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Smart Grid: Technology and Applications, Wiley, 2011.

REFERENCE BOOKS

1. Andres Carvallo, John Cooper, The Advanced Smart Grid: Edge Power Driving Sustainability, Artech House Publishers July 2011.

2. Wilson, Robert G., and Northcote-Green, James. Control and Automation of Electrical Power Distribution Systems. United Kingdom, CRC Press, 2017.

3. Momoh, James A. Electric Power Distribution, Automation, Protection, and Control. United States, CRC Press, 2017.

504215	SOLAR PHOTOVOLTAIC SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To analyze solar photovoltaic system applications.

To identify various energy technologies, codes, certifications and their relationship with solar photovoltaic system.

CO-PO MAPPING:

CO/PO	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	-	2	-	-	2		
CO3	3	3	-	1	1	-	-	-	-	-	-	-		
CO4	3	3	-	-	1	1	-	-	1	2	-	-		
CO5	3	3	-	-	1	1	-	-	1	-	1	2		

UNIT I INTRODUCTION **9**

Fossil fuel energy usage and global warming; role of renewable energy in sustainable development; renewable energy sources; global potential for solar electrical energy systems. Extra-terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky insulation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data.

UNIT II PV CELLS AND MODULES **9**

Photovoltaic cell and its simple model; i-v and p-v characteristics; PV modules and arrays; effect of shading, use of bypass and blocking diodes; influence of temperature; types of solar cells and their performance; schemes for maximum power point tracking; solar PV concentrators.

UNIT III PV INVERTERS **9**

Grid-connected single phase PV inverter schemes and control; power processing schemes based on single string, multi-string and ac module technologies; types of grid interface; power electronic converters used in single phase PV systems and their operation; transformer less inverters, centralized grid-connected three-phase inverters for large PV installations.

UNIT IVSCHEMES WITH BATTERY ENERGY STORAGE **9**

Power processing schemes and control for stand-alone applications; batteries for energy storage – types, charging, battery sizing and turn-around efficiency; other types of energy storage for PV systems; grid connected schemes with standby energy storage.

UNIT V SYSTEM LEVEL ISSUES **9**

Design related issues; grounding, dc arcing and other safety related issues; islanding; harmonics; electro-magnetic interference; energy yield and economics of a PV installation – Case study: Faults identification in a solar PV system.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Analyze solar photovoltaic system energy and building resources.

CO2: Critically assess solar photovoltaic system applications, site evaluation.

CO3: Investigate solar photovoltaic systems and their relationship with energy conservation.

CO4: Compare and contrast solar photovoltaic system energy sources and applications.

CO5: Apply contemporary energy products and technologies to solar photovoltaic systems and energy conservation

TEXT BOOKS:

1. Gilbert M. Masters: Renewable and Efficient Electric Power Systems. John Wiley & Sons, 2013.

2. Solanki: Solar Photovoltaics: Fundamentals, Technologies and Applications. PHI Learning Pvt.

Ltd, 2015

REFERENCE BOOKS

1. Verlinden, Pierre, et al. Photovoltaic Solar Energy: From Fundamentals to Applications. United Kingdom, Wiley, 2017.

2. Practical Handbook of Photovoltaic: Fundamentals and Applications. Netherlands, Elsevier Science, 2012.

ELECTIVE – IV

504216 SOFT COMPUTING TECHNIQUES L T P C

3 0 0 3

COURSE OBJECTIVES:

To learn the basic concepts of Soft Computing

To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems

To apply soft computing techniques to solve problems.

CO-PO MAPPING:

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

UNIT I INTRODUCTION 9

Introduction of soft computing, soft computing vs hard computing, various types of soft computing techniques, Fuzzy Computing, Neural Computing, Genetic Algorithms, Probabilistic reasoning, applications of soft computing.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Introduction, Model of Artificial Neuron, Architectures, Learning Methods, Deep learning, Taxonomy of ANN Systems, Single-Layer ANN System, Applications of ANN in research.

UNIT III FUZZY SYSTEMS 9

Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, introduction & features of membership functions, Extension Principle, Fuzzy If-Then Rules, Fuzzy Inference Systems, Sugeno Fuzzy Models, Fuzzification, Defuzzification, Applications

UNIT IV GENETIC ALGORITHMS 9

Basic Concepts- Working Principles -Encoding- Fitness Function – Reproduction -Inheritance Operators – Cross Over – Inversion and Deletion -Mutation Operator – Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS 9

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination – LR-Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP-

Inference by Fuzzy BP – Fuzzy ArtMap: A Brief Introduction

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the different soft computing techniques.

CO2: Understand neural network architectures and learning algorithms, for different applications

CO3: Explore the use of Fuzzy and Genetic Algorithm

CO4: Understand different Optimization techniques in soft computing

CO5: Introduce Hybrid and Other advanced model in soft computing.

TEXT BOOKS:

1. S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.

2. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

3. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.

REFERENCES:

1. Pratihar, Dilip K. Soft Computing: Fundamentals and Applications. India, Alpha Science International Limited, 2014.

2. Fundamentals of Soft Computing: Theory, Concepts and Methods of Artificial Intelligence, Neurocomputing. India, BPB Publications, 2018.

3. Konar, Amit. Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain. United States, CRC Press, 2018.

504217 SENSORS AND TRANSDUCERS L T P C

3 0 0 3

COURSE OBJECTIVES:

To understand the concepts of measurement technology.

To learn the various sensors used to measure various physical parameters.

To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

CO-PO MAPPING:

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

UNIT I INTRODUCTION 9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors –

Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING and DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Expertise in various calibration techniques and signal types for sensors.

CO2: Apply the various sensors in the Automotive and Mechatronics applications

CO3: Study the basic principles of various smart sensors.

CO4: Implement the DAQ systems with different sensors for real time applications

CO5: Study the basic principles of nano sensors.

TEXT BOOKS:

1. Patranabis D, Sensors and Transducers, 2nd Edition, PHI, New Delhi, 2010.

2. Sawney A K and Puneet Sawney, A Course in Mechanical Measurements and Instrumentation and Control, 12th edition, Dhanpat Rai and Co, New Delhi, 2013.

REFERENCE BOOKS:

1. Materials and Applications for Sensors and Transducers III. Switzerland, Trans Tech Publications Limited, 2014.

2. Richard Zurawski, Industrial Communication Technology Handbook 2nd edition, CRC Press, 2015.

504218 POWER ELECTRONIC APPLICATIONS IN POWER SYSTEM L T P C

3 0 0 3

COURSE OBJECTIVES:

To select of the electrical machines for energy conversion

To study of hybrid systems of renewable energy

CO-PO MAPPING:

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

UNIT I STEADY STATE AND DYNAMIC PROBLEMS 9

Flexible AC transmission systems (FACTS), Principles of series and shunt compensation, Description of static var compensators (SVC), Thyristor Controlled series compensators (TCSC), Static phase shifters (SPS), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPFC)

UNIT II MODELLING AND ANALYSIS OF FACTS CONTROLLERS 9

Control strategies to improve system stability, Power Quality problems in distribution systems, The FACTS optimization problem. Transient and dynamic stability enhancement using FACTS components. Concepts of modern grid.

UNIT III HARMONICS 9

Harmonics creating loads, modelling, harmonic propagation, Series and parallel resonances, harmonic power flow, Mitigation of harmonics, filters, passive filters, Active filters, shunt, series hybrid filters, voltage sags & swells, voltage flicker

UNIT IVHARMONICS MITIGATION 9

Mitigation of power quality problems using power electronic conditioners, IEEE standards, HVDC Converters and their characteristics, Control of the converters (CC and CEA), Parallel and series operation of converters

UNIT V ELECTRICAL MACHINES FOR RENEWABLE ENERGY 9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG, Power Converters, Wind Power Application

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Study and understand the ac power flow and its control

CO2: Appreciate the effect of compensation of using different controllers in the practical systems.

CO3: Understand the control strategies to improve system performance and stability of the system

CO4: Study of harmonics and its mitigation, power quality concepts

CO5: Study the stability considerations in power system.

TEXT BOOKS:

1. Applications of Power Electronics in Power System. India, Laxmi Publications Pvt Limited, 2009.

2. Kumar, Vinod, et al. Power Electronics, Drives, and Advanced Applications. United States,

CRC Press, 2020.

REFERENCE BOOKS:

1. Hase, Yoshihide. Handbook of Power Systems Engineering with Power Electronics Applications. United Kingdom, Wiley, 2012.

2. Bose, Bimal K. Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications. United States, Wiley, 2019.

504219 VEHICULAR POWER SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

To acquire knowledge in power sources for various vehicles

CO-PO MAPPING:

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

UNIT I AIRCRAFT POWER SYSTEMS 9

Introduction –conventional electrical systems, power generation systems- overview of vehicular power systems - Introduction – aircraft electrical distribution systems, Stability analysis

UNIT II SPACE POWER SYSTEMS 9

Introduction – international space station, primary power system, secondary power system- Support systems, space craft power systems, alternate power sources - Earth observing system, electrical power systems for space based radar satellites - Modeling, analysis and simulation considerations – typical DC/DC converter in a multi-converter dc power electronic system with the zero-order approximations of its inputs and outputs

UNIT III POWER SYSTEMS FOR SEA AND UNDERSEA VEHICLES 9

Introduction – power system configurations, power electronics building blocks – pebb applications in the system - Controller architecture for power electronic – Centralized digital controller - Direct stiffness method - portal frames – single bay single storey – with and without sway - Tutorials on digital controller design and direct stiffness method - Concepts -Element and Global stiffness matrices -Co-ordinate transformations - Rotation matrix – Derivation of global stiffness matrix from element stiffness

UNIT IVAUTOMOTIVE POWER SYSTEMS 9

Introduction – conventional 14V electric system architecture – Advanced electrical loads, increasing the system voltage to 42V - Advanced distribution systems, starter, alternator and integrated starter/alternator (ISA), Machine in brief: induction, permanent magnet and axial flow, ISA coupling configurations

UNIT V FUEL CELL BASED VEHICLES 9

Introduction – important properties of fuel cells for vehicles, light-duty vehicles and heavy-duty vehicles - Various alternate fuels cell vehicles, fuel cell transit bus technology current status and future technologies - Aerospace applications, other applications of fuel cells

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Understand the development of electric power systems for various types of vehicles.

CO2: Familiarize with the modeling and analysis of recent power electronics system.

CO3: Equip themselves with advanced power electronic converters and electric motor drives for vehicular applications.

CO4: Design DC and AC distribution architectures

CO5: Acquire knowledge on fuel cell based vehicles

TEXT BOOKS:

1. Ehsani, Mehrdad. Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles. Switzerland, CRC Press, 2003.

2. Space Power Systems Engineering. United States, Elsevier Science, 2014.

REFERENCE BOOKS:

1. Bekiarov, Stoyan B., et al. Uninterruptible Power Supplies and Active Filters. Ukraine, CRC Press, 2017.

2. Hayes, John G., and Goodarzi, G. Abas. Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles. United Kingdom, Wiley, 2018.

504220 MEMS AND NEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

To introduce the concepts of micro and nano electromechanical devices

To know the fabrication process of Microsystems

To know the design concepts of micro sensors and micro actuators

To introduce the concepts of quantum mechanics and nano systems

CO-PO MAPPING:

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

UNIT I INTRODUCTION TO MEMS AND NEMS 9

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT II MEMS FABRICATION TECHNOLOGIES **9**

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

UNIT III MICRO SENSORS **9**

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

UNIT IV MICRO ACTUATORS **9**

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch.

UNIT V NANO DEVICES **9**

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

Total: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to

CO1: Interpret the basics of micro/nano electromechanical systems including their applications and advantages

CO2: Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.

CO3: Analyze the key performance aspects of electromechanical transducers including sensors and actuators

CO4: Comprehend the theoretical foundations of quantum mechanics and Nano systems

CO5: Gain an idea about RF Switch

TEXT BOOKS:

1. Lyshevski, Sergey Edward. MEMS and NEMS: Systems, Devices, and Structures. United States, CRC Press, 2018.

2. Lyshevski, Sergey Edward. Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering, Second Edition. United States, CRC Press, 2018.

REFERENCE BOOKS:

1. Advances in Micro/Nano Electromechanical Systems and Fabrication Technologies. Croatia, IntechOpen, 2013.

2. Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators. Netherlands, Springer, 2010.

OPEN ELECTIVES

		L	T	P	C
504901	**PLC AND SCADA**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE:

To become familiar with the fundamentals of PLC and its applications in the electrical engineering discipline

To write PLC programs using ladder diagrams

To acquire a good knowledge about SCADA system fundamentals and applications

CO-PO MAPPING:

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

UNIT I INTRODUCTION TO PLC PROGRAMMING 9

Systematic approach in designing an process control system - History of PLC- Principle of operation- Architecture of PLCs- Advantages & disadvantages of PLCs. Selection criteria for PLC - Program Scan- PLC programming languages- Fundamentals of Ladder diagram- basic components and symbols.

UNIT II ADVANCED PLC FUNCTIONS 9

Developing Fundamental PLC Wiring Diagrams - Ladder Logic Programs – Internal relays - PLC in computer integrated manufacturing – Computer Numeric control – Robotics - Industrial processes: Bottle filling system- AC Motor starter - Program development - Safe systems

UNIT III SCADA ARCHITECTURE 9

Evolution and Definition of SCADA- Fundamentals of modern SCADA systems - SCADA system desirable properties - Basic SCADA Architecture: Human Machine Interface - Master Terminal Unit- Remote Terminal Unit - Sensors, actuators and wiring

UNIT IV SCADA COMMUNICATIONS 9

SCADA communication–various industrial communication technologies –wired and wireless methods - fiber optics– open standard communication protocols - SCADA server- SCADA functions – Spread spectrum radio for SCADA

UNIT V SCADA APPLICATIONS 9

SCADA in Electric Power systems - Automatic substation control- SCADA configuration- Energy management system- system operating states- system security- SCADA system security issues - SCADA economics

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students can able to

CO1: Understand the fundamentals of PLC and its applications in the electrical engineering discipline

CO2: Write PLC programs using ladder diagrams

CO3: Understand about SCADA system fundamentals and architecture

CO4: Explain about SCADA communication techniques and protocols

CO5: Understand about SCADA system applications and economics

TEXT BOOKS:

1. Frank D. Petruzella, "Programmable Logic Controllers", 3rd Edition, Tata McGraw Hill Education, 2005.
2. Stuart A Boyer, "SCADA - Supervisory Control and Data Acquisition", 4th Edition, International Society of Automation, 2010.

REFERENCE BOOKS:

1. Gary Dunning, "Introduction to Programmable Logic Controllers", 2nd Edition, Delmar Thomson Learning, 2001
2. Gordon Clarke, Deon Reynders, "Modern SCADA Protocols: DNP3,60870.5 and Related Systems", Newness Publications, Oxford, UK, 2004
3. W.Bolton, "Programmable Logic Controllers", 5th Edition, Newness Publications, 2009.

504902 AUTOMOTIVE ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To familiarize with the basic auto electrical systems.

To know layout of wiring and connections of electrical systems in automobiles.

To acquire a good knowledge about working of different electrical components used in automobiles.

CO-PO MAPPING:

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

UNIT I INTRODUCTION **9**

Storage, Distribution systems - Generation of electric energy - Lighting system - Battery system - 12 Volt & 24 Volt systems - Insulation and earth (negative and positive earthing) system - types of cables - circuit breakers, Relays, Switches - Layout of 2, 3 and 4 wheeler vehicles, Buses and Commercial vehicles

UNIT II ENGINE STARTING SYSTEM **9**

Principle - Starting torque - engine resistance torque - power required for starting of engine - Starter motor and its circuit - Types of drive mechanisms: bendix drive, pinion type, axial sliding armature starter - Slipping and overrunning of clutches - automatic switches for starting - cold starting devices: Glow plug & choke.

UNIT III CHARGING AND LIGHTING SYSTEM **9**

Types of charging system: D.C. dynamo, AC dynamo, flywheel magneto charging system and Alternator (more emphasis on Alternators). Charging system - controlling & regulator system: Lighting system of vehicle, head lamp, tail lamp, brake lamp, parking lamp etc, other types of lamps –

UNIT IV IGNITION SYSTEM REQUIREMENTS 9

Types of Ignition systems: Ballast Resistance, Ignition coil characteristics, Cam angle & contact angle gap, spark advance mechanism, spark plug - ignition timing - multi-cylinder distributor - Distributor (contact breaker ignition system), limitations of coil ignition system, electronic Ignition systems. Voltage and current required for Spark. Spark Plug, characteristics, material, types, plug fouling.

UNIT V ELECTRICAL EQUIPMENTS AND ACCESSORIES 9

Wind screen wipers - windscreen washers - power windows - doors locks -Rear wind shield glass heating system - Rear view mirror Adjusting - Day light regulating system - Central Locking system - Convertible Mechanism.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe the basics concepts of automobile systems.

CO2: Explain the aspects of starting systems.

CO3: Distinguish the types of lighting system, charging system.

CO4: Explain the various process of ignition system.

CO5: Demonstrate the electrical equipment and accessories

TEXT BOOKS:

1. L. Statini, "Automotive Electrical and Electronics", Delmar Publications, 2013.
2. Tom denton, "Automotive Electrical And Electronics Systems", Allied Publishers, 2016.

REFERENCE BOOKS:

1. Kholi.P.L "Automotive Electrical Equipment", Tata McGraw Hill Private Limited, New Delhi, 1983.
2. Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press, 1999
3. Crouse, W.H "Automobile Electrical Equipment", Tata McGraw Hill Private Limited, New York, 3rd Edition, 1996.

504903 ENERGY MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVE:

To develop the students to get knowledge about Energy management such as economic analysis and Load management to emphasize the energy management on various electrical equipment

CO-PO MAPPING:

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

UNIT I INTRODUCTION TO ENERGY MANAGEMENT 9

Commercial and Non-commercial energy - final energy consumption - energy needs of growing economy - energy pricing - energy conservation and its importance - Re-structuring of the energy supply sector - Energy Conservation Act-2001 and its features - electricity tariff - Thermal Basics - need and types of energy audit - Energy management/audit approach- understanding energy costs.

UNIT II PLANING AND ANALYSIS 9

Methods for preparing process flow - material and energy balance diagrams - Energy policy purpose - location of energy management - roles and responsibilities of energy manager – employees training and planning - financial analysis techniques

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES 9

Introduction to fuels - properties of fuel oil, coal and gas - principles of combustion - combustion of oil, coal and gas - Boilers: Types, combustion in boilers, performances evaluation, analysis of losses -Steam System: Properties of steam, assessment of steam distribution losses, steam trapping, condensate and flash steam recovery system – furnaces - temperature control, draft control, wasteheat recovery – refractory – cogeneration – case study.

UNIT IV ENERGY EFFICIENCY IN COMPRESSED AIR SYSTEM 9

Compressed Air System: Types of air compressors - compressed air system components – saving opportunities - Refrigeration System: Vapour compression refrigeration cycle – refrigerants – factors affecting refrigeration and air conditioning system - Vapour absorption refrigeration system: working principle - types - cooling tower - flow control strategies and energy saving - Diesel Generating system: Factors affecting selection - energy performance assessment of diesel conservation avenues – case study

UNIT V ENERGY EFFICIENCY IN ELECTRICAL UTILITIES 9

Fans and blowers: Types - efficient system operation - flow control strategies –Pumps and Pumping System: system operation - flow control methods - Lighting System: Light source, choice of lighting, luminance requirements – ballast - occupancy sensors - energy efficient lighting controls – case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Learn about the need for energy management and auditing process.

CO2: Know about basic concepts of materials and energy balance.

CO3: Understand the energy management in thermal utilities.

CO4: Know the concepts of compressed air system and its efficiency improvement.

CO5: Learn about the concept of lighting systems, light sources and various forms of cogeneration.

TEXT BOOKS:

1. Umesh Rathore, Energy Management, S.K. Kataria & Sons, 2011
2. Thomas D.Eastop, Energy Efficiency: For Engineers and Technologists, Logman Scientific &Technical, 1990

3. Larry C. Witte, Philip S.Schmidt, David R.Brown, Industrial Energy Management and Utilization, Springer Berlin Heidelberg, 1988

REFERENCE BOOKS:

1. Moncef Krati, Energy Audit of Building Systems: An Engineering Approach, Second Edition, CRC Press, 2016.
2. Sonal Desai, Handbook of Energy Audit, McGraw Hill Education (India) Private Limited, 2015
3. Michael P.Deru, Jim Kelsey, Procedures for Commercial Building Energy Audits, American Society of Heating, Refrigerating and Air conditioning Engineers, 2011.

INTERDISCIPLINARY COURSES

SEMESTER I

S. No	Course Code	Course Title	Department	L	T	P	C
THEORY							
1	508002	Basic Electrical & Electronics Engineering	Marine Engineering	3	0	0	3
PRACTICAL							
2	508102	Electrical & Electronics Engineering Laboratory	Marine Engineering	0	0	3	2

SEMESTER II

S. No	Course Code	Course Title	Department	L	T	P	C
THEORY							
1	501013	Basic Engineering	All Branches Except Marine Engineering	3	0	0	3
PRACTICAL							
2	501106	Electrical & Electronics Engineering Laboratory	All Branches Except Marine Engineering	0	0	3	2

SEMESTER III

S. No	Course Code	Course Title	Department	L	T	P	C
THEORY							
1	504003	Electro Magnetic Field Theory	Electronics and Communication Engineering	3	0	0	3
2	505003	Electrical Technology	Electronics and Communication Engineering	3	0	0	3
3	506002	Electrical Machines	Electronics and Instrumentation Engineering	3	0	0	3
4	510005	Fundamentals of Electrical Drives	Mechanical Engineering	3	0	0	3
5	508012	Electrical Measurements and DC Machines	Marine Engineering	3	0	0	3
PRACTICAL							

6	505103	Electrical Technology Laboratory	Electronics and Communication Engineering	0	0	3	2
7	506101	Electrical Machines Laboratory	Electronics and Instrumentation Engineering and	0	0	3	2
8	510103	Electrical Machines Laboratory	Mechanical Engineering	0	0	3	2

SEMESTER IV

S. No	Course Code	Course Title	Department	L	T	P	C
THEORY							
1	508020	AC Electrical Machines	Marine Engineering	3	0	0	3
2	509006	Electrical Drives & Control	Mechanical and Automation Engineering	3	0	0	3
PRACTICAL							
3	508112	Electrical Machines and Measurements Laboratory	Marine Engineering	0	0	3	2
4	509104	Electrical Drives & Control Laboratory	Mechanical and Automation Engineering	0	0	3	2

SEMESTER V

S. No	Course Code	Course Title	Department	L	T	P	C
THEORY							
1	508023	Marine Electrical Technology	Marine Engineering	3	1	0	4

SEMESTER VI

S. No	Course Code	Course Title	Department	L	T	P	C
THEORY							
1	509017	Control System Engineering	Mechanical and Automation Engineering	3	0	0	3
PRACTICAL							

3	509109	Control System Engineering Laboratory	Mechanical and Automation Engineering	0	0	3	2

SEMESTER I

508002 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (I SEM MARINE ENGINEERING BRANCH ONLY)

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To provide an understanding of the fundamentals of electrical and electronics engineering discipline.

CO-PO MAPPING:

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

UNIT I D.C. AND A.C. CIRCUITS 9

Electrical quantities, Ohm's Law, Resistors - Series and parallel combinations, Kirchoff's laws – Node and Mesh analysis – Star-delta transformation. Sinusoidal functions – RMS (effective) and Average values - Phasor representation - sinusoidal excitation applied to purely resistive - inductive and capacitive circuits - power and power factor Three phase circuits - Star / Mesh connections with balanced loads.

UNIT II MAGNETIC CIRCUITS 9

Definition of MMF, Flux and reluctance - Leakage factor - Reluctances in series and parallel (series and parallel magnetic circuits) - Electromagnetic induction - Fleming's rule - Lenz's law - Faraday's laws - statically and dynamically induced EMF - Self and mutual inductance - Analogy of electric and magnetic circuits.

UNIT III SEMICONDUCTOR DEVICES & APPLICATIONS 9

Characteristics of PN junction diode-Zener effect-Zener diode & its characteristics, Half wave & Full wave rectifiers-Voltage regulation. BJT- CB, CC, CE configuration & characteristics, Elementary treatment of small signal Amplifiers.

UNIT IV DIGITAL ELECTRONICS 9

Binary Number system-Logic gates-Boolean Algebra-Half & Full Adders-Flip flops-A/D conversion – Successive approximation register- Dual slope converter – Sigma to delta converter - D/A conversion- Binary weighted resistor – R-2R Ladder (Simple Concepts).

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 9

Types of signals: Analog & Digital, - VHF Signal – Sampling and Quantization-Modulation & Demodulation: Principle of AM & FM. wireless Communication Systems: Radio, FDMA, TDMA and CDMA, Microwave, Satellite & Optical fibre Communication (Block diagram approach only).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Express their knowledge in DC and AC circuits operation.

CO2: Express the fundamental laws and concepts of Magnetic circuits

CO3: Express the function of Various Electronic devices.

CO4: Develop the logic gates and express the Fundamentals of digital electronics.

CO5: Express their knowledge in principles of Communication system.

TEXT BOOKS:

1. B.L.Theraja "Fundamentals of Electrical Engineering and Electronics" S. Chand & Co. Reprint 2013.

REFERENCE BOOKS:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, (Paperback 2017).
2. V.K. Metha,"Principles of Electronics" S. Chand & Company Ltd, 10th Edition, 2014.
3. Kennedy, Davis,"Electronic communication systems", Tata McGraw Hill International 6th Edition, 2017.

508102	**ELECTRICAL AND ELECTRONICS LABORATORY (I SEM MARINE ENGINEERING BRANCH ONLY)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

To provide an understanding of the fundamentals of electrical and electronics engineering discipline.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Residential House wiring using switches, fuse, indicator, lamp and Energy meter
2. Different Types of wiring (Staircase and Fluorescent Lamp wiring)
3. Verification of Ohm's law
4. Verification of Kirchoff's laws
5. Measurement of Electrical quantities (Voltage, current, power and power factor in RLC series

circuit)
6. Case study on Electrical equipment (Fan, Lamp, Iron box and motor)
7. V-I Characteristics of PN Junction diode
8. V-I Characteristics of Zener diode
9. Voltage regulation using Zener Diode
10. Experimentally obtain the input and output characteristics of BJT under CB Configuration.
11. Experimentally obtain the input and output characteristics of BJT under CE Configuration.
12. Experimentally obtain the input and output characteristics of JFET.
13. Study of
(i) Active and passive components
(ii) Signal generation and measurement using AFO and CRO
14. Voltage regulation using IC7805.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end the course the students can able to,
CO1: Design House wiring system
CO2: Measure the various Electrical Quantities in a circuit
CO3: Attend the troubleshooting of electrical equipment
CO4: Check the status of Semiconductor devices
CO5: Measure waveform using CRO.

SEMESTER II

501013	**BASIC ENGINEERING** **(For all branches except Marine)**	**L T P C** **2 0 0 2**

COURSE OBJECTIVES:

To study the basic construction materials, surveying & special structure
To study the sources of Energy and Power Generation
To study the manufacturing processes and machining operations.
To study the fundamentals of DC & AC circuits
To study the fundamentals of semiconductor Devices and Digital Electronics.

CO-PO MAPPING:

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

A – CIVIL ENGINEERING

UNIT I CONSTRUCTION MATERIALS AND SURVEYING 6

Construction Materials – Properties, Types and uses of Stone, Bricks, Sand, Cement, Steel. Stone Masonry - Brick Masonry – Types. Types and Uses of Beam, Column, Lintels, Flooring, Roofing. Foundation – Footings – Types. Basic Requirements of Building – Planning – Criteria. Surveying - Object of Surveying – Classification of Surveying – Instruments used for Chain surveying – Calculation of Areas. Leveling – Principle of leveling – Types – Plane Table Surveying.

B – MECHANICAL ENGINEERING

UNIT II ENERGY 6

Renewable and non-renewable energy sources - types, characteristics - advantages/disadvantages. Hydro, thermal and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications).

UNIT III: MANUFACTURING PROCESS AND MACHINING OPERATIONS 6

Metal forming processes – Rolling, forging, drawing, extrusion and sheet metal operations-fundamentals only. Metal Joining processes – Welding - arc and gas welding, Soldering and Brazing. Casting process – Patterns -Moulding tools - Types of moulding – fundamentals of machining processes.

C - ELECTRICAL ENGINEERING

UNIT IV FUNDAMENTALS OF ELECTRIC CIRCUITS 6

Introduction to DC and AC circuits : Active and Passive elements - Electrical quantities - Ohm's Law - Resistors - Series and parallel combinations - Kirchoff's laws – Ideal Sources - Source Transformation – Magnetic circuits : Faraday's laws – Induced EMF and inductances - Sinusoidal functions – RMS (effective) and Average values - Phasor representation - sinusoidal excitation applied to purely resistive, inductive and capacitive circuits - power and power factor (Derivative part only) - Megger.

D - ELECTRONICS ENGINEERING

UNIT V SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS 6

PN Junction Diode and its characteristics – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers -Binary Number System: Decimal to binary conversion - Binary arithmetic – Addition - Subtraction-Multiplication-Boolean algebra – Logic Gates: AND, OR, NAND, NOR, NOT, XOR and XNOR gates.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of this course the students can able to,

CO1: Explain the usage of construction material and proper selection of construction materials and also measure distances and area by surveying.

CO2: Understand the basics of Energy Sources and Power Generation

CO3: Acquire the knowledge about various manufacturing processes.

CO4: Solve simple circuits and express the concept of fundamentals of circuits

CO5: Express the function of semiconductor devices and develop the truth tables of logic gates.

TEXT BOOKS:

1. B.L.Theraja, “Fundamentals of Electrical Engineering and Electronics”, S.Chand Publications, 28th edition, reprint 2013.
2. K. Venugopal & Dr.V. PrabhuRaja, G.Sreekanjana “Basic Civil & Mechanical Engineering”, Anuradha Publishers, (2010).
3. Shetty, M.S, "Concrete Technology", S. Chand and Company Ltd, New Delhi, 2015

REFERENCES:

1. D.P. Kothari and I.J. Nagrath, “Basic Electrical and Electronics Engineering”, Tata Mcgraw hill, First edition 2014.
2. V.K. Metha,”Principles of Electronics” S. Chand & Company Ltd, 10th Edition, 2014
3. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, 2005.
4. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., Elements of Workshop Technology, Vol. I & II, Indian Book Distributing Company Calcutta, 2007.
5. Nag, P.K., Power Plant Engineering, Tata McGraw-Hill, New Delhi, 2008.

501106 BASIC ELECTRICAL AND ELECTRONICS LABORATORY (For all branches except Marine)

L	T	P	C
0	0	3	2

COURSE OBJECTIVES:

To impart practical knowledge on House wiring system, Measurement of Electrical Quantities, Handling electrical equipment, Semiconductor devices operation and Functioning of Logic Gates

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Residential House wiring using switches, fuse, indicator , lamp and Energy meter
2. Different Types of wiring (Staircase and Fluorescent Lamp wiring)
3. Verification of Ohm’s law
4. Measurement of Electrical quantities (Voltage, current, power and power factor in RLC series circuit)
5. Calculation of Magnetic flux in an electrical circuit.
6. Measurement of earth resistance using megger
7. V-I Characteristics of PN Junction diode
8. V-I Characteristics of Zener diode
9. Voltage regulation using Zener Diode
10. Verification of basic gates operation
11. Verification of Half wave and Full wave rectifier operation
12. Study of

13. Active and passive components
14. Signal generation and measurement using AFO and CRO

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end the course the students can able to,

CO1: Design House wiring system

CO2: Measure the various Electrical Quantities in a circuit

CO3: Perform the troubleshooting of electrical equipment

CO4: Check the status of Semiconductor devices

CO5: Check the Functioning of Logic Gates

SEMESTER III

504003 **ELECTROMAGNETIC FIELD THEORY (For III Semester ECE)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To study the concept of electrostatics, electrical potential, energy density.

To study the concept of magneto statics, magnetic flux density, scalar and vector potential.

To study the concept of Electric and Magnetic fields in material

CO-PO MAPPING:

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

UNIT I VECTOR ANALYSIS **9**

Vector fields – Different Co-ordinate systems-Rectangular, Cylindrical and Spherical coordinate systems. Gradient - Divergence – Curl - Line Integral-Surface Integral-Divergence theorem-Stoke's theorem

UNIT II ELECTROSTATICS **9**

Coulomb's Law in Vector Form – Definition of Electric Field Intensity – Electric Field due to discrete charges – Electric field due to continuous charge distribution - Electric Field due to charges distributed uniformly on an infinite line – Electric Field on the axis of a uniformly charged circular disc-Electric Scalar Potential – Relationship between potential and electric field - Potential due to infinite uniformly charged line – Potential due to electrical dipole - Electric Flux Density – Gauss Law – Proof of Gauss Law.

UNIT III MAGNETOSTATICS **9**

Theories of magnetic field- Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I – Magnetic field intensity on the axis of a circular loop–

Ampere's circuital law. Magnetic flux density – Lorentz Law of force – Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential.

UNIT IV ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9

Poisson's and Laplace's equation – Electric field in free space, conductors, dielectric -Dielectric polarization – Capacitance- Dielectric strength - Electric field in multiple dielectrics – Electrostatic energy and energy density – Boundary conditions for electric fields. Definition of Inductance – Inductance of loops and solenoids – Definition of mutual inductance – simple examples. Energy density in magnetic fields – magnetic boundary conditions.

UNIT-V ELECTRODYNAMIC FIELDS AND ELECTROMAGNETIC WAVES 9

Displacement current - Maxwell's equations (differential and integral forms) –.Electro Magnetic Wave equations – Uniform plane waves - Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors-skin depth, Poynting Theorem.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will able to

CO1: Recite and discuss the fundamentals of vector fields

CO2: Illustrate the concept of Electric field and solve the problems

CO3 : Define laws of magnetic field and calculate its parameters

CO4 : Discuss the behavior of electric and magnetic fields in materials

CO5: Derive Maxwell's, Electromagnetic waves equation and illustrate the behavior of electromagnetic waves.

TEXT BOOKS:

1. Mathew N.O. Sadiku, 'Principles of Electromagnetics', Oxford press, 6th edition, 2015.

2. William H.Hayt, 'Engineering Electromagnetics', Tata McGraw Hill edition, 8th edition, 2013.

REFERENCES:

1. Joseph. A.Edminister, 'Theory and Problems of Electromagnetics', Third edition, Schaum Series, Tata McGraw Hill, 2011.

2. AshutoshPramanik, 'Electromagnetism – Theory and Applications', Prentice-Hall of India Private Limited, New Delhi, 2009.

3. Kraus and Fleish, 'Electromagnetics with Applications', Tata McGraw Hill International Editions, Fifth Edition, 2010.

505003 **ELECTRICAL TECHNOLOGY (For III Semester ECE)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The aim of this course is to provide the fundamental knowledge on Electrical networks and

machines.

CO-PO MAPPING:

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

UNIT I: ANALYSIS OF ELECTRIC CIRCUITS 9

Mesh Analysis in DC and AC circuits – Nodal Analysis in DC and AC circuits – Network Theorems in DC circuits – Thevenin's theorem – Superposition theorem- Reciprocity theorem – Maximum power transfer theorem.

UNIT II NETWORK FUNCTIONS 9

Network Functions: Driving Point Impedance and Admittance, Transfer Impedance and Admittance, Concept of poles and zeroes in a network function, Necessary conditions for driving point functions and transfer functions. Application of Laplace Transforms: Resistance Element, Inductance Element, Capacitance Element, Step Response of RL, RC and RLC circuits, Impulse Response of Series RL, RC circuits

UNIT III NETWORK TOPOLOGY 9

Tree – graph – Cut-set matrix – Tie-set matrix – One port network – two port network – Parameters of two port network- Z, H and ABCD Parameters - Asymmetrical networks: Image and Iterative impedances - Image transfer constant and iterative transfer constant- Symmetrical networks: characteristic impedance and propagation constant. Properties of L, T and Pi section types, Bridged T-Network

UNIT IV DC MACHINES AND TRANSFORMERS 9

Construction of D.C. Machines - Principle and theory of operation of D.C. generator - EMF equation - Characteristics of D.C. generators - Principle of operation of D.C. motor - Voltage equation - Torque equation - Types of D.C. motors and their characteristics – Starters -– Stepper motor – working – types of stepper motor. Construction details of shell and core type transformers- Principle of operation - EMF equation - Tests on transformers - Equivalent circuit - Regulation and efficiency of a transformer.

UNIT V AC MACHINES 9

Construction details - Principle of alternators- EMF equation–Principle of operation of Synchronous motor -Starting methods – Torque equation–Effect of change in excitation -.Single phase Induction motor - Construction and principle of operation - Double field revolving theory – Types- Split Phase induction motor – 3 phase induction motor – Working principle - Torque equation- Condition for maximum torque.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon completion of this Course, the students will able to

CO1: Discuss the DC and AC complex circuits and analysis using Mesh and nodal analysis and

different types of network theorem

CO2: Discuss the circuit parameter and transfer function, pole and zero placement and location, basic of laplace transform and apply in circuit parameters

CO3: Discuss the network topology and apply in the circuits and discuss the one and two port network, different types of parameters and draw the equivalent circuits

CO4: Discuss the construction and principle of DC generator, motor and transformer and drive the EMF equation of generator, motor and transformer and apply the machines and Problems

CO5: Discuss the construction and principle of AC machines and drive the EMF equation of ac machines and apply the machines and Problems

TEXT BOOKS:

1. S.P. Ghosh and A.K. Chakraborty, "Network Analysis and Synthesis", McGraw Hill, 1st edition, 2009.
2. Sudhakar, A. and Shyam Mohan.S.P, Circuits and Networks Analysis and Synthesis, 4th edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi 2010.
3. B.L. Theraja and A.K.Theraja, "A Text book of Electrical Technology- Vol. II, S.C Chand and Co., New Delhi, Reprint 2011.

REFERENCE BOOKS:

1. M.E. Van Valkenburg, Network Analysis, PHI, 3rd edition, 2009.
2. Abhijit Chakrabarti., Circuit Theory Analysis and Synthesis, 7th Revised Edition paper back 2018.
3. M.S.Sarma and M.K.Pathak, "Electrical Machines", Cengage Learning, 2012
4. Nagrath, I.J., and Kothari, D.P., "Electrical Machines", Tata McGraw - Hill, 4th edition, 2010

506002 **ELECTRICAL MACHINES (For III Semester EIE)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To expose the students to the basic principles of Electro mechanical Energy Conversion in DC Machines and Transformers.

CO-PO MAPPING:

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

UNIT I INTRODUCTION **9**

Electrical machine types – Energy balance – Magnetic field system – Simple electro mechanical system – Inductance – Statically induced EMF and dynamically induced EMF – Torque.

UNIT II DC GENERATOR **9**

Constructional detail-principle of operation – EMF equation-Methods of excitation –Types of generator –Characteristics of generator- Armature reaction – commutation- parallel operation-Voltage regulation of DC Generators - Applications.

UNIT III DC MOTOR **9**

Principle of operation – back EMF and torque equation – Condition for maximum power - Types of DC Motors – DC shunt Motor – DC Series motor - characteristics of Motor – necessity of starter – types of starters – 3 point starter – 4 point starter.

UNIT IV SPEED CONTROL METHODS & TESTING OF DC MACHINES **9**

Factors controlling motor speed – speed control of DC shunt motor and series motor- armature control method and field control method – testing of DC machines – Brake test – Swinburne's test – Hopkinson's test – Retardation test.

UNIT V TRANSFORMERS **9**

Construction – principle of operation- hysteresis – core losses – EMF equation – Transformer on no load – Transformer on load - equivalent circuit – Open circuit and short test on transformer - efficiency and voltage regulation – auto transformer – 3 phase transformer – Testing of transformer

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will able to

CO1: Recite and describe the basic principles of Electro mechanical Energy Conversion

CO2: Interpret the concept of DC generators and their characteristics

CO3: Discuss the concept of DC motor and their characteristics

CO4: Categorize the methods of testing and speed control of DC motor

CO5: Describe the working of transformer and classify the transformer and also evaluate the efficiency of transformer by solving problems.

TEXT BOOKS:

1. Theraja, B.L., "A Text book of Electrical Technology", Vol. II, S.C Chand and Co., New Delhi, Reprint 2014.

2. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 4th edition, 2010.

REFERENCES:

1. Fitzgerald.A.E., Charles KingselyJr, Stephen D.Umans, 'Electric Machinery', McGraw Hill Books Company, 6th edition, 2005.

2. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', John Wiley&Sons, 2007.

3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 1st edition,2010.

510005	**FUNDAMENTALS OF ELECTRICAL DRIVES (For III Semester Mechanical Engineering)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To understand the basic concepts of different types of electrical machines and their performance.
To study the different methods of starting D.C motors and induction motors.
To study about the performance of conventional and solid-state drives

CO-PO MAPPING:

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

UNIT I INTRODUCTION 9

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DC MOTOR DRIVES 9

DC motor drives – dc motors & their performance - shunt, series, compound - permanent magnet motor- universal motor - dc servomotor – braking – regenerative - dynamic braking - plugging.

UNIT III INDUCTION MOTOR DRIVES 9

Induction motor drives – stator voltage control of induction motor – torque-slip characteristics – operation with different types of loads – operation with unbalanced source voltages and single phasing - effect of harmonics and control of harmonics.

UNIT IV STARTING METHODS 9

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase induction motors starters: Stator resistance starter, rotor resistance starter, auto transformer starter- Single phase induction motors: Split phase - capacitor start - capacitor start and capacitor run – Shaded pole induction motor.

UNIT V SPEED CONTROL OF D.C. AND AC DRIVES 9

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system –overview of SCR and chopper – speed control using controlled rectifiers and DC choppers Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Speed control using AC voltage regulators – applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this Course, the students will able to
CO1: Express the concepts of Electrical drives
CO2: Discuss about the characteristics of DC Motors
CO3: Express the starting methods of DC and AC motors.
CO4: Explain about the speed control of DC Motors
CO5: Explain about the speed control of AC Motors

TEXT BOOKS:

1. Gopal K.Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi, 2013.
2. B.L. Theraja and A.K.Theraja, “A Text book of Electrical Technology- Vol. II, S.C Chand and Co., New Delhi, Reprint 2011.

REFERENCES:

1. Vedam Subrahmaniam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 2010
2. Partab. H., “Art and Science and Utilization of Electrical Energy”, Dhanpat Rai and Sons, 2017
3. Pillai.S.K “A First Course on Electric Drives”, Wiley Eastern Limited, 2012
4. Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2nd edition, 2017.

508012 ELECTRICAL MEASUREMENTS AND DC MACHINES (For III Semester Marine Engineering)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To introduce the concepts about measurement practices and measuring instruments.
To impart knowledge about transducers and Data acquisition system
To impart knowledge about construction and operation of D.C. Machines in general and generators in particular.
To familiarize the students with the operation and speed control of D.C. motors.

CO-PO MAPPING:

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

UNIT I PRINCIPLES OF MEASUREMENT 9

Basic requirements of measuring instrument – principles of indicating instruments – control and damping devices – Moving coil and moving iron instruments and their use as voltmeters and ammeters – Dynamometer type wattmeter – Thermocouple instruments - Extension of instrument range.

UNIT II ELECTRICAL MEASUREMENTS 9

Induction type energy meters-megger (Basic construction & principles of operation only). – Single phase and three phase wattmeter for power measurement – Measurement of energy- speed-frequency and phase difference – Measurement of resistance- inductance and capacitance by Bridge method – Magnetic measurement.

UNIT III TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive- capacitive & inductive

transducers – Piezoelectric transducers – Photoelectric transducer – Measurement of speed- Measurement of pressure- flow- temperature – simple electronic measuring devices – CRO- IC tester- Signal generator- Timers- Introduction to data acquisition system

UNIT IV PRINCIPLES OF D.C. MACHINES AND GENERATORS 9

Direct current machines - principle of working – winding - e.m.f. equation - armature reaction, commutation- brush shift- compensating winding etc.

D.C. generator, their characteristics, methods of excitation, parallel operation, equalizer busbar, performance characteristics.

UNIT V D.C. MOTORS 9

DC motor - characteristics - starting and reversing methods - speed-torque equations- Speed torque characteristics - starters- speed control - testing of DC motors- Losses and efficiency- braking of DC motor **TOTAL: 45 PERIODS**

COURSE OUTCOMES:

Upon completion of this Course, the students will able to

CO1: To show their knowledge about the working of measuring instruments.

CO2: To express the concepts about measurement practices and measuring instruments.

CO3: To express the function of transducers and data acquisition system

CO4: To explain the operation of D.C. generators.

CO5: To explain the operation and characteristics of D.C. motors.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', DhanpatRai and Co, 2015.

2. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co., New Delhi, Reprint 2011.

3. Bhattacharya, SK., "Electrical Machines", 4th Edition, Tata McGraw-Hill Education Publisher, India, 2014.

REFERENCES:

1. Uppal S.L., "Electrical Power", 13th Edition, Khanna publishers, Mumbai, 2018.

2. Berde M.S, "Electric Motor Drives", 1st Edition, Khanna Publishers, Mumbai, 1995.

3. W. Laws, "Electricity Applied to Marine Engineering", 4th edition, The Institute of Marine Engineers, London, 1998.

505103 ELECTRICAL TECHNOLOGY LABORATORY (For III SEM ECE)

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To expose the students to the practical knowledge on Circuits, DC and AC machines and develop their experimental skill.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Laws.
2. Verification of Thevenin's and Super position Theorems.
3. Study of Single-Phase RLC Series Circuits.
4. Measurement of Power by Two-Wattmeter Method.
5. Case study on Electrical equipments (Fan, Lamp, Iron box and motor)
6. Magnetization Curve of a Separately Excited DC Generator.
7. Load Characteristics of Shunt Generator.
8. Load Characteristics of DC Shunt Motor.
9. Load characteristics of DC series motor.
10. Speed Control of DC Shunt Motor.
11. O.C and S.C Tests on Single-Phase Transformer.
12. Load Test on Single-Phase Transformer.
13. Load test on single phase induction motor
14. Load Test on Three-Phase Induction Motor.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Verify the fundamental laws and theorems in an electric circuits.
CO2: Use characteristics of various electrical drives depending on their type excitation.
CO3: Develop knowledge helpful for application of DC and AC machines.
CO4: Conduct speed control of different types of electrical machines.
CO5: Conduct different types of testing in electrical machines.

TEXT BOOKS:

1. Bimbra P. S., Electrical Machinery, 7/e, Khanna Publishers, 2011.
2. Theraja B. L., A Textbook of Electrical Technology vol. II, S. Chand & Company, New Delhi, 2010.

REFERENCES:

1. Kothari D. P. Laboratory Manual for Electrical Machines, I K International Publishing House Pvt. Ltd.
2. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.

506101 **ELECTRICAL MACHINES LABORATORY (For III SEM EIE)** **L T P C**

0 0 3 2

COURSE OBJECTIVE:

To provide strong background in different types of excitation for D.C. Machines and A.C. Machines.

To gain knowledge on various lab experiments connected with D.C. Machines and A.C. Machines and there by achieve the design concepts.

To attain knowledge on application of D.C. Machines and A.C. Machines concepts with respect to the performance characteristics.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Brake test on DC Shunt motor
2. Brake test on DC Series motor
3. Brake test on DC Compound Motor
4. Speed control of DC shunt motor (Armature / Field control)
5. Swinburne's test.
6. Load test on three phase squirrel cage Induction motor
7. Load test on Single - phase Induction Motor.
8. Speed control of three phase squirrel cage Induction Motor
9. Speed control of Single - phase Induction Motor.
10. Speed control of DC Motor using rectifier.
11. Speed control of DC Motor using chopper.
12. Study of Starters for AC& DC Machine.

Additional Experiments:

Using MATLAB, simulate the following tests

1. Load characteristics of DC shunt motor.
2. Speed control of DC Motor using rectifier.
3. Speed control of DC Motor using chopper.
4. Speed control of Single-phase induction motor using inverter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Use characteristics of various electrical drives depending on their type excitation.

CO2: Develop knowledge helpful for application of DC and AC machines.
CO3: Conduct speed control of different types of electrical drives.
CO4: Understand the concept of different types of testing in electrical dives.
CO5: Know the procedure to conduct speed control tests on electrical drives.

TEXT BOOKS:

1. Bimbra P. S., Electrical Machinery, 7/e, Khanna Publishers, 2011.
2. Theraja B. L., A Textbook of Electrical Technology, S. Chand & Company, New Delhi, 2008.

REFERENCES:

1. Kothari D. P. Laboratory Manual for Electrical Machines, I K International Publishing House Pvt. Ltd.
2. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.

510103 **ELECTRICAL MACHINES LABORATORY (For III SEM Mechanical Engineering)**

L	T	P	C
0	0	3	2

COURSE OBJECTIVE:

To provide strong background in different types of excitation for D.C. Machines and A.C. Machines.
To gain knowledge on various lab experiments connected with D.C. Machines and A.C. Machines and there by achieve the design concepts.
To attain knowledge on application of D.C. Machines and A.C. Machines concepts with respect to the performance characteristics.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Brake test on DC Shunt motor
2. Brake test on DC Series motor
3. Brake test on DC Compound Motor
4. Speed control of DC shunt motor (Armature / Field control)
5. Swinburne’s test.
6. Load test on three phase squirrel cage Induction motor
7. Load test on Single - phase Induction Motor.
8. Speed control of three phase squirrel cage Induction Motor
9. Speed control of Single - phase Induction Motor.

10. Speed control of DC Motor using rectifier.
11. Speed control of DC Motor using chopper.
12. Study of Starters for AC& DC Machine.

Additional Experiments:

Using MATLAB, simulate the following tests

1. Load characteristics of DC shunt motor.
2. Speed control of DC Motor using rectifier.
3. Speed control of DC Motor using chopper.
4. Speed control of Single-phase induction motor using inverter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Use characteristics of various electrical drives depending on their type excitation.
CO2: Develop knowledge helpful for application of DC and AC machines.
CO3: Conduct speed control of different types of electrical drives.
CO4: Understand the concept of different types of testing in electrical dives.
CO5: Know the procedure to conduct speed control tests on electrical drives.

TEXT BOOKS:

1. Bimbra P. S., Electrical Machinery, 7/e, Khanna Publishers, 2011.
2. Theraja B. L., A Textbook of Electrical Technology, S. Chand & Company, New Delhi, 2008.

REFERENCES:

1. Kothari D. P. Laboratory Manual for Electrical Machines, I K International Publishing House Pvt. Ltd.
2. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.

SEMESTER IV

508020 **AC ELECTRICAL MACHINES (For IV Semester Marine Engineering)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To expose the students to the concepts about Distribution of Electric power and AC Machines used in Marine engineering.

CO-PO MAPPING:

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

UNIT I ALTERNATORS 9

Alternators – general arrangement – construction of salient pole and cylindrical rotor types – types of stator windings – e.m.f equation – distribution and pitch factor – waveform of e.m.f. generated – rotating magnetic field – armature reaction – voltage regulation – load characteristics – open circuit and short ,.circuit tests – e.m.f and m.m.f. methods – parallel operation of alternators – KW and KVA sharing – Brushless alternator – static excitation system.

UNIT II TRANSFORMERS 9

Transformers – Principle of operation- e.m.f. equation - phasor diagrams for no load conditions- useful and leakage flux- leakage reactance - equivalent circuits- voltage regulation- losses and efficiency- open circuit and short circuit tests- parallel operation- three phase transformer – core and shell type auto transformer - current and potential transformer.

UNIT III SYNCHRONOUS MOTORS 9

Principle of operation – Starting methods -Torque equation- Equations for Power input and power developed – Effect of Change in excitation-V and inverted V curves-Hunting-Method of starting - Synchronous condenser-Current loci for constant power input- constant excitation and constant power developed - merits and limits of synchronous motor over others -Applications.

UNIT IV INDUCTION MACHINES 9

Three phase induction motor –Principle of operation and theory of action – slip speed– rotor to stator relationship – rotor frequency – rotor emf. and current – equivalent circuit relationship between rotor IR loss and rotor slip – torque/Slip characteristics – starting torque and maximum running torque - starting of special high torque induction motors – single phase induction motor – principle and operational characteristics – starting control – constructional details

UNIT V CONTROL OF INDUCTION MACHINES 9

Starting of induction motor – method of starting – Direct on-line starters – Star – delta starter – auto-transformer starter- Stator Resistance starter- Rotor resistance Starter – Speed control of induction motor-Insulated gate bipolar transistor (IGBT) motor speed control- motor speed control by thyristors – Supply Frequency Control-Controlling Number of poles- Electric Breaking of an induction machines-Injecting slip power-Frequency E.M.F into Rotor Circuit.

TOTAL: 45 PERIODS

COURSE OUTCOME:

After completing the course the students will able to,

CO1: Express their knowledge in the procedure for producing electricity on board ships through alternators and associated controls.

CO2: Explain the principle, features and types of transformers

CO3: Explain the principle and characteristics of synchronous motors.

CO4: The express their knowledge in the principle of working and starting methods of Induction motors.

CO5: The expose their knowledge in Speed control and trouble shooting of induction machines.

TEXT BOOKS:

1. Theraja, B.L., “A Text book of Electrical Technology”, Vol. II, S.C Chand and Co., New Delhi,

Reprint 2011.
2. Elstan.A. Fernandez, "Marine Electrical Technology", 1st Edition, "Sterling Book House", Mumbai, 2013.

REFERENCE BOOKS:

1. Uppal S.L., "Electrical Power", 13th Edition, Khanna publishers, Mumbai, 2018.
2. Berde, M.S., "Electric Motor Drives", 1st Edition, Khanna Publishers, Mumbai, 1995.
3. W. Laws, "Electricity Applied to Marine Engineering", 4th edition, The Institute of Marine Engineers, London, 1998.

509006 **ELECTRICAL DRIVES AND CONTROL (For IV Semester MAE)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To understand the basic concepts of different types of electrical machines and their performance.
To study the different methods of starting D.C motors and induction motors.
To study about the performance of conventional and solid-state drives

CO-PO MAPPING:

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

UNIT I INTRODUCTION 9

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound –Characteristics of single phase and three phase induction motors.

UNIT II STARTING METHODS 9

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase induction motors starters: Stator resistance starter, rotor resistance starter, auto transformer starter- Single phase induction motors: Split phase - capacitor start - capacitor start and capacitor run – Shaded pole induction motor.

UNIT IV SOLID STATE SPEED CONTROL OF D.C. DRIVES 9

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system –overview of SCR and chopper – speed control using controlled rectifiers and DC choppers –applications.

UNIT V SOLID STATE SPEED CONTROL OF A.C. DRIVES 9

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will able to,

CO1: Express the concepts of Electrical drives

CO2: Discuss about the characteristics of DC Motors

CO3: Express the starting methods of DC and AC motors.

CO4: Explain about the speed control of DC Motors

CO5: Explain about the speed control of AC Motors

TEXT BOOKS:

1. Gopal K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2013.

2. B.L. Theraja and A.K.Theraja, "A Text book of Electrical Technology- Vol. II, S.C Chand and Co., New Delhi, Reprint 2011.

REFERENCES:

1. Vedam Subrahmaniam, "Electric Drives (Concepts and Applications)", Tata McGraw, 2011.

2. Pillai.S.K "A First Course on Electric Drives", Wiley Eastern Limited, 2012

3. Singh. M.D., K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 2006.

509104 ELECTRICAL DRIVES AND CONTROL LABORATORY (For IV Semester MAE)

L	T	P	C
0	0	3	2

COURSE OBJECTIVE:

To expose the students to the operation and control of electrical drives and develop their practical skill.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Brake test on DC Shunt motor
2. Brake test on DC Series motor
3. Brake test on DC Compound Motor
4. Speed control of DC shunt motor (Armature / Field control)

5. Swinburne's test.
6. Load test on three phase squirrel cage Induction motor
7. Load test on Single - phase Induction Motor.
8. Speed control of three phase squirrel cage Induction Motor
9. Speed control of Single - phase Induction Motor.
10. Speed control of DC Motor using rectifier.
11. Speed control of DC Motor using chopper.
12. Study of Starters for AC& DC Machine.

Additional Experiments:

1. Using MATLAB, simulate the following tests
2. Load characteristics of DC shunt motor.
3. Speed control of DC Motor using rectifier.
4. Speed control of DC Motor using chopper.
5. Speed control of Single-phase induction motor using inverter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Use characteristics of various electrical drives depending on their type excitation.
CO2: Develop knowledge helpful for application of DC and AC machines.
CO3: Conduct speed control of different types of electrical drives.
CO4: Understand the concept of different types of testing in electrical dives.
CO5: Know the procedure to conduct speed control tests on electrical drives.

TEXT BOOKS:

1. Bimbra P. S., Electrical Machinery, 7/e, Khanna Publishers, 2011.
2. Theraja B. L., A Textbook of Electrical Technology, S. Chand & Company, New Delhi, 2008.

REFERENCES:

1. Kothari D. P. Laboratory Manual for Electrical Machines, I K International Publishing House Pvt. Ltd.
2. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.

SEMESTER V

508023	**MARINE ELECTRICAL TECHNOLOGY (For V Semester Marine Engineering)**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

COURSE OBJECTIVES:

To impart about the regulations observed onboard ships regarding electrical equipment wherever applicable.

To impart about the use of electrical instruments onboard ships

To find out and rectify various kinds of faults onboard ships.

CO-PO MAPPING:

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

UNIT I POWER DISTRIBUTION, REGULATIONS AND TROUBLESHOOTING 9+3

Requirements & Regulations – safe electrical equipment for hazardous areas – American safety standards – common definitions – British and European standards – tanker installations – Installations Ashore – Indian Standards.

Systems of AC distribution – general concept – single, two and three phase systems with 2,3 and 4 wires – power distribution – general Distribution scheme – specific systems for ship"s service – tankers schemes – primary power bus – need for emergency power supply – method of supply – passenger and cargo vessels requirements – shore supply –precautions to be taken while consuming shore supply – arrangement to ensure proper phase supply – remote switches to ventilating fans – fuel pumps – lubricating oil pumps and purifiers.

Maintenance & Troubleshooting: Introduction – Planned Preventive Maintenance – Life-Breakdown and Condition maintenance- Troubleshooting- Maintenance of specific equipment – Recommended list of spares- tools & Accessories.

Troubleshooting of Monitoring system: Test and Calibration of sensors - Test and Calibration of tranducers – Construction and operation principles of insulation tester – continuity tester – mulity tester – clamp meter.

UNIT II SPECIAL ELECTRICAL SYSTEM IN SHIPS 9+3

Do"s and Don"ts – Electric shock – first aid – conditions of shock risk – selection of AC and DC generators for use on ships – merits and demerits – location and Installation of generator sets.

Emergency lighting – Requirement of lighting of Deck and pump house of oil tankers. Alarm Indication Systems: Fire alarms and Detection – Heat detectors – Smoke detectors – Combustion detectors – Miscellaneous alarm indicator systems – Scanning type system – Sequential starting and cut outs for an automatic fired boiler incorporating safety devices and combustion control equipment – incinerators – Sewage plants – Bilge oil separators.

UNIT III ELECTRICAL SYSTEM AND PROCTIVE DEVICES 9+3

Insulated & Earthed neutral systems – introduction – circuit faults – causes –prevention – earth fault indicators – detection and clearance – alternators.

Switchboards & Switchgear: Main and sub switchboard-Rating and Characteristics of Main switchboards – group starter boards – distribution Fuse boards – bus bars – instrumentation & controls – circuit breakers – alternator CB"s – MCCB"s – miniature CB"s-RCCB"s – arc fault Current Interrupts – fused Isolators – fault protection devices – introduction – over-voltage-surge-transients – ripple – spikes – DC generator protection –alternator and system protection –

protection through fuses – protection Discrimination Motor Protection.

UNIT IV CABLES AND LIGHTING SYSTEMS 9+3

Electrical Cables: Cables- conductors – Wire Sizes-Current Rating – testing-codes-Practical tips. Insulation – protection and temperature ratings – insulation classes – A- B- E- F- H- Insulation for High temperatures – Insulating Materials – Cable insulation & Sheath – Formation of polymers-classification- Polymerization mechanisms – filters – Cross – linking – Cable gland – Degrees of Protection – Temperature Ratings – Temperature Rise – Determination of hot temperature.

Lighting Systems: Introduction – Incandescent Lamps – Discharge lamps – HCLPMF lamps – High pressure Mercury Fluorescent lamps – High and Low pressure sodium vapour lamps – Lamp caps – Effect of voltage on lamp performance – Navigation & signal lights – Signals for a power driven ship under way (At night).

UNIT V PROPULSION AND STEERING SYSTEMS 9+3

Propulsion Systems: Auxiliary propulsion systems – Layout and Optimizing storage space – Electrical Propulsion – Advantages & Disadvantages DC constant current systems – DC motor supplied from alternators – Turbo – electric propulsion – AC single speed and Induction motor drives – Fixed speed alternators – Cycloconverter device-Diesel Electric propulsion – Thruster and Water jet propulsion.

Steering Systems & Gyrocompasses: Fundamentals – Auto Navy steering Systems – Type P – Electro hydraulic Steering – Control systems-Typical system configuration-Components-Auto Steer-Types- Structure – Gyroscopes – Compass Considerations. Deck Machinery & Cargo Equipment: Anchor Windlass – Cargo winches – Hydra lift Marine cranes-Maritime GMC A.S.-Hagglunds Drives & H.W. Carlsen AB-Magnetic disc brakes.

LECTURES: 45 TUTORIALS: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Elstan.A. Fernandez, "Marine Electrical Technology", 1st Edition, "Sterling Book House", Mumbai, Reprint 2014.

2. H.D. Mc George," Marine Electrical equipment and Practice", II Edition, Butter Worth, Heinemann limited Revised, 2012.

REFERENCE BOOKS:

1. BOWIC C.T., Marine Electrical Practice, 5th Edition, "Butter Worthy", London, 1981.

2. LAW S.W., "Electricity applied to Marine Engineering", 4th Edition, "The Institute of Marine Engineers", London, 1998.

SEMESTER VI

		L	T	P	C
509017	**CONTROL SYSTEM ENGINEERING (For VI Semester MAE)**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

To understand the basic components of control systems.
To Gain knowledge in various time domain and frequency domain tools
To understand the methods and analyze the stability of systems
To understand the function of hydraulic and pneumatic control system

CO-PO MAPPING:

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

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Introduction and classification of control systems - Terminology - plant, process, system, disturbances, controlled variable, manipulated variable etc.- Transfer function - Translational and rotational mechanical systems – Simple pneumatic- hydraulic and thermal systems - Transfer function of AC Servomotor.

UNIT II TIME AND FREQUENCY RESPONSE ANALYSIS 9

Mathematical expression for standard test signals – Type and order of systems – Step response of first order and second order systems - Time domain specifications – Introduction to PID Controller - Frequency response analysis – frequency domain specifications of second order systems – bode plots – Determination of Gain margin and phase margin.

UNIT III HYDRAULIC CONTROL SYSTEM 9

Basic elements of hydraulic circuit - Principle used in hydraulic circuit - Sources of hydraulic power – Hydraulic servo system - Proportional, Integral, Derivative controller with its transfer function - Comparison between hydraulic and electrical control system- advantages and disadvantages.

UNIT IV PNEUMATIC CONTROL SYSTEM 9

Basic elements of pneumatic circuit - Difference between pneumatic and hydraulic control systems –Pressure systems – Resistance and Capacitance of pressure system -Force balance and force distance type controllers - Nozzle-flapper amplifier- Pneumatic Relay - PD, PI and PID controller along with its transfer function.

UNIT V STABILITY ANALYSIS 9

Stability analysis - Types of stability - location of roots in s-plane for stability – Routh Hurwitz criterion – relative stability analysis – root locus technique – construction of root loci – Stability analysis – Stability analysis using Root locus.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the students can able to,
CO1: Express the methodology for modelling dynamic systems with concept of stability
CO2: Determine the type and order of systems, draw the bode plot and determine the gain margin and phase margin from bode plot.
CO3: Express the function of hydraulic system

CO4: Express the function of pneumatic control system
CO5: Analyse the stability of the system using root locus and Routh's table

TEXT BOOKS:

1. I.J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 5th edition, 2018.
2. Katsuhiko Ogata, "Modern control theory", Prentice Hall, Fifth edition, 2010.

REFERENCE BOOKS:

1. Norman S.Nise, "Control Systems Engineering", 6th edition, John Wiley, New Delhi, 2010.
2. Richard C. Dorf, Robert H Bishop, "Modern control systems", Prentice Hall, Twelfth edition, 2011.
3. Farid Golnargh and B.C. Kuo, "Automatic Control Systems", Prentice Hall of India Ltd., 10th edition New Delhi, 2018.

509109 CONTROL SYSTEM ENGINEERING LABORATORY (For VI Semester MAE)

L	T	P	C
0	0	3	2

COURSE OBJECTIVES:

To provide hands on training in MATLAB simulink / PLC
To provide practical knowledge in design and development of control system
To provide practical knowledge to verify the stability of a system
To provide practical knowledge in designing of PID controller.

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Introduction to simulation software like MATLAB/LABVIEW
2. Modeling of physical system using simulation software
3. Simulation of linear system to different inputs
4. Digital simulation of first and second order systems
5. For the given system form the transfer function, plot the location of the system zeros and poles using simulation software
6. Stability analysis by root locus plot using MATLAB program.
7. Design of PID Controller for the second order system.
8. Stability analysis of linear systems using Bode plot.
9. DC and AC position control systems.

10. Stepper motor control system.
11. Introduction of programmable logic controller and ladder diagram.
12. Develop the ladder diagram for industrial process.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Develop MATLAB simulink model

CO2: Design and develop the control systems

CO3: Design the PID controller.

CO4: Verify the stability of a system

CO5: Develop Ladder diagram for industrial process.