P.S.R. ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Sevalpatti (P.O), Sivakasi – 626140.

B.E. Electrical and Electronics Engineering

CURRICULUM AND SYLLABI

UG Regulations 2016

Department of Electrical and Electronics Engineering

CANDIDATES ADMITTED DURING 2016-2017 AND ONWARDS

Institute Vision and Mission

Vision

- To contribute to the society through excellence in technical education with societal values and thus a valuable resource for industry and the humanity.

Mission

- To create an ambience for quality learning experience by providing sustained care and facilities.
- To offer higher level training encompassing both theory and practices with human and social values.
- To provide knowledge based services and professional skills to adapt tomorrow's technology and embedded global changes.

Department Vision and Mission

Vision

- To be a technical hub of creating Electrical and Electronics Engineers with superior quality, human values and ethical views.

Mission

- To provide an excellent, innovative and comprehensive education in electrical and electronics engineering.
- To create a conducive learning environment and train the students in the latest technological development domain to enhance career opportunities.
- To produce competent and disciplined engineers suitable for making a successful career in industry/research.

Programme Educational Objectives

1. Lead a professional career by acquiring the basic knowledge in the field of specialization and allied Engineering.
2. Assess the real life problems and deal with them confidently relevance to the society.
3. Engage in lifelong learning by pursuing higher studies and participating in professional organizations.
4. Exhibit interpersonal skills and able to work as a team for success.

Program Outcomes

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply knowledge of mathematics, physical sciences and Electrical and Electronics Engineering fundamentals.
2. Problem Analysis: Able to identify, formulate, analyze and solve Electrical and Electronics Engineering problems.
3. Design/development of solutions: Able to design and realize Electrical and Electronics systems to meet desired needs within practical constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

4. Investigations: Able to investigate and conduct experiments, as well as to analyze and interpret data.
5. Modern tool usage: Use of techniques, skills, and modern engineering tools necessary for engineering practice.
6. The Engineer and society: Contextual knowledge to assess societal, health, safety, legal and cultural issues related to Engineering.
7. Environment and sustainability: Realize the impact of Electrical Engineering solutions in a global, economic and environmental context.
8. Ethics: Apply ethical principles and commitment to professional ethics and responsibility.
9. Individual and team work: Function as an individual and as a member or leader in multidisciplinary teams.
10. Communication: Communicate effectively with the engineering community and society at large.
11. Project management and finance: Knowledge and understanding of management and business practices and their limitations.
12. Lifelong learning: Recognize the need for, and have the ability to engage in life-long learning.

Program Specific Outcomes

Engineering Graduates will be able to:

1. Skilled to analyze, design and test various electrical and electronic circuits, control systems, instrumentation systems, computer systems, microprocessor and microcontroller based systems.
2. Exhibit knowledge and hands-on competence in the application of Electrical machines and Power Electronics based drives systems.
3. Design and investigate problems in power system network along with protection schemes and effective utilization of electrical energy.
4. Develop a project management tool for solving complex electrical / electronic problems by applying the knowledge of basic sciences, mathematics and engineering fundamentals.

P.S.R.ENGINEERING COLLEGE, SIVAKASI-626140
UG REGUALTIONS-2016
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
CURRICULUM
[I – VIII SEMESTERS - FULL TIME]

Total Credits: 179

SEMESTER - I

Sl	Code	Course Title	Category	L-T-P	C
1	161HS11	Essential English	HS	3-0-0	3
2	161MA11	Engineering Mathematics – I	BS	3-1-0	4
3	161PH11	Engineering Physics	BS	3-0-0	3
4	161CY11	Engineering Chemistry	BS	3-0-0	3
5	161CS11	Fundamentals of Computing and C Programming	ES	3-0-0	3
6	161ME11	Engineering Graphics	ES	1-0-4	3
7	161PC17	Physics and Chemistry Laboratory – I	BS	0-0-4	2
8	161CS17	Computer Practice Laboratory -1	ES	0-0-4	2
9.	161EE17	Engineering Practices Laboratory	ES	0-0-4	2
					No. of Credits: 25

SEMESTER – II

Sl	Code	Course Title	Category	L-T-P	C
1	161HS21	Technical English	HS	3-0-0	3
2	161MA21	Engineering Mathematics - II	BS	3-1-0	4
3	161PH21	Physics of Materials	BS	3-0-0	3
4	161CY21	Environmental Science	BS	3-0-0	3
5	161EE21	Electric Circuits Theory	PC	3-0-0	3
6	161EE22	Electronic Devices and Circuits	PC	3-0-0	3
7	161PC27	Physics and Chemistry Laboratory -II	BS	0-0-4	2
8	161EE27	Electric Circuits Laboratory	PC	0-0-4	2
9	161EE28	Electronics Devices and Circuits Laboratory	PC	0-0-4	2
					No. of Credits: 25

SEMESTER – III

Sl	Code	Course Title	Category	L-T-P	C
1	161MA31	Transforms and Partial Differential Equation	BS	3-1-0	4
2	161EE31	Linear Integrated Circuits	PC	3-0-0	3
3	161EE32	Digital Circuits and Design	PC	3-0-0	3
4	161EE33	Electromagnetic Theory	PC	3-1-0	4
5	161EE34	Measurements and Instrumentation	PC	3-0-0	3
6	161EE35	Data Structures and Algorithms	ES	3-0-2	4
7	161EE37	Integrated Circuits Laboratory	PC	0-0-4	2
8	161EE38	Measurements and Instrumentation Laboratory	PC	0-0-4	2
9	161HS39	Functional English I	EEC	0-0-2	0
					No. of Credits: 25

SEMESTER – IV

Sl	Code	Course Title	Category	L-T-P	C
1	161MA42	Statistics and Numerical Methods	BS	3-0-0	3
2	161EE41	Control Systems	PC	3-0-0	3
3	161EE42	DC Machines and Transformer	PC	3-0-0	3
4	161EE43	Basics of Power Plant Engineering	PC	3-0-0	3
5	161EE44	Transmission and Distribution	PC	3-0-0	3
6	161EE45	Communication Engineering	ES	3-0-0	3
7	161EE47	Control System Laboratory	PC	0-0-4	2
8	161EE48	DC Machines and Transformer Laboratory	PC	0-0-4	2
9	161HS49	Functional English II	EEC	0-0-2	0
					No. of Credits: 22

SEMESTER – V

Sl	Code	Course Title	Category	L-T-P	C
1	161EE51	Digital Signal Processing	PC	3-0-0	3
2	161EE52	Rotating AC Machines	PC	3-0-0	3
3	161EE53	Power Electronics	PC	3-0-0	3
4	161EE54	Protection and Switchgear	PC	3-0-0	3
5	161EE55	High Voltage Engineering	PC	3-0-0	3
6	161EE56	Object Oriented Programming	ES	3-0-2	4
7	161EE57	Rotating AC Machines Laboratory	PC	0-0-4	2
8	161EE58	Power Electronics Laboratory	PC	0-0-4	2
9	161HS59	Career English I	EEC	0-0-2	0
					No. of Credits: 23

SEMESTER – VI

Sl	Code	Course Title	Category	L-T-P	C
1	161EE61	Power System Analysis	PC	3-0-0	3
2	161EE62	Solid State Drives	PC	3-0-0	3
3	161EE63	Advanced Microprocessor and Microcontrollers	PC	3-0-0	3
4	161HS61	Engineering Economics and Management	HS	3-0-0	3
5	161EEEXX	Elective-I	PE	3-0-0	3
6	161EEEXX	Elective-II	PE/OE	3-0-0	3
7	161EE67	Industrial Drives and Control Laboratory	PC	0-0-4	2
8	161EE68	Advanced Microprocessor and Microcontroller Laboratory	PC	0-0-4	2
9	161EE69	Mini Project	EEC	0-0-2	1
10	161HS69	Career English II	EEC	0-0-2	0
					No. of Credits: 23

SEMESTER – VII

Sl	Code	Course Title	Category	L-T-P	C
1	161EE71	Power System Operation and Control	PC	3-0-0	3
2	161EE72	Design of Electrical Machines	PC	3-1-0	4
3	161EE73	Wiring, Estimation and Costing	PC	3-0-2	4
4	161EE74	Electric Energy Generation, Utilization and Conservation	PC	3-0-0	3
5	161EEEXX	Elective – III	PE	3-0-0	3
6	161EEEXX	Elective – IV	PE/OE	3-0-0	3
7	161EE77	Power System Simulation Laboratory	PC	0-0-4	2
8	161EE78	Comprehension Laboratory	PC	0-0-4	2
					No. of Credits: 24

SEMESTER – VIII

Sl	Code	Course Title	Category	L-T-P	C
1	161EEEXX	Elective – V	PE	3-0-0	3
2	161EEEXX	Elective – VI	PE	3-0-0	3
3	161EE87	Project Work	EEC	0-0-12	6
					No. of Credits: 12

PROGRAM ELECTIVES

Sl	Code	Course Title	Category	L-T-P	C
1.	161EEE01	Power Quality	PE	3-0-0	3
2.	161EEE02	High Voltage Transmission System	PE	3-0-0	3
3.	161EEE03	Flexible AC Transmission Systems	PE	3-0-0	3
4.	161EEE04	Renewable Energy Sources	PE	3-0-0	3
5.	161EEE05	Special Electrical Machines and controllers	PE	3-0-0	3
6.	161EEE07	Smart Grid Design and Analysis	PE	3-0-0	3
7.	161EEE11	Power System Economics and Control Techniques	PE	3-0-0	3
8.	161EEE15	Distributed Generation Systems and Micro grid	PE	3-0-0	3
9.	161EEE16	High Voltage Direct Current Transmission	PE	3-0-0	3
10.	161EEE17	CAD for Electrical Systems	PE	3-0-0	3
11.	161EEE19	Distribution system automation	PE	3-0-0	3
12.	161EEE21	Embedded System Design	PE	3-0-0	3
13.	161EEE22	Robotics and Automation	PE	3-0-0	3
14.	161EEE24	Bio-medical Instrumentation	PE	3-0-0	3
15.	161EEE25	VHDL based Digital System Design	PE	3-0-0	3
16.	161EEE27	Nano-Dielectrics	PE	3-0-0	3
17.	161EEE32	Intelligent Control System	PE	3-0-0	3
18.	161EEE33	PLC and Distributed control system	PE	3-0-0	3

OPEN ELECTIVES

Sl	Code	Course Title	Category	L-T-P	C
1.	161OE401	Energy Audit and Conservation	OE	3-0-0	3
2.	161OE403	Sensors and Transducers	OE	3-0-0	3
3.	161OE406	Vehicular Electric Power Systems	OE	3-0-0	3
4.	161OE407	Domestic and Industrial Electrical Installation	OE	3-0-0	3

Courses offered by CSE Department

Sl	Code	Course Title	Category	L-T-P	C
1	161OE101	Web development using PHP	OE	3-0-0	3
2	161OE102	Programming in PERL	OE	3-0-0	3
3	161OE103	Multimedia & Animation Tools	OE	3-0-0	3
4	161OE104	Multicore Architecture	OE	3-0-0	3
5	161OE105	Green Computing	OE	3-0-0	3
6	161OE106	Soft Computing	OE	3-0-0	3

Courses offered by ECE Department

Sl	Code	Course Title	Category	L-T-P	C
1	161OE201	Medical Electronics	OE	3-0-0	3
2	161OE202	Digital Image Processing	OE	3-0-0	3
3	161OE203	Consumer Electronics	OE	3-0-0	3
4	161OE204	Multimedia Compression and Communication	OE	3-0-0	3
5	161OE205	Avionics	OE	3-0-0	3
6	161OE206	High Speed Networks	OE	3-0-0	3

Courses offered by Bio-Tech Department

Sl	Code	Course Title	Category	L-T-P	C
1	161OE501	Process Equipment and Plant Design	OE	3-0-0	3
2	161OE502	Biomaterials	OE	3-0-0	3
3	161OE503	Biosensors	OE	3-0-0	3
4	161OE504	Food Science and Technology	OE	3-0-0	3

Courses offered by Mechanical Department

Sl	Code	Course Title	Category	L-T-P	C
1	161OE601	Maintenance Engineering	OE	3-0-0	3
2	161OE602	Non Destructive Testing and Materials	OE	3-0-0	3
3	161OE603	Operations Research	OE	3-0-0	3
4	161OE604	Renewable Sources of Energy	OE	3-0-0	3
5	161OE605	Robotics	OE	3-0-0	3

Courses offered by Civil Department

Sl	Code	Course Title	Category	L-T-P	C
1	161OE701	Disaster Management System	OE	3-0-0	3
2	161OE702	Fundamentals of Fire Safety Engineering	OE	3-0-0	3

3	161OE703	Optimization in Engineering	OE	3-0-0	3
4	161OE704	Renewable Energy Sources	OE	3-0-0	3
5	161OE705	Environmental Impact and Risk Assessment	OE	3-0-0	3
6	161OE706	Environment and Ecology	OE	3-0-0	3
7	161OE707	Technology Management	OE	3-0-0	3
8	161OE708	Sustainable Management of Urban Ecology	OE	3-0-0	3

Courses offered by MBA Department

Sl	Code	Course Title	Category	L-T-P	C
1	161OE801	Essentials of Management	OE	3-0-0	3
2	161OE802	Fundamentals of Marketing	OE	3-0-0	3
3	161OE803	Managing Human Resources	OE	3-0-0	3
4	161OE804	Engineering Economics and Financial Accounting	OE	3-0-0	3

HS -Humanities and Social Sciences including Management, BS - Basic Sciences including Mathematics, Physics, Chemistry, Biology; ES - Engineering Sciences, *including* Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation; PC - Program Core, PE - Program Elective, OE - Open Elective, EEC – Employability Enhancement Course

Additional Eligibility requirement for the award of degree

1. The co-curricular activities one or more of the following is/are compulsory for a student in the first three years of his/her study with satisfactory grade to eligible for the award of degree with a satisfactory grade is compulsory to be eligible for the award of degree in the first two years of study
    - National Service Scheme (NSS)
    - Youth Red Cross (YRC)
    - Red Ribbon Club (RRC)
    - Institute of Electrical Electronics Engineering (IEEE)
    - Indian Society for Technical Education (ISTE)
    - Society of Automotive Engineers (SAE)
    - Sports & Games
2. Every student should undergo In Plant Training/Internship/Industrial visit with due approval of HOD & Principal

SEMESTER I

161HS11	**ESSENTIAL ENGLISH**	**L-T-P**	**C**
		3-0-0	**3**

Programme: B.E/B.TECH. Common to all Branches **Sem: I Category: HS**

AIM: To impart Basic English Language skill to develop the students ability to use English effectively

Course Outcomes:

The Students will be able to

CO1: Understand and use different forms of language

CO2:Write formal letters

CO3:Speak in English with clarity

CO4:Listen actively and grasp the contents of the speech

CO5:Read general texts and comprehend their content

CO6:Use grammar to make meaning in both speaking and writing

UNIT I **9**

Grammar-tense –past simple, present simple, verbal vs non-verbal communication, Vocabulary-Commonly used words-Spelling, Reading- Reading News papers, Writing- Formal Letters-Requisition for leave- Bona fide, Listening- Listening to famous speeches, Speaking- introducing oneself

UNIT II **9**

Grammar-tense- past and present simple continuous, Vocabulary- Prefixes, Suffixes-Parts of Speech, Reading- Basic reading comprehension, Writing Formal Letters- Permission letters- In-plant training-Industrial visit, Listening- Listening to Interviews, Speaking- Speaking about interests, one's friends, hobbies, favourite programmes.

UNIT III **9**

Grammar-tense-past and present perfect, Vocabulary -Forms of Verb-Analogy-Sentences-Types, Reading-Cloze Test, Writing- Paragraph writing-descriptions-Comparing and contrasting- describing pictures, Listening- Listening to News, Speaking- Future plan-Native place, Appropriate body language

UNIT IV **9**

Grammar-perfect tenses, Vocabulary -Single-line definitions-Pronoun-Adverbs-Preposition, Reading-Reading for comprehension, Writing- e- mail- basic conventions writing – Instructions-Recommendations, Listening- Listening to Debates, Speaking- Giving opinions

UNIT V **9**

Grammar- subject –verb agreement, Vocabulary –commonly confused words-Linkers-Abbreviation-Voice, Reading- Reading for Inferences, Writing- Agenda Note-taking- Editing the text, Listening-Listening to Telephonic Conversation, Speaking- short talks on general topics, short conversations

Total Periods 45

Text Books

1. Jack.C.Richards, interchange (fourth edition), Cambridge University Press, New Delhi. 2015 ISBN 9781107570894

References

1. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011
2. www.usingenglish.com
3. www.grammar.org
4. www.audioenglish.com
5. http://www.manythings.org
6. www.onestopenglish.com
7. www.learnenglish.com

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1										3		3				3
CO2										3		2				3
CO3							2			3		3				3
CO4							2			3		3				3
CO5										3		3				3
CO6										3		2				3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161MA11 ENGINEERING MATHEMATICS - I L-T-P C

3-1-0 4

Programme: B.E/B.TECH. Common to all Branches **Sem: I Category: BS**

AIM: The Course is aimed at Developing the basic mathematical skills of Engineering Student

Course Outcomes:

The Students will be able to

CO1: Find the inverse of given matrix and reduce matrix equation using Cayley-Hamilton Theorem.

CO2: Elaborate given function as a power series using Taylor's series.

CO3: Develop a series solution to an ODE, and recognize special functions defined by series.

CO4: Make use of Calculus in finding the envelope, Evolutes & Involutes.

CO5: Check whether the series is convergent or divergent.

CO6: Evaluate maxima and minima for function of two variables.

MATRICES 12

Characteristic equation - Eigen Values and Eigen vectors of a real matrix - Properties of Eigen values – Cayley - Hamilton Theorem (without proof) and its application - Orthogonal Transformation of a Symmetric matrix to diagonal form - Quadratic form - Orthogonal reduction to canonical form.

ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

DIFFERENTIAL CALCULUS 12

Curvature - Radius of curvature - Cartesian and Parametric Coordinates - Circle of Curvature - Involutes and Evolutes – Envelope.

FUNCTIONS OF SEVERAL VARIABLES 12

Partial Derivatives - Total Derivative - differentiation of Implicit function – Jacobian - Taylor's Expansion - Maxima/Minima for function of two variables - Method of Lagrange's multipliers.

SEQUENCES AND SERIES 12

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test and D'Alembert's ratio test – Alternating series – Leibnitz's test - Series of positive and negative terms – Absolute and conditional convergence.

Total Periods 60

Text Books

1. B.S.Grewal, 'Higher Engineering Mathematics', Thirty Sixth Edition, Khanna Publishers, Delhi,2005.
2. Kreyszig, *E.*, 'Advanced Engineering Mathematics', 8th edition, John Wiley Sons, 2001.

References

1. Greenberg. M.D, 'Advanced Engineering Mathematics', Second Edition, Pearson Education Inc. (First Indian reprint), 2002.
2. Venkataraman M.K., 'Engineering Mathematics', Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.

3. Veerarajan.T, 'Engineering Mathematics (for first year)', Fourth Edition, Tata McGraw – hill publishing company Ltd, New Delhi, 2005.
4. Ravish R Singh, Mukul Bhatt, 'Engineering Mathematics-I', McGraw Hill Education (India) Private Ltd, New Delhi.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3										3	3	3	2	3
CO2	3	3										2	3	3	2	3
CO3	2	2										2	3	3	2	3
CO4	1	1											3	3	2	3
CO5	3	3											3	3	2	3
CO6	2	2										3	3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161PH11 **ENGINEERING PHYSICS** **L-T-P C**

3-0-0 3

Programme: B.E/B.TECH. Common to all Branches **Sem: I Category: BS**

AIM: To endow the students with the fundamentals of Physics and apply new ideas in the field of Engineering and Technology.

Course Outcomes:

The Students will be able to

CO1: Understand the theory and various crystal structures and crystal growth techniques.

CO2: Acquire knowledge about the properties of sound and effect of sounds within the building.

CO3: Attain the knowledge of ultrasonic waves and their application in the field of Non-destructive testing and Sonogram.

CO4: Gain knowledge about basic equations of Quantum mechanics and its applications.

CO5: Know about the basic configuration of a Laser, types of lasers and the industrial applications of Laser.

CO6: Understand principle behind fiber optic communication and the electronic devices involved in the transmission and reception of data.

CRYSTAL PHYSICS **9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Crystal growth techniques- Solution, melt (Bridgemann and Czochralski).

ACOUSTICS **9**

Classification of sound – Decibel-Weber- Fechner Law- Sabine's formula-Derivation using growth and decay method- absorption coefficient and its determination- Acoustic of building-Factors affecting acoustics of buildings and their remedies.

ULTRASONICS **9**

Production of ultrasonics – Magnetostriction - Piezoelectric methods - Velocity measurement – Acoustic grating - Industrial applications –Non Destructive Testing – Pulse echo system through transmission and reflection modes - SONAR, Medical applications – Sonograms.

QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation)- Photoelectric effect - Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box.

APPLIED OPTICS **9**

LASERS: Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B coeffcients – Derivation- Types of lasers – CO_2, Nd-YAG - Industrial Applications - Lasers in welding, cutting – Holography and its applications.

FIBER OPTICS: Optical Fiber-Classification- Principle and propagation of light in optical fibres-Numerical aperture and Acceptance angle-Fibre optical communication system- Sensors (Active and passive) –Displacement and Temperature Sensors.

Total Periods 45

Text Books

1. Gaur R. K., Gupta S. C., 'Engineering Physics', Dhanpat Rai Publications, New Delhi(2003).
2. Avadhanulu M. N., Kshirsagar, P. G., 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.

References

1. Serway and Jewett., 'Physics for Scientists and Engineers with Modern Physics',6th Edition, Thomson Brooks/Cole, Indian reprint (2007).
2. AritherBeiser, 'Concepts of Modern Physics', Tata McGraw Hill, NewDelhi (2010).
3. Palanisamy, P.K., 'Engineering Physics', Scitech publications, Chennai, (2007).
4. Rajendran, V and Marikani A, 'Engineering Physics', Tata McGraw Hill Publications Ltd, III Edition, New Delhi, (2004).
5. Chitra Shadrach and SivakumarVadivelu, 'Engineering Physics', Pearson Education, New Delhi, (2007).

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1				3					2	3	2	1	3
CO2	3	2	2				3					2	3	2	1	3
CO3	2	2					3					1	3	2	1	3
CO4	3	2	2				2					2	3	2	1	3
CO5	3	2	2				2					2	3	2	1	3
CO6	3	2	2				2					2	3	2	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161CY11 ENGINEERING CHEMISTRY L-T-P C

3-0-0 3

Programme: B.E/B.TECH. Common to all Branches **Sem: I Category: BS**

AIM: To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

Course Outcomes:

The Students will be able to

CO1: Demonstrate the essential concept of water and their properties and applications.
CO2: The treatment of water for potable and industrial purposes
CO3: Understand the operating principles and the reaction involved in electrochemistry.
CO4: Explain the core concepts of surface chemistry.
CO5: Illustrate the structure, properties and applications of nano materials.
CO6: Learn the principles, importance and application of analytical techniques.

WATER TECHNOLOGY 9

Hardness-Types and Estimation by EDTA method, alkalinity – types of alkalinity and determination– Domestic water treatment –disinfection methods (Chlorination, ozonation, UV treatment) – Boiler feed water– requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process – desalination and reverse osmosis.

ELECTROCHEMISTRY 9

Electrochemical cells – reversible and irreversible cells – EMF –– electrochemical series and its significance-Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH– potentiometer titrations (redox - Fe^{2+}vs dichromate) and conducto-metric titrations (acid-base – HCI vsNaOH) titrations

SURFACE CHEMISTRY 9

Adsorption- types – adsorption of gases on solids – adsorption isotherms –Frendlich and Langmuir isotherms – adsorption of solutes from solution – role of adsorbents in catalysis, ion-exchange adsorption and pollution abatement.

NANOCHEMISTRY 9

Nanomaterials – introduction to nanochemistry – synthesis – hydrothermal, solvothermal – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparticles and applications. Carbon nanotubes- fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

SPECTROSCOPY & QUANTITATIVE ANALYSIS 9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – Determination of the amount of calcium in milk powder by EDTA Complexometry - Estimation of iodine in iodized common salt by Iodometry - Estimation of phosphoric acid in soft drinks (coca cola) by molybdenum blue method .

Total Periods 45

Text Books

1. P. Kannan, A. Ravikrishnan, 'Engineering Chemistry', Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.
2. P.C.Jain and Monica Jain, 'Engineering Chemistry', Dhanpat Rai Pub, Co., New Delhi (2002).

References

1. S.S. Dara, S.S. Umare, 'Engineering Chemistry', S. Chand & Company Ltd., New Delhi 2010.
2. B.K.Sharma, 'Engineering chemistry', Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. B.Sivasankar, 'Engineering chemistry', Tata McGraw Hill Publishing Company (P) Ltd., New Delhi, 2006.
4. Pradeep, 'Nano the essential', McGraw Hill Publishing Company (P) Ltd., New Delhi.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3			2	3			2		3	2	1	2	3
CO2	3	2				3			2		2	2	2	1	2	3
CO3							2					2	2	1	2	3
CO4	2	1	2				2					1	2	1	2	3
CO5	3	2	2			1			2			2	2	1	2	3
CO6	3	3	3			2	3			2		3	2	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161CS11 FUNDAMENTALS OF COMPUTING AND C PROGRAMMING **L-T-P C**

3-0-0 3

Programme: B.E/B.TECH. Common to all Branches **Sem: I Category: ES**

AIM: To provide an awareness to Computing and Programming

Course Outcomes:

The Students will be able to

CO1: Able to have fundamental knowledge on basics of computers hardware and number systems.

CO2: Able to understand the basic terminology used in computer programming.

CO3: Able to write, compile and debug programs in C language.

CO4: Able to use different data types in a computer program.

CO5: Able to design programs involving decision structures, loops and functions.

CO6: Able to understand the dynamics of memory by the use of pointers.

INTRODUCTION **9**

Generation and Classification of Computers- Basic Organization of a Computer – Number System – Binary – Decimal – Conversion – Problems. Software – Types, Development Steps. Algorithm – Pseudo code – Flow Chart. Problem formulation – Problem Solving.

C PROGRAMMING BASICS **9**

Introduction to Unix Operating System – Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

ARRAYS AND STRINGS **9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

FUNCTIONS AND POINTERS **9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

STRUCTURES AND UNIONS **9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure – Union – Programs using structures and Unions – File Manipulation – Storage classes – Pre-processor directives.

Total Periods 45

Text Books

1. Anita Goel and Ajay Mittal, 'Computer Fundamentals and Programming in C', Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. PradipDey, ManasGhosh, 'Fundamentals of Computing and Programming in C', 1st edition, Oxford University Press, 2009.
3. Yashavant P. Kanetkar, 'Let Us C', BPB Publications, 13/e, 2011.

References

1. Byron S Gottfried, 'Programming with C', Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.

2. Dromey R.G., 'How to Solve it by Computer', Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, 'The C Programming language', Second Edition, Pearson Education, 2006.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2											3			1
CO2	3	2											3			1
CO3	3	3	2							1			3			1
CO4	3	2	1										3			1
CO5	2	2	3										3			1
CO6	2	2			1								3			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161ME11 ENGINEERING GRAPHICS L-T-P C

1-0-4 3

Programme: B.E./B.Tech. Common to All Branches **Sem: I Category: ES**

Aim: To develop graphics skills for students

Course Outcomes:

The Students will be able to

CO1: Follow the conventions used in engineering graphics

CO2:Practice plane curves and free hand sketching

CO3:Draw the projections of points, lines and plane

CO4: Draw the projections of simple solids and their sectional views

CO5: Describe the applications of development of surfaces

CO6: Practice isometric and perspective projections

CONCEPTS AND CONVENTIONS (Not for Examination) 1

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

PLANE CURVES 8

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.

PROJECTION OF POINTS, LINES AND PLANE SURFACES 9

Projection of straight lines located in the first quadrant – inclined to both planes – Determination of true lengths and true inclinations– Projection of regular polygonal and circular lamina inclined to both reference planes.

PROJECTION OF SOLIDS 9

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9

Sectioning of above solids in simple vertical position by cutting planes inclined to HP and perpendicular to VP – Obtaining true shape of section.

Development of lateral surfaces of truncated solids – Prisms, Pyramids, Cylinder and Cone.

ISOMETRIC AND PERSPECTIVE PROJECTIONS 9

Principles of isometric projection – isometric scale – isometric projections of truncated Prisms, Pyramids, Cylinder and Cone.

Perspective projection of simple prism and pyramid by Visual ray method

Total Periods 45

Text Books:

1. K.V. Natrajan, ‘A text book of Engineering Graphics’, Dhanalakshmi Publishers, Chennai (2015).
2. M.S. Kumar, ‘Engineering Graphics’, D.D. Publications, (2014).

References:

1. K. Venugopal and V. Prabhu Raja, ‘Engineering Graphics’, New Age International (P) Limited (2015).
2. M.B. Shah and B.C. Rana, ‘Engineering Drawing’, Pearson Education (2014).
3. K.C. John, ‘Engineering Graphics for degree’ PHI Learning Pvt. Ltd., New Delhi, (2013).
4. BasantAgarwal and Agarwal C.M., ‘Engineering Drawing’, Tata McGraw Hill Publishing

Company Limited, New Delhi, (2013).

5. Gopalakrishna K.R., 'Engineering Drawing' (Vol. I&II combined), Subhas Stores, Bangalore, (2014).

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

Special points applicable to end semester examination on Engineering Graphics:

1. There will be five questions, first question is compulsory from Unit-I on engineering curves.Other four questions are either or type from Unit-II to V
2. All questions will carry equal marks of 20 each making a total of 100
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size
4. The end semester examination will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		3		3					1			2	1	1	
CO2	3		2		2					1			2			
CO3	3		2		3					1			2			
CO4	3		3		2					1			2	1	1	
CO5	3		3		3					1			2	1	1	
CO6	2		2		3					1			2			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161PC17 PHYSICS AND CHEMISTRY LABORATORY-I L-T-P C

0-0-4 2

Programme: B.E/B.TECH. Common to all Branches **Sem: I Category: BS**

AIM: To introduce the basic Physics concepts through experiments and to impart the basic analysis in chemistry.

Course Outcomes:

The Students will be able to

CO1: Understand the laser light propagation in optical fibre

CO2: Learn the principle of interference.

CO3: Gain the knowledge of ultrasonic velocity in a liquid medium.

CO4: Understand the knowledge of their home town water

CO5: Estimate the amount of substance by potentiometric technique

CO6: Outline the application of analytical instrument

LIST OF EXPERIMENTS - PHYSICS PART

(A minimum of five experiments shall be offered)

S.No **NAME OF THE EXPERIMENT**

1. (a) Determination of Particle Size using Diode LASER.
   (b) Determination of wavelength of the LASER source.
   (c) Determination of Acceptance angle and Numerical aperture of an optical fibre.
2. Determination of thickness of thin wire – Air wedge method.
3. Determination of Velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. Determination of Dispersive power of a prism using Spectrometer.
5. Determination of Young's modulus of the material - Non uniform bending
6. Determination of thermal conductivity of a bad conductor - Lee's Disc method

LIST OF EXPERIMENTS – CHEMISTRY PART

S.No **NAME OF THE EXPERIMENT**

1. Estimation of Total Hardness of their home town Water by EDTA method.
2. Estimation of Copper in brass by EDTA method.
3. Estimation of Ferrous Ion by Potentiometric Titrations.
4. Conductometric Titration of strong acid Vs strong base
5. Estimation of Alkalinity of Water sample
6. Estimation of iron by spectrophotometer (Demo only)

Total Periods 48

References

1. Text book of Quantitative Inorganic Analysis, A.I.Vogel, ELBS,London.
2. Practical A. Ravikrishnan Engineering Chemistry, Sri Krishna Publications, Chennai (2002)
3. Engineering Physics Laboratory Manual
4. Engineering Chemistry Laboratory Manual

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1				1					1	3	2	3	3
CO2	1	2	2				1					1	3	2	3	3
CO3	2	1	3				2					2	3	2	3	3
CO4	2	2	1				2					1	3	2	3	3
CO5	3	2	1				1					2	3	2	3	3
CO6	2	1	3				2					2	3	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161CS17 COMPUTER PRACTICES LABORATORY-I L-T-P C

0-0-4 2

Programme: B.E/B.TECH. Common to all Branches **Sem: I Category: ES**

AIM: To provide an awareness to Computing and C Programming

Course Outcomes:

The Students will be able to

CO1: Represent the fundamental concept on basics commands in Linux.

CO2: Illustrate the commands to write, compile and debug programs in C language.

CO3: Formulate the problems and implement algorithms in C.

CO4: Identify programming components that efficiently solve computing problems in real-world.

CO5: Design application oriented programs in C.

CO6: Elaborate the structures and unions through which derived data types can be formed.

LIST OF EXPERIMENTS

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. C Programming using Simple statements and expressions
4. Scientific problem solving using decision making and looping.
5. Simple programming for one dimensional and two dimensional arrays.
6. Solving problems using String functions
7. Programs with user defined functions – Includes Parameter Passing
8. Program using Recursive Function and conversion from given program to flow chart.
9. Program using structures and unions.
10. Program using files

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2						2				3			3
CO2	3	2	2						2				3			3
CO3	3	2	3						2				3			3
CO4	2	3	2						2				3			3
CO5	3		2						2				3			3
CO6	2		2										3			3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE17 ENGINEERING PRACTICES LABORATORY L-T-P C

0-0-4 2

Programme: B.E.- Electrical and Electronics Engineering **Sem: I Category: ES**

AIM: To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

Course Outcomes:

The Students will be able to

CO1. Express the pipe connections and identify the various components used in plumbing.

CO2. Produce simple wooden joints using wood working tools.

CO3. Create simple lap, butt and tee joints using arc welding equipments.

CO4. Generate the simple components using lathe and drilling machine.

CO5. Facilitate the operation of fluorescent lamp, staircase wiring and measure the consumed electrical energy.

CO6. Express and analyze the fundamentals of Boolean algebra and digital logic gates.

GROUP A CIVIL AND MECHANICAL

I .CIVIL ENGINEERING PRACTICE

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

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 using Power Tools only:

a) Study of the joints in roofs, doors, windows and furniture.
b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II. MECHANICAL ENGINEERING PRACTICE

Welding:

a) Preparation of arc welding of butt joints, lap joints and tee joints.
b) Gas welding practice

Basic Machining:

a) Simple Turning and Taper turning
b) Drilling Practice

Sheet Metal Work:

a) Forming and Bending:
b) Model making – Trays, funnels, etc.
c) Different type of joints.

Machine assembly practice:

a) Study of centrifugal pump
b) Study of air conditioner

Demonstration on:

a) Smithy operations, upsetting, swaging, setting down and bending.
Example – Exercise – Production of hexagonal headed bolt.
b) Foundry operations like mould preparation for gear and step cone pulley.
c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B ELECTRICAL AND ELECTRONICS

III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energymeter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power and power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3		3				3				3			3
CO2	2	2	3		3				3				3			1
CO3	2	2	3		3				3				3			3
CO4	2	1	3		3				3				3			1
CO5	2						1		3	2		3	3	2	1	3
CO6	2						1		3	2		2	2	2	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER II

161HS21	TECHNICAL ENGLISH	L-T-P	C
		3-0-0	3

Programme: B.E/B.TECH. Common to all Branches **Sem: II Category: HS**

AIM: To develop students communication in English with specific reference to their area of specialization and the workplace.

Course Outcomes:

The Students will be able to

CO1:Recall words and their meaning for the specific purpose

CO2: Write job applications

CO3: Listen and comprehend talks and lectures on technical subjects

CO4: Write issue- based essays

CO5:Describe a process both in speaking and writing

CO6:Summarize the key points

UNIT I **9**

Grammar- active voice and passive voice, Vocabulary -Technical words-Foreign words-Adjective-Extended definitions Reading- Reading Technical passages, Writing- Formal Letters-Complaint letter- Listening- Listening to TED Talks to take notes, Speaking- Introducing others

UNIT II **9**

Grammar-question tags, Vocabulary -Interrogative Statements-Acronym-One-word substitution, Reading- Note-taking, Writing- describing a process ,dialogue writing Listening- Listening to Group Discussion Speaking- Public Speech practice

UNIT III **9**

Grammar- reported speech, Vocabulary -Conditional Clauses-Punctuation-Concord, Reading- Reading Book/film/music reviews, Writing- Report –accident, survey, feasibility Listening-Listening to Technical Presentation, Speaking- Reporting events

UNIT IV **9**

Grammar- reported speech, Vocabulary -Words followed by Prepositions-Articles-Action verb, Reading-Reading Famous speech text, Writing-Minutes-Checklist Listening-Listening for gist, Speaking- making mini presentations.

UNIT V **9**

Grammar-practice, Vocabulary- Cause and effect Reading-Reading for vocabulary, Writing- Dialogue writing using ‘wh’ and ‘Yes/ No’-job application-resume –Essay Listening- Listening for filling Information, Speaking- Participating in Group Discussions

Total Periods 45

Text Books

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012

References

1. www.usingenglish.com
2. www.grammar.org
3. www.audioenglish.com
4. http://www.manythings.org

5. www.tedtalks.com
6. www.inktalks.com
7. www.documentariesheaven.com
8. www.nature.com

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	3	3	3				3
CO2									3	3	3	3				3
CO3							3		3	3	2	3				3
CO4										2		3				3
CO5									3	3	2	3				3
CO6												3				3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161MA21 ENGINEERING MATHEMATICS - II L-T-P C

3-1-0 4

Programme: B.E/B.TECH. Common to all Branches **Sem: II Category: BS**

AIM: To analyze the engineering problems using the techniques and the mathematical skills acquired by studying vector calculus, Laplace transform, complex variables and multiple integral.

Course Outcomes:

The Students will be able to

CO1: Apply Laplace transform to solve first and second order differential equations with elementary forcing function.

CO2: Classify Green's theorem to evaluate line integrals along simple closed contours on the plane.

CO3: Construct an analytic function using the properties of analytic function.

CO4: Make use of Cauchy's residue theorem for applications in Engineering.

CO5: Evaluate complicated real integrals using the basics of analytic functions and the complex Integration.

CO6: Apply double integration to find area between two curves.

LAPLACE TRANSFORM 12

Laplace transform – Conditions for existence – Transform of elementary functions –Basic properties – First Shifting Theorem -Transform of derivatives on tf(t) , f(t)/t and periodic functions – Transform of unit step function and impulse functions. Inverse Laplace transform by partial fraction method and Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy– Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function(without proof) – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w = z+c, cz, 1/z, and bilinear transformation.

COMPLEXINTEGRATION 12

Statement and application of Cauchy's theorem and Cauchy's integral formula, Taylor and Laurent expansion, Singularities, Classification, Residues, Cauchy's residue theorem, Contour integration (Type I&II).

MULTIPLE INTEGRALS 12

Double Integration – Cartesian and Polar co-ordinates – Change of order of Integration - Change of variable between Cartesian and polar co-ordinates – Triple integration – Area as a double integral by Cartesian co-ordianates – Volume as a triple integral.

VECTORCALCULUS 12

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

Total Periods 60

Text Books

1. B.S.Grewal, 'Higher Engineering Mathematics', Thirty Sixth Edition, Khanna Publishers, Delhi, 2005.
2. T. Veerarajan, 'Engineering Mathematics(for first year)', Fourth Edition, Tata McGraw – hill publishing company Ltd, New Delhi, 2005.

References

1. Greenberg. M.D, 'Advanced Engineering Mathematics', Second Edition, Pearson Education Inc. (First Indian reprint), 2002.
2. Venkataraman.M.K., 'Engineering Mathematics', Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Kreyszig, E., Advanced Engineering Mathematics, 8th edition, John Wiley Sons, 2001.
4. Ravish R Singh, Mukul Bhatt, 'Engineering Mathematics-I', McGraw Hill Education(India)Private Ltd, New Delhi.
5. Dr.P.Kandasamy, Dr.K.Thilagavathy, Dr.K.Gunavathy, S.Chand & Company Ltd. Ram Nagar, New Delhi.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2		2								3	3	3	2	3
CO2	2	1		2									3	3	2	3
CO3	2	1		2								1	3	3	2	3
CO4	1	2		2								2	3	3	2	3
CO5	2	2											3	3	2	3
CO6	3	3										3	3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161PH21	PHYSICS OF MATERIALS	L-T-P	C
		3-0-0	3

Programme: B.E. (CSE, EEE & ECE) **Sem: II Category: BS**

AIM: To endow the students with the fundamentals of physics, materials and apply new ideas in the field of Engineering and Technology.

Course Outcomes:

The Students will be able to

CO1: Understand the theory and processing of conducting, superconducting materials.

CO2: Acquire knowledge of classification of semiconducting materials.

CO3: Gain knowledge about the types of magnetic and dielectric materials and their applications.

CO4: Understand about some exciting properties of modern engineering materials.

CO5: Acquire knowledge about nanomaterials and their properties and applications.

CO6: Attain a clear view of material characterization techniques.

CONDUCTING MATERIALS 9

Conductors: classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

Super Conductors: properties - Types of super conductors - Applications of superconductors – SQUID, cryotron, magnetic levitation.

SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration– Hall effect – Determination of Hall coefficient – Applications.

MAGNETIC AND DIELECTRIC MATERIALS 9

Magnetic Materials: Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications.

Dielectric Materials: Polarization - electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation –dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

OPTICAL MATERIALS 9

Classification of optical materials – properties – Luminescence – Fluorescence and phosphorescence - LED – Polymer Light emitting materials – Plasma light emitting materials – LCD – optical data storage techniques like DVD, Blue ray disc

NANO MATERIALS AND CHARACTERISATION TECHNIQUES 9

Nanomaterials: synthesis – chemical vapour deposition– ball milling - properties of nanoparticles and applications.

Characterisation: Principle, Characterisation and applications of X- Ray diffraction – Scanning Electron Microscope – Transmission Electron Microscope - Atomic Force Microscope

Total Periods 45

Text Books

1. William D. Callister, Jr., 'Material Science and Engineering', John Wiley & Sons Inc., Seventh Edition, New Delhi (2010).
2. Ragavan, V., 'Material science and Engineering', Prentice Hall of India (2004).

References

1. Arumugam M., 'Materials Science', Anuradha publications, Kumbakonam (2006).
2. Koch C., 'Nanostructured materials: processing, properties and applications', William Andrew Pub (2008).
3. Kasap, S.O., 'Principle of Electronic Materials and devices', Tata Mc-Graw Hill (2007).
4. Charles P. Poole and Frank J.Ownen., 'Introduction to Nanotechnology', Wiley India (2007).
5. Charles Kittel., 'Introduction to solid state Physics', John Wiley & Sons, 7th editions, Singapore (2007).

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1				1					1	3	2	2	3
CO2	3	1	2				1					1	3	2	2	3
CO3	3	1	1				1					1	3	2	2	3
CO4	3	2	2				2					1	3	2	2	3
CO5	3	2	2				1					2	3	2	2	3
CO6	3	2	2				1					2	3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161CY21 ENVIRONMENTAL SCIENCE L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: II Category: BS**

AIM: To Impart the social groups and individuals to acquire knowledge of pollution and environmental degradation

Course Outcomes:

The Student will be able to

CO1: Understand the basic concepts of environment studies and natural resources

CO2: Get knowledge about ecosystem and biodiversity.

CO3: Identify and analyse causes, effects and control measures of various types of pollution.

CO4: Get the knowledge about types of disaster and mitigation measures

CO5 : Understand the impact of social issues

CO6: To understand the role of a human being in maintaining a clean environment.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. dams and their effects on forests and tribal people–Energy resources: Growing energy needs, renewable (solar energy and wind energy) and non renewable energy sources- Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generation (block diagram only), Petroleum processing and fractions, LPG and Natural gas.

ECOSYSTEM AND BIODIVERSITY 9

ECOSYSTEM : Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem-Nitrogen cycle, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the Forest ecosystem and Aquatic ecosystems (lake and rivers) –**BIODIVERSITY** : Introduction to Biodiversity – Definition– Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values –India as a mega-diversity nation – Hot-spots of biodiversity

ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Marine pollution (d) Noise pollution (e) Thermal pollution – Solid waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT 9

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents -case studies- Goal of Green chemistry

HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – Population explosion – Family Welfare Programme – Human Rights – Value Education – HIV/AIDS –Women and Child Welfare – Role of Information Technology in Environment and human health-Case studies.

Total Periods 45

Text books:

1. A. Ravikrishnan, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Private Limited, 2010.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

References:

1. Anubha Kaushik, C.P. Kaushik, 'Environmental Science and Engineering', New Age International Publishers, 2016.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill Publishing Company Ltd, New Delhi, ISBN: 0070601690, 2006.
3. Raman Sivakumar, 'Introduction to Environmental Science and Engineering', Tata McGraw Hill Education Private Limited, New Delhi, 2010.
4. P.Meenakshi, 'Elements of Environmental Science and Engineering', PHI learning (P) Ltd., India.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2							2		1	2			
CO2	2	3	2				1		1	2	1	1	2			
CO3	2	3	1							1		1	2			1
CO4	2	3	2									1	2			1
CO5	2	3	1							2	1	2	1			
CO6	2	3	1							2	1	3	1			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE21 ELECTRIC CIRCUITS THEORY L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: II Category: PC**

AIM: To expose the students to the basic networks in circuits and learn about the various types of circuits.

Course Outcomes:

The Student will be able to

CO1. Able to apply basic electrical laws and also analyze mesh and nodal analysis for DC and AC circuits.

CO2. Able to compare various network theorems for DC and AC circuits.

CO3. Able to identify various resonance conditions.

CO4. Able to identify transient response in DC and AC circuits.

CO5. Able to convert one parameter to another parameter in two port network.

CO6. Able to calculate electrical quantities in three phase balanced and unbalanced circuits.

BASIC CIRCUITS ANALYSIS 9

Ohm's Law – Kirchhoff's laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 9

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenin's and Norton's Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

RESONANCE CIRCUITS 9

Series and parallel RLC Circuits – their frequency response – Quality factor and Bandwidth.

TRANSIENT RESPONSE FOR DC AND AC CIRCUITS 9

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input-Two-Port networks (interrelationships between the parameters).

ANALYSING THREE PHASE CIRCUITS 9

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

Total Periods 45

Text books:

1. K.Mahadevan, C.Chitra, 'Electric Circuits Analysis', PH1 Pvt. Ltd., New Delhi, (2015).
2. Sudhakar. A and Shyam Mohan. SP, 'Circuits and Networks: Analysis and Synthesis', 3rd Edition, TMH, 2006.

References:

1. Paranjothi SR, 'Electric Circuits Analysis', New Age International Ltd., 2nd edition, New Delhi,(2000).
2. Chakrabati A, 'Circuits Theory (Analysis and synthesis)', Dhanpath Rai and Sons, New Delhi, (1999).
3. Joseph A. Edminister, Mahmood Nahri, 'Electric circuits', Schaum's series, Tata McGraw-Hill, New Delhi (2001).
4. Charles K. Alexander, Mathew N.O. Sadik, 'Fundamentals of Electric Circuits', Second Edition, McGraw Hill, (2003).

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	1							1	3	2	2	2
CO2	2	2	1	1	1								3	2	2	2
CO3	2	2	1	1	1						1	1	3	2	2	2
CO4	2	2	1	2	2						1	1	3	2	2	2
CO5	3	2	2	2	2		1						3	2	2	2
CO6	2	2	2	1	1		1						3	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE22 ELECTRONIC DEVICES AND CIRCUITS L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: II Category: PC**

AIM: To study the structure, operation, characteristics and applications of the basic electronic devices.

Course Outcomes:

The Student will be able to

CO1. Illustrate the construction and principle of operation of PN junction diode along with its application.

CO2. Analysis the characteristics of various configurations.

CO3. Identify the hybrid parameters of the transistor in various configuration methods.

CO4. Illustrate the construction and characteristics of JFET, MOSFET and its equivalent circuits.

CO5. Illustrate the functioning of amplifiers and oscillator circuits.

CO6. Interpret the wave shaping circuits and its applications.

PN DIODE AND ITS APPLICATIONS 9

PN junction diode - VI characteristics – diode resistance, temperature effects – Drift and diffusion currents – Rectifiers: HWR, FWR, - Zener diode – VI characteristics, Zener as Regulators, LED, LCD characteristics and applications.

BJT AND ITS APPLICATIONS 9

Junction transistor – Transistor construction – Input and output characteristics of CE, CB and CC configurations – Transistor hybrid model for CE configuration– Analytical expressions for transistor characteristics– Transistor switching times – cascade connection – Darlington connection - Opto-couplers.

FET AND ITS APPLICATIONS 9

FET – VI characteristics, VP, JFET – small signal model – LF and HF equivalent circuits – CS and CD amplifiers –MOSFET - Characteristics – enhancement and depletion.

AMPLIFIERS AND OSCILLATORS 9

Differential amplifiers: CM and DM –feedback amplifiers – stability – voltage / current, series / shunt feedback – Oscillators – Hartley, Colpitts, RC phase shift, Crystal.

PULSE CIRCUITS 9

RC wave shaping circuits – Diode clampers and clippers – Multivibrator- Schmitt triggers – UJT based saw tooth oscillators.

Total Periods 45

Text books:

1. S.Salivahanan, N.Suresh Kumar, 'Electronic Devices and Circuits', Third edition, Tata McGraw Hill publishing Co.Ltd., 2012
2. David A.Bell, 'Electronic Devices & circuits', Prentice Hall of India/Pearson Education, Fourth edition, Ninth printing, 2007.

References:

1. R.S.Sedha, 'A text book of Applied Electronics', S.Chand & Company Ltd., 2004.
2. Albert Paul Malvino, 'Electronic Principles', 5th Edition, Tata McGraw Hill publishing Co.Ltd., 1997.
2. Robert Boylestad and Louis Nashelsky, 'Electronic Devices and Circuits', 9th Edition, Prentice-Hall of India Private Ltd, New Delhi, 2009/PHI.
3. Jacob Millman & Christos.C.Halkias, 'Electronic devices and circuits', Tata McGraw Hill publishing company ltd., Third edition, 2010.
4. G.K. Mithal, 'Electronic devices and circuits', Khanna publishers, 1997.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2		3	1							3	3	2	1	3
CO2	2	3		3	2						1	3	3	2	1	3
CO3	2	3	1	3	2						1	3	3	2	1	3
CO4	2	3	2	2	3						1	3	3	2	1	3
CO5	2	3	1	2	3							3	3	2	1	3
CO6	2	3	1	2	3						1	3	3	2	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161PC27 PHYSICS AND CHEMISTRY LABORATORY-II L-T-P C

0-0-4 2

Programme: Common to all Branches **Sem: II Category: BS**

AIM: To introduce the basic Physics concepts through experiments and to impart knowledge on the application of chemistry in engineering branches.

Course Outcomes:

The Students will be able to

CO1: Understand the rigidity modulus of the materials.

CO2: Learn the Young's modulus of the material.

CO3: Study the flow of liquid in capillary tube.

CO4: Determine the quantity of unknown solution by instrumental method.

CO5: Analyze the quality of water.

CO6: Estimate the molecular weight of polymer.

LIST OF EXPERIMENTS - PHYSICS PART

(A minimum of five experiments shall be offered)

S.No **NAME OF THE EXPERIMENT**

1. Torsional pendulum – Determination of rigidity modulus
2. Determination of Young's modulus of the material – Uniform bending
3. Determination of viscosity of liquid – Poiseuille's method.
4. Determination of wavelength of mercury spectrum- Spectrometer Grating.
5. Determination of Band Gap of a semiconductor material.
6. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.

LIST OF EXPERIMENTS – CHEMISTRY PART

S.No **NAME OF THE EXPERIMENT**

1. Esimation of HCl by pH metry
2. Conductometric titration of mixture of acids (HCl& CH_3COOH)
3. Estimation of Chloride ion in water sample by Argentometric method.
4. Determination of molecular weight of a polymer by viscometry method
5. Determination of corrosion rate by weight loss method

Total Periods 48

References

1. Text book of Quantitative Inorganic Analysis, A.I.Vogel, ELBS,London.
2. 'Practical A. Ravikrishnan Engineering Chemistry', Sri Krishna Publications, Chennai (2002)
3. Engineering Physics
4. Laboratory Manual
5. Engineering Chemistry Laboratory Manual

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1				1					1	3	2	3	3
CO2	2	2	1				1					1	3	2	3	3
CO3	2	2	1				1					1	3	2	3	3
CO4	2	2	1				1					1	3	2	3	3
CO5	3	2	2				2					2	3	2	3	3
CO6	2	2	2				2						3	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE27 ELECTRIC CIRCUITS LABORATORY L-T-P C

0-0-4 2

Programme: B.E -Electrical and Electronics Engineering **Sem: II Category: PC**

AIM: To motivate the students for solving AC and DC circuits, various networks theorems and to solve the transient and frequency response.

Course Outcomes:

The Students will be able to

CO1. Illustrate the basic concepts of electric circuits.

CO2. Reduce more complicated circuits into the Thevenin's and Norton's equivalent circuits and Maximum power transfer circuits.

CO3. Design simple circuits for maximum power transfer to a load.

CO4. Examine the electric circuits using mesh and nodal analysis.

CO5. Illustrate the transient response of RLC circuits.

CO6. Compute the frequency response of resonant and tuned circuits.

LIST OF EXPERIMENTS

1. Verification of ohm's laws and Kirchhoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of Superposition Theorem
4. Verification of Maximum Power Transfer Theorem.
5. Verification of Reciprocity Theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3		2								1	3	3	2	3
CO2	3	3	1								1		3	3	2	3
CO3	3	3	2	2							1	2	3	3	2	3
CO4	3	3											3	3	2	3
CO5	3	3	3				1				1		3	3	2	3
CO6	3	3	2				1						3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE28 ELECTRONIC DEVICES AND CIRCUITS LABORATORY L-T-P C

0-0-4 2

Programme: B.E- Electrical and Electronics Engineering **Sem: II Category: PC**

AIM: To study the characteristics and to determine the device parameters of various solid-state devices.

Course Outcomes:

The Students will be able to

CO1: Illustrate the VI characteristics of PN diode and Zener diode.

CO2: Construct the VI characteristics of various configurations of BJT and FET.

CO3: Illustrate the VI characteristics of UJT and analyze its relation.

CO4: Describe the VI characteristics of Opto-coupler.

CO5: Design the rectifier circuit using PN.

CO6: Develop the Oscillator Circuits.

LIST OF EXPERIMENTS

1. Characteristics of P-N Junction diode.
2. Characteristics of Zener diode.
3. Characteristics of JFET/MOSFET.
4. Input and Output Characteristics of Transistor in CE configuration.
5. Input and Output Characteristics of Transistor in CB configuration
6. Single phase half wave and full wave rectifiers.
7. Characteristics of UJT
8. Common Emitter amplifier.
9. RC phase Shift Oscillator Circuits.
10. Characteristics of Opto-coupler.
11. PCB Designing.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	1						1	2	3	3	2	3
CO2	3	2	3	2	1						1	2	3	3	2	3
CO3	3	2	3	2	1						1	2	3	3	2	3
CO4	3	2	3	2	1							2	3	3	2	3
CO5	3	2	3	2	1							2	3	3	2	3
CO6	3	2	3	2	1							2	3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER III

161MA31 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION **L-T-P C**

3-1-0 4

Programme: B.E.- Electrical and Electronics Engineering **Sem: III Category: BS**

AIM: The Course is aimed at developing the basic mathematical skills of Engineering Student.

Course Outcomes:

The Students will be able to

CO1: Classify the Fourier series and half range Fourier sine and cosine series.

CO2: Explain the Fourier transform and with their properties.

CO3: Determine Z-inverse transform using convolution theorem and partial fraction method.

CO4: Solve the partial differential equation by using Lagrange's linear equation.

CO5: Analyze separation of variable to solve linear partial differential equation.

CO6: Discuss the formation of partial differential equation.

FOURIER SERIES **12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

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.

PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations(without reducing the standard type) – Linear partial differential equations of second and higher order with constant coefficients.

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) – Fourier series solutions in Cartesian coordinates.

Z -TRANSFORMS AND DIFFERENCE EQUATIONS **12**

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

Total Periods 60

Text Books

1. Grewal, B.S, 'Higher Engineering Mathematics', 40th Edition, Khanna publishers, Delhi.
2. Veerarajan.T., 'Transforms and Partial Differential Equation', Tata Mc-GrawHill Publishing Company limited, New Delhi 2012.

References

1. Bali, N.P and Manish Goyal, 'A Textbook of Engineering Mathematics', 8th Edition, Laxmi Publications(P) Ltd. 2012.
2. Ramana B.V., 'Higher Engineering Mathematics', 6th reprint Tata Mc-Graw Hill Publishing Company limited, New Delhi 2008.
3. Glyn James, 'Advanced Modern Engineering Mathematics', 3rd edition-Pearson Education 2008.
4. Erwin Kreyszig 'Advanced Engineering Mathematics', 9th edition-Wiley India 2011.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3										3	3	2	3	3
CO2	2	3										3	3	2	3	3
CO3	1	2										3	3	2	3	3
CO4	1	1											3	2	3	3
CO5	1	1										1	3	2	3	3
CO6	2	2											3	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE31 LINEAR INTEGRATED CIRCUITS L-T-P C
3-0-0 3

Programme: B.E.- Electrical and Electronics Engineering **Sem: III Category: PC**

AIM: To introduce the concepts for realizing functional building blocks in ICs, fabrications & application of ICs.

Course Outcomes:

The Students will be able to

CO1. Define the IC fabrication procedure and model the basic electronic circuits.

CO2. Infer the characteristics, realize and design the circuit for signal analysis using Op-amps.

CO3. Construct the basic applications of Op-amp like differentiator, integrator, summing amplifiers etc.

CO4. Interpret the internal functional blocks and the applications of special ICs like Timers, regulator Circuits, ADCs.

CO5. Analyze Phase Locked Loop circuit functioning and its applications.

CO6. Illustrate the operation voltage regulators, function generator IC, isolation amplifiers, opto-coupler, opto electronic ICs.

IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging.

CHARACTERISTICS OF OP-AMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator, precision rectifier.

APPLICATIONS OF OP-AMP 9

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

SPECIAL ICs 9

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase locked loop circuit functioning and applications, Analog multiplier ICs.

APPLICATION ICs 9

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

Total Periods 45

Text Books

1. Ramakant A. Gayakwad, 'Op-amps and Linear Integrated Circuits', 4th Edition, PHI Learning, 2015.
2. D. Roy Choudhury and Shail B.Jain, 'Linear Integrated Circuits', 4th Edition, New Age, 2011.

References

1. Jacob Millman and Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', 2nd Edition, Tata McGraw Hill, 2011.
2. Robert F.Coughlin and Fredrick F.Driscoll, 'Op-amp and Linear ICs', 4th Edition, Pearson Education, 2002.
3. S.Salivahanan and V.S Kanchana Bhaskaran , 'Linear Integrated Circuits' , Second edition , Tata McGraw Hill, 2008.
4. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 3rd Edition, 2011.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2						1						3	2	1	2
CO2	3	3	3				2						3	2	1	2
CO3	3	3	3				2						3	2	1	2
CO4	3	3	3				2				1	1	2	2	1	2
CO5	3	3	1				2				1	1	2	2	1	2
CO6	3	3	1				2						3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE32 DIGITAL CIRCUITS AND DESIGN L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: III Category: PC**

AIM: To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.

Course Outcomes:

The Students will be able to

CO1. Describe the common forms of number system in digital electronic circuits and conversion between them.

CO2. State the different types of Combinational Circuits.

CO3. Explain the synchronous sequential circuits.

CO4. Design of Asynchronous sequential circuits.

CO5. Summarize the Special Characteristics of digital integrated circuits.

CO6. Illustrate circuits with Programmable Logic Devices.

NUMBER SYSTEM & BOOLEAN ALGEBRA 9

Review of number system; types and conversion, codes. Boolean algebra: De-Morgan's theorem, switching functions and simplification using K-maps & Quine McCluskey method.

COMBINATIONAL CIRCUITS 9

Design of Logic gates. Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip flops - SR, D, JK and T. design of synchronous sequential circuits – Synchronous counters, Sequence generator and detector with the support of state diagram; state reduction; state assignment. Analysis of synchronous sequential circuits.

ASYNCHRONOUS SEQUENCTIAL CIRCUITS 9

Design of fundamental mode and pulse mode circuits – primitive state / flow table – Minimization of primitive state table –state assignment – Excitation table – Excitation map- cycles – Races –Hazards: Static –Dynamic –Essential –Hazards elimination.

PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES 9

Memories: ROM, PROM, PLA, PAL, and FPGA, digital logic families: TTL, ECL, and CMOS.

Total Periods 45

Text Books

1. M. Morris Mano, 'Digital Logic and Computer Design', Pearson Education, Inc., 2016.
2. John M.Yarbrough, 'Digital Logic, Application & Design', Cengage learning, 2006.

References

1. S. Salivahanan and S. Arivazhagan, 'Digital Circuits and Design', 4th Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.
2. Charles H.Roth. 'Fundamentals of Logic Design', Thomson Publication Company, 2015.
3. Donald P.Leach and Albert Paul Malvino, 'Digital Principles and Applications', 8th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2014.
4. R.P.Jain, 'Modern Digital Electronics', 4th Edition, Tata McGraw–Hill publishing company limited, New Delhi, 2009.
5. Thomas L. Floyd, 'Digital Fundamentals', Pearson Education, Inc., New Delhi, 2012.
6. Donald D.Givone, 'Digital Principles and Design', Tata McGraw-Hill Publishing company limited, New Delhi, 2012.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2		1		2		1	2	3	2	2	3
CO2	3	3	3	1	2		1	2			1	2	3	2	2	3
CO3	3	3	3	1	1	1	1			1		2	3	1	1	3
CO4	3	2	3	1			1	1			2	2	3	2	2	2
CO5	3	2	3	1	1	1	1				1	2	3	1	2	3
CO6	3	1	3	2	2	1	1				1	2	3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE33 ELECTROMAGNETIC THEORY L-T-P C
3-1-0 4

Programme: B.E. Electrical And Electronics Engineering **Sem: III Category: PC**

AIM: To expose the students to the fundamentals of electromagnetic fields and their applications in Electrical Engineering

Course Outcomes:

The Students will be able to

CO1. State the principles of Coulomb's Law and Gauss's law to electric fields in the Cartesian, cylindrical and spherical coordinate systems.

CO2. Determine electrostatic field parameters using Laplace's and Poisson's equation

CO3. Discuss Biot-Savart law and Ampere's circuit law with the associated boundary conditions.

CO4. Understand the concepts of magnetic forces and magnetic materials

CO5. Solve Maxwell's equations in integral and differential forms to time-varying field problems

CO6. Determine the attenuation constant, phase constant, and skin depth for waves in a loss, lossless, free space medium, where the conductivity may range from low to high.

ELECTROSTATICS 12

Introduction to various Co-ordinate Systems - Coulomb's law – Electric field intensity – electric fields due to point, line, surface and volume charge distributions – Electric flux density – Gauss's law and its applications – Electric potential – potential gradient – Divergence and divergence theorem.

ELECTROSTATICS APPLICATIONS 12

Current and current density – Continuity of Current - Conductors and Dielectrics - Boundary conditions – capacitance – Capacitance of system of conductors – Energy stored in capacitor – Energy density - Poisson's and Laplace's equations (simple problems).

MAGNETOSTATICS 12

Lorentz force, magnetic field intensity (H) -Magnetic field intensity – Biot – Savart Law – Ampere's Law – Magnetic field due to straight conductors, circular loop, infinite sheet of current – Curl – Stoke's theorem – Magnetic flux – Magnetic flux density – The Scalar and Vector magnetic potentials – Force on a moving charge and current elements – Force and Torque on closed circuit.

MAGNETOSTATICS APPLICATIONS 12

Introduction to magnetic materials – Magnetization and Permeability – Magnetic boundary conditions – Magnetic circuit – Potential energy and forces on Magnetic materials – Inductance and mutual inductance – Inductance of solenoids, toroids, and transmission lines.

ELECTROMAGNETIC FIELDS AND WAVE PROPAGATION 12

Faraday's Law – Time varying magnetic field - Conduction current and Displacement current – Maxwell's equation in point and integral forms – Electromagnetics Wave Equations - Wave propagation in free space, Dielectrics, conductors – Power and the Pointing Vector.

Total Periods 60

Text Books

1. Mathew N. O. Sadiku, 'Elements of Electromagnetics', Oxford University Press, 1st Edition, 2014.
2. Willian Hayt, 'Engineering Electromagnetics', McGraw Hill, New York, 8th revised edition, 2011.

References

1. Joseph. A. Edminister, 'Theory and Problems of Electromagnetics', 2nd Edition, Schaum Series, Tata McGraw Hill, 1993.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', Prentice-Hall of India Private Limited, New Delhi, 2014.
3. Gangadhar.K.A, P.M. Ramanathan, 'Field theory', Khana pumlishers, New Delhi, 15th edition, 2008.

4. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, 5th Edition, 1999.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1		1		1		2	2	3	2	1	2
CO2	3	3	1	1	2	1	1	2			2	2	3	2	2	2
CO3	3	3	2	2	2		1	2		1		2	3	1	2	2
CO4	3	2	2	1	2	2	1	1			2	2	3	2	2	2
CO5	2	2											3	2	2	1
CO6	3	3	1							1			3	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE34	MEASUREMENTS AND INSTRUMENTATION	L-T-P	C
		3-0-0	3

Programme: B.E. Electrical and Electronics Engineering **Sem: III Category: PC**

AIM: To provide adequate knowledge in electrical instruments and measurements techniques.

Course Outcomes:

The Students will be able to

CO1. Define functional elements, characteristics and errors of an instrument.

CO2. Evaluate the measured data and calibrate it for error rectification.

CO3. Manipulate the electrical and electronic quantities by using measuring instruments.

CO4. Measure the unknown values of electrical components using bridge circuits.

CO5. Recall various types of recorders and display devices.

CO6. Describe the classification of transducer according to its application.

CHARACTERISTICS,ERRORS & STANDARDS OF INSTRUMENTS 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

ELECTRICAL AND ELECTRONIC INSTRUMENTS 9

Classification of measuring instruments- Essential requirements of an instrument-Construction, working principle and Torque equation of Permanent Magnet Moving Coil instruments - Attraction type and Repulsion type Moving iron instruments- Electro-dynamometer type wattmeter and Induction type Energy meter – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

MEASUREMENT OF RESISTANCE, INDUCTANCE & CAPACITANCE 9

D.C & A.C potentiometers, Series and shunt type ohmmeter- D.C Bridges: Wheatstone Bridge, Kelvin's bridge, Kelvin's double bridge- A.C bridges: Maxwell bridge, Anderson bridge, Hays bridge, Schering bridge, Wein's bridge, Megger. Electrostatic and electromagnetic interference – Grounding techniques.

STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD and dot matrix display – Data Loggers.

TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive and inductive transducers – Piezoelectric, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

Total Periods 45

Text Books

1. Sawhney A K, 'A Course in Electrical and Electronic Measurement and Instrumentation', Dhanpat Rai & Sons, New Delhi, 18th Edition, 2012.
2. Gupta J.B., 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2009.

References

1. Prithwiraj Purkait, Budhaditya Biswas, Chiranjib Koley 'Electrical and Electronics Measurements and Instrumentation', McGraw Hill Education India, First Edition, 2013.
2. Doeblin E., 'Measurement Systems: Application and Design', Tata Mc-Graw Hill Book Co., Fifth Edition, New Delhi, 2004.
3. Moorthy D.V.S, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2008.

4. Patranabis.D, 'Sensors and Transducers', PHI Learning Pvt. Ltd., 2003.
5. Kalsi H.S, 'Electronic Instrumentation', McGraw Hill Education India, 3rd Edition, 2010.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3			1		2				1	1	3			1
CO2	3	3	3		1		2				1	1	3		1	
CO3	3	2	1		1						2	1	1	2	1	2
CO4	3	2			1						2	1	3			1
CO5	3	1			1						2	1	3			1
CO6	3	3			1		2				1	1	3			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE35 DATA STRUCTURES AND ALGORITHMS L-T-P C

3-0-2 4

Programme: B,E,- Electrical and Electronics Engineering **Sem: III Category: ES**

AIM: To master the design and applications of linear, tree, and graph structures. To understand various algorithm design and analysis techniques.

Course Outcomes:

The Students will be able to

CO1. Recognize various data structures.

CO2. Illustrate the operations for maintaining common data structures.

CO3. Write programs using linked structures such as List, trees, and graphs.

CO4. Applying appropriate data structures for computing problems.

CO5. Determine algorithm correctness and time efficiency class.

CO6. Implement advanced data structures (dynamic hash structures, heaps, AVL and multiway search trees, radix-based search trees)

LINEAR STRUCTURES 8

Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – applications of lists –Stack ADT – Queue ADT – circular queue implementation – Applications of stacks and queues.

TREE STRUCTURES 8

Need for non-linear structures – Tree ADT – tree traversals – left child right sibling data structures for general trees – Binary Tree ADT – expression trees – applications of trees– binary search tree ADT.

BALANCED SEARCH TREES AND INDEXING 8

AVL trees – Binary Heaps – B-Tree – Hashing – Separate chaining – open addressing –Linear probing.

GRAPHS 8

Definitions – Topological sort – breadth-first traversal - shortest-path algorithms –minimum spanning tree – Prim's and Kruskal's algorithms – Depth-first traversal –biconnectivity – Euler circuits – applications of graphs.

ALGORITHM DESIGN AND ANALYSIS 8

Greedy algorithms – Divide and conquer – Dynamic programming – backtracking –branch and bound – Randomized algorithms – algorithm analysis – asymptotic notations recurrences – NP-complete problems.

Total Periods 40

Text Books

1. M. A. Weiss, 'Data Structures and Algorithm Analysis in C', Pearson Education, Asia, 2011.
2. ISRD Group, 'Data Structures using C', 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., 2012.

References

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, 'Data Structures and Algorithms', Pearson Education, 1983.
2. R. F. Gilberg, B. A. Forouzan, 'Data Structures: A Pseudo code approach with C',Second Edition, Thomson India Edition, 2007.
3. Sara Baase and A. Van Gelder, 'Computer Algorithms', 3rd Edition, Pearson Education, 2002.
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, 'Introduction to algorithms', 3rd Edition, Prentice Hall of India Ltd, 2009.

LIST OF EXPERIMENTS

1. Implement singly and doubly linked lists.

2. Represent a polynomial as a linked list and write functions for polynomial addition.
3. Implement stack and use it to convert infix to postfix expression.
4. Implement array-based circular queue and use it to simulate a producer consumer problem.
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree.
7. Implement insertion in AVL trees.
8. Implement priority queue using heaps.
9. Implement hashing techniques.
10. Perform topological sort on a directed graph to decide if it is acyclic.
11. Implement Dijkstra's algorithm using priority queues.
12. Implement Prim's and Kruskal's algorithms.
13. Implement a backtracking algorithm for Knapsack problem.
14. Implement a branch and bound algorithm for traveling salesperson problem.
15. Implement any randomized algorithm.

Total Periods 20

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3				3								3			2
CO2	3				1								3			2
CO3	3		2	3	3								3			2
CO4	3		2	3									3			2
CO5	3		1		1								3			2
CO6	3		2										3			2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE37 INTEGRATED CIRCUITS LABORATORY L-T-P C

0- 0-4 2

Programme: B.E-Electrical and Electronics Engineering **Sem: III Category: PC**

AIM: To introduce the concepts for realizing functional building blocks in ICs, fabrications & application of ICs.

Course Outcomes:

The Students will be able to

CO1. Substitute functions using SOP, POS form for adder, subtractor and code converters.

CO2. Design the Op-Amp application

CO3. Demonstrate the adder, comparator, and Integrator and Differentiator circuits.

CO4. Develop the shift registers, multiplexer and demultiplexer.

CO5. Implement the 4-bit modulo counters as synchronous and asynchronous types using FF IC's and specific counter IC, ADC and DAC.

CO6. Demonstrate the circuit for communication application- PLL and VCO.

LIST OF EXPERIMENTS

1. Study of Basic Digital IC's.
   (Verification of truth table for AND, OR, XOR, NOT, NOR, NAND, JK FF, RS FF, D FF)
2. Implementation of Boolean Functions, Adder/ Subtraction circuits.
3. a) Code converters, Parity generator and parity checking, Excess 3, 2s Complement, Binary to grey code using suitable IC's.
4. Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers:
   Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO Modes using situable IC's.
7. Multiplex/ De-multiplex :
   Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer.
8. Timer IC application.
   Study of NE/SE 555 timer in Astable, Monostable operation.
9. Applications of Op-Amp:
   Slew rate verifications, inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Study of Analog to Digital Converter and Digital to Analog Converter:
    Verification of A/D conversion using dedicated IC's.

10. Study of VCO and PLL ICs
    i. Voltage to frequency characteristics of NE/ SE 566 IC.
    ii. Frequency multiplication using NE/SE 565 PLL IC.
11. Schmitt Trigger and precision rectifier.
12. Developing simple electronic projects.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3					2			1	3	3	2	2
CO2	3	3	2	1	1				2			3	3	1		2
CO3	3	3	2	1			2		3			3	3	1		2
CO4	3	3	2		1				1			2	3			1
CO5	3	3	2	1			2				1		3	2		3
CO6	3	3	2	2			1		1		1	1	3	3		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE38 MEASUREMENTS AND INSTRUMENTATION LABORATORY **L-T-P C**

0-0-4 2

Programme: B.E. Electrical and Electronics Engineering **Sem: III Category: PC**

AIM: The aim of this lab is to fortify the students with an adequate work experience in the measurement of different quantities and also the expertise in handling the instruments involved.

Course Outcomes:

The Students will be able to

CO1. Measure the unknown voltage using LVDT and Strain gauge.

CO2. Measure the unknown elements by using AC and DC bridges.

CO3. Estimate the design of Instrumentation amplifiers.

CO4. Design 8 bit A/D converter and D/A converter.

CO5. Determine the given energy meter and current transformer.

CO6. Measurement of iron loss.

LIST OF EXPERIMENTS

1. Study of LVDT and Strain Gauge.
2. AC bridges – Maxwell's Bridge and Schering's Bridge.
3. DC bridges – Wheatstone Bridge and Kelvin's Double Bridge.
4. Instrumentation amplifiers.
5. A/D and D/A converters.
6. Study of transients.
7. Calibration of 3- ϕ Energy Meter by Phantom Loading.
8. Calibration of current transformer and potential transformer.
9. Measurement of three phase power and power factor.
10. Measurement of iron loss.
11. Non-contact Measurement of Speed.
12. Measurement of harmonics in rectifier circuits.
13. Improvement of Power Factor with appropriate capacitors

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1		2	3				2			2	3		1	2
CO2	3	2	2	1	2				1			1	3	1		2
CO3	3	2	1	1	3				1	1			3	2	1	2
CO4	3		1	2	3				2	3			3	2	1	1
CO5	3	2		2	2		1		2	1		1	3	2	1	2
CO6	3	2		3	3				3	3		1	3	3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161HS39 FUNCTIONAL ENGLISH I L-T-P C

0-0-2 0

Programme: Common to all Branches **Sem: III Category: EEC**

AIM: To create an Environment to improve learner's communication skill.

Course Outcomes:

The Students will be able to,

CO1. Impart basics of Language & Grammar relating to Business Communication

CO2. Develop learners ability to understand Technical communication

CO3. Estimate learners ability to understand any kind of text

CO4. Learn the nuances of effective writing by using short and crisp sentences.

CO5. Listen talks and lectures on technical subjects

CO6. Describe a process both in speaking and writing

UNIT I **6**

GRAMMAR: Parts of Speech, Tense- simple present, perfect, continuous, present perfect continuous.

READING: Reading different genres of text (literature, media and technical) for comprehension. Reading for making inferences, reading news bulletins and weather forecast, advertisements.

WRITING: , Writing apology letters, Writing e-mail –difference between formal and informal mails, giving information, making an enquiry, answering, announcing a job opportunity, enquiry, confirming terms, informing about a new service.

LISTENING: Telephone etiquette- types of calls, greetings, making and receiving a call, transferring information, making appointments and closing a call. Listening to telephonic conversation, listening to famous personalities' speech.

SPEAKING: **Role play**- planning a training course, phoning a hotel, enquiring about a new job, launching a new product, negotiating a deal and interviewing someone about a change in job.**Just a minute**- describing a business trip, the importance of internal communication of the company, describing a product and how it is advertised.

UNIT II **6**

GRAMMAR: Simple past, perfect, continuous, past perfect continuous.

READING: Reading technical article and making notes, Reading a technical report for gist.

WRITING: Making and taking notes, writing project introduction, Writing for giving assurance and Notice, Agenda and Minutes.

LISTENING: Listening to documentaries, listening to interviews.

SPEAKING: Small talks- introducing oneself, remembering one's childhood, describing one's positive and negative features, making comparisons, describing abilities and skills, making requests and seeking permissions.

UNIT III **6**

GRAMMAR: Simple future, perfect, continuous, future perfect continuous. Voice. Conditional Clause.

READING: Cloze test, Reading and answering questions, reading job advertisements, job interviews.

WRITING: Memos, writing user manuals, product review.

LISTENING: Listening to group discussion

SPEAKING: Expressing personal opinion about social issues.

Total Periods 18

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	3	3	3				
CO2									3	3	3	3				
CO3									3	3	3	3				
CO4									3	3	3	3				
CO5									3	3	3	3				3
CO6									3	3	3	3				3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER IV

161MA42	**STATISTICS AND NUMERICAL METHODS**	**L-T-P**	**C**
		3-0-0	**3**

Programme: **B.E. Mechanical, Civil, EEE, Bio-tech Engineering** **Sem: IV** **Category: BS**

AIM: To achieve high accuracy, many separate operate operation must be carried out.

Course Outcomes:

The students will be able to

CO1. Classify the tests for single variance and equality of variances.

CO2. Determine Eigen values of a matrix by Power method

CO3. Apply Numerical integration using Trapezoidal and Simpson's 1/3 rules.

CO4. Implement Newton's forward and backward difference interpolation.

CO5. Solve ODE by Numerical method.

CO6. Analyze the boundary value problem by Numerical method.

TESTING OF HYPOTHESIS **9**

Sampling distributions – Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **9**

Newton-Raphson method – Gauss Elimination method – Pivoting – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method.

INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTERGRATION **9**

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rules.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9**

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge- Kutta method for solving first and second order equations – Milne's predictor-corrector methods for solving first order equations – Finite difference methods for solving second order equation.

BOUNDARY VALUE PROBLEMS OF ORDINARY DIFFERENTIALEQUATIONS **9**

Finite difference methods for solving second order ordinary differential equation- Finite differences solution of one dimensional heat equation by explicit and implicit methods - One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total Periods 45

Text books

1. Johnson R.A., and Gupta C.B., 'Miller and Freund's Probability and Statistics for Engineers', Pearson Education, Asia, 8th edition, 2011.
2. Grewal B.S. and Grewal J.S., 'Numerical methods in Engineering and Science', 10th Edition, Khanna Publishers, New Delhi, 2014.

References

1. Walpole R.E., Myers R.H., Myers S.L., and Kye, 'Probability and Statistics for Engineers and Scientists', Pearson Education, Asia, 9th edition, 2012.
2. Spiegel M.R., Schiller J., and Srinivasan R.A., 'Schaum's Outlines Probability and Statistics', Tata McGraw Hill edition, 2004.
3. Chapra S.C., and Canale R.P., 'Numerical Methods for Engineers', 7th Edition, Tata McGraw-Hill,

New Delhi, 2014.

4. Gerald C.F., and Wheatley, P.O., 'Applied Numerical Analysis', 6th Edition, Pearson Education Asia, New Delhi, 2006.
5. G. Balaji, 'Statistics and Numerical Methods', 11th Edition, G. Balaji Publishers, 2015.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3									3	3	2	3	3
CO2	1	3	3									1	3	2	3	3
CO3	1	2	3										3	2	3	3
CO4	2	2	3									2	3	2	3	3
CO5	2	1	2									1	3	2	3	3
CO6	2	1										1	3	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE41 **CONTROL SYSTEMS** **L-T-P C**

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: IV Category: PC**

AIM: To provide sound knowledge in the basic concepts of linear control theory and design of control system.

Course Outcomes:

The Students will be able to

CO1. Formulate transfer function for various physical systems.

CO2. Determine transfer function by applying reduction techniques.

CO3. Perform time response analysis for I and II order system with different test inputs.

CO4. Analyze various methods of frequency domain analysis.

CO5. Verify the stability of the system.

CO6. Design a suitable compensator for the given specifications.

SYSTEMS AND THEIR REPRESENTATION **9**

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

TIME DOMAIN ANALYSIS **9**

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

FREQUENCY DOMAIN ANALYSIS **9**

Frequency response – Bode plot – Polar plot – Constant M and N circles – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

STABILITY ANALYSIS **9**

Characteristic equation – Location of roots on s-plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterions.

COMPENSATOR DESIGN **9**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

Total Periods 45

Text Books

1. K. Ogata, 'Modern Control Engineering', 5th Edition, Prentice Hall, 2010.
2. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', 4th Edition, New Age International Publishers, 2007.

References

1. B.C. Kuo, 'Automatic Control Systems', 9th Edition, Wiley India Pvt Ltd., 2014.
2. M. Gopal, 'Control Systems, Principles & Design', 4th Edition, Tata McGraw Hill, New Delhi, 2012.
3. S. Seshadhri, B. Subathra, 'Control Systems', 1st Edition, Tata McGraw Hill, 2012.
4. G. R. Venkatakrishnan, S. Salivahanan, R. Rengaraj, 'Control Systems Engineering', 1 Edition, Pearson Education, 2016.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1								2	3	2	2	3
CO2	3	3	2	1	2							1	3	2	1	1
CO3	3	3	3	2	2		2					2	3	3	1	2
CO4	3	3	2	1	2							1	3	2	1	3
CO5	3	3	2	1	1						2	2	3	3	2	3
CO6	3	3	3	1	2						2	1	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE42 DC MACHINES AND TRANSFORMERS L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: IV Category: PC**

AIM: To expose the students to the basic principles of Electro mechanical Energy Conversion in Electrical Apparatus and the operation of DC Machines and Transformers.

Course Outcomes:

The Students will be able to

CO1. Illustrate the concept of basic magnetic circuits, Electromotive force and Torque

CO2. Elaborate the principles of electromechanical energy conversion in singly and multiply excited systems.

CO3. Sketch the construction and explain the working principle, characteristics of DC Generators.

CO4. Illustrate the principles and speed control of DC Motors.

CO5. Explain the constructional details and performance characteristics of 1Φ and 3Φ transformer.

CO6. Analyze the performance of three phase transformer.

MAGNETIC CIRCUITS AND ELECTROMECHANICAL SYSTEMS 9

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque - Energy in magnetic system – Field energy and coenergy-force and torque equations – singly and multiply excited magnetic field systems.

DC GENERATOR 9

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Armature reaction and commutation – Parallel operation of DC shunt and compound generators.

DC MOTOR 9

Principle of operation – Back emf and torque equation – Characteristics of series, shunt and compound motors – Starting of DC motors – Types of starters – Speed control of DC series and shunt motors.

TRANSFORMER 9

Constructional details of core and shell type transformers – Types of windings – Principle of operation – emf equation – Transformation ratio – Transformer on no-load – Parameters referred to HV / LV windings – Equivalent circuit – Transformer on load – Regulation – Parallel operation of single phase transformers – Auto transformer – Three phase transformers – Vector group.

TESTING OF DC MACHINES AND TRANSFORMERS 9

Losses and efficiency in DC machines and transformers – Condition for maximum efficiency – Testing of DC machines – Brake test, Swinburne's test, Retardation test and Hopkinson's test – Testing of transformers – Polarity test, load test, open circuit and short circuit tests – All day efficiency.

Total Periods 45

Text Books

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', 4th Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
2. P.S. Bimbhra, 'Electrical Machinery', 7th Edition, Khanna Publishers, 2011.

References

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', 7th Edition, Tata McGraw Hill publishing Company Ltd, 2012.
2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2009.

3. K. Murugesh Kumar, 'Electric Machines I', 1st Edition, Vikas publishing house Pvt. Ltd, 2010.
4. Stephen Chapman, 'Electric Machinery Fundamentals', 4th Edition, McGraw Hill Companies Inc. 2012.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2									2	3		3
CO2	3	3	1	1									2	3		1
CO3	3	3	2	2								1	2	3		1
CO4	3	3	1	1								1	2	3		2
CO5	3	3	2	2								1	2	3		1
CO6	3	3	2	2								1	2	3		1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE43 BASICS OF POWER PLANT ENGINEERING L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: IV Category: PC**

AIM: Expose the students to basics of various power plants so that they will have the comprehensive idea of power system operation.

Course Outcomes:

The Students will be able to

CO1. Illustrate the layout of steam power plant with coal handling and cooling systems.

CO2. Construct the hydro electric power plant and various types of turbines.

CO3. Outline the nuclear power plant and nuclear reactors.

CO4. Illustrate the layout of gas and thermal power plant.

CO5. Demonstrate the non conventional power plants.

CO6. Summarize various renewable energy systems.

THERMAL 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- dearearators-cooling tower.

HYDRO ELECTRIC POWER PLANTS 9

Layout-dams-selection of water turbines-types-pumped storage hydel plant.

NUCLEAR POWER PLANTS 9

Principles of nuclear energy- Fission reactions-nuclear reactor-nuclear power plants

GAS AND DIESEL POWER PLANTS 9

Types open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance-reheating, inter coolings, regeneration-advantage and disadvantages- Diesel engine power plant-component and layout.

NON-CONVENTIONAL POWER GENERATION 9

Solar energy collectors, OTEC, wind power plants, tidal power plants and geothermal resources, bio-mass, fuel cell, MHD power generation-principle, thermo electric power generation, thermionic power generation.

Total Periods 45

Text Books

1. R.K.Rajput, 'A Text Book of Power System Engineering', 1st Edition, Lakshmi Publication, 2006.
2. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, 4th Edition, 2014.

References

1. Arora and Domkundwar, 'A Course in Power Plant Engineering', 6th Edition, Dhanapat Rai and Co.Pvt.Ltd., New Delhi, 2013.
2. Bernhardt G.A.Skrotzki and William A. Vopat, 'Power station Engineering and Economy', Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
3. G.D. Rai, 'An introduction to power plant technology', Khanna Publishers, Delhi, 2015.
4. M.M. El-Wakil, 'Power Plant Technology', McGraw Hill 1984.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		2		1	1	2	2	3	2	3	2	1	1		2
CO2	3		2	1	1	2	3	1	3	1	2	2			2	2
CO3	3	2	1		1	2	2	2	2	2	2	2			3	2
CO4	3	2	1	2	1	2	3	1	2	1	2	1	2	2	3	2
CO5	3	2	1	2	1	1	2	1	1	2	1	1	2	2	3	2
CO6	3	3		2		2	2	1		3	2	2	3	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE44	TRANSMISSION AND DISTRIBUTION	L-T-P	C
		3-0-0	3

Programme: B.E. Electrical and Electronics Engineering **Sem: IV Category: PC**

AIM: To understand the importance and the functioning of transmission and distribution of the electric power in an electrical utility (or) a power system.

Course Outcomes:

The Students will be able to

CO1. Illustrate the generation transmission and distribution system.

CO2. Calculate transmission line parameters.

CO3. Analyze the performance of various transmission lines.

CO4. Examine the power flow through a transmission line.

CO5. Analyze the voltage distribution in insulator strings and cables.

CO6. Evaluate various bus bar schemes in power system.

INTRODUCTION **9**

Structure of electric power system - different operating voltages of generation, transmission and distribution – advantage of higher operating voltage for AC transmission. An introduction to EHV AC transmission, HVDC transmission and FACTs. Mechanical design of transmission line between towers – sag and tension calculations using approximate equations taking into account the effect of ice and wind.

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 - skin and proximity effects - interference with neighboring communication circuits. Corona discharge characteristics – critical voltage and loss. (Simple diagrams of typical towers and conductors for 400, 220 and 110 kV operations)

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. An introduction to power angle diagram - surge-impedance loading, load ability limits based on thermal loading; angle and voltage stability considerations.

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 – insulation resistance, capacitance, dielectric stress and grading – tan δ and power loss -thermal characteristics.

SUBSTATION, GROUNDING SYSTEM AND DISTRIBUTION SYSTEM **9**

Classification, functions and major components of substations. Bus-bar arrangements - substation bus schemes - single bus, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker-and-a-half with two main buses, double bus-bar with bypass isolators. Importance of earthing in a substation. Qualitative treatment to neutral grounding and earthing practices in substations. Feeders, distributors and service mains. DC distributor – 2-wire and 3-wire, radial and ring main distribution. AC distribution – single phase and three phase 4-wire distribution.

Total Periods 45

Text Books

1. B.R.Gupta, 'Power System Analysis and Design', S. Chand, New Delhi, 2011.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd., New Delhi, 2008.

References

1. Luces M. Fualkenberry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2006.
2. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Publishing Company, 2003.
3. Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi.
4. 'Tamil Nadu Electricity Board Handbook', 2007.
5. S.L.Uppal, S.Rao 'Electrical Power Systems', Khanna Publishers, 2009.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1		1	1				1	3	1		3	2
CO2	3	2	2	1	1	1	1				1	2	3		2	3
CO3	3	2	1	1	1	1	1				1	2	2	1	2	2
CO4	3	2	3	1	2	1	2				2	3	2		2	3
CO5	3	2	3	1	2	1	1				1	2	2		3	2
CO6	3	2	3	1	1	1	2				1	3	2	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE45 COMMUNICATION ENGINEERING L-T-P C

3-0-0 3

Programme: B.E. - Electrical and Electronics Engineering **Sem: IV Category: ES**

AIM: To introduce the concepts of communication systems engineering using wire and wireless medium.

Course Outcomes:

The Students will be able to

CO1. Classify various analog modulation techniques

CO2. Express the different digital modulation technique

CO3. Illustrate different source coding techniques

CO4. Relate TDMA, CDMA & FDMA

CO5. Summarize data transmission over fiber optic media.

CO6. Describe the general satellite system & their orbits.

ANALOG COMMUNICATION 9

Principles of amplitude modulation, AM Voltage & power distribution, Balanced Modulator, AM transmitters: High level and Low level transmitter, Diode Detector, AM receiver: TRF & Super heterodyne receiver.

Angle modulation - FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation, Bandwidth requirements for Angle modulated waves, FET reactance modulator, FM transmitters: PLL & Armstrong Method, Balanced slope detector, FM receiver.

DIGITAL COMMUNICATION 9

Introduction, Shannon limit for information capacity, ASK, FSK bit rate and baud, FSK transmitter & receiver ,BPSK transmitter & receiver , QPSK transmitter & receiver ,QAM transmitter & receiver ,DPSK transmitter & receiver , carrier recovery – squaring loop, Costas loop.

DIGITAL TRANSMISSION 9

Introduction, Pulse modulation, PCM – PCM sampling, Sampling rate, Signal to Quantization Noise Rate, DM transmitter and receiver , ADM transmitter and receiver, DPCM transmitter and receiver ,pulse transmission – Inter symbol interference, eye patterns.

SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES 9

Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques –TDMA-FDMA-CDMA-SDMA.

SATELLITE AND OPTICAL COMMUNICATION 9

Satellite System Link Model -Kepler's Law, Orbit Types. Optical Communication Systems-Elements of Optical Fiber Transmission link, Types, Losses, Sources and Detectors.

Total Periods 45

Text Books

1. Wayne Tomasi, 'Advanced Electronic Communication Systems Fundamentals through advanced', 6th Edition, Pearson Education, 2014.

References

1. H.Taub, D L Schilling, G Saha, 'Principles of Communication', 4th Edition, McGraw-Hill Publication, 2015.
2. Simon Haykin, 'Communication Systems', 5th Edition, John Wiley & Sons. 2009.
3. Dennis Roddy, 'Satellite Communications', McGraw-Hill Publication, 4th Edition 2008.
4. Gerd Keiser, 'Optical Fiber Communication', McGraw Hill, 5th Edition, 2013.
5. Rappaport. T.S., 'Wireless communications', 2nd Edition, Pearson Education, 2010.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2		2	1	1	2		1		1	2	1	2	3
CO2	3	2	3			1	1			2		1	2	1	1	3
CO3	3	3	3		2		2		1	2		2	2	1	1	3
CO4	3	1	2			1	1			1		1	2		2	3
CO5	3	1	2		2		1			3		1	2	1	2	3
CO6	3	1	2		2		1					1	2		2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE47 **CONTROL SYSTEMS LABORATORY** **L-T-P** **C**

0-0-4 **2**

Programme: B.E. Electrical and Electronics Engineering **Sem: IV** **Category: PC**

AIM: To provide sound knowledge in the basic concepts of linear control theory and design of control system.

Course Outcomes:

The Students will be able to

CO1. Develop the transfer function model for DC and AC Servomotor.

CO2. Simulate Type - 0 and Type - 1 system with different test inputs.

CO3. Develop the transfer function of DC Generator and Motor.

CO4. Analyze the stability of linear system using MATLAB.

CO5. Simulate first and second order system using MATLAB.

CO6. Design the various controllers in control system.

LIST OF EXPERIMENTS

1. Determination of transfer functions of DC Servomotor.
2. Determination of transfer functions of AC Servomotor.
3. Analog simulation of Type - 0 and Type – 1 system.
4. Determination of transfer functions of DC Generator.
5. Determination of transfer functions of DC Motor.
6. Stability analysis of linear systems.
7. DC and AC position control systems.
8. Stepper motor control system.
9. Digital simulation of first order systems.
10. Digital simulation of second order systems.
11. Study of PID Controller.
12. Closed loop control of temperature.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3			1		1		3	3		1	3	3	2	3
CO2	3	3		2	1		1		3	3		1	3	3	2	3
CO3	3	3		3	2		1		3	3		1	3	3	2	3
CO4	3	3		3	3		2		3	3		2	3	3	2	3
CO5	3	3	2	3	3		2		3	3		2	3	3	2	3
CO6	3	3	2	3	3		2		3	3		2	3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE48 DC MACHINES AND TRANSFORMER LABORATORY L-T-P C

0-0-4 2

Programme: B.E. Electrical and Electronics Engineering **Sem: IV Category: PC**

AIM: To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

Course Outcomes:

The Students will be able to

CO1. Perform the open circuit test and the load test on a given DC generator and draw the characteristic curves.

CO2. Evaluate the direct test on a given DC motor.

CO3. Design a speed controller for the dc shunt motor by field and armature control method also to draw its characteristic curves.

CO4. Determine the load test on a given DC machines and draw its performance curves.

CO5. Calculate the Efficiency and Regulation on a given single phase transformer.

CO6. Determine the load test on a given single phase transformer and draw its performance curves.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of separately excited and self excited DC generators.
2. Load characteristics of DC compound generator with differential and cumulative connection.
3. Load characteristics of DC shunt and compound motor.
4. Load characteristics of DC series motor.
5. Swinburne's test and speed control of DC shunt motor.
6. Hopkinson's test on DC motor – generator set.
7. Load test on single-phase transformer and three phase transformer connections.
8. Open circuit and short circuit tests on single phase transformer.
9. Sumpner's test on transformers.
10. Separation of no-load losses in single phase transformer.
11. Testing of Transformer oil and insulation.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	2				3			3	3	1	1	3
CO2	3	2	1		2				2	2	1	3	3	3	1	3
CO3	3	1	3	3		2		3	2	1		3	3	3	1	3
CO4	3	2	1	2	1	1			3		1	3	3	2	1	2
CO5	2	1	1		1				3		1		3	3	1	2
CO6	3	2	1	1	2	1			3		1	3	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161HS49 **FUNCTIONAL ENGLISH II** **L-T-P C**

0-0-2 0

Programme: Common to all Branches **Sem IV Category: EEC**

AIM: To Create an Environment to experiment communication skills with Intermediate resources.

Course Outcomes:

The Students will be able to,

CO1. Describe the gain of accurate and appropriate Basic communication

CO2. Apply different forms of advanced grammar.

CO3. Write words and their meaning for the specific purpose

CO4. Develop students' accuracy in Written Communication

CO5. Improve Communication Skills in formal and informal situations.

CO6. Summarize the key points

UNIT I **6**

GRAMMAR: Concord, Sentence structure,

READING: Reading a passage and finding an error, reading charts, tables, graphs and making inference.

WRITING: Creative writing-paragraph and essay writing, writing memo

LISTENING: listening to short conversation, instructions and directions.

SPEAKING: Describing- what I enjoy about my studies, describing about the history of a company, describing various designations in the company, describing a product and how it is advertised, describing the selection process of a company.

UNIT II **6**

GRAMMAR: If clause.

READING: reading leaflet and pamphlets, reading for gathering information.

WRITING: writing report, proposals.

LISTENING: Listening to lectures and ted talks.

SPEAKING: Mini presentation on technical topics- English for presentations- Difference between lecture speech and presentation- what makes a good presentation-planning, purpose, audience, gathering information, using av materials, gestures, and interaction ability

UNIT III **6**

GRAMMAR: Reported speech.

READING: reading and interpreting visual material, reading online content and reading technical reports.

WRITING: Writing product review, writing instructions and recommendations.

LISTENING: Listening to technical presentation, speeches and interviews.

SPEAKING: Group discussion, general interaction.

Total Periods 18

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	3	3	3				3
CO2											3	3				3
CO3												3				3
CO4										3		3				3
CO5									3	3	3	3				3
CO6									3	3	3	3				3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER V

161EE51 DIGITAL SIGNAL PROCESSING L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: V Category: PC**

AIM: To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain.

Course Outcomes:

The Student will be able to

CO1. Evaluate the DFT and FFT of discrete time sequence.
CO2. Design digital IIR Butterworth and Chebyshev filters.
CO3. Implement digital filters using various structures such as direct, cascade and parallel form.
CO4. Design digital FIR filters using the windowing technique.
CO5. Implement digital FIR filters using various structures such as Transversal, linear phase, and poly phase structures.
CO6. Find the finite precision effects such as input quantization, coefficient quantization multiplication round off and limit cycle oscillations.

INTRODUCTION 9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z- transform, application to discrete systems - Stability analysis, frequency response – Convolution – Fourier transform of discrete sequence.

DISCRETE FOURIER TRANSFORM & COMPUTATION 9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure.

DFT- FFT AND SAMPLING 9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques - Hanning window, Hamming window, Blackmam window – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

DIGITAL SIGNAL PROCESSORS 9

Introduction – Architecture – Features – Addressing Formats – Functional modes. Introduction to Commercial Processors.

Total Periods 45

Text Books

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', 4th Edition, Pearson Education, New Delhi, 2012.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', 4th Edition, Tata McGraw Hill, New Delhi, 2011.

References

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.
2. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.
3. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing', Tata McGraw Hill, New Delhi, 2003.
4. Texas TMS 320C54X user manual (website).

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2										3	2	1	2
CO2	3	3	3	2								1	3	2	1	2
CO3	3	2	3		2							1	3	2	2	2
CO4	3	3	3		2						1	1	3	1	1	2
CO5	3	2	3								1	1	3	2	1	2
CO6	3	3	2									1	3	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE52 ROTATING AC MACHINES L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: V Category: PC**

AIM: To expose the students to the concepts of synchronous and asynchronous machines and analyze their performance.

Course Outcomes:

The Students will be able to

CO1. Describe construction and performance of salient and non – salient type synchronous generators.

CO2. Analyze the principle of operation and performance of synchronous motor.

CO3. Illustrate construction, principle of operation and performance of induction machines.

CO4. Impart Knowledge on starting and speed control of three-phase induction motors.

CO5. Describe the construction, principle of operation and performance of single phase induction motors.

CO6. Choose a suitable special motor for domestic applications.

SYNCHRONOUS GENERATOR 9

Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF, ZPF and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory– Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics - Capability curves.

SYNCHRONOUS MOTOR 9

Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed.

THREE PHASE INDUCTION MOTOR 9

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Double cage rotors – Induction generator – Synchronous induction motor.

STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9

Need for starting – Types of starters – Rotor resistance, Autotransformer and Star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

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

Total Periods 45

Text Books

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', 4th Edition, Tata McGraw Hill Publishing Company Ltd 2010.
2. B.L.Theraja, A.K.Theraja, 'A Textbook of Electrical Technology: Volume 2 AC and DC Machines', S.Chand, 2008.

References

1. P.S. Bhimbhra, 'Electrical Machinery', 7th Edition, Khanna Publishers, 2011.
2. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', 7th Edition, Tata

McGraw Hill publishing Company Ltd, 2012.
3. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2009.
4. K. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt Ltd, 2002.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		2	2		1	1					1	2	3	1	3
CO2	3	3		2		1					1	1	2	2	1	3
CO3	3	2	2	2								1	3	3	1	3
CO4	3	2	2	2		1						1	2	3	1	2
CO5	3	2	1	2								1	2	3	1	3
CO6	3	2	1	1								1	3	3	1	3

161EE53 POWER ELECTRONICS L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: V Category: PC**

AIM: To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.

Course Outcomes:

The Students will be able to

CO1. Construct the characteristics of various power semiconductor devices.

CO2. Analyze the 1Φ and 3 Φ ac-to-dc circuits.

CO3. Design AC voltage controller and cyclo-converter.

CO4. Analyze the steady state continuous and discontinuous modes and basic converter topologies

CO5. Design choppers for various topologies in converter.

CO6. Illustrate the principles and operation of UPS and analyze the power electronic equipments for effective power transmission.

POWER SEMICONDUCTOR DEVICES 9

Introduction - Power Diodes - Power Transistors - Power MOSFETs - IGBTs - Thyristor family: SCRs, TRIAC, GTOs, MCT and IGCT - Static and Dynamic characteristics - Protection circuits - Series and parallel connections.

AC TO DC CONVERTERS 9

Uncontrolled Bridge Rectifiers – 1-Phase and 3-Phase – R, RL and RLE load – Average load voltage and load current – effect of free-wheeling diode – controlled rectifiers –1-Phase and 3-Phase half wave converters - single phase half and fully controlled bridge converters – continuous and discontinuous operation – average load voltage and load current for continuous mode – effect of free-wheeling diode - input power factor for ripple free load current – 3 phase half and fully controlled converters (no analysis) – Dual converters.

DC TO DC CONVERTERS 9

Principle of step-up and step-down operation - Single quadrant DC chopper with R, RL and RLE load - Time ratio control - Estimation of average load voltage and load current for continuous current operation - Two quadrant and four quadrant DC choppers. Buck, Boost ,Buck- Boost, converters – Isolated topologies – Resonant converters

DC TO AC CONVERTERS 9

Types - Voltage source and current source inverters - Single phase bridge inverters - Three phase bridge inverters - Control of AC output voltage - Harmonic reduction.

AC TO AC CONVERTERS & CONTROL CIRCUITS 9

Single phase full wave controller with R and RL load - Estimation of RMS load voltage, RMS load current and input power factor - Three phase AC voltage controllers (No analysis). Functional requirements of switching control circuits - Generation of control signals for single phase AC to DC converters - Cosine wave crossing control, ramp comparator approach. Generation of timing pulses for DC choppers

Total Periods 45

Text Books

1. Rashid M H, 'Power Electronics – Circuits, Devices and Applications', 4th Edition, Prentice Hall of India, New Delhi, 2013.
2. P.S.Bimbhra, 'Power Electronics', Khanna Publishers, New Delhi, 2012.

References

1. Vedam Subramanyam, 'Power Electronics', New Age International, New Delhi, 2008.
2. Joseph Vithayathil, 'Power Electronics', Tata McGraw-Hill, New Delhi, 2010.

3. L.Umanand, 'Power Electronics: Essentials & Applications', Wiley India, New Delhi, 2009.
4. Ned Mohan, T.M.Undeland, W.P.Robbins, 'Power Electronics: Converters, applications and design', John Wiley and Sons, 3rd Edition, 2006.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	3								1	3	2	1	2
CO2	3	3	2	3	2				2	1	1	1	3	2	1	3
CO3	3	3	2	2	2							1	3	2	2	3
CO4	2	3	2	2	2							1	3	3	2	3
CO5	3	3	3	2	2				2	1	1	1	3	2	2	3
CO6	3	3	3	2	2				2	2	1	1	3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE54	PROTECTION AND SWITCHGEAR	L-T-P	C
		3-0-0	3

Programme: B.E. Electrical and Electronics Engineering **Sem: V** **Category: PC**

AIM: To expose the students to the various faults in power system and learn the various methods of protection scheme.

Course Outcomes:

The student will be able to

CO1. Define the importance of protection in a Power system network.

CO2. Identify suitable protection scheme for generation, transmission and distribution.

CO3. Select a suitable relay for an electrical network

CO4. Explain about microprocessor based numerical relaying concepts.

CO5. Infer various arc quenching process in AC and DC circuit breakers.

CO6. Recognize the operation of various types of Circuit breakers.

OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS **9**

Electromagnetic relays – Over current relays - directional relays, distance –relays – differential relays - under frequency relays.

APPARATUS PROTECTION **9**

Zones of protection and essential qualities of protection – Protection scheme - Apparatus protection transformer, generator, motor, protection of bus bars, transmission lines – CTs and PTs and their applications in protection schemes.

MICROPROCESSOR BASED NUMERICAL PROTECTION RELAYS **9**

Numerical relay – Data acquisition system – IC elements and circuits for interfaces – A/D converter, Analog multiplier, S/H circuit - Over current relay – Impedance relay – Directional relay – Reactance relay – Measurement of R and X.

THEORY OF CIRCUIT INTERRUPTION **9**

Physics of arc phenomena and arc interruption, Restriking voltage & Recovery voltage, rate of rise of recovery voltage, resistance switching, current chopping and interruption of capacitive current – DC circuit breaker.

CIRCUIT BREAKERS **9**

Types of Circuit Breakers – Air blast, Air break, oil SF_6 and Vacuum circuit breakers – comparative merits of different circuit breakers – Testing of circuit breakers.

Total Periods 45

Text Books

1. Badri Ram, Vishwakarma, 'Power System Protection and Switchgear', 2nd Edition, Tata McGraw hill, 2011.
2. V.K.Mehtha,R.K.Mehtha, 'Principles of Power System', Tata McGraw hill. of India Pvt. Ltd., New Delhi, 2003.

References

1. Sunil S. Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, Thirteenth Edition 2008.
2. B. Ravindranath, and N. Chander, 'Power System Protection & Switchgear', Wiley Eastern Ltd., 2011.

3. C.L. Wadhwa, 'Electrical Power Systems', Newage International (P) Ltd., 2009.
4. M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 2009.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1			1						1	3	1	3	3
CO2	3	2	1			1						1	3	1	2	3
CO3	3	2	1		1						1	1	2	1	2	3
CO4	3	2	1		1						2	1	3	1	1	2
CO5	3	3	1	1	1						1	1	3		2	2
CO6	3	2	1	1	1	1					2	1	1		2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE55 HIGH VOLTAGE ENGINEERING L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: V Category: PC**

AIM: To expose the students to various types of over voltage transients in power system and its effect on power system.
- Generation of over voltages in laboratory.
- Testing of power apparatus and system.

Course Outcomes:

The Students will be able to

CO1. Analyze the various origins of over voltages and its effect on power system.

CO2. Make out the various breakdown phenomena in gases, liquid and solid dielectrics.

CO3. Discuss the concepts used for the generation of high voltages and currents.

CO4. Expound the concepts used for the measurement of high voltages and currents also design corresponding circuits.

CO5. Exemplify high voltage testing techniques of power apparatus in power systems.

CO6. Discern the concepts of insulation co-ordination.

OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages, Corona and its effects – Reflection and Refraction of Travelling waves- Protection against overvoltages.

DIELECTRIC BREAKDOWN 9

Gaseous breakdown in uniform and non-uniform fields – Penning effect, Corona discharges – Vacuum breakdown –Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics.

GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC, AC, impulse voltages and currents – Triggering and control of impulse generators.

MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers – Peak Voltmeter, Generating Voltmeters – Capacitance Voltage Transformers, Electrostatic Voltmeters –Sphere Gaps – High current shunts- Digital techniques in high voltage measurement.

HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination.

Total Periods 45

Text Books

1. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newness Second Edition Elsevier , New Delhi, 2005.
2. S.Naidu and V. Kamaraju, 'High Voltage Engineering', 5th Edition, Tata McGraw Hill, Fifth Edition, 2013.

References

1. Subir Ray, 'An Introduction to High Voltage Engineering', 2nd Edition, PHI Learning Private Limited, New Delhi, Second Edition, 2013.
2. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.
3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2		1	2					1	3		3	
CO2	3	1		3	2	1	2	1				3	3		3	2
CO3	3	3	2	1	2							1	3		3	2
CO4	3	3	2	2	3	1	1	2	2	2	1	2	3	1	3	2
CO5	3	3			1		1	1	1		2	2	3	2	3	2
CO6	3	2	1									1	3	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE56 OBJECT ORIENTED PROGRAMMING **L-T-P 3-0-2 C 4**

Programme: B.E. Electrical and Electronics Engineering **Sem: V Category: ES**

Aim To introduce the concepts Object Oriented Programming

Course Outcomes:

The Students will be able to.

CO1. Differentiate between structures oriented programming and object oriented programming.
CO2. List the use object oriented programming language like C++ and associated libraries to develop object oriented programs.
CO3. Apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language.
CO4. Discuss concepts of operator-overloading, constructors and destructors.
CO5. Apply exception handling and use built -in classes.
CO6. Design problem solutions using Object Oriented Techniques.

OBJECT ORIENTED PROGRAMMING FUNDAMENTALS **8**

Procedure Oriented Programming vs. Object Oriented Programming (OOP). Object oriented programming concepts – Classes, reusability, encapsulation, inheritance, polymorphism, dynamic binding, and message passing. C++ Programming features - constructors – static members – constant members – member functions – pointers – references - Role of this pointer – Storage classes – function as arguments.

OBJECTS AND CLASSES **8**

Structures and classes: Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor. Object as function arguments, default copy constructor, returning object from function, Arrays of object, string, The standard C++ String class. String Handling – Nested classes.

INHERITANCE AND POLYMORPHISM **8**

Inheritance – Types, Polymorphism – compile time and run time polymorphisms – function overloading – operators overloading – dynamic memory allocation Importance of virtual function, function call binding, virtual functions, implementing late binding, need for virtual functions, abstract base classes and pure virtual functions, virtual destructors.

FILES AND POINTERS **8**

Components of a file, different operation of the file, communication in files, creation of file streams, stream classes, header files, updating of file, opening and closing a file, filepointers and their manipulations, functions manipulation using file pointers, detecting end-of file. Pointer: Addresses and pointers. The address of operator and pointer and arrays. Pointer andFaction pointer and C-types string. Memory management: New and Delete, pointers to objects, debugging pointers.

TEMPLATES AND EXCEPTIONS **8**

Function templates, Class templates Exceptions. Standard Template Library: Introduction algorithms, sequence containers, iterators, specialized iterators, associative containers, strong user-defined object, function objects.

Total Periods 40

Lab Component:

Implement the following topics:

1. Constructors & Destructors

2. Copy Constructor.
3. Friend Function & Friend Class.
4. Inheritance.
5. Polymorphism & Function Overloading.
6. Overload Unary & Binary Operators.
7. Exception Handling Mechanism.

Total Periods 20

Text Books:

1. BjarneStroustrup, 'The C++ Programming Language', 3/e, Pearson Education, 2007.
2. B. Trivedi, 'Programming with ANSI C++', Oxford University Press, 2012.
3. K.R Venugopal and RajkumarBuyya, 'Mastering C++', Tata McGraw Hill, 2/e, 2013.

References:

1. Robert Lafore, 'Object Oriented Programming in C++', Techmedia Publication, 4/e, 2002.
2. E. Balagurusamy, 'Object oriented Programming with C++', Tata McGraw-Hill, 6/e, 2013.
3. Herbert shield, 'The complete reference C++', McGraw Hill Publication, 9th edition, 2014.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2									1	3			2
CO2	3	2	2									1	3			2
CO3	3		2									1	3			2
CO4	2	2	1										3			2
CO5	1	2	1									1	3			2
CO6	3	3	2										3			2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE57 ROTATING AC MACHINES LABORATORY L-T-P C

0-0-4 2

Programme: B.E. Electrical and Electronics Engineering **Sem: V Category: PC**

AIM: To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

Course Outcomes:

The Students will be able to

CO1. Analyze the performance of synchronous generators and their application to power system.

CO2. Analyze the performance characteristics of induction motors and their application to industry.

CO3. Differentiate the no-load losses in induction motor

CO4. Construct the circle diagram and analyze the performance of induction motor.

CO5. Analyze the performance of synchronous motor under different excitation conditions.

CO6. Choose a suitable A.C. starter for industrial application.

LIST OF EXPERIMENTS

1. Load test on alternator
2. Load test on 1-phase induction motor
3. Load test on 3-phase squirrel cage induction motor
4. Load test on 3-phase slip ring induction motor
5. Regulation of alternator by EMF and MMF methods
6. Regulation of alternator by ZPF and ASA methods
7. Separation of no load losses in induction motor
8. No load and blocked rotor test on 3-phase squirrel cage induction motor
9. V and inverted V curves of synchronous motor
10. No load and blocked rotor test on 1-phase squirrel cage induction motor
11. Regulation of three phase salient pole alternator by slip test
12. Study of A.C. motor starters

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2		1	1	1	1	1		2	3	3		2
CO2	3	3	3	2		1	1		3	1	2	2	3	3	1	3
CO3	3	1	1	2		1	1	1		2		2	3	2		2
CO4	3	3	3	2	1	2	1		1	1		2	3	3		3
CO5	3	2	3	2		2			3	2	2	2	3	3		2
CO6	3		1			2	1					3	3	3		1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE58 POWER ELECTRONICS LABORATORY L-T-P C

0-0-4 2

Programme: B.E. Electrical and Electronics Engineering **Sem: V Category: PC**

AIM: To study the power electronics devices characteristics and its applications.

Course Outcomes:

The Students will be able to

CO1. Explain the Characteristics of SCR, MOSFET and IGBT

CO2. Analyze the transient characteristics of SCR and MOSFET

CO3. Design a circuit on AC to DC fully controlled converter

CO4. Design AC to DC half-controlled converter

CO5. Design Step down and step up MOSFET based choppers

CO6. Design IGBT based single-phase and three-phase PWM inverter and cycloconverter.

LIST OF EXPERIMENTS

1. Characteristics of SCR
2. Characteristics of TRIAC
3. Characteristics of power MOSFET
4. Characteristics of power IGBT
5. Transient characteristics of MOSFET
6. Single phase half wave controlled converter
7. Single phase fully controlled converter
8. Step up & step down DC choppers
9. Single phase AC voltage controller using thyristors
10. Single phase IGBT based pwm inverter
11. Three phase IGBT based inverter
12. Single phase cycloconverter
13. Single phase full bridge inverter

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		2	3		1				2	2	2	3	3		2
CO2	3		2	2		1				2	2	2	3	3		2
CO3	3	3	3	2	2	1	2	1	2	2	3	3	2	3		2
CO4	3	3	3	2	2	1	2	1	2	2	2	3	3	3		2
CO5	3	2	3	3	2	1	2	1	2	2	2	2	3	3		2
CO6	3	2	3	3	2	1	2	1	2	2	1	2	2	3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161HS59 **CAREER ENGLISH I** **L-T-P C**

0-0-2 0

Programme: COMMON TO ALL BRANCHES **Sem: V Category: EEC**

Prerequisites: Functional English II

AIM: To Improve learners' Communication Skills in English.

Course Outcomes:

The students will be able to,

CO1. Develop the Language Skills, Soft Skills; Inter Personal Skills, Decision Making and Business Communication.

CO2. Competent in Presentation skill.

CO3. Knowledge of effective classroom speaking and presentation.

CO4. Provide opportunities to learners to practice their communicative skills to become proficient users of English.

CO5. Write job applications

CO6. Enhance their writing skill by undergoing frequent practice.

UNIT I **6**

Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

UNIT II **6**

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples.

UNIT III **6**

Covering letter- strategies to write, resume and it's various kinds.

Total Periods 18

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3	3	3	3				3
CO2										3		2				3
CO3									2	3		2				3
CO4									2	3		2				3
CO5									2	3						3
CO6											2					3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER – VI

161EE61	POWER SYSTEM ANALYSIS	L-T-P	C
		3-0-0	3

Programme: B.E.- Electrical and Electronics Engineering **Sem: VI Category: PC**

AIM: To expose the students to be familiar with the modeling of power system and to apply different methods to analyze power system for the purpose of system planning and operation.

Course Outcomes:

The Students will be able to

CO1. Design modeling of basic power system components and representation of single line diagram.

CO2. Evaluate the bus admittance and bus impedance matrix for a power system network.

CO3. Develop power flow model for a power system network.

CO4. Solve power flow equation using numerical methods such as Gauss Seidel method, Newton-Raphson (N-R) method and Fast Decoupled Power Flow (FDPF) method.

CO5. Illustrate the importance of fault analysis and stability analysis.

CO6. Analyze various unbalanced fault conditions using symmetrical components and sequence networks.

INTRODUCTION **9**

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. Simple building algorithms for the formation of Y-Bus matrix and Z-Bus matrix.

POWER FLOW ANALYSIS **9**

Importance of power flow analysis in planning and operation of power systems. Statement of power flow problem - classification of buses into P-Q buses, P-V (voltage-controlled) buses and slack bus. Development of Power flow model in complex variables form and polar variables form. Power Flow methods - Gauss-Seidel method, Newton-Raphson (N-R) method and Fast Decoupled Power Flow (FDPF) method - algorithm and flowchart; Comparison of the three methods.

FAULT ANALYSIS – BALANCED FAULTS **9**

Importance short circuit (or) for fault analysis - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents.

FAULT ANALYSIS – UNBALANCED FAULTS **9**

Introduction to symmetrical components – sequence impedances – sequence networks – representation of single line to ground, line to line and double line to ground fault conditions - Unbalanced fault analysis - problem formulation – analysis using Z-bus impedance matrix – algorithm and flow chart.

STABILITY ANALYSIS **9**

Importance of stability analysis in power system planning and operation - classification of power system stability - angle and voltage stability – simple treatment of angle stability into small-signal and large-signal (transient) stability.

Single Machine Infinite Bus (SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time by using modified Euler method and Runge-Kutta second order method - Algorithm and flow chart.

Total Periods 45

Text Books

1. Hadi Saadat, 'Power System Analysis', 3rd Edition (revised), Tata McGraw Hill Publishing Company, 2011.
2. D.P. Kothari, I.J. Nagarath, 'Power System Engineering', 3rd Reprint, Tata McGraw-Hill Publishing Company Ltd., 2008.

References

1. P. Kundur, 'Power System Stability and Control', 1st Edition, Tata McGraw Hill Publications, 2006.
2. Olle I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, Second Edition, 2003.
3. I.J. Nagrath and D.P. Kothari, 'Modern Power System Analysis', 4th Edition, Tata McGraw-Hill Publishing Company, 2011.
4. K.Nagasarkar and M.S. Sukhija, 'Power System Analysis', 1st Edition, Oxford University Press, 2007.
5. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', 1st Edition, McGraw Hill International Book Company, 2003.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3			2	2			1			2	1	3	3
CO2	3	3	3			2	1						2	1	3	3
CO3	3	3	3			1				1	1	1	2	2	3	3
CO4	3	3	3			1	2			1	2	1	3	2	3	3
CO5	3	3	3			1	2			2	1	1	2	2	3	2
CO6	3	3	3			1	2			2	2	1	3	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE62 **SOLID STATE DRIVES** **L-T-P C**

3-0-0 3

Programme: B.E.- Electrical and Electronics Engineering **Sem: VI Category: PC**

AIM: To study and understand the operation of electric drives controlled from a power electronic converter and to introduce the design concepts of controllers.

Course Outcomes:

The students will be able to

CO1. Express the characteristics of electrical drives.

CO2. Analyze the operation of converter fed DC drive.

CO3. Analyze the operation of chopper fed DC drive.

CO4. Illustrate various speed control strategies for induction motor drive.

CO5. Describe open loop and closed loop control of synchronous motor drive.

CO6. Design of controller for controlling speed of an electrical drive.

DRIVE CHARACTERISTICS **9**

Equations governing motor load dynamics - steady state stability - Multi quadrant dynamics in the speed torque plane - Typical load torque characteristics -Selection of Motor power rating – Thermal model of motor for heating and cooling - Types of duty - Acceleration, deceleration, starting and stopping.

CONVERTER / CHOPPER FED DC MOTOR DRIVE **9**

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive: Continuous and discontinuous conduction mode - Chopper fed D.C drive: Time ratio control and current limit control - Operation of four quadrant converter/chopper fed drive – Closed loop control.

INDUCTION MOTOR DRIVES **9**

Stator side control: Stator voltage control - Adjustable frequency drives: v/f control, constant slip-speed control and constant air-gap flux control – Basics of voltage/current fed inverters - Block diagram of closed loop drive.

Rotor side control: Rotor resistance control and slip power recovery scheme - Static control of rotor resistance using DC chopper - Block diagram of closed loop drive – Vector control.

SYNCHRONOUS MOTOR DRIVES **9**

Open loop volts/hertz control and self-control of synchronous motor: Marginal angle control and power factor control - Permanent magnet synchronous motor Block diagram of closed loop control.

DESIGN OF CONTROLLERS FOR DRIVES **9**

Transfer function for dc motor, load and converter – Closed loop control with current and speed feedback - Armature voltage control and field weakening mode control - Design of controllers: Current controller and speed controller - Converter selection and characteristics.

Total Periods 45

Text Book

1. Gopal K.Dubey, 'Fundamentals of Electrical Drives', 2nd Edition, Narosa Publishing House, 2012.
2. Bimal K.Bose. 'Modern Power Electronics and AC Drives', PHI Learning, 2005.

References

1. S.K.Pillai, 'A First course on Electrical Drives', 3rd Edition, New Age International, 2012.
2. Murphy J.M.D and Turnbull, 'Power Electronic Control of AC Motors', Pergamon Press, Oxford 1988.
3. Gopal K.Dubey, 'Power semiconductor controlled drives', Prentice Hall Inc., New Jersey, 1989.
4. R.Krishnan, 'Electric Motor & Drives: Modeling, Analysis and Control', 1st Edition, PHI, 2009.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2										2	3	1	2
CO2	3	2	2		2	3	2				2	2	2	3	2	2
CO3	3	2	2		2	1	2				1	2	3	3	2	2
CO4	3	2	2		2	1	2				1	2	2	3	2	2
CO5	3	2	2		2	1	2				1	2	2	3	2	2
CO6	3	2	2		2	1	2				1	2	3	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE63 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS **L-T-P C**

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: VI Category: PC**

AIM: To learn the architecture, programming, interfacing and rudiments of system design of microprocessors and microcontrollers.

Course Outcomes:

The Students will be able to

CO1. Identify the basic elements and functions of contemporary microprocessors and microcontrollers

CO2. Discuss microprocessor or microcontroller based systems to peripheral devices and systems at the chip level.

CO3. Apply peripheral devices and circuits to microprocessors and microcontrollers.

CO4. Discuss the architecture and software aspects of microprocessor 8086.

CO5. Develop skills in simple applications with programming using microprocessor

CO6. Illustrate standard architecture and peripheral subsystem of PIC 16F877 and 8051

8085 MICROPROCESSOR **9**

Hardware Architecture- pinouts - Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure -addressing modes – instruction set ,programming and its applications

PERIPHERALS INTERFACING **9**

Programmable Peripheral Interface (PPI 8255) –Programmable Interval Timer (PIT 8253) – 8259 Programmable Interrupt Controller – keyboard & display controller (8279) - Interfacing serial I /O (8251)- Direct Memory Access (8237) - ADC/DAC interfacing.

8086 MICROPROCESSOR **9**

Hardware Architecture- pin diagram– Memory interfacing –Interrupt structure -addressing modes – instruction set -simple programming of 8086 and its applications

APPLICATIONS OF MICROPROCESSOR **9**

Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature controller, Stepper motor controller, traffic light controller.

MICROCONTROLLERS **9**

8051 Architecture- Instruction set - Addressing modes - Assembly language programming- Special function Registers - Introduction to PIC Microcontrollers 16F877 -PIC development tools-CPU Architecture and Instruction set-Hardware architecture and pipelining-program memory consideration-Register file structure

Total Periods 45

Text Books

1. Doughlas V.Hall, 'Microprocessors and Interfacing, Programming and Hardware', TMH, 2012.
2. R.S.Gaonkar, 'Microprocessor Architecture Programming and Application', 5th Edition, CBS Publishers, 2011.
3. Krishna Kant, 'Microprocessors and microcontrollers Architecture, Programming and System design 8085, 8086, 8051, 8096', PHI-Third Printing-2010.

References

1. John .B.Peatman , 'Design with PIC Microcontroller', Prentice Hall, 1997
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, 'The 8051 Microcontroller and Embedded Systems: Using Assembly and C', Second Edition, Pearson education, 2011.
3. KrishnaKant, 'Microprocessor & Microcontrollers', Eastern Company Edition, Prentice Hall Of

India, Delhi, 2010.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2					1					1	3	2	2	3
CO2	3	2	2		2		1				2	1	3	2	2	3
CO3	2	2	2		2		1				1	1	3	2	2	3
CO4	3	2			2		1				2	1	3	2	2	3
CO5	3	2	2		2		1				2	1	3	2	2	3
CO6	3	2			2		1				2	1	3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161HS61 ENGINEERING ECONOMICS AND MANAGEMENT L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: VII Category: HS**

AIM: To impart knowledge about basics of economics and cost analysis related to engineering so as to take economically sound decisions

Course Outcomes:

The Students will be able to

CO1. Explain about the fundamentals of economic concepts.
CO2. Describe the concept of theory of production and Human resource management.
CO3. Demonstrate the Management Principles, functions of management & organizational structures.
CO4. Solve inflation and different types of replacement problems.
CO5. Prepare internal rate of return, payback period, net present value and cost benefit analysis.
CO6. Prepare feasibility reports and break-even analysis.

FUNDAMENTALS OF ECONOMICS 9

Concept and scope of engineering economics - basic concepts of goods, utility, value and wealth - relation between economic decision and technical decision - Law of demand & supply – factors influencing demand - elasticity of demand – demand forecasting - Basic economic problems - causes, types and measures to control Poverty, Un employment and Inflation.

THEORY OF PRODUCTION 9

Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur) - Law of variable proportions & law of returns to scale - Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection - Corporate Social Responsibility; meaning, importance - Business Ethics; meaning, importance.

FUNCTIONS OF MANAGEMENT 9

Introduction to Management & administration, skill, types and roles of managers – Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory – Functions of Management – Planning, Organizing, Staffing, Directing, Controlling – Organizational Structures; meaning, principles of organization, types (explanation with merits and demerits), span of control, departmentalization.

DEPRECIATION AND REPLACEMENT ANALYSIS 9

Depreciation – various methods of depreciations – inflation adjusted decisions – procedure to adjust inflation – Types of maintenance – types of replacement problem - determination of economic life of an asset – replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender.

COST ANALYSIS 9

Types of costing – traditional costing approach – activity base costing – cost output relationship in the short run and in long run – types of pricing and its practice – appraising project profitability – internal rate of return – payback period – net present value – cost benefit analysis –feasibility reports- break even analysis - managerial uses of break even analysis.

Total Periods 45

Text Books

1. Dewett K.K. &Varma J.D., 'Elementary Economic Theory', S Chand & Co., 2006.
2. Suma Damodaran, 'Managerial economics', Oxford University press 2006.

References

1. Sharma,K.K , 'Principle of Economics', Abishek publications,2002.
2. PanneerSelvam, R, 'Engineering Economics', Prentice Hall of India Ltd, New Delhi, 2001.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			3						2		1	1				1
CO2			2						2		2					3
CO3			1						2		3					1
CO4			2						3		2					1
CO5			1						2		3	1				1
CO6			2								2					1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE67 INDUSTRIAL DRIVES AND CONTROL LABORATORY L-T-P C
0-0-4 2

Programme: B.E. Electrical and Electronics Engineering **Sem: VI Category: PC**

AIM: To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

Course Outcomes:

The Students will be able to

CO1. Design the fully controlled converter with R & RL load using MOSFET.

CO2. Design the open loop & closed loop control of converter fed dc motor drive.

CO3. Design the open loop & closed loop control of chopper fed dc motor drive.

CO4. Simulate the VSI fed AC drives.

CO5. Simulate the Open loop and Closed loop converter/ chopper fed DC motor drive.

CO6. Design a controller for Stepper motor.

LIST OF EXPERIMENTS

1. Simulation of single phase fully controlled converter with R & RL load.
2. Simulation of three phase fully controlled converter with R & RL load.
3. Simulation of open loop control of converter fed dc motor drive.
4. Simulation of closed loop control of converter fed dc motor drive.
5. Simulation of open loop control of chopper fed dc motor drive.
6. Simulation of closed loop control of chopper fed dc motor drive.
7. Simulation of VSI fed 3φ induction motor drive.
8. Simulation of VSI fed 3φ synchronous motor drive.
9. Microcontroller based Speed control of chopper fed DC motor.
10. Speed control of converter fed DC drive using microcontroller.
11. Speed control of Stepper motor.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		2	3					2		1	1	3	3	1	2
CO2	3		2	3					2			1	3	2	1	2
CO3	3		2	3					2			2	2	3	1	2
CO4	3		2	3					2		1	2	3	3	1	2
CO5	3		2	3					2			2	3	2	1	2
CO6	3		2	3					2		1	2	3	3	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE68 **ADVANCED MICROPROCESSOR AND MICROCONTROLLER LABORATORY** **L-T-P** **C**

0-0-4 **2**

Programme: B.E. Electrical And Electronics Engineering **Sem: VI** **Category: PC**

AIM: To Learn The Architecture, Programming, Interfacing And Rudiments Of System Design Of Microprocessors And Microcontrollers.

Course Outcomes:

The Student will be able to

CO1. Apply the Fundamentals of Assembly Level Programming of Microprocessors and Microcontroller.

CO2. Familiarize with the assembly level programming in different processors.

CO3. Interface Various Peripherals Using Microprocessors And Microcontrollers.

CO4. Troubleshoot Interactions between Software And Hardware.

CO5. Design a Simple Application Using Advanced Microprocessors.

CO6. Develop Skills in Simple Applications Development With Programming Using Microprocessor

LIST OF EXPERIMENTS

1. Basic Arithmetic and Logic Operations Using 8085 And 8086
2. Programs for Sorting and Searching Using 8085 And 8086
3. Interfacing and Programming of Interrupt Controller
4. Interfacing ADC and DAC with 8085.
5. Interfacing and Programming of Traffic Light Controller and Digital Clock Using Timer.
6. Interfacing, Programming of Stepper Motor & DC Motor Speed Control.
7. Microcontroller 8051- Sample Programs Through IDE Using KEIL Software
8. Read The Key and Display the Key Via Ports Using PIC Microcontroller
9. LED and LCD Interface Using PIC Microcontroller.
10. Simple Application Design Using Arduino Board.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	2				1	1			3	2	2	3
CO2	3	1	2	2	2				1	1			2	2	1	3
CO3		1	2	2	2				1	1	1	1	3	2	1	3
CO4	3	1		2	2				1	1	1	1	3	1	2	3
CO5	3	1		2	2				1	1	1	1	3	2	2	3
CO6	3	1		2	2				1	1			3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE69 **MINI PROJECT** **L-T-P** **C**

0-0-2 **1**

Programme: B.E. Electrical And Electronics Engineering **Sem VI Category: EEC**

AIM: To develop a simplified electrical and electronic model suitable for any application

The students will be able to

CO1. Identify suitable problem in electrical and electronic circuits

CO2. Apply the knowledge of fundamental engineering

CO3. Design and Develop a suitable solution for the problem

CO4. Enhance the technical and non-technical Knowledge

CO5. Optimize the performance cost

CO6. Prepare documentation of observed results and maintain team work

Total Periods 18

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2		3	2	1	2	2	3	3	2	1	3
CO2	3	1	2	2	2	1	2	2	1	1	2	1	3	2	2	3
CO3	3	1	2	2	2	1	2	1	1	1	1	1	2	2	2	3
CO4	3	1		2	2				1	1			3	1	1	3
CO5	3	1		2	2				1	1			3	2	2	3
CO6	3	1		2	2				2	2			3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161HS69 **CAREER ENGLISH II** **L-T-P** **C**

0-0-2 **0**

Programme: Common to all Branches **Sem VI Category: EEC**

AIM: To practice English for Enhancing Employability skills.

Course Outcomes:

At the end of the Course students will be able to,

CO1. To enlarge the students' aptitude and reasoning skills

CO2. To acquire knowledge about the various principles of communication, understand its various stages and the role of audience and purpose, deal with the barriers that affect communication in a professional set up.

CO3. To practice English for Enhancing Employability skills

CO4. To develop students job prospects through oral communication.

CO5. To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures.

CO6. Endure with the barriers that affect communication in a professional set up

UNIT I **6**

Verbal analogy, verbal reasoning, error spotting, sentence completion.

6

UNIT II

Why is GD part of selection process? - Structure of GD – Moderator - Strategies in GD – Team work - Body Language - Mock GD -Video samples

UNIT III **6**

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

1. Resume / Report Preparation /
2. Presentation Skills: Students make presentations on given topics.
3. Group Discussion: Students participate in group discussions.
4. Interview Skills: Students participate in Mock Interviews.

Total Periods **18**

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1												3				3
CO2									2	3		3				3
CO3									3	3		3				3
CO4									3	3		3				3
CO5									3	3		3				3
CO6							2									3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER-VII

161EE71 POWER SYSTEM OPERATION AND CONTROL L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: VII Category: PC**

AIM: To understand the day to day operation of power system and the control actions to be implemented on the system to meet the minute-to-minute variation of system load demand.

Course Outcomes:

The Students will be able to

CO1. Illustrate the various system load characteristics and importance of load forecasting.

CO2. Estimate Maximum demand, Demand Factor, Load factor and load curve of the Generation station.

CO3. Analyze the load frequency control of a Single and Two Area system.

CO4. Express the concepts of Automatic Voltage Regulator, Unit Commitment and Economic Dispatch problems.

CO5. Evaluate static and dynamic systems and their modeling of typical excitation system.

CO6. Explicate the system hardware configuration of SCADA and EMS functions.

INTRODUCTION 9

System load – variation - load characteristics - load curves and load-duration curve (daily, weekly and annual) - load factor - diversity factor. Importance of load forecasting and simple techniques of forecasting. An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).

REAL POWER - FREQUENCY CONTROL 9

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

REACTIVE POWER–VOLTAGE CONTROL 9

Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control - tap-changing transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Statement of economic dispatch problem – cost of generation – incremental cost curve co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients). Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods - forward dynamic programming approach. Numerical problems only in priority-list method using full-load average production cost.

COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems. Concept of energy control centre (or) load dispatch

centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology - state estimation - security analysis and control. Various operating states (Normal, alert, emergency, in-extremis and restorative). State transition diagram showing various state transitions and control strategies.

Total Periods 45

Text Books

1. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', 3rd Edition, John Wiley & Sons, Inc., 2013.
2. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Fourth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.

References

1. Chakrabarti & Halder, 'Power System Analysis: Operation and Control', 3rd Edition, Hall of India, 2010.
2. Hadi Saadat, 'Power System Analysis', 3rd Edition 2011.
3. P. Kundur, 'Power System Stability and Control', MC Craw Hill Publisher, USA, 2012.
4. Olle I. Elgerd, 'Electric Energy Systems theory - An Introduction', Tata McGraw Hill Publishing Company Ltd. New Delhi, 2nd Edition 2003.
5. 5. T.J.E. Miller, 'Reactive Power Control in Electric power systems', John Wiley and sons, 2010.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2		3	3					2	3	2	3	3
CO2	3	3	2	2		3	2					2	3	1	3	2
CO3	3	3	2	2	2	1	2					2	3	1	3	3
CO4	2	3	2	2		1				2		2	3	1	3	2
CO5	3	3	2	2			1				1	1	3	1	3	2
CO6	2	3	2	2	2	2				2	1	2	3	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE72 DESIGN OF ELECTRICAL MACHINES L-T-P C
3-1-0 4

Programme: B.E. Electrical and Electronics Engineering **Sem: VII Category: PC**

AIM: To enable the students gain fair knowledge on design of magnetic circuits and electrical machines

Course Outcomes:

The Students will be able to

CO1. Identify specific electrical and magnetic loadings for machines.

CO2. Evaluate the electrical engineering materials and its ratings.

CO3. Construct the various design procedure involves in an armature and field systems of D.C. machines.

CO4. Illustrate the overall dimensions and operating characteristics of transformers and its cooling methods.

CO5. Analyze the stator, rotor of cage machine and wound rotor machine.

CO6. Design the armature and field systems of salient pole machine and turbo alternators.

INTRODUCTION 12

Major considerations in Electrical Machine Design - Electrical Engineering Materials – design limitations and specifications-Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal considerations - Heat flow – Temperature rise.

DC MACHINES 12

Output Equations – Main Dimensions – choice of specific loadings- Magnetic circuit calculations – Gap contraction factor - Net length of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

TRANSFORMERS 12

Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank with cooling tubes - Methods of cooling of Transformers.

INDUCTION MOTORS 12

Output equation for Induction motor – Main dimensions – choice of specific loadings-Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Stator design-Design of rotor bars & slots – Design of end rings – Design of wound rotor.

SYNCHRONOUS MACHINES 12

Output equations – Run away speed-choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

Total Periods 60

Text books

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 2013.

2. Say.M.G, 'The Performance and Design of Alternating current Machines', Isaac Pitman & sons Ltd., 2005.

References

1. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.
2. A.Shanmugasundaram, G.Gangadharan, R.Palani, 'Electrical Machine Design Data Book', New Age Intenational Pvt. Ltd., Reprint 2015.
3. Balbir Singh, 'Electrical Machine Design', Vikas Publishing House, 1982.
4. M.Ramesh,M.Sheela Sankari, 'Design of Electrical Machines', Lakshmi Publications,2016

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	1	1					1	3	3	1	2
CO2	3	3	2	2		1						1	2	2	1	2
CO3	3	3	3	2	2		1				2	1	3	3	1	2
CO4	3	3	3	2	2		1				2	1	3	3		3
CO5	3	3	3	2	2		1				2	1	3	3		2
CO6	3	3	3	2	2		1				2	1	3	3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE73 **WIRING, ESTIMATION AND COSTING** **L-T-P C**

3-0-2 4

Programme: B.E.- Electrical and Electronics Engineering **Sem: VII Category: PC**

AIM: To impart knowledge on Electrical supply systems and its protection equipments, Different wiring methods and Estimation for electrical wiring.

Course Outcomes:

The Students will be able to

CO1. Address Electrical supply systems and its protection equipments
CO2. Differentiate various wiring systems
CO3. Design a simple wiring system for domestic application
CO4. Identify the elements for performing estimation and costing
CO5. Estimate the load requirements and type of supply requirement
CO6. Evaluate the material and labor requirement

INTRODUCTION **9**

Electrical supply system-Three-phase four wire distribution system-Types of domestic loads-Protection against Electric shock-Earthing- Domestic Wiring Protection equipments: Fuse-Miniature Circuit Breaker – Residual Current Circuit Breaker or Earth Leakage Circuit Breaker-General requirements of Electrical Installations.

TYPES AND INSTALLATION OF WIRING SYSTEMS **9**

Types of wires, Factors influencing the choice of wiring system, Types of wiring system, Conduit Wiring System, Accessories, Advantages and Disadvantages of Conduit Wiring Systems, IE rules, 1956: rules 50, 56, 57, 58, 60,61 – Internal wiring systems – Looping-in system – Ring system – tree system - Position of switches, cutouts, main switch board, sub-distribution boards.

DESIGN OF SIMPLE ELECTRICAL CIRCUIT **9**

System of Connection of Appliances and accessories-Schematic diagram and Wiring diagram of Light and Fan circuits-Wiring diagram of a single tube light controlled by a switch-Alarm circuits without relays-Alarm circuits with relays.

ELEMENTS OF ESTIMATION **9**

Introduction -Purpose of Estimating and Costing-Qualities of a good Estimator-Essential Elements of Estimating and Costing-Tender-Guidelines for Inviting Tenders-Quotation-Other Important Factors of Estimating and Costing.

DOMESTIC ELECTRICAL INSTALLATION AND ESTIMATES **9**

Estimation of load requirements-Estimation of connected load, Maximum demand, and type of supply required for a domestic building and related problem- Determination of size of distribution boards – Different types of commonly available distribution boards-Estimation of Accessories required, wiring materials and labour requirement for a domestic building and related problem-Pre-commissioning tests for domestic wiring Installation: Visual Inspection, Testing- Special features applicable for High-Rise apartment buildings.

Total Periods 45

Text Book

1. Uppal S.L, 'Electrical Wiring - Estimating and Costing', Khanna Publishers, 6th Edition, 2011.
2. J.B. Gupta, 'A Course in Electrical Installation Estimating and Costing', S. K. Kataria & Sons, 9th Edition, 2013.

References

1. Giridharan M.K., 'Electrical Systems Design', I.K. International Publishing House, New Delhi, 2nd edition, 2011.5
2. Raina K.B., Bhattacharya S.K., 'Electrical Design Estimating and Costing', New Age International Pvt. Ltd., Publishers, 2010.

LIST OF EXPERIMENTS

1. Introduction AutoCAD Electrical
2. Workflow in Auto CAD
3. Representation of Electrical Components
4. Illustration of wires and Type of connections
5. Introduction of Panel Layouts
6. Perform Electrical Audit
7. Develop simple wiring for Domestic and Industrial applications

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2			2						3	2	1	3	2
CO2	3	2	2			2						3	2	2	3	2
CO3	3	2	3			2	2	2				3	3	1	3	2
CO4	3	2	2			2	2	2				3	2	1	3	2
CO5	3	2	2			2	2					3	3	2	3	2
CO6	3	2	2			1						2	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE74 ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION **L-T-P C**

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem: VII Category: PC**

AIM: To expose students to the main aspects of electric energy, utilization and conservation.

Course Outcomes:

The Students will be able to

CO1. Sketch the construction and explain about the various types of conventional, non – conventional Power plants.

CO2. Represent the Economics of generation systems and capacitors for improving power factor.

CO3. Analyze illumination calculation and also evaluate about various types of lamps.

CO4. Illustrate the construction for various methods of electric heating and welding.

CO5. Discuss about the characteristics of welding generator and transformer.

CO6. Identify the requirements for traction system and the recent trends in electrical traction.

POWER GENERATION **9**

Review of conventional methods – thermal, hydro and nuclear based power generation. Non conventional methods of power generation – fuel cells - tidal waves – Geothermal - municipal waste – wind – geothermal – solar - bio-mass. Effect of distributed generation on power system operation.

ECONOMIC ASPECTS OF GENERATION **9**

Economic aspects of power generation – load and load duration curves – number and size of units – cost of electrical energy – tariff. Economics of power factor improvement – power capacitors – power quality. Importance of electrical energy conservation – methods – energy efficient equipment. Introduction to energy auditing.

ILLUMINATION **9**

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, and sports ground - energy efficiency lamps.

INDUSTRIAL HEATING AND WELDING **9**

Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – resistance welding – electric arc welding - welding generator, welding transformer and the characteristics.

ELECTRIC TRACTION **9**

Merits of electric traction – requirements of electric traction system – supply systems – train movement - mechanism of train movement – traction motors and control – braking – recent trends in electric traction.

Total Periods 45

Text Books

1. C.L. Wadhwa, ‘Generation, Distribution and Utilization of Electrical Energy’, (Third Edition) New Age International Pvt. Ltd, 2012.
2. B.R.Gupta, ‘Generation of Electrical Energy’, Eurasia Publishing House (p) Ltd, New Delhi, 6th edition, 2008.

References

1. H. Partab, ‘Art and Science of Utilization of Electrical Energy’, Dhanpat Rai and Co, New Delhi, 2004.
2. E. Openshaw Taylor, ‘Utilization of Electrical Energy in SI Units’, Orient Longman Pvt. Ltd, 2006.

3. J.B. Gupta, 'Utilization of Electric Power and Electric Traction', S.K.Kataria and sons, 2002.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2			3	2						2	2	3	2
CO2	3	3	2	2		2	2					1	2	2	3	2
CO3	3	3	3	2		2	2		1			2	3	2	3	2
CO4	3	3	3	2		2	2					3	2	2	3	2
CO5	3	3	3			2	2					1	3	2	3	2
CO6	3	3	3	1		2	2	1				1	3	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE77 POWER SYSTEM SIMULATION LABORATORY L-T-P C

0-0-4 2

Programme: B.E. Electrical And Electronics Engineering **Sem: VII Category: PC**

AIM: To acquire software development skills and experience in the usage of standard packages necessary for analysis and simulation of power system required for its planning, operation and control.

Course Outcomes:

The Students will be able to

CO1. Analyze the computation parameters and modeling of transmission lines

CO2. Develop the building algorithm for formation of bus admittance and impedance matrices.

CO3. Recognize the algorithm and flowchart to solve load flow analysis problems using G-S, N-R, and F-D method.

CO4. Simulate the MATLAB program to solve transient stability analysis for single and multi-machine infinite bus system.

CO5. Solve electromagnetic transient problems and economic dispatch problem in power systems.

CO6. Demonstrate the Load frequency control problem using single area and two area power systems.

LIST OF EXPERIMENTS

1. Computation of Parameters and Modeling of Transmission Lines.
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis - I: Solution of Load Flow And Related Problems Using Gauss-Seidel Method.
4. Load Flow Analysis - II: Solution of Load Flow and Related Problems Using Newton Raphson method.
5. Load Flow Analysis - II: Fast-Decoupled Method.
6. Fault Analysis.
7. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
8. Transient Stability Analysis of Multimachine Power Systems.
9. Electromagnetic Transients in Power Systems.
10. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems.
11. Economic Dispatch in Power Systems.

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3		2	1			1		3	2	3	1	3	1
CO2	3	3	3		2	2			1		2		2		3	3
CO3	3	3	3		1	1			2		3	1	2		3	3
CO4	3	3	3		3	3			2		2		3	1	3	3
CO5	3	3	3		3	2			2		2	2	3	2	3	2
CO6	3	3	3		2	2			1		1		2	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EE78 COMPREHENSION LABORATORY L-T-P C

0-0-4 2

Programme: B.E. Electrical and Electronics Engineering **Sem: VII Category: PC**

AIM: To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

Course Outcomes:

The student will able to

CO1. Enhance the technical and non-technical Knowledge

CO2. Interpret the pictorial description into a speech and apply correct form of language while speaking

CO3. Enrich their soft skills

CO4. Experience online technical examinations for relevant electrical and soft skill courses

CO5. Analyze, design and solve tutorial problems on electrical and electronic circuits

CO6. Review, prepare and present technological developments

Total Periods 48

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		1	2	2					2		2	3	3	3	3
CO2	3		1	2	1					2		2	3	2	2	1
CO3	3		1	2	1					2		2	3	2	2	3
CO4	3		1	2	2				2	2	1	1	3	3	2	2
CO5	2	3	2	1	1		2			1	2	2	1	1	1	1
CO6	2	3	2	1	2		3		3	2	2	3	3	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER VIII

161EE87 **PROJECT WORK** **L-T-P** **C**

0-0-12 **6**

Programme: B.E. Electrical And Electronics Engineering **Sem: VIII Category: EEC**

AIM: To prove the personal abilities and the skill to develop, produce and present an extended piece of work.

Course Outcomes:

The Student will be able to

CO1. Identify and describe the problem and scope of project clearly.

CO2. Collect, analyze and present data into meaningful information using relevant tools

CO3. Select, plan and execute a proper methodology in problem solving

CO4. Work independently and ethically

CO5. Present the results in written and oral format effectively

CO6. Identify basic entrepreneurship skills in project management

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2		3	2	1	2	2	3	3	2	1	3
CO2	3	1	2	2	2	1	2	2	1	1	2	1	3	2	2	3
CO3	3	1	2	2	2	1	2	1	1	1	1	1	2	2	2	3
CO4	3	1		2	2				1	1			3	1	1	3
CO5	3	1		2	2				1	1			3	2	2	3
CO6	3	1		2	2				2	2			3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

PROGRAM ELECTIVES (PE)

161EEE01	POWER QUALITY	L-T-P	C
		3-0-0	3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To study the various issues affecting power quality, their production, monitoring and suppression.

Course Outcomes:

The Students will be able to

CO1. Describe the various power quality issues in power systems and methods of suppression.

CO2. Analyze the sources of sags and interruptions in power system.

CO3. Recognize the severity of sag and mitigation of voltage sags in transmission line.

CO4. Categorize the sources of over voltages and mitigation methods of voltage swells in transmission line.

CO5. Demonstrate the computer analysis tools for transients using PSCAD and EMTP softwares.

CO6. Select the suitable type of filters for reducing the harmonics in transmission line.

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.

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 sags due to induction motor starting - Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

OVERVOLTAGES **9**

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding – line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

HARMONICS **9**

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

POWER QUALITY MONITORING **9**

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters – disturbance analyzer. Applications of expert systems for power quality monitoring.

Total Periods **45**

Text Books

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality', 3rd Edition, McGraw Hill, 2012.
2. G.T. Heydt, 'Electric Power Quality', 2nd Edition. West Lafayette, IN, Stars in Circle Publications,

1994.

References

2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', New York: IEEE Press, 2000.
3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', New York: Wiley, 2000.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2					3				1	2	1	1	3	1
CO2	3	2					1				1	2	2		3	2
CO3	3	2	1		1		1				1	2	2		3	2
CO4	3	2	1		1		1				1	2	2		3	1
CO5	3	2	1	2	3		1				2	2	3	1	3	3
CO6	3	2	1		2						2	2	2		3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE02 HIGH VOLTAGE TRANSMISSION SYSTEMS L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM:

i. To understand the concept, planning of DC power transmission and comparison with AC power transmission.
ii. To analyze HVDC converters.
iii. To study about circuit breaker and surges.
iv. To understand the concept of compensation in AC transmission systems.
v. To impart knowledge about HVDC systems and EHV-AC system.

Course Outcomes:

The Students will be able to

CO1. Recognize the historical development of transmission system and analyse the various kinds of DC links.
CO2. Analyze the converters with their gate controlling characteristics.
CO3. Impart Knowledge on basic protection techniques of HVDC systems.
CO4. Represent the transmission voltages, power handling capacity and line losses in transmission line.
CO5. Illustrate the various types of over voltages and calculation of switching surges.
CO6. Originate the voltage controller using synchronous condenser both shunt and series.

INTRODUCTION TO HVDC SYSTEMS AND EHV-AC SYSTEM 9

Introduction - Historical development - Comparison between AC and DC transmission - kinds of DC links.

ANALYSIS OF CONVERTERS 9

Three phase fully controlled thyristor bridge converters - Equivalent circuits - Characteristics of Converters- Gate control - Basic means of control characteristics - Constant current control - Constant extinction angle control - Harmonic analysis - Filters.

TRANSMISSION LINE PARAMETERS 9

Basis of protection of HVDC systems - DC reactors - voltage and current oscillations - Clearing line faults and re-energizing the line - Over voltage protection. Introduction of HVAC transmission - Transmission voltages - average values of line parameters – Power handling capacity and line loss - Costs of transmission lines and equipments - Mechanical considerations in line performance.

CIRCUIT BREAKER AND SURGES 9

Origin of over voltages and their types - Short circuit current and circuit breaker - Recovery voltage – Ferro resonance over voltages - Calculation of switching surges - Single phase equivalents – Generalized equations for single phase and three phase representations.

FLEXIBLE AC TRANSMISSION 9

Problem at power frequency - Generalized constants - No load voltage conditions and charging current -Power circle diagram and its use - Voltage control using synchronous condenser - Shunt and series compensation - Sub synchronous resonance in series capacitor compensated lines - Flexible AC transmission.

Total Periods 45

Text Books

1. K.R.Padiyar, ‘HVDC Power Transmission System Technology and System Interactions’, Wiley Eastern Ltd., 2005.
2. Das Begamudre, ‘Extra High voltage AC Transmission’, Rakosh Wiley eastern Ltd., New Delhi, 2009.

References

1. Colin Adamson, and N.G.Hingorani, 'High Voltage Direct Current Power Transmission', Garraway Limited, England, 1960.
2. E.W.Kimbark, 'Direct Current Transmission', Vol. I, Wiley Interscience, New York, 1971.
3. B.J.Kory (ed), 'High Voltage Direct Current converters and Systems', Macdonald & co., London, 2015.
4. B.M. Weedy, 'Electric Power Systems', John Wiley & Sons, London,4th edition, 2009.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3												1	2	3	2
CO2	3	2			1						2	1	1	1	2	2
CO3	3	1			1	2					1	1	1	2	3	2
CO4	3	1				2							1		2	1
CO5	3	1	2			2						1	1		3	1
CO6	3	1			1		1						1	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE03 FLEXIBLE AC TRANSMISSION SYSTEMS L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To provide a knowledge of application of power electronics in the efficient design and operation of power systems.

Course Outcomes:

The Students will be able to

CO1. Express the basic concepts of flexible AC transmission systems and fundamental idea about the FACTS controllers.

CO2. Realize the influence of SVC on system voltage.

CO3. Recognize the different modes of operation and modeling of TCSC.

CO4. Illustrate the SVC & TCSC applications.

CO5. Demonstrate the operation of Static Synchronous Compensator (STATCOM) modes of operation and modeling of UPFC for power flow studies.

CO6. Illustrate Controller interactions & its type. Realize the co-ordination of multiple controllers

INTRODUCTION 9

Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of static Var Compensator (SVC) – Thyristor Switched Series capacitor (TCSC) – Unified power flow controller (UPFC).

STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of SVC for power flow and transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping – Prevention of voltage instability.

THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping-SSR Mitigation.

VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-Enhancement of transient stability - Prevention of voltage instability. SSSC-operation of SSSC and the control of power flow –Modeling of SSSC in load flow and transient stability studies. Applications: SSR Mitigation-UPFC and IPFC

CO-ORDINATION OF FACTS CONTROLLERS 9

Controller interactions – SVC – SVC interaction, TCSC - TCSC interaction, Co-ordination of multiple controllers using linear control techniques – Control coordination.

Total Periods 45

Text Books

1. R.Mohan Mathur, Rajiv K.Varma, 'Thyristor – Based Facts Controllers for Electrical Transmission Systems', IEEE press and John Wiley & Sons, Inc, 2011.
2. Narain G. Hingorani, 'Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems', Standard Publishers Distributors, Delhi, 2011.

References

1. K.R.Padiyar, 'FACTS Controllers in Power Transmission and Distribution', New Age International (P) Limited, Publishers, New Delhi, 2016.
2. A.T.John, 'Flexible A.C. Transmission Systems', Institution of Electrical and Electronic Engineers (IEEE), 1999.
3. Enrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez, César Angeles-Camacho,

'FACTS: Modeling and Simulation in Power Networks', Wiley 2004.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2		1		2				1	1	2	2	3	1
CO2	2	3	2		1		2				2	2	2		3	2
CO3	3	2	3		1		2					1	1	1	3	2
CO4	3	2	2		2		1				2	1	2	1	3	2
CO5	3	2	2				2				2	2	1		3	2
CO6	3	2	3		2		2				2	1	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE04 RENEWABLE ENERGY SOURCES L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To instruct the importance of renewable energy and its utilization for the thermal and electrical energy needs and also the environmental aspects of these resources.

Course Outcomes:

The Students will be able to

CO1. Utilize the solar energy for various applications.

CO2. Evaluate wind velocity, wind energy storage and their applications.

CO3. Justify the need for bio energy, biomass, biogas, source composition and technology for utilization.

CO4. Analyze the various types' energy resources.

CO5. Highlight the importance of energy storage, transport and utilization of energy.

CO6. Summarize other possible renewable energy sources.

SOLAR ENERGY **9**

Solar Radiation – Measurements of solar Radiation and sunshine – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion– solar Cells – PV Systems – PV Applications.

WIND ENERGY **9**

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

BIO – ENERGY **9**

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics.

OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY **9**

Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues.

OTHER ENERGY SOURCES **9**

Hydrogen, generation, storage, transport and utilization, Applications: power generation, transport – Fuel cells – technologies, types – economics and the power generation.

Total Periods 45

Text book

1. G.D. Rai, 'Non Conventional Energy Sources', Khanna Publishers, New Delhi, 2006.
2. S.P. Sukhatme, 'Solar Energy', Tata McGraw Hill Publishing Company Ltd., New Delhi, 2008.

Reference

1. Godfrey Boyle, 'Renewable Energy', Power for a Sustainable Future, Oxford University Press,U.K., 2012.
2. Twidell, J.W. & Weir, A., 'Renewable Energy Sources', EFN Spon Ltd., UK, 3rd edition, 2015.
3. G.N. Tiwari, 'Solar Energy – Fundamentals Design, Modelling and applications', Narosa Publishing House, New Delhi, 2012.
4. L.L. Freris, 'Wind Energy Conversion systems', Prentice Hall, UK, 1990.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3				1				2	2	1	2	1	1
CO2	1	1	3	2			1				1	1	1	2	2	1
CO3	2	1	3	1			1					2	1	1	2	1
CO4	1	3	2	1			2				1	2	1	1	2	3
CO5	3	2	1				2						1	2	2	1
CO6	2	3	1				2						1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE05 SPECIAL ELECTRICAL MACHINES & CONTROLLERS L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category: PE**

AIM: To explore the theory and applications of special electrical machines and its controllers

Course Outcomes:

The Students will be able to

CO1. Describe the construction and principle of operation of stepper motors.

CO2. Apply the driver system to stepper motors

CO3. Express the various controllers of switched reluctance motors.

CO4. Illustrate the construction, principle of operation, control and performance of permanent magnet brushless D.C. motors

CO5. Analyze the construction, principle of operation and control of permanent magnet synchronous motors.

CO6. Explain the characteristics of Hysteresis, Servo and Linear Motors.

STEPPER MOTORS 9

Types - Constructional features – principle of operation – variable reluctance motor – single and Multi-stack configurations – Permanent Magnet Stepper motor – Hybrid stepper motor. Different modes of Excitation - theory of torque predictions – Drive systems and circuit for open-loop and closed-loop control of stepper motor

SWITCHED RELUCTANCE MOTORS 9

Constructional features – principle of operation –Torque Equation - Power Converters for SR Motor – Rotor Sensing Mechanism & Logic Controller – Sensorless Control of SR motor – Applications.

PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control – Applications

PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power Controllers, Torque speed characteristics, Self control, Vector control, Current control Schemes – Applications.

OTHER SPECIAL MACHINES 9

Principle of operation and characteristics of Hysteresis motor – servo motor – Linear motor – Applications.

Total Periods 45

Text Books

1. E.W.Kimbark, 'Direct Current Transmission', Vol. I, Wiley Interscience, New York, 1971.
2. Miller T J E, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford New Delhi, 1989.

References

1. Naser A and Boldea L, 'Linear Electric Motors: Theory Design and Practical Applications', Prentice Hall Inc., New Jersey 1987.
2. Kenjo T, 'Stepping Motors and their Microprocessor Controls', Clarendon Press London, 2003.
3. Kenjo, T and Naganori, S, 'Permanent Magnet and brushless DC motors', Clarendon Press, Oxford, New Delhi, 1989.

4. Floyd E Saner, 'Servomotor Applications', Pittman, London, 1993.
5. William H Yeadon, Alan W Yeadon, 'Handbook of Small Electric Motors', McGraw-Hill, New Delhi, 2001.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2								1	1	2	3	1	1
CO2	3	2	3		1						2	2	2	3	2	3
CO3	3	2	3		1						2	1	2	3		3
CO4	3	2	2		2						1	2	2	3	1	3
CO5	3	2	2		1						1	1	1	3		2
CO6	3	2	1		1						1	1	2	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE07 SMART GRID DESIGN AND ANALYSIS L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM:

1. To understand the concepts and design of Smart grid.
2. To understand the various communication and measurement technologies in smart grid.
3. To understand the analysis and stability of smart grid.
4. To learn the renewable energy resources and storages integrated with smart grid.

Course Outcomes:

The Students will be able to

CO1. Discriminate power grid with smart grid.

CO2. Realize smart grid market drivers, stakeholders, functions and measures.

CO3. Recognize the various measurement and communication techniques.

CO4. Identify the challenges and weakness of the load flow methods.

CO5. Analyze the various tools for voltage and angle stability assessment in smart grid.

CO6. Categorize the integration issues of renewable energy resources with smart grid.

SMART GRID ARCHITECTURAL DESIGNS 9

Introduction – Comparison of Power grid with Smart grid – power system enhancement – communication and standards - General View of the Smart Grid Market Drivers - Stakeholder Roles and Function - Measures - Representative Architecture - Functions of Smart Grid Components- Wholesale energy market in smart grid-smart vehicles in smart grid.

SMART GRID COMMUNICATIONS AND MEASUREMENT TECHNOLOGY 9

Communication and Measurement - Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS) - Advanced metering infrastructure- GIS and Google Mapping Tools.

PERFORMANCE ANALYSIS TOOLS FOR SMART GRID DESIGN 9

Introduction to Load Flow Studies - Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods - Load Flow State of the Art: Classical, Extended Formulations, and Algorithms –Load flow for smart grid design-Contingencies studies for smart grid.

STABILITY ANALYSIS TOOLS FOR SMART GRID 9

Voltage Stability Analysis Tools-Voltage Stability Assessment Techniques-Voltage Stability Indexing-Application and Implementation Plan of Voltage Stability in smart grid-Angle stability assessment in smart grid-Approach of smart grid to State Estimation-Energy management in smart grid.

RENEWABLE ENERGY AND STORAGE 9

Renewable Energy Resources-Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology-Demand Response Issues-Electric Vehicles and Plug-in Hybrids-PHEV Technology-Environmental Implications-Storage Technologies-Grid integration issues of renewable energy sources.

Total Periods 45

Text Books

1. James Momoh, ‘Smart Grid: Fundamentals of design and analysis’, John Wiley & sons Inc, IEEE press 2015.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, ‘Smart Grid:Technology and Applications’, John Wiley & sons inc, 2012.

References

1. Fereidoon P. Sioshansi, 'Smart Grid: Integrating Renewable, Distributed & Efficient Energy', Academic Press, 2012.
2. Clark W.Gellings, 'The smart grid: Enabling energy efficiency and demand response', Fairmont Press Inc, 2009.
3. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1		3						2	1	2	1	3	1
CO2	3	2	1		2						1	2	2	1	2	2
CO3	3	2	1		2							1	2	1	3	1
CO4	3	2	2		2						2	1	2	1	3	2
CO5	3	2	1		3						2	2	2	2	3	1
CO6	3	2	1										2	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE11 POWER SYSTEM ECONOMICS AND CONTROL TECHNIQUES **L-T-P C**

3-0-0 3

Programme: B.E Electrical and Electronics Engineering **Sem:** **Category: PE**

AIM: To understand the economics of power system operation.To realize the requirements and methods of real and reactive power control in power system. To recognize the recent advancements in power system operation.

Course Outcomes:

The Students will be able to

CO1. Calculate various factors evaluating the nature of load.
CO2. Interpret different electrical tariff structures.
CO3. Formulate economic dispatch problem along with various constraints.
CO4. Identify the best unit commitment solution among various generating units..
CO5. Highlight the importance of load frequency control.
CO6. Represent the modeling of Automatic Voltage Regulator

INTRODUCTION **9**

Types of load – components of system loads - load curves – load factor, demand factor, diversity factor, capacity factor, utilization factor, base load and peak load stations- Reserve Capacity and requirements - Load Forecasting-Electrical Tariff-types of tariff.

ECONOMIC DISPATCH AND UNIT COMMITMENT **9**

Economic Load Dispatch-characteristics of generation unit, Co-ordination equations with and without transmission loss, General problem formulation and common constraints-Unit Commitment - Constraints in unit commitment-Solution methods.

REAL POWER - FREQUENCY CONTROL **9**

Load frequency control-Generator, Prime mover, Governor & Load models – LFC of a single area and two area systems-Tie line bias control-steady state and transient response- Automatic Voltage Regulator – Exciter and Generator models-steady state and transient response.

REACTIVE POWER–VOLTAGE CONTROL **9**

Reactive power and Voltage control–Load Compensation- power factor correction, voltage regulation, load balancing-Maximum load ability of transmission lines-Line Compensation-Static shunt capacitor / inductor-tap changing transformer, VAR compensators, Introduction to FACTS.

COMPUTER CONTROL OF POWER SYSTEMS **9**

Recent trends in real time control of power systems-Power system control centers with SCADA / EMS –Restructuring of power system – fundamentals and operational restrictions–Introduction to Smart Grid.

Total Periods 45

Text Books

1. Abhijit Chakrabarti & Sunita Halder, 'Power System Analysis- Operation & Control', PHI New Delhi, 3rd Edition, 2010.
2. Allen J. Wood, Bruce F. Wollenberg, 'Power Generation Operation and Control', Wiley India 2nd Edition, 2015.

References

1. K Uma Rao, 'Power System Operation & Control', Wiley India 1st Edition, 2013.
2. Robert H.Miller, James H.Malinowski, 'Power System Operation', Tata McGraw-Hill, 2nd Edition, 2009.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2									2	1	2	2
CO2	3	2	1	1		1							3	1	2	1
CO3	3	2	3	2									3	1	3	2
CO4	2	3	1		1						1	1	3	2	2	2
CO5	3	2	1		2						2	1	2	1	2	2
CO6	3	2	2		3						3	1	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE15 DISTRIBUTED GENERATION SYSTEMS AND MICROGRID **L-T-P C**

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category: PE**

AIM: To understand the planning and operational issues related to Distributed Generation.

Course Outcomes:

The Students will be able to

CO1. Represent the current scenario in Distributed Generation and renewable sources in Distributed Generation.

CO2. Plan the optimal placement of DG sources in distribution systems.

CO3. Interconnect the grid with distributed generation

CO4. Realize problems associated with integration of distributed generation.

CO5. Illustrate the various issues and challenges of DG in power system.

CO6. Analyze the micro grid with connecting of multiple DGs.

INTRODUCTION **9**

Need for Distributed generation, renewable sources in distributed generation, current scenario in Distributed Generation, Planning of DGs – Siting and sizing of DGs – optimal placement of DG sources in distribution systems.

GRID INTEGRATION OF DISTRIBUTED GENERATION **9**

Technical impacts of DGs – Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems.

IMPACT OF DISTRIBUTED GENERATION **9**

Technical impacts of DGs – Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems.

ISSUES AND CHALLENGES OF DISTRIBUTED GENERATION **9**

Economic and control aspects of DGs –Market facts, issues and challenges - Limitations of DGs. Voltage control techniques, Reactive power control, Harmonics, Power quality issues. Reliability of DG based systems – Steady-state and Dynamic analysis

MICRO GRID **9**

Introduction to micro-grids – Types of micro-grids – autonomous and non-autonomous grids – Sizing of micro-grids- modeling & analysis- Micro-grids with multiple DGs – Micro- grids with power electronic interfacing units. Transients in micro-grids - Protection of micro-grids – Case studies.

Total Periods 45

Text Books

1. Soni, Gupta, Bhatnagar and Chakrabarti, ‘A text book on Power Systems Engg.’, Dhanapat Rai and Sons, New Delhi, 2009.
2. Wadhwa, C.L., ‘Generation, Distribution and Utilisation of Electrical Energy’, Wiley Eastern Ltd, N.D.2011.

References

1. Deshpande M.V., ‘Elements of Electrical Power systems Design’, New Delhi, TMH , 1990.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		1		2		1				2	1	2	1	3	2
CO2	3	2	2		1		2				1	1	2	2	1	2
CO3	3	2	2		2		2				2	1	3	2	3	2
CO4	3	3	3		2		2				2	1	2	1	3	2
CO5	3		2		2	1	2				2	1	1	2	3	2
CO6	3	2	2		2		2				2	1	2	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE16 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To understand and analyze power system operation, stability, control and protection.

Course Outcomes:

The Students will be able to

CO1. Illustrate the concept, planning of DC power transmission and comparison with AC Power transmission

CO2. Analyze the HVDC converters.

CO3. Design the controller for HVDC system.

CO4. Analyze the harmonics and design suitable filters.

CO5. Elaborate the model and analysis the DC system under steady state

CO6. Perform power flow analysis for AC and DC systems.

INTRODUCTION 9

DC Power transmission technology – Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in HVDC technology – DC breakers – Operating problems – HVDC transmission based on VSC – Types and applications of MTDC systems.

ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter – Analysis of Graetz circuit with and without overlap – Pulse number – Choice of converter configuration – Converter bridge characteristics – Analysis of a 12 pulse converters – Analysis of VSC topologies and firing schemes.

CONVERTER AND HVDC SYSTEM CONTROL 9

Principles of DC link control – Converter control characteristics – System control hierarchy – Firing angle control – Current and extinction angle control – Starting and stopping of DC link – Power control – Higher level controllers – Control of VSC based HVDC link.

REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state – Sources of reactive power – SVC and STATCOM – Generation of harmonics – Design of AC and DC filters – Active filters.

POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC quantities – DC system model – Inclusion of constraints – Power flow analysis – case study.

Total Periods 45

Text Books

1. Padiyar, K. R., 'HVDC power transmission system', New Age International (P) Ltd., New Delhi, Second Edition, 2010
2. Edward Wilson Kimbark, 'Direct Current Transmission', Vol. I, Wiley interscience, New York, London, Sydney, 1971.

References

1. Kundur P., 'Power System Stability and Control', McGraw-Hill, 1993.
2. Colin Adamson and Hingorani N G, 'High Voltage Direct Current Power Transmission', Garraway Limited, London, 1960.
3. Arrillaga, J., 'High Voltage Direct Current Transmission', Peter Pregrinus, London, 1998.
4. S. Kamakshaiah, V. Kamaraju, 'HVDC Transmission', Tata McGraw Hill Education Private Limited, 2011.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3				1							2	2	1	3	2
CO2	2	3	2		2						2	1	3	1	3	2
CO3	3	2	3		3						2	1	2	1	3	2
CO4	3	2	1		2						2		3	2	3	2
CO5	3	2	1		2						2		2	1	3	2
CO6	3	2	3		2						2		3	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE17 CAD FOR ELECTRICAL SYSTEMS L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To introduce the basics of Computer Aided Design technology for the design of Electrical systems.

Course Outcomes:

The Students will be able to

CO1. Recognize the importance of computer aided design method.
CO2. Familiar with basic electromagnetic field equations.
CO3. Formulate the problem for CAD applications.
CO4. Analyze the Finite Element Method as applicable for Electrical Engineering.
CO5. Represent the organization of a typical CAD package.
CO6. Design different Electrical apparatus using Finite Element Method.

INTRODUCTION **9**

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

MATHEMATICAL FORMULATION OF FIELD PROBLEMS **9**

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance – Inductance- Laplace and Poisson's Equations – Energy functional.

PHILOSOPHY OF FEM **9**

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

CAD PACKAGES **9**

Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

DESIGN APPLICATIONS **9**

Voltage Stress in Insulators – Capacitance calculation – Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

Total Periods 45

Text Books

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, Yes DEE publishers, Indian reprint, 2007.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor & Francis, 2005.

References

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 2011.
4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.
5. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2			2						2	1	2	1	2	2
CO2	3	2											3	1	1	2
CO3	3	2	2		2						3	1	3	2	1	3
CO4	3	2	2		2						2	1	3	1	2	2
CO5	3	2	2		2						2	1	2	2	1	3
CO6	3	2	3		2						2	1	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE19 **DISTRIBUTION SYSTEM AUTOMATION** **L-T-P** **C**

3-0-0 **3**

Programme: B.E.- Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To understand and appreciate the basic control techniques involved in distribution automation and also get introduced to the various communication systems involved in distribution automation.

Course Outcomes:

The Students will be able to

CO1. Represent the Distribution Automation Systems and the Control techniques involved.

CO2. Develop a clear idea on the layout of the substations and feeders and also on the various management techniques viz., load management and voltage management.

CO3. Illustrate the Distribution Automation Systems on both in hardware and software.

CO4. Identify an appropriate method of communication for any particular distribution system with a view of automation.

CO5. Discuss the benefits of distribution automation based on its categorization.

CO6. Evaluate the economic aspects of any distribution system with automation.

INTRODUCTION TO DISTRIBUTION AUTOMATION SYSTEM **9**

Introduction to Distribution Automation, Control System Interfaces, Control and Data requirements, Centralized (Vs) Decentralized Control, Distribution Automation System, DAS Hardware, DAS Software, DA Capabilities, Automation system computer facilities.

DESIGN OF SUBSTATION **9**

Layout of substations and feeders - design considerations. Distribution system load flow - optimal siting and sizing of substations - optimal capacitor placement. Distribution system monitoring and control - SCADA, Remote metering and load control strategies - Optimum feeder switching

COMMUNICATION SYSTEM **9**

DA Communication Requirements - reliability, Cost Effectiveness, Data Rate Requirements, Two Way Capability - outages and faults, Ease of operation and maintenance - Communication Systems used - Distribution line carrier (Power line carrier), Telephone, Cable TV, Radio, AM Broadcast, FM SCA, VHF Radio, UHF Radio etc.

DISTRIBUTION AUTOMATION BENEFITS **9**

DA Benefit Categories - Capital Deferred Savings - Operation and Maintenance Savings – Interruption Related Savings - Customer-related Savings - Operational savings. Improved operation – Function Benefits.

ECONOMIC IMPACTS **9**

Economic impacts - Automation on Distribution Systems, Integration of benefits into economic evaluation. Development and Evaluation of Alternate plans - Operation and Maintenance Cost Evaluation, Evaluation of Alternatives.

Total Periods **45**

Text Book

1. Momoh A. Momoh, James A. Momoh., 'Electric Power Distribution, Automation, Protection, and Control', CRC Press, 2007.
2. Gonen., 'Electric Power Distribution System Engineering', 3rd Edition, BSP Books, Pvt. Ltd, 2014.

References

1. D. Bassett, K. Clinard, J. Grainger, S. Purucker, and D. Ward, 'Tutorial Course: Distribution Automation', IEEE Tutorial Publication 88EH0280-8-PWR, 1988.
2. IEEE Working Group on 'Distribution Automation'.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2					1							2	1	1	2
CO2	2	1	2			2					2		2	1	1	2
CO3	2	1											2	1	2	1
CO4	2	1											2	1	2	1
CO5	2	2	2			2							2	1	2	1
CO6	2	2	2			2	3						2	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE21	EMBEDDED SYSTEM DESIGN	L-T-P	C
		3-0-0	3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To understand the importance of Smart Grid technologies in electric power systems through smart instruments.

Course Outcomes:

The Students will be able to

CO1. Illustrate the concepts Embedded Computers and its challenges.
CO2. Sketch the architecture and explain the embedded system.
CO3. Demonstrate the embedded processor with its computation units.
CO4. Develop a network for embedded system and analyze it.
CO5. Apply the concepts and characteristics of embedded system for real-time applications.
CO6. Implement the real-time system for the required specification and verify its quality.

EMBEDDED DESIGN PROCESS **9**

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design- Structural Description, Behavioural Description, Design Example: Model Train Controller, ARM processor- processor and memory organization.

EMBEDDED PROCESSOR AND COMPUTING PLATFORM **9**

Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock, Hybrid Architecture.

NETWORKS **9**

Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

REAL-TIME CHARACTERISTICS **9**

Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line Versus On-line scheduling.

SYSTEM DESIGN TECHNIQUES **9**

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design, Quality Assurance, Design Example: Telephone PBX, Ink jet printer, Personal Digital Assistants, Set-top Boxes.

Total Periods 45

Text Books

1. Wayne Wolf, 'Computers as Components: Principles of Embedded Computing System Design', 3rd Edition, Morgan Kaufman Publishers, 2012.
2. Jane W.S. Liu, 'Real-Time systems', Pearson Education Asia, 2000.

References

1. C. M. Krishna and K. G. Shin, 'Real-Time Systems', McGraw-Hill, 1997.
2. Frank Vahid and Tony Givargis, 'Embedded System Design: A Unified Hardware/Software Introduction', John Wiley & Sons, 2001.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3				2						2	2	3	2		2
CO2	3	2			2						2	2	3	1		2
CO3	3	2			2						2	2	3	1		3
CO4	2	3	2	2	2						2	2	3	3		3
CO5	3	1	2	3	3	3					2	2	3	1		3
CO6	3	1	1	2	3	3					2	2	3	1		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE22 ROBOTICS AND AUTOMATION L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To learn the fundamentals of robotics and its safety issues

Course Outcomes:

The Students will be able to

CO1. Represent the state of art technology and products in automation

CO2. Highlight the functions of the basic components of a Robot

CO3. Design Robot Kinematics and develop its program.

CO4. Elaborate the concepts and techniques in robot manipulation kinematics.

CO5. Highlight Robot safety issues and economics.

CO6. Instruct the use of various types of End of Effectors, Sensors and its Automation.

FUNDAMENTALS OF ROBOT 9

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

SENSORS AND MACHINE VISION 9

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications

ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots

Total Periods 45

Text books

1. Klafter R.D., Chmielewski T.A and Negin M., 'Robotic Engineering - An Integrated Approach', Prentice Hall, 2003.
2. Groover M.P., 'Industrial Robotics-Technology Programming and Applications', McGraw Hill, 2001.

References

1. Craig J.J., 'Introduction to Robotics Mechanics and Control', Pearson Education, 2017.
2. Deb S.R., 'Robotics Technology and Flexible Automation' Tata Mc Graw Hill Book Co., 2010.
3. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., 'Robotics Control, Sensing, Vision and Intelligence', McGraw Hill Book Co., 2008.
4. Janakiraman P.A., 'Robotics and Image Processing', Tata Mc Graw Hill, 1995.
5. Rajput R.K., 'Robotics and Industrial Automation', S.Chand and Company, 2008.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	1	2				1	2	3	1		2
CO2	3	2	2	2	3	3	2				2	2	3	2		2
CO3	3	2	2	2	3	2	2				2	2	3			2
CO4	3	2	2	2	3	1	2				2	2	3	2		2
CO5	3		2	2		2					2	2	3			2
CO6	3	2	2	2	3	1	2				1	2	3			2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE24 BIOMEDICAL INSTRUMENTATION L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To make the student to acquire an adequate knowledge about the physiological systems of the human body and relate them to the parameters that have clinical importance

Course Outcomes:

The Students will be able to

CO1. Classify major systems of the human body so as to analyze the systems to which bio-medical instrument may be used suitably.

CO2. Use of electrodes, amplifiers & transducers in biomedical measurement system

CO3. To monitor various bio-potentials like ECG, EEG, EMG and ERG.

CO4. Observe non-electrical parameter measurements related to cardio-vascular system and pulmonary system.

CO5. Analyze various imaging systems and different types of biotelemetry systems

CO6. Illustrate measurements using Pacemakers, defibrillators and various assisting and therapeutic equipments

PHYSIOLOGY AND TRANSDUCERS 9

Cell and its structure – Resting and Action Potential – Nervous system: Functional organization of the nervous system – Structure of nervous system, neurons - synapse –transmitters and neural communication – Cardiovascular system – respiratory system – Basic components of a biomedical system - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

ELECTRO – PHYSIOLOGICAL MEASUREMENTS 9

Electrodes –Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers: Preamplifiers, 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 equipments.

NON-ELECTRICAL PARAMETER MEASUREMENTS 9

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound –Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers pH of blood –measurement of blood pCO_2, pO_2, finger-tip oxymeter - ESR, GSR measurements .

MEDICAL IMAGING 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems.

ASSISTING AND THERAPEUTIC EQUIPMENTS 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers – Lithotripsy.

Total Periods 45

Text books

1. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', 2nd Edition, Pearson Education, 2002.
2. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co. Ltd., 2014.

References

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley &Sons, 2008.
3. J.Webster, 'Medical Instrumentation', John Wiley Sons, 2010.
4. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1		2	1							3			1
CO2	3	1	2	1	1	2	1						3			1
CO3	3	2	2	1	1	1							3			1
CO4	3	1	1	2	2	1	2						3			1
CO5	3	1	2	2	2	2							3			1
CO6	3	2	2		2								3			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE25 **VHDL BASED DIGITAL SYSTEM DESIGN** **L-T-P** **C**

3-0-0 **3**

Programme: B.E.- Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: To teach the fundamental concepts of hardware description languages and design of digital systems using HDL program.

Course Outcomes:

The Students will be able to

CO1. Demonstrate the VHDL concepts and basic hardware programming using VHDL.

CO2. Describe the modeling structure and configurations in VHDL.

CO3. Illustrate the file handling and model simulation in VHDL.

CO4. Explain the principle parts in programmable circuits (PLD, FPGA).

CO5. Describe how small designs are implemented in programmable circuits.

CO6. Design a complex digital system using VHDL.

BASIC MODELING CONCEPTS **9**

Introduction to VHDL-Capabilities-Hardware abstraction-Basic Terminology-Data Objects- Data types-Operators-Entities-Architecture-Concurrent signal assignment-Sequential signal assignment-Selected signal assignment-Concurrent statements-Sequential statements- Behavioral dataflow modeling.

STRUCTURAL MODELING AND CONFIGURATIONS **9**

Structural modeling – Components - Declaration and instantiation - Generics-Configuration - Specification and declaration - Default rules-Conversion functions - Direct instantiation - Incremental binding

SUBPROGRAMS AND PACKAGES **9**

Procedure-Functions-Overloading-Packages-Declaration and Package body-Design file- Design libraries-Order of analysis-Implicit visibility-Explicit visibility-Type conversion- Generate statements-Signature-Aliases**.**

FILE HANDLING AND MODEL SIMULATION **9**

File declaration-Reading-Writing-Explicit open and close operations-Variable file names- Writing a test bench-Modeling entity interfaces-Styles of modeling-Modeling delays- Modeling control operations**.**

PLDs AND ADVANCED PROGRAM CONCEPTS **9**

PLDs - Basic concepts - Programmable Logic element - Programmable Logic Array - Programmable array Logic-Complex PLDs-Structure of standard PLDs-Concepts-Clock divider-Pulse counter-Seven segment display and Barrel Shifter.

Total Periods 45

Text Book

1. Bhasker.J, ‘A VHDL Primer’, Pearson Education, India, 3rd Ed., 2015.
2. Navabi.Z, ‘VHDL:Analysis and Modeling of Digital Systems’, Mcgraw Hill Book Co.,1st Ed., 1998.

References

1. James O Hamblen and tyron S. Hall,springerlink, ‘Rapid Prototyping of Digital Systems - SOPC Ed.’, Kluwer Academic Publishers, 1st International Ed., 2012.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2			1					1	1	3			1
CO2	3	1	1		1	1					1		3			1
CO3	3	2	2		1	2					1	1	3			1
CO4	3	2	1		2	1						2	3			1
CO5	3	1	1		2	1						3	3			1
CO6	3	1	1								1		3			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE27 **NANO DIELECTRICS** **L-T-P** **C**

3-0-0 **3**

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM:

Course Outcomes:

The Students will be able to

CO1. Describe about nano materials

CO2. Classify the various ceramic nano composites.

CO3. Interpret the application of nano materials

CO4. Illustrate the polymer composite processing techniques.

CO5. Summarize different biological nano composite materials and its synthesis process.

CO6. Perform Modeling of various nano composite materials.

INTRODUCTION TO NANO MATERIALS **9**

Introduction to nanomaterials- Definition of nanocomposite, nanofillers, classification of nanofillers, carbon and noncarbon based nanofillers - Properties of nanomaterials- role of size in nanomaterials, nanoparticles, semiconducting nanoparticles, nanowires, nanoclusters, quantum wells, conductivity and enhanced catalytic activity in the macroscopic state.

BULK METAL AND CERAMICS NANOCOMPOSITES AND ITS APPLICATIONS **9**

Ceramic/Metal Nanocomposites - Metal Matrix Nanocomposites - Bulk Ceramic Nanocomposites - Thin-Film Nanocomposites: Multilayer and Granular Films - Carbon Nanotube-Based Nanocomposites - Functional Low-Dimensional Nanocomposites - Particle-Dispersed Magnetic Nanocomposites - Magnetic Multilayer Nanocomposites - Inorganic Nanocomposites for Electrical Applications - Applications of Nanocomposite Wires and Nanocomposite Particles.

POLYMER-BASED AND POLYMER-FILLED NANOCOMPOSITES **9**

Nanoscale Fillers - Nanofiber or Nanotube Fillers - Carbon Nanotubes - Nanotube Processing - Equi-axed Nanoparticle Fillers - Inorganic FillerPolymer Interfaces - Processing of Polymer Nanocomposites - Nanotube/Polymer Composites - Layered FillerPolymer Composite Processing - Polyamide Matrices - Polymer Composite Processing - Direct Mixing - Solution Mixing - In-Situ Polymerization - In-Situ Particle Processing – Ceramic / Polymer Composites - In-Situ Particle Processing Metal/Polymer Nanocomposites - Properties of Composites.

NATURAL NANOBIOCOMPOSITES **9**

Natural Nanocomposite Materials - Biologically Synthesized Nanoparticles - Biologically Synthesized Nanostructures -Biologically Derived Synthetic Nanocomposites - Protein-Based Nanostructure Formation - DNA-Templated Nanostructure Formation - Protein Assembly - Biologically Inspired Nanocomposites - Lyotropic Liquid-Crystal Templating -Liquid-Crystal Templating of Thin Films - Block-Copolymer Templating - Colloidal Templating.

MODELING OF NANOCOMPOSITES **9**

Introduction The Need For Modeling - Current Conceptual Frameworks - Multiscale Modeling - Multiphysics Aspects.

Total Periods **45**

Text Books

1. P.M. Ajayan, L.S. Schadler, P.V.Braun, ‘Nanocomposite Science and Technology’, WILEY-VCH Verlag GmbH Co. KGaA, Weinheim, 2003.
2. Yiu-Wing Mai and Zhong-Zhen Yu, ‘Polymer nanocomposites’, First published, Wood head

Publishing Limited and CRC Press LLC, USA, 2006.

References

1. Gary Wiederrecht, 'Handbook of Nanofabrication', Elsevier, 2010.
2. Nick Kanello Poulos, 'Nanoporous materials: Advance techniques for characterization, Modeling and Processing', CRC press, 2011.
3. Claudia Altavilla and Enrico Ciliberto, 'Inorganic Nanoparticles: Synthesis, Application and Perspectives', CRC Press, 2011.
4. CR Rowe, 'Handbook of Thermoelectrics', CRC, Ed.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1											3			1
CO2	3	1	3										2			1
CO3	3												3			1
CO4	3	2	3										3			2
CO5	3		1										3			1
CO6	3		2										3			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE32 **INTELLIGENT CONTROL** **L-T-P** **C**

3-0-0 **3**

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** **PE**

AIM: The objective of this course is to provide a thorough introduction to the field of soft computing techniques to modeling, optimization, and control.

Course Outcomes:

The student will be able to

CO1. Enumerate the architecture of intelligent control systems.

CO2. Illustrate the concept of artificial neuron and their learning factors.

CO3. Discuss the concept of genetic algorithm and it's optimization techniques.

CO4. Summarize the concept of fuzzy logic system.

CO5. Highlight the case studies of real time problems.

CO6. Elaborate the stability analysis of fuzzy control systems.

INTRODUCTION **9**

Approaches to intelligent control- Architecture for intelligent control- Symbolic reasoning system, rule-based systems, and the AI approach- Knowledge representation- Expert systems.

ARTIFICIAL NEURAL NETWORKS **9**

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller

GENETIC ALGORITHM **9**

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems.

FUZZY LOGIC SYSTEM **9**

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

APPLICATIONS **9**

GA application to power electronic optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural-Network interconnection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems.

Total Periods **45**

Text books

1. Padhy.N.P., 'Artificial Intelligence and Intelligent System', Oxford University Press, 2005.

2. S.N.Sivanandam & S.N.Deepa, 'Principles of Soft Computing', 2nd Edition, John Wiley & Sons, 2011.

References

1. Jacek.M.Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing House, 1999.
2. Zimmerman H.J, 'Fuzzy set theory-and its Applications', Kluwer Academic Publishers, Reprint 2014.
3. Driankov, Hellendroon, 'Introduction to Fuzzy Control', Narosa Publishers.
4. Kosko, B, 'Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine

Intelligence', PrenticeHall, NewDelhi, 2009.
5. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, New Delhi, 2008.
6. KOSKO. B. 'Neural Networks and Fuzzy Systems', Prentice-Hall of India Pvt. Ltd., 2009.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1		2	2					1	3			2
CO2	3	2	2	2	2	2	2					1	3			2
CO3	3	2	2	2	3	2	2				2	1	3			2
CO4	2	2	2	2	2	2	2				2	1	3			2
CO5	2	2	2	2	3	2	2				2	1	3			2
CO6	3		3	2		2	2				1	1	3			2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161EEE33	PLC AND DISTRIBUTED CONTROL SYSTEM	L-T-P	C
		3-0-0	3

Programme: B.E.- Electrical and Electronics Engineering **Sem:** **Category:** PE

AIM: To gain knowledge on concepts towards controller design using PLC and human machine interface system.

Course Outcomes:

The student will be able to

CO1. Illustrate the history and stage by stage development of PLC.
CO2. Develop a program using PLC programming language.
CO3. Represent the concept of human machine interface.
CO4. Demonstrate the concept of SCADA system and communication standard.
CO5. Represent the DCS architecture, control unit and its interface.
CO6. Elaborate the interfacing issues in distributed control system

INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLERS **9**

Definition and History of PLC - Manufacturing and assembly Processes - PLC Advantages and Disadvantages – Overall PLC System Architecture – PLC CPU, Input and Output Modules. Input, and output, On/Off devices- Input and output analog devices.

PROGRAMMING OF PLC **9**

Programming Languages: Ladder Diagram, Function Block Diagram, Instruction List, Structured Text and Sequential Function Charts – Ladder Diagram: Basic relay Instructions, Timer and Counter Instructions, Arithmetic and Comparison Functions – Creating Ladder Diagrams using Process Control Descriptions.

HUMAN-MACHINE INTERFACES **9**

Human-Machine Interactions: Models for Human-Machine Interactions, Systems of Human-Machine Interactions – User Machine interfaces: User-Machine interface system, User-Machine interface Hardware – Industrial Application Example: Human Machine interfaces in Robotic systems.

SCADA **9**

SCADA Systems: Hardware – Software – Open Systems and Communication Standards - Fundamentals of SCADA- Communications, Remote Terminal Unit, PLCs as RTUs – Communication Architectures and Philosophies – SCADA Protocols: HDLC and MODBUS.

DISTRIBUTED CONTROL SYSTEMS (DCS) **9**

Introduction - Emergence of DCS Architecture – Comparison of Architectures - Local Control Unit: Architecture - Process Interfacing Issues - operator interface – engineering interfaces.

Total Periods 45

Text Book

1. Rajesh Mehra, Vikrant VIJ, 'PLCs and SCADA Theory and Practice', University Science Press, Lakshmi Publication, 2016.
2. Michael P Lukas, 'Distributed Control systems', Van Nostrand Reinhold Company, New York, 1995

References

1. Frank D. Petruzella, 'Programmable Logic Controllers', Tata Mc Graw-Hill, New Delhi, 2011.
2. Peng Zhang, 'Advanced Industrial Control Technology', Elsevier, 2010.
3. David Bailey, Edwin Right, 'Practical SCADA for Industry', Newnes (Elsevier), Mumbai, 2003.
4. John W. Webb and Ronald A. Reis, 'Programmable logic controllers: Principles and Applications', Prentice Hall India, New Delhi, 2009

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2								2	1	3			
CO2	2	2	2	3	3	1					1	1	3			2
CO3	3	2	2	3	1	1					2	1	3			2
CO4	2	2	2	3	3	1					1	1	3			2
CO5	2	2	2	3	3	1					1	1	3			2
CO6	3		3	3							1	1	3			2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

OPEN ELECTIVES (OE)

161OE401	ENERGY AUDIT AND CONSERVATION	L-T-P	C
		3-0-0	3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category:** OE/PE

AIM: To develop different types of skills so that students are able to acquire plan and supervise for conservation of electrical energy

Course Outcomes:

The Students will be able to

CO1. Identify the demand supply gap of energy in Indian scenario.

CO2. Carry out energy audit of an industry/Organization.

CO3. Draw the energy flow diagram of an industry.

CO4. Identify the energy wasted or a waste stream.

CO5. Select appropriate energy conservation method to reduce the wastage of energy.

CO6. Evaluate the techno economic feasibility of the energy conservation technique adopted.

ELEMENTS OF ENERGY CONSERVATION AND MANAGEMENT **9**

General energy problem, Sector wise Energy consumption, demand supply gap, Scope for energy conservation and its benefits Energy conservation Principle – Maximum energy efficiency, Maximum cost effectiveness, Mandatory provisions of EC act, Features of EC act-Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC), Energy management concept and objectives, Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting. Energy management programmes.

ENERGY CONSERVATION APPROACHES IN INDUSTRIES **9**

Energy saving opportunities in electric motors, Benefits of Power factor improvement and its techniques-Shunt capacitor, Synchronous Condenser etc., Effects of harmonics on – Motors, and remedies leading to energy conservation., Energy conservation by VSD, Methods and techniques of energy conservation in ventilation and air conditioners, compressors pumps, fans and blowers, Area Sealing, Insulating the Heating / cooling fluid pipes , automatic door closing- Air curtain, Thermostat / Control., Energy conservation in electric furnaces, ovens and boilers., lighting techniques – Natural , CFL, LED lighting sources and fittings.

TECHNO-ECONOMIC EVALUATION OF ENERGY CONSERVATION OPTION **9**

New equipment, technology, staffing, training, calculation and costing of energy conservation project. Depreciation cost, sinking fund method. Cost evaluation by Return on Investment (RoI) and pay back method etc., Risk analysis. Case study.

ENERGY CONSERVATION IN POWER GENERATION, TRANSMISSION AND DISTRIBUTION **9**

Performance improvement of existing power plant: co-generation, small hydro, DG Set, Demand side management, Load response programmes, Types of tariff and restructuring of electric tariff, Technical measures to optimize T and D losses.

ENERGY AUDIT **9**

Energy audit and its benefits, Energy flow diagram, Preliminary, Detailed energy audit., Methodology of preliminary energy audit and Detailed energy audit – Phase I, Pre audit, Phase II- Audit and Phase III- Post audit, Energy audit report., Electrical Measuring Instruments - Power Analyser, Combustion analyzer, fuel efficiency monitor, thermometer-contact, infrared, pitot tube and manometer, water flowmeter, leak detector, tachometer and luxmeter, IE rules and regulations for energy audit, Electricity act(Numerical).

Total Periods **45**

Text Books

1. Paul W. O Callaghan, 'Energy Management – A comprehensive guide to reducing costs by efficient energy use', McGraw Hill, England, 1993.
2. BEE Study Material, 'Energy Management & Energy Audit', www.bee-india.com.

References

1. IEEE Std. 739-1995, 'IEEE recommended practice for energy management in industrial and commercial facilities'.
2. Amit K. Tyagi, 'Handbook on Energy Audits and Management', TERI, 2003.
3. W.R. Murphy and G. McKay, 'Energy management', Butterworth & Co Publishers, Oxford, UK, 2001.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1										3		1	1
CO2	3	2	2	2									3		2	1
CO3	3	2	2										3		1	1
CO4	2	2	1										3		1	1
CO5	1	1	2				2						3		2	1
CO6	2	2	1										3		2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161OE403 SENSORS AND TRANSDUCERS L-T-P C

3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category: OE/PE**

AIM: To enable the students to select and design suitable instruments to meet the requirements of industrial applications and various transducers used for the measurement of various physical quantities

Course Outcomes:

The Students will be able to

CO1. Enumerate the principle of measurement system and errors in transducer.

CO2. Analyse the mathematical model of transducers.

CO3. Construct the principles of various types of resistive transducer.

CO4. Interpret the functioning of inductive type transducers.

CO5. Apply capacitive transducer for suitable system.

CO6. Construct about the working of different types of sensors.

MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS 9

Measurements – Basic method of measurement – Generalized scheme for measurement systems – Units and standards – Errors – Classification of errors, error analysis – Statistical methods – Sensor – Transducer – Classification of transducers – Basic requirement of transducers.

CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs

RESISTIVE TRANSDUCERS 9

Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications – Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer

INDUCTIVE AND CAPACITIVE TRANSDUCER 9

Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

MISCELLEANEOUS TRANSDUCERS 9

Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers

Total Periods 45

Text Books

1. Sawhney. A.K, 'A Course in Electrical and Electronics Measurements and Instrumentation', 18th Edition, Dhanpat Rai & Company Private Limited, 2007.
2. 2. Renganathan. S, 'Transducer Engineering', Allied Publishers, Chennai, 2003.

References

1. Doebelin. E.A, 'Measurement Systems – Applications and Design', Tata McGraw Hill, New York, 2000.
2. Patranabis. D, 'Sensors and Transducers', Prentice Hall of India, 1999.
3. John. P, Bentley, 'Principles of Measurement Systems', III Edition, Pearson Education, 2000.
4. 4. Murthy.D.V.S, 'Transducers and Instrumentation', Prentice Hall of India, 2001.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2								1	1	2	3	1	1
CO2	3	2	3		1						2	2	2	3	2	3
CO3	3	2	3		1						2	1	2	3		3
CO4	3	2	2		2						1	2	2	3	1	3
CO5	3	2	2		1						1	1	1	3		2
CO6	3	2	1		1						1	1	2	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161OE406 VEHICULAR ELECTRIC POWER SYSTEMS L-T-P C
3-0-0 3

Programme: B.E. Electrical and Electronics Engineering **Sem:** **Category: OE/PE**

AIM: This course introduces the fundamental concepts, principles and analysis of hybrid and electric vehicles

Course Outcomes:

The Students will be able to

CO1. Understand the various aspects of hybrid and electric vehicles.
CO2. Plan the selection of electrical machines for hybrid and electric vehicles.
CO3. Select various energy storage technologies for hybrid and electric vehicles.
CO4. Implement energy management techniques for hybrid and electric vehicles.
CO5. Analyze the energy management strategy for various vehicular systems.
CO6. Highlight the applications of various vehicular systems.

INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES 9

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance, Capabilities, Automation system computer facilities.

ELECTRICAL MACHINES FOR ELECTRIC VEHICLES 9

Introduction to electric components used in hybrid and electric vehicles- Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, and Switched Reluctance Motor drives- drive system efficiency.

ENERGY STORAGE TECHNOLOGIES 9

Energy storage technologies in hybrid vehicles-flywheel, hydraulic, fuel cell and hybrid fuel cell energy storage system-ultra capacitors- comparison- battery charging control.

ENERGY MANAGEMENT STRATEGIES 9

Introduction to energy management strategies used in hybrid and electric vehicle, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy strategies.

APPLICATIONS OF ELECTRIC VEHICLES 9

Electrical power system in air craft, sea and undersea vehicles, space vehicles-hybrid vehicle control strategies-supporting subsystem.

Total Periods 45

Text Books

1. Chris Mi, M. Abul Masrur, David Wenzhong Gao, 'Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives', Wiley, 2011.
2. Ali Emadi, Mehrdad Ehsani, John M. Miller, 'Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles', CRC Press, 2010.

References

1. Ion Boldea and S.A Nasar, 'Electric drives', CRC Press, 2005.
2. Sandeep Dhameja, 'Electric Vehicle Battery Systems', Newnes, 2002.
3. Iqbal Husain, 'Electric and Hybrid Vehicles: Design Fundamentals', CRC Press, 2nd Edition, 2010.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3			2					1	3	2	3	1
CO2	3	1	2	2			2					1	2	3	3	1
CO3	2	2	3	2								1	3	3	2	1
CO4	2	2	2	3			2					1	2	3	1	1
CO5	2	2	1	2			2					1	2	3	3	1
CO6	2	2	1	2			2					1	3	1	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

161OE407 DOMESTIC AND INDUSTRIAL ELECTRICAL INSTALLATIONS **L-T-P C**

3-0-0 3

Programme: B.E.- Electrical and Electronics Engineering **Sem:** **Category: OE / PE**

AIM: To impart knowledge on Electrical supply systems and its protection equipments, Different wiring methods and Estimation for electrical wiring.

Course Outcomes:

The Students will be able to

CO1. Explain the basic Electrical Distribution systems.

CO2. Design lighting system for domestic, commercial and industrial applications.

CO3. Assess the material requirements for a wiring work.

CO4. Categorize different types of wiring practice.

CO5. Perform electrical inspection and accident analysis.

CO6. Adapt Do's and Don'ts in wiring and lighting systems.

INTRODUCTION **9**

Load - Contracted demand, Maximum demand, Power factor – Power Supply - Single Phase, Three phase supply, Three phase wiring. Protective devices in Electrical Installations – Fuse, MCB, MCCB's, RCCB, ELCB - Earthing for Electrical Safety.

TYPES AND INSTALLATION OF WIRING SYSTEMS **9**

Types of wiring - Accessories used in Domestic wiring practice - wire ratings, FRLS type wires and PVC pipes. Planning Electrical Wiring for Buildings - Checking Electrical wiring in Flats.Electrical Distribution Design in Multi-stored Residential Flats and Commercial Buildings- Lightning Arrestors for Buildings.

ELECTRICAL INSTALLATION IN INDUSTRY **9**

Planning Electrical installations - Types of cable - ratings and types - Installations of electrical cables. Sub-station Layout and Design - Electrical installations in Hotels, Hospital wiring - Earthing in Power and Distribution - Lightning Arrestors for Industrial applications.

DO'S AND DON'TS WIRING **9**

Guidelines for Electrical Contractors - General specifications for electrical installation work, Electrical Maintenance, treatment for electric shock, Electricity Legislation. Points to be inspected, while carryout an Electrical Inspection.

LIGHTING **9**

Home lighting -Different types of lamps and applications -Types of lighting schemes and design of lighting system for home, office and industrial work place - Energy Efficient lightings.Do's and don'ts in lighting - Selection of lamps and luminars for lighting purpose, Simple fault findings in lighting

Total Periods 45

Text Book

1. B.RajaRao, 'Electricity for Architects, Project Consultants and Builders', B.RajaRao Technical Books Publishers, Chennai.
2. J.B. Gupta, 'A Course in Electrical Installation Estimating and Costing', S. K. Kataria& Sons, 9th Edition, 2013.

References

1. V.S.Rao, 'Operation & Maintenance of Electrical Equipment - Volume I & II', 2008 Edition, Media Promoters & Publishers Pvt. Ltd., Mumbai.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2										1	3		1	1
CO2	3	2	2	2	2						1	2	3	1	1	2
CO3	3	2	2		2						1	2	3		1	2
CO4	3	2	2		2							2	3		1	2
CO5	2	2	3			2					2	2	2		1	2
CO6	3	2	3	2		2					1	3	3	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

B.E., Electrical and Electronics Engineering

• Department VISION & MISSION

• Vision:

- To be a technical hub of creating Electrical and Electronics engineers with superior quality, human values and ethical views.

• Mission:

- To provide an excellent, innovative and comprehensive education in electrical and electronics engineering.
- To create a conducive learning environment and train the students in the latest technological development domain.
- To enhance the students potential by creating awareness on educational and career opportunities.
- To produce competent and disciplined engineers suitable for making a successful career in industry/research.

Program Specific Outcomes (PSOs)

PSO1

Skilled to analyze, design and test various electrical and electronic circuits, control system, instrumentation system, computer systems, microprocessor and microcontroller based systems.

PSO2

Exhibit knowledge and hands-on competence in the application of Electrical machines and power electronic based drives system.

PSO3

Design and investigate problems in power system network along with protection schemes and effective utilization of electrical energy.

PSO4

Develop a project management tool for solving complex electrical/electronic problems by applying the knowledge of basic sciences, mathematics and engineering fundamentals.

Department of Electrical and Electronics Engineering

P.S.R. ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)
(Accredited by NAAC and listed under 12(B) of UGC Act, 1956)
Sevalpatti (P.O), Sivakasi – 626140.