Vel Tech Multi Tech

Dr.Rangarajan Dr.Sagunthala Engineering College

An Autonomous Institution

B.E – ELECTRICAL AND ELECTRONICS ENGINEERING
CURRICULUM SYLLABUS
Regulation 2019
CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To prepare graduates to have successful and flourishing carrier in the electrical and electronics industry.
PEO2: To make students able to excel in their carrier with ethical values and managerial skills to solve real life technical problems.
PEO3: To make students capable of solving problems in Electrical and Electronics Engineering which are found in utilities and industries.
PEO4: To help students to engage in quest for self – learning and life - long learning.

PROGRAM OUTCOMES

PO1: Engineering knowledge: Enables to apply the knowledge of differential equations, integrals, matrix theory, Laplace, Fourier and z-transformation for engineering problems.

PO2: Problem analysis: Enables to define Basic science, Circuit theory, Electromagnetic Field theory, Control theory and to apply them to analyze complex engineering problems.

PO3: Design/development of solutions: Enables to configure and apply solutions to transmission and distribution networks, electrical apparatus and to handle the engineering aspects of Electrical Energy Generation and Utilization.

PO4: Use research-based knowledge: Enable to analysis, synthesis and interpret the data to provide valid conclusions.

PO5: Modern tool usage: Enables to design, implement and evaluate computer-based system/tools to meet the desired needs.

PO6: The engineer and society: Enables to apply the knowledge gained to assess societal, health, legal and cultural issues, and consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Enables to understand the impact of the Electrical engineering solutions in societal and environmental contexts and demonstrates the knowledge of and need for sustainable development.

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

PO9: Individual and team work: Enables to function effectively on teams to full-fill the goals.

PO10: Communication: Enables to express the dynamic solutions to fit-into the engineer community.

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

PO12: Life-long learning: Enables to recognize the need for, and have the preparation to engage in continuing professional development.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Vision

To emerge as a centre of academic excellence in Electrical and Electronics engineering and related fields through knowledge acquisition and propagation meeting global practices

Mission

- To nurture the talent and to facilitate the students with research ambience in Electrical and Electronics Engineering.
- To propagate lifelong learning.
- To impart the right proportion of knowledge, attitudes and ethics in students, to enable them take up positions of responsibility in the society and make significant contributions.

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SEMESTER – I

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				**L**	**T**	**P**	
1	191HS101	English for Engineering Students	HSS	3	0	0	3
2	191MA101	Engineering Mathematics - I	BS	2	2	0	3
3	191CH101	Engineering Chemistry	BS	3	0	0	3
4	191PH101	Engineering Physics	BS	3	0	0	3
5	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
6	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
7	191ME112	Engineering Graphics	ES	2	2	0	3
PRACTICAL							
8	191PH10A	Physics Laboratory	BS	0	0	2	1
9	191CH10A	Chemistry Laboratory	BS	0	0	2	1
Total				**19**	**4**	**4**	**23**

SEMESTER – II

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				**L**	**T**	**P**	
1	191HS201	Environmental Science and Engineering	HSS	3	0	0	3
2	191MA201	Engineering Mathematics II	BS	2	2	0	3
3	191PH203	Material Science for Electrical Engineering	BS	3	0	0	3
4	191CS211	Problem Solving and Python Programming	ES	3	0	0	3
5	191EC211	Electronic Devices and Circuits	ES	3	0	0	3
6	191EE221	Electric Circuit Analysis	PC	2	2	0	3
PRACTICAL							
7	191CS21A	Problem Solving and Python Programming Laboratory	ES	0	0	2	1
8	191ME21A	Engineering Practices Laboratory	ES	0	0	4	2
9	191EE22A	Circuits and Devices Laboratory	PC	0	0	4	2
Total				**16**	**4**	**10**	**23**

SEMESTER - III

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
				L	T	P	
THEORY							
1	191MA301	Linear Algebra and Numerical Methods	BS	2	2	0	3
2	191CS312	Object Oriented Programming	ES	3	0	0	3
3	191EE321	Network Analysis and Synthesis	PC	2	2	0	3
4	191EE322	Integrated Electronics	PC	3	2	0	4
5	191EE323	DC Machines and Transformers	PC	3	2	0	3
PRACTICAL							
6	191CS31B	Object Oriented Programming Laboratory	ES	0	0	2	1
7	191EE32A	DC Machines and Transformers Laboratory	PC	0	0	2	1
8	191EE32B	Integrated Circuits Laboratory	PC	0	0	2	1
Total				**13**	**8**	**6**	**19**

SEMESTER - IV

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
				L	T	P	
THEORY							
1	191MA404	Fourier Series and Transforms	BS	2	2	0	3
2	191EE421	Electromagnetic Theory	PC	3	0	0	3
3	191EE422	Control Systems	PC	2	2	0	3
4	191EE423	AC Rotating Machines	PC	3	0	0	3
5	191EE424	Microprocessors and Microcontrollers	PC	3	0	0	3
6	191EE425	Measurement and Instrumentation	PC	3	0	0	3
PRACTICAL							
7	191EE42A	AC Rotating Machines Laboratory	PC	0	0	2	1
8	191EE42B	Microprocessors and Microcontrollers Laboratory	PC	0	0	2	1
9	191MC46A	Internship 1	MC	0	0	0	0
Total				**16**	**4**	**4**	**20**

SEMESTER - V

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
				L	T	P	
THEORY							
1	191EE511	Embedded System	ES	3	0	0	3
2	191EE521	Analog Electronics and Applications	PC	3	0	0	3
3	191EE522	Power Electronics	PC	3	0	0	3
4	191EE523	Transmission and Distribution	PC	3	0	0	3
5		Program Elective – I	PE	3	0	0	3
6		Open elective I	OE	3	0	0	3
PRACTICAL							
7	191EE51A	Embedded Laboratory	ES	0	0	2	1
8	191EE52A	Control and Instrumentation Laboratory	PC	0	0	2	1
9	191MC56A	Circuit Simulation Laboratory	MC	0	0	2	0
Total				**18**	**0**	**8**	**20**

SEMESTER-VI

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
				L	T	P	
THEORY							
1	191HS601	Industrial Management and Economics	HSS	3	0	0	3
2	191EE621	Digital Signal Processing	PC	3	0	0	3
3	191EE622	Power System Analysis	PC	3	0	0	3
4	191EE623	Solid State Drives	PC	3	0	0	3
5		Program Elective -II	PE	3	0	0	3
6		Open Elective-II	OE	3	0	0	3
PRACTICAL							
7	191HS60A	Professional Communication	HSS	0	0	2	1
8	191EE62A	Power Systems Laboratory	PC	0	0	2	1
9	191EE62B	Power Electronics Laboratory	PC	0	0	2	1
10	191MC66A	Internship 2	MC	0	0	0	0
Total				**18**	**6**	**6**	**21**

SEMESTER-VII

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				**L**	**T**	**P**	
1	191HS701	Professional Ethics in Engineering	HSS	3	0	0	3
2	191EE721	High Voltage Engineering	PC	3	0	0	3
3	191EE722	Protection and Switchgear	PC	3	0	0	3
4		Program Elective – III	PE	3	0	0	3
5		Open elective III	OE	3	0	0	3
6		Open Elective - IV	OE	3	0	0	3
PRACTICAL							
7	191EE72A	Renewable Energy Systems Laboratory	PC	0	0	2	1
8	191EE77A	Project Work Phase I	PROJ	0	0	4	2
Total				**18**	**3**	**8**	**21**

SEMESTER-VIII

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				**L**	**T**	**P**	
1		Program Elective - IV	PE	3	0	0	3
2		Program Elective - V	PE	3	0	0	3
PRACTICAL							
3	191EE87A	Project Work Phase II	PROJ	0	0	20	10
Total				**6**	**0**	**20**	**16**

PROGRAM ELECTIVE – I (V SEMESTER)

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191HS531	Principles of Management	PE	3	0	0	3
2	191EE531	Communication Engineering	PE	3	0	0	3
3	191EE532	Digital Instrumentation	PE	3	0	0	3
4	191EE533	Electrical Machine Design	PE	3	0	0	3
5	191EE534	Theories of Power plant	PE	3	0	0	3
6	191EE535	Visual Languages and Applications	PE	3	0	0	3

PROGRAM ELECTIVE – II (VI SEMESTER)

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191EE631	Computer Aided Design for Electrical Apparatus	PE	3	0	0	3
2	191EE632	Fundamentals of Nano - science	PE	3	0	0	3
3	191EE633	Human Rights and Duties: Conceptual Perspectives	PE	3	0	0	3
4	191EE634	Microcontroller Based System Design	PE	3	0	0	3
5	191EE635	SMPS and UPS	PE	3	0	0	3
6	191EE636	Special Electrical Machines	PE	3	0	0	3

PROGRAM ELECTIVE – III (VII SEMESTER)

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191EE731	Alternative Energy Systems	PE	3	0	0	3
2	191EE732	Electric Energy Generation Utilization and Conservation	PE	3	0	0	3
3	191EE733	Electric Traction	PE	3	0	0	3
4	191EE734	Energy Resources and Utilization	PE	3	0	0	3
5	191EE735	Modern Power Converters	PE	3	0	0	3
6	191EE736	Power Electronics for Renewable Energy Systems	PE	3	0	0	3

PROGRAM ELECTIVE – IV (VIII SEMESTER)

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				**L**	**T**	**P**	
1	191EE831	Energy Efficiency in Buildings	PE	3	0	0	3
2	191EE832	HVDC Transmission	PE	3	0	0	3
3	191EE833	Industrial Automation	PE	3	0	0	3
4	191EE834	Intellectual Property Rights	PE	3	0	0	3
5	191EE835	Power Systems Operation and Control	PE	3	0	0	3
6	191EE836	Power System Transients	PE	3	0	0	3
7	191EE837	Real Time Systems	PE	3	0	0	3

PROGRAM ELECTIVE – V (VIII SEMESTER)

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				**L**	**T**	**P**	
1	191EE838	Electrical and Hybrid Vehicles	PE	3	0	0	3
2	191EE839	Electrical Energy Audit	PE	3	0	0	3
3	191ES8310	Embedded Control of Electric Drives	PE	3	0	0	3
4	191EE8311	Flexible AC Transmission Systems	PE	3	0	0	3
5	191EE8312	Micro Electro Mechanical Systems	PE	3	0	0	3
6	191EE8313	Power Quality	PE	3	0	0	3
7	191EE8314	Power System Stability	PE	3	0	0	3

HUMANITIES AND SOCIAL SCIENCE (HSS)

S. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	191HS101	English for Engineering Students	HSS	3	3	0	0	3
2	191HS201	Environmental Science and Engineering	HSS	3	3	0	0	3
3	191HS601	Industrial Management and Economics	HSS	3	3	0	0	3
4	191HS60A	Professional Communication	HSS	2	0	0	2	1
5	191HS701	Professional Ethics in Engineering	HSS	3	3	0	0	3

BASIC SCIENCES (BS)

S. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	191MA101	Engineering Mathematics - I	BS	4	2	2	0	3
2	191CH101	Engineering Chemistry	BS	3	3	0	0	3
3	191PH101	Engineering Physics	BS	3	3	0	0	3
4	191PH10A	Physics Laboratory	BS	2	0	0	2	1
5	191CH10A	Chemistry Laboratory	BS	2	0	0	2	1
6	191MA201	Engineering Mathematics II	BS	4	2	2	0	3
7	191PH203	Material Science for Electrical Engineering	BS	3	3	0	0	3
8	191MA301	Linear Algebra and Numerical Methods	BS	4	2	2	0	3
9	191MA404	Fourier Series and Transforms	BS	4	2	2	0	3

ENGINEERING SCIENCES (ES)

S. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	191ME111	Basic Civil and Mechanical Engineering	ES	3	3	0	0	3
2	191EE111	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
3	191ME112	Engineering Graphics	ES	4	2	2	0	3
4	191CS211	Problem Solving and Python Programming	ES	3	3	0	0	3
5	191EC211	Electronic Devices and Circuits	ES	3	3	0	0	3
6	191CS21A	Problem Solving and Python Programming Laboratory	ES	2	0	0	2	1
7	191ME21A	Engineering Practices Laboratory	ES	4	0	0	4	2
8	191CS312	Object Oriented Programming	ES	3	3	0	0	3
9	191CS31B	Object Oriented Programming Laboratory	ES	2	0	0	2	1
10	191EE511	Embedded System	ES	3	3	0	0	3
11	191EE51A	Embedded Laboratory	ES	2	0	0	2	1

PROFESSIONAL CORE (PC)

S. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	191EE221	Electric Circuit Analysis	PC	4	2	2	0	3
2	191EE22A	Circuits and Devices Laboratory	PC	4	0	0	4	2
3	191EE321	Network Analysis and Synthesis	PC	4	2	2	0	3
4	191EE322	Integrated Electronics	PC	5	3	2	0	4
5	191EE323	DC Machines and Transformers	PC	5	3	2	0	3
6	191EE32A	DC Machines and Transformers Laboratory	PC	2	0	0	2	1
7	191EE32B	Integrated Circuits Laboratory	PC	2	0	0	2	1
8	191EE421	Electromagnetic Theory	PC	3	3	0	0	3
9	191EE422	Control Systems	PC	4	2	2	0	3
10	191EE423	AC Rotating Machines	PC	3	3	0	0	3
11	191EE424	Microprocessors and Microcontrollers	PC	3	3	0	0	3
12	191EE425	Measurement and Instrumentation	PC	3	3	0	0	3
13	191EE42A	AC Rotating Machines Laboratory	PC	2	0	0	2	1
14	191EE42B	Microprocessors and Microcontrollers Laboratory	PC	2	0	0	2	1
15	191EE521	Analog Electronics and Applications	PC	3	3	0	0	3
16	191EE522	Power Electronics	PC	3	3	0	0	3
17	191EE523	Transmission and Distribution	PC	3	3	0	0	3
18	191EE52A	Control and Instrumentation Laboratory	PC	2	0	0	2	1
19	191EE621	Digital Signal Processing	PC	3	3	0	0	3
20	191EE622	Power System Analysis	PC	3	3	0	0	3
21	191EE623	Solid State Drives	PC	3	3	0	0	3
22	191EE62A	Power Systems Laboratory	PC	2	0	0	2	1
23	191EE62B	Power Electronics Laboratory	PC	2	0	0	2	1
24	191EE721	High Voltage Engineering	PC	3	3	0	0	3
25	191EE722	Protection and Switchgear	PC	3	3	0	0	3
26	191EE72A	Renewable Energy Systems Laboratory	PC	2	0	0	2	1

CREDIT DISTRIBUTION

S. NO	CATEGORY	CREDIT	
		REGULAR	LATERAL
1	BS (Basic Science)	23	06
2	HSS (Humanities and Social Science)	13	07
3	ES (Engineering Science)	26	8
4	PC (Professional Core Courses)	62	57
5	PE (Professional Elective Courses)	15	15
6	OE (Open Elective Courses)	12	12
7	MC (Mandatory Courses)	00	00
8	PROJ(Project)	12	12
TOTAL		**163**	**117**

SUMMARY

S. NO	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	**HSS**	**3**	**3**	**-**	**-**	**-**	**4**	**3**	**-**	**13**
2	**BS**	**11**	**6**	**3**	**3**	**-**	**-**	**-**	**-**	**23**
3	**ES**	**9**	**9**	**4**	**-**	**4**	**-**	**-**	**-**	**26**
4	**PC**	**-**	**5**	**12**	**17**	**10**	**11**	**7**	**-**	**62**
5	**PE**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**6**	**15**
6	**OE**	**-**	**-**	**-**	**-**	**3**	**3**	**6**	**-**	**12**
7	**MC**	**-**	**-**	**-**	**0**	**0**	**0**	**-**	**-**	**-**
8	**PROJ**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**10**	**12**
	TOTAL	**23**	**23**	**19**	**20**	**20**	**21**	**21**	**16**	**163**

SEMESTER – I

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191HS101 / ENGLISH FOR ENGINEERING STUDENTS			3	0	0	3

COURSE OBJECTIVES

- ✓ Equip students with the English language skills required for the successful undertaking of academicstudies.
- ✓ Improve general and academic listening skills
- ✓ Provide guidance and practice in basic geranial and classroom conversation and to engage in specific academic speaking activities
- ✓ Strengthen the reading and writing skills of students of engineering

SYLLABUS

UNIT - I	VOCABULARY BUILDING	9

Word formation, Prefixes and Suffixes, Root words from foreign languages, Synonyms, Antonyms, Compound Nouns, Standard Abbreviations.

UNIT - II	GRAMMATICAL COMPETENCY	9

Noun, Verb, Adjective, Subject-Verb Agreement, Articles, Prepositions, Purpose expressions, Model Verbs.

UNIT - III	BASIC WRITING SKILLS	9

Sentence structure, Phrases, Clauses, Coherence, Cohesion (using linking words), Paragraph Writing (Descriptive and Narrative)

UNIT - IV	READING SKILLS	9

Reading Strategies, Skimming and Scanning, Reading Comprehension exercises with multiple choice and open ended questions, Transforming Information in the form of charts, Note Making.

UNIT - V	ORAL COMMUNICATION	9

(This unit involves interactive practice sessions in Language Lab)

- Listing Comprehension.
- Pronunciation, Syllable and Stress, Rhythm and Intonation.
- General conversations and dialogues, common in everyday situations.
- Short Speech.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Infer meanings of unfamiliar words from context
CO2	Enable to achieve linguistic competence and be able to use grammar as a tool or resource in the comprehension and creation of oral and written discourse efficiently according to the situation.
CO3	Write cohesively, coherently and flawlessly with a wide range of vocabulary and organizing their ideas logically on a topic.
CO4	Activate and reinforce the habit of reading and writing effectively in their discipline.
CO5	Collaborate with multicultural environment.

TEXT BOOKS

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", Orient Blackswan, Chennai - 2012.
2. Dhanavel S. P, "English and Communication Skills for Students of Science and Engineering", Orient Blackswan, Chennai - 2011.
3. "Communication Skills", Sanjay Kumar and Pushp Lata, Oxford University Press, 2011.

REFERENCES

1. "Study Writing", Liz Hamp-Lyons and Ben Heasly, Cambridge University Press, 2006.
2. "Remedial English Grammar", F.T. Wood. Macmillan. 2007.
3. "Practical English Usage", Michael Swan. OUP. 1995.
4. "Exercises in Spoken English", Parts. I-II, CIEFL, Hyderabad. Oxford University Press.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191MA101 / ENGINEERING MATHEMATICS - I			2	2	0	3

COURSE OBJECTIVES

- ✓ To develop greater knowledge and understanding of mathematics and to attain the skills necessary for success in the study of higher mathematics.

SYLLABUS

UNIT - I	MATRICES	12

Characteristic equation, Eigen values and Eigen vectors of a real matrix, Properties of Eigen values, Cayley Hamilton theorem, Orthogonal reduction of a symmetric matrix to diagonal form, Reduction of quadratic form by orthogonal transformation, Applications.

UNIT - II	GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	11

Curvature, Cartesian and Polar coordinates, Centre of curvature, Circle of curvature, Evolutes and Envelopes, Applications.

UNIT - III	FUNCTIONS OF SEVERAL VARIABLES	11

Function of two variables, Partial derivatives, Total derivative, Change of Variables, Jacobians, Taylor's expansion, Maxima and Minima, Constrained Maxima and Minima by Lagrangian Multiplier method, Applications.

UNIT - IV	ORDINARY DIFFERENTIAL EQUATIONS	11

Linear differential equations of second and higher order with constant coefficients, Method of variation of parameters, Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation and Legendre's linear equation, Simultaneous linear equations with constant coefficients, Applications.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application.
CO2	Determine the bending of family of curves using differential calculus which deals in various disciplines.
CO3	Apply partial derivatives in various engineering problems.
CO4	Identify and solve the real time problems using higher order differential equations.

TEXT BOOKS

1. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley & Sons. Singapore, 10th edition, 2012.
2. Grewal B.S, "Higher Engineering Mathematics", Khanna Publications, 42nd Edition, 2012.

REFERENCES

1. Veerarajan. T, "Engineering Mathematics I", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
2. Kandasamy.Pet.al. "Engineering Mathematics", Vol. I (4th revised edition), S. Chand & Co, New Delhi, 2000.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191CH101 / ENGINEERING CHEMISTRY			3	0	0	3

COURSE OBJECTIVES

- ✓ To acquaint the students with the developments of microscopic chemistry in terms of atomic, molecular, and intermolecular forces and acquires the knowledge of water treatment. The students will be able to analyze the properties and applications of polymer and advanced materials.

SYLLABUS

UNIT - I	CHEMICAL BONDING	9

Types of chemical bonds, bond polarity, dipole moment, partial ionic character, consequences. Weak Interactions, Hydrogen bonding, van der Waals forces, influence on properties of matter. Metallic bond, free electron theory, MO treatment, band theory- metals, semiconductors and insulators. Non stoichiometric semiconductors, chalgogen semiconductors. Defect structures of crystals-Schottky and Frenkel defects.

UNIT - II	WATER CHEMISTRY	9

Hardness, determination (EDTA method). Water softening, zeolite and demineralization processes. Desalination by electro-dialysis and reverse osmosis. Water analysis by fluoride ion, Water quality parameters, Instrumental methods for water analysis- AAS, flame emission spectroscopy, ICP-MS and photocolorimetry.

UNIT - III	ELECTRO CHEMISTRY	9

Electrode potential, standard and reference electrodes, Nernst equation, emf series, applications. Galvanic and concentration cells. Applications of potential measurements, glass electrode, pH measurement, acid- base titration, redox titration. Conductance measurement, applications - conductometric titrations.

UNIT - IV	POLYMERS	9

Classification, degree of polymerization, molecular weight – Mn and Mw. Polymerization reactions. Glass transition temperature, factors affecting Tg, determination by DSC. Polymer processing, compounding, outline of moulding techniques compression, injection, extrusion and blow moulding. Charge transport in conjugated polymers, doped conjugated polymers, glucose biosensor. Polymers for LED and LCD displays.

UNIT - V	ADVANCED MATERIALS	9

Carbon nanotubes and carbon fibers, graphene and polymer nano-composites, properties and applications - morphological studies by SEM and TEM. Solid oxide materials and polymer electrolytes, energy storing applications. Polymer blends and alloys, photo and electroluminescence materials, insulating materials, photopolymers and photoresists for electronics, polymer photovoltaics.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyse microscopic chemistry in terms of atomic, molecular and Intermolecular forces for real time applications of semiconductors.
CO2	Investigate the various water treatment and softening methods.
CO3	Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells.
CO4	Explain the basic principle, types and mechanism of polymerization process and techniques.
CO5	Assess the properties, characterization and applications of advanced materials for energy storage.

TEXT BOOKS

1. Mary Jane Shultz, “Engineering Chemistry”, Cengage Learning, USA, 2009.
2. Palanna O. G., “Engineering Chemistry”, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi, 2009.

REFERENCES

1. Gowarikar V. R., Viswanathan N.V and Jayadev Sreedhar, “Polymer Science”, New Age International (P) Ltd., New Delhi, 2011
2. Vijayamohanan K. Pillai and Meera Parthasarathy, “Functional Materials - A Chemist’s Perspective”Universities Press, India, 2012.
3. Gesser H.D., “Applied Chemistry - A Textbook for Engineers and Technologies”, Springer, New York, 2008.
4. Shashi Chawla, “A Text book of Engineering Chemistry”, Dhanpat Rai & Co, New Delhi, 2005.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191PH101 / ENGINEERING PHYSICS			3	0	0	3

COURSE OBJECTIVES

- ✓ The course aims to equip engineering undergraduates with principles of Physics in a broader sense with a view to lay foundation for the various engineering courses.

SYLLABUS

UNIT - I	PROPERTIES OF SOLIDS	9

Elasticity, Hooke's law, stress -strain diagram, Poisson's ratio, Factors affecting elasticity, Bending moment, Depression of a cantilever, Young's modulus by uniform bending, Young's modulus by non-uniform bending (Theory and Experiment), Torsional stress and twisting couple, Torsional Pendulum ((Theory and Experiment) I-shaped girders.

UNIT - II	PRINCIPLES OF LASERS	9

Properties of laser radiation and their significance-wavelength, power, monochromaticity, coherence. Types of lasers working media and their radiation characteristics-Power, wavelength and operational modes of He-Ne, Carbon-dioxide. Physical principles of Laser beam delivery systems. Applications- Industry and Medical. Selection of lasers for various applications.

UNIT - III	OPTICAL FIBRE SYSTEMS	9

Optical Fibres, Propagation mechanism, Critical Angle, Snell's Law, Total Internal Reflection, Acceptance cone, Numerical aperture, Types of fibers, Attenuation, Active and passive fibre sensors (Temperature and Displacement), Applications (Industry and Medical), communication in optical fiber, Endoscope.

UNIT - IV	WAVE NATURE OF PARTICLES	9

Introduction to Quantum mechanics, Black body radiation, Planck's Hypothesis, Compton Effect (Theory and Experiment), Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Schrodinger equation for one dimensional problems, particle in a box-SEM and TEM.

UNIT - V	SOLID STATE PHYSICS	9

Crystalline and non crystalline materials, Lattice, Unit cell, Bravais lattice, Lattice planes, Miller indices, Expression for inter planar spacin, Bragg's law, Diffraction of X-rays by crystal planes, Co-ordination number, Atomic packing factors (SC, FCC, BCC and HCP structures), Diamond and graphite structures (qualitative treatment) , Crystal growth techniques (Bridgman and Czochralski).

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Demonstrate the proficiency on the properties of matter and its applications
CO2	Describe the working principles of Laser and its developments in industrial and medical applications
CO3	Explain the propagation of waves in optical fibers and their applications
CO4	Apply the theory of wave nature of particles in various microscopic applications
CO5	Analyze the structure of materials and its crystal growth techniques

TEXT BOOKS

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. "Introduction to Solid State Physics", 7th Edition, Charles Kittel, Wiley, Delhi 2007.
3. "Engineering Physics", R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8th Edition, New Delhi (2001).

REFERENCES

1. E. Hecht, "Optics", Pearson Education, 2008.
2. "Laser Fundamentals", William T. Silfvast, 2nd Edition, Cambridge University press, New York, 2004.
3. "Fundamentals of Physics", 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York 2001.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191ME111 / BASIC CIVIL AND MECHANICAL ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To create awareness on fundamental knowledge on various domains of civil engineering
- ✓ To introduce the sources of water and treatment of water, sewage treatment and transportation modes
- ✓ To introduce the fundamentals of Power Plant Engineering
- ✓ To introduce the fundamentals of IC engines
- ✓ To introduce the fundamentals of Energy resources and refrigeration cycles

SYLLABUS

UNIT - I	SCOPE OF CIVIL ENGINEERING	9

Introduction, Functions and role of Civil Engineer, Branches of Civil Engineering, Materials, Properties, classification and characteristics of building stones, bricks, timber, cement and cement concrete, reinforcing steel, Components of residential building, Foundation, Types and necessity.

UNIT - II	WATER RESOURCES & ENVIRONMENTAL ENGINEERING	9

Sources of water, Hydrologic cycle, Rain water harvesting, importance, methods of rain water harvesting, Water demand estimation, Sources of water, Quality of water, Treatment of water. Water distribution. Sewerage, collection, treatment and disposal of sewage, Septic tanks.

UNIT - III	POWER PLANTS, PUMPS AND TURBINES	9

Introduction to Power Plant, Classification of Power Plants, Working principle of steam, Gas, Diesel, Hydro-electric, Geo-thermal and Nuclear Power plants, Merits and Demerits, Pumps and turbines, working principle of single acting and double acting Reciprocating pumps, Centrifugal Pump.

UNIT - IV	IC ENGINES	9

Introduction to Internal combustion engines, Working principle of Petrol and Diesel Engines, Four stroke and two stroke cycles, Comparison of four stroke and two stroke engines.

UNIT - V	RENEWABLE ENERGY AND REFRIGIRATION	9

Introduction to renewable energy sources, Non renewable energy sources, Comparison of Electrical Energy Storage Technologies. Vapour compression Refrigeration system, Vapour absorption refrigeration system.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Explain the usage of construction material and proper selection of construction materials.
CO2	Explain about water resources, sewage treatment and transportation systems.
CO3	Explain about the components use in power plants.
CO4	Describe the internal combustion engines.
CO5	Explain about the renewable energy sources and refrigeration cycles.

TEXT BOOKS

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co, New Delhi, 1996.

REFERENCES

1. S.K. Garg, “Water Supply Engineering”, Khanna publishers, Delhi, 2005.
2. Seetharaman S, “Basic Civil Engineering”, Anuradha Agencies, 2005.
3. T. Jha and S.K. Sinha, “Construction and Foundation Engineering”, Khanna publishers, Delhi, 2003.
4. Venugopal K. and Prahu Raja V, “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam, 2000.
3. Ramamrutham S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd. 1999.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191EE111 / BASIC ELECTRICAL AND ELECTRONICS ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the structure of Electric Power Systems.
- ✓ To execute safety precautions.
- ✓ To study about Electric laws.
- ✓ To know about construction of meters.
- ✓ To understand about Electronics and Communication systems.

SYLLABUS

UNIT - I	INDIAN ELECTRICITY SCENARIO	9

Electric Power, Generation resources, Transmission types & Distribution system (levels of voltage, power ratings and statistics), Regulatory Authorities governing Indian Electricity Protection & Safety, Hazards of electricity-shock, effects of electricity on the human body. Electrical safety practices, Protection devices.

UNIT - II	BASICS OF ELECTRICAL COMPONENTS	9

Evolution of Electricity and Electrical inventions - Charge, Electric potential, voltage, current, power, energy, DC, AC, time period, frequency, phase, flux, flux density, RMS, Average, Peak, Phasor &Vector diagram.

UNIT - III	BASIC LAWS OF ELECTRIC SYSTEMS & MEASUREMENTS	9

Electric Circuits, Passive components (RLC), Ohm's law, KCL, KVL, Faraday's law, Lenz's law-Illustrative examples, Analog Moving Iron, Moving Coil and Digital meters, Types and usage..

UNIT - IV	BASICS ELECTRONICS	9

Electrical Vs Electronics, Electronic products and systems, Electronic Devices (Diode–Forward bias, reverse bias, Transistor (CE, CB, CC), Electronic components, Electronic Circuits-Rectifier, Regulator &IC-Basic Amplifiers and Oscillators- Communication system Block diagram (Transmitter and Receiver).

UNIT - V	BASICS OF COMMUNICATION ENGINEERING	9

Amplitude Modulation, AM, DSBSC, SSBSC, VSB–PSD, modulators and demodulators, Angle Modulation, PM and FM–PSD.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Summarizes about different structures of Power system and safety measures.
CO2	Explain about the basics of Electricity.
CO3	Discuss on various electric circuits and use of measuring instruments
CO4	Clarify the working of basic electronic devices such as diode, transistor and operational amplifiers
CO5	Infer about Digital Electronics and Communication System.

TEXT BOOKS

1. S Salivahanan, Rangarajan, "Basic Electrical Electronics & Measurement Engineering", Tata McGraw Hill Publishing Co Ltd.
2. "Basic Electric Engineering", D P Kothari & Nagrath, Tata McGraw Hill.
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age international pvt.ltd. 2003.

REFERENCES

1. M.S. Sukhija and T.K. Nagsarkar, "Basic Electrical and Electronic Engineering", Oxford, 2016.
2. Albert Paul Malvino, "Electronic Principles", Tata Mcgraw Hill, 2002.
3. Simon Haykin, "Communication Systems", Wiley Eastern, Third Edition, 1996.
4. M.Morris Mano, Digital Design, Third Edition, Pearson Publication.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191ME112/ ENGINEERING GRAPHICS			2	2	0	3

COURSE OBJECTIVES

- ✓ To explain the importance of an engineering drawing and explain the role of computer aided design.
- ✓ To convey the basics of engineering drawing of curves and concepts of free hand sketching.
- ✓ To teach different methods of making views of simple objects resembling points, lines and surfaces.
- ✓ To teach different methods of making views of simple objects resembling points, lines and surfaces.
- ✓ To establish the importance of sections and developments made in drawing.
- ✓ To develop an intuitive understanding of underlying significance of using pictorial drawings.

SYLLABUS

UNIT - I	PLANE CURVES AND FREE HAND SKETCHING	9

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views-Free hand sketching of multiple orthographic views from single pictorial view of objects.

UNIT - II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	9

Orthographic projections - Introduction - Principles -Principal planes-First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes, Determination of true lengths and true inclinations by rotating line method, traces. Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT - III	PROJECTION OF SOLIDS	9

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

UNIT - IV	SECTION OF SOLIDS & DEVELOPMENT OF LATERAL SURFACES OF SOLIDS	9

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

UNIT - V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	9

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

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Draw engineering curves and apply the concepts of free hand sketching.
CO2	Draw orthographic views of points, lines and surfaces.
CO3	Draw visualizations of simple solid objects as per orthographic projections.
CO4	Draw sections and developments made in drawing.
CO5	Draw pictorial drawings of simple objects.

TEXT BOOKS

1. N.D. Bhatt, Engineering Drawing, 49th edition, Charotar Publishing House, 2006.

REFERENCES

1. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008
3. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
4. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191PH10A / PHYSICS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ Students will be able to demonstrate an understanding of the scientific method, so that they may use the training beneficial in their higher pursuits.

LIST OF EXPERIMENTS

1	Determination of Rigidity modulus – Torsion pendulum.
2	Determination of Young's modulus by non-uniform bending method.
3	Determination of Planck's Constant and work function of materials using photo electric effect experiment.
4	Determination of wavelength, and particle size using Laser.
5	Determination of acceptance angle in an optical fiber.

DEMONSTRATION

1	Determination of wavelength of mercury spectrum – spectrometer grating.
2	Demonstration of Crystal Growth Technique.
3	Determination of fiber thickness – Air Wedge method.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Apply the principles of properties of matter in determining the various elastic properties.
CO2	Attains the practical knowledge to apply principles of optics for various engineering applications.
CO3	Demonstrate the technical knowledge on quantum mechanical concepts.

REFERENCES

1. Wilson J.D. and Hernandez C.A., "Physics Laboratory Experiments", Houghton Mifflin Company, New York, 2005.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191CH10A / CHEMISTRY LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To furnish the conceptual understanding of the basic principles involved in chemical analysis.
- ✓ To attain the analytical knowledge of students by conducting various experiments.

LIST OF EXPERIMENTS

1	Determination of total, permanent, temporary, calcium and magnesium hardness of water by EDTA method.
2	Conductometric titration - determination of strength of an acid.
3	Estimation of iron by potentiometry.
4	Determination of molecular weight of polymer by viscosity average method.
5	Determination of dissolved oxygen in a water sample by Winkler's method.
6	Determination of Na / K in water sample by Flame photometry (Demonstration).
7	Estimation of Copper in ore.
8	Estimation of nickel in steel.
9	Determination of total alkalinity and acidity of a water sample.
10	Determination of rate of corrosion by weight loss method.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Acquire knowledge on quantitative chemical analysis by instrumentation and volumetric method.
CO2	Analyze the water sample for hardness, chloride, sodium /potassium content, dissolved oxygen etc.
CO3	Solve analytical problems in spectrometer and flame photometer for the identification and quantification.

REFERENCES

1. Vogel's Textbook of quantitative chemical Analysis (8th edition, 2014).

SEMESTER – II

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191HS201 / ENVIRONMENTAL SCIENCE AND ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ This course provides the basic knowledge of structure and function of ecosystem and better understanding of natural resources, biodiversity and their conservation practices.
- ✓ It describes the need to lead more sustainable lifestyles, to use resources more equitably.
- ✓ It helps to create a concern for our environment that will trigger pro-environmental action, including activities we can do in our daily life to protect it.
- ✓ Furthermore, it deals the social issues and ethics to develop quality engineer in our country.

SYLLABUS

UNIT - I	ENVIRONMENT – AN OVERVIEW	9

Ecosystem - concept, structure, function, types, Energy flow in ecosystem, Biodiversity and its conservation, values of biodiversity, threats to biodiversity conservation of biodiversity, Natural resources - types, uses.

UNIT - II	ENVIRONMENTAL IMPACT OF ENERGY SOURCES	9

Sources of primary energy, present and future consumption of energy, environmental impacts of energy development- oil, natural gas, coal, hydro electric, nuclear power, wind mill and solar panels, Urban problems related to energy, case studies

UNIT - III	CLIMATIC CHANGE AND SOLID WASTE MANAGEMENT	9

Environmental pollution- air, water, soil, marine and noise pollution- green house gases- causes, effects- global warming, ozone layer depletion, acid rain-sources and effects. Pollution control strategies, preventive measures, green technologies, green building concepts, standards and regulations, role of individuals, Sustainable development, Hazardous wastes, e-waste, source effect, management, Nuclear waste-sources, effects, management, Recycling of waste, Future challenges.

UNIT - IV	HUMAN POPULATION AND THE ENVIRONMENT	9

Population growth, variation among nations, population explosion, family welfare programme, environment and human health, human rights, value education, HIV / AIDS, women and child welfare, role of information technology in environment and human health, Case studies.

UNIT - V	ENVIRONMENTAL LAW AND ETHICS	9

Legal provision in India, environmental acts - air, water, forest, soil and wildlife. Environmental ethics, theories and codes, resource consumption patterns, equity-disparity, urban-rural equity issues, need for gender equity, preserving resource for future generation, right of animals, ethical basis of environment education and awareness, ethical problem solving- changing attitude, conservation ethics and traditional value systems of India, Effect of social media on the adolescent.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Interpret the concept of ecosystem, biodiversity and its conservation.
CO2	Demonstrate the environmental impacts of energy development.
CO3	Categorize the various environmental pollutions and select suitable preventive measures.
CO4	Perceive the environmental effects of human population and the implementation of welfare programs.
CO5	Recall the environmental ethics and legal provisions.

TEXT BOOKS

1. Henry, JG & Heinke, GW, "Environmental Science and Engineering", 2nd Edition, PHI Learning Private limited, New Delhi, 2011.
2. Kaushik, A & Kaushik, CP, Environmental Science and engineering", 3rd Edition, New Age International (P) Limited, New Delhi, 2009.
3. Erach Bharucha, "Text book for Environmental sciences for Undergraduate courses", UGC, 2004.

REFERENCES

1. Masters, GM & Ela, WP, "Introduction to Environmental Engineering and Science", 3rd Edition, PHI Learning Private limited, New Delhi, 2009.
2. Encyclopedia of environmental ethics and philosophy. Available at www.gmu.ac.ir/download/booklibrary/e-library/Encyclopaedia of Environmental Ethics and philosophy.pdf.

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191MA201 / ENGINEERING MATHEMATICS II			2	2	0	3

COURSE OBJECTIVES

- ✓ To understand double and triple integration and enable them to find area and volume using multiple integrals.
- ✓ To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- ✓ To understand analytic functions of complex variables and conformal mappings.
- ✓ To know the basics of residues, complex integration and contour integration.
- ✓ To understand Laplace transform and use it to represent system dynamic models and evaluates their time responses.

SYLLABUS

UNIT - I	MULTIPLE INTEGRALS	12

Double integration, Cartesian and polar coordinates, Change of order of integration, Triple integration In cartesian coordinates.

UNIT - II	VECTOR CALCULUS	12

Gradient, divergence and curl, Directional derivative, Ir-rotational and solenoidal vector fields, Simple problems on Vector differentiation, Vector integration, Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs).

UNIT - III	ANALYTIC FUNCTION	12

Functions of a complex variable, Analytic functions, Necessary conditions, Cauchy Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs), Properties of analytic function, Construction of analytic function by Milne Thomson method, Conformal mapping : $w = z + c$, cz , $1/z$, z^{2} - bi-linear transformation.

UNIT - IV	COMPLEX INTEGRATION	12

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs), Taylor's and Laurent's series expansions, Singularities, Residues, Cauchy's residue theorem (excluding proof), Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

UNIT - V	LAPLACE TRANSFORM	12

Laplace transform, Sufficient condition for existence, Transform of elementary functions, Basic properties, Transforms of unit step function and impulse functions, Transform of periodic functions. Inverse Laplace transform, Statement of Convolution theorem, Initial and final value theorems, Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Evaluate multiple integrals using change of variables.
CO2	Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.
CO3	Construct analytic functions of complex variables and transform functions using conformal mappings.
CO4	Estimate the real and complex integrals over suitable closed paths and contours.
CO5	Compute linear differential equations using Laplace transform techniques

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Delhi, 42nd Edition, 2012.
2. Kreyzig E., "Advanced Engineering Mathematics", John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10th Edition, 2010.

REFERENCES

1. Arunachalam T. and Sumathi K, "Engineering Mathematics II", Sri Vignesh Publications, Coimbatore, Third Edition, 2011.
2. Kandasamy P., Thilagavathy K. and Gunavathy K, "Engineering Mathematics", S. Chand & Co., New Delhi, 2008.
3. Veerarajan T, "Engineering Mathematics" (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
4. Venkataraman M.K, "Engineering Mathematics", Volume - II, The National Pub. Co., Chennai, 2003.

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191PH203 / MATERIAL SCIENCE FOR ELECTRICAL ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To introduce the essential principles of materials science for Electrical engineering applications and become proficient in magnetic, optical and new engineering properties of materials

SYLLABUS

UNIT - I	ELECTRICAL PROPERTIES OF MATERIALS	9

Conduction in metals- Mobility and Conductivity,- Classical free electron theory of metals-Widemaan Franz Law -Band theory of Solids -Classification of solids on basis of band theory- Fermi distribution function-Effect of temperature on Fermi function-Density of energy states–Carrier concentration in metals

UNIT - II	ELECTRONIC MATERIALS	9

Classification of semiconductors-Intrinsic, Extrinsic,- derivation of carrier concentration in intrinsic and extrinsic semiconductors-Fermi Level and its variation with temperature and impurity concentration-Determination of band gap-Hall effect–Determination of Hall coefficient–Applications

UNIT - III	DIELECTRIC AND MAGNETIC MATERIALS	9

Electric Susceptibility-Dielectric Constant-Electronic, Ionic and Orientation - Frequency and Temperature dependence of Polarization- Uses of dieleIctrics (Capacitors and Transformers)-Origin of magnetic moment – Bohr magneton – Classification of magnetic materials (Dia, Para and Ferro magnetism)– Domain theory–Hysteresis– soft and hard magnetic materials

UNIT - IV	OPTICAL PROPERTIES OF MATERIALS	9

Classification of optical materials–carrier generation and recombination processes-Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode – solar cell - LED – Organic LED – Laser diodes – Optical data storage techniques.

UNIT - V	NEW ENGINEERING MATERIALS	9

Metallic Glasses-Types of metallic glasses-Preparation-Properties and applications-Superconductors- Properties- Types- High Temperature Superconductor and Applications-Shape memory alloys (SMA)-Application of SMA

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Apply the Electron theory of solids to distinguish the electrical and thermal conductivity of various materials.
CO2	Identify the importance of semiconductors and its devices towards recent trends in engineering.
CO3	Categorize dielectric and magnetic materials and knowing their properties and applications in current technology.
CO4	Recognize the optical materials used in various optoelectronic devices.
CO5	Demonstrate the new engineering materials and exposure of superconductor in current technology.

TEXT BOOKS

1. Solid State Physics,S.O.Pillai,6thEdition,NewAge International Publisher, India,2009
2. Materials Science and Engineering- An Introduction, William D. Callister, 6th Edition,JohnWiley, USA,2004.

REFERENCES

1. The Science and Engineering of Materials, Donald R.Askland and Pradeep P.Phule, 5thEdition, Cengage Learning Publisher, USA, 2006

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191CS221 / PROBLEM SOLVING AND PYTHON PROGRAMMING			3	0	0	3

COURSE OBJECTIVES

- ✓ To know the basics of algorithmic problem solving.
- ✓ To read and write simple Python programs.
- ✓ To develop Python programs with conditionals and loops.
- ✓ To define Python functions and call them.
- ✓ To use Python data structures – lists, tuples, dictionaries.
- ✓ To do input/output with files in Python.

SYLLABUS

UNIT - I	ALGORITHMIC PROBLEM SOLVING	9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion) Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, Guess an integer number in a range, Towers of Hanoi.

UNIT - II	DATA, EXPRESSIONS, STATEMENTS	9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT - III	CONTROL FLOW, FUNCTIONS	9

Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT - IV	LISTS, TUPLES, DICTIONARIES	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT - V	FILES, MODULES, PACKAGES	9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Develop algorithmic solutions for simple computational problems.
CO2	Write and execute simple python programs.
CO3	Implement Python program with control structures and function for solving problems.
CO4	Represent compound data using Python list, tuples, and dictionaries.
CO5	Read and write data from/to files in Python programs.

TEXT BOOKS

1. Allen B.Downey,``ThinkPython:HowtoThinkLikeaComputerScientist‘‘,2ndedition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016(http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
2. Timothy A. Budd, ―Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
3. John V Guttag,―Introduction to Computation and Programming Using Python‘‘,Revised and expanded Edition, MIT Press , 2013

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191EC211/ ELECTRONIC DEVICES AND CIRCUITS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the concept of semiconductor diode
- ✓ To learn the operation and characteristics of BJT and FET transistors.
- ✓ To study various types of display and power devices
- ✓ To learn positive and negative feedback circuits

SYLLABUS

UNIT - I	SEMICONDUCTOR DIODES	9

Ideal diode-Current-voltage characteristics, Terminal characteristics of junction diode – Zener diode and applications –Diode logic gates-Clipping and Clamping circuits-Voltage doubler - Schottky-Barrier diode-Varactor –Photo diode-Tunnel diode.

UNIT - II	TRANSISTOR AMPLIFIER	9

BJT-Structure, Operation–Three modes of configuration–Currents in Transistor–Relation between α,β& γ– load line– Transistor as an amplifier (CE)-h parameter–Av and Ap

UNIT - III	FIELD EFFECT TRANSISTOR	9

JFET-Structure, Operation of N Channel and P Channel - Drain and Transfer characteristics-Applications of JFET-MOSFET types- Characteristics of Enhancement and depletion mode-Comparison of JFET and MOSFET.

UNIT - IV	POWER DEVICES AND DISPLAY DEVICES	9

SCR, DIAC, TRIAC, Power BJT, Power MOSFET, IGBT Heat sinks and junction temperature, LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

UNIT - V	FEEDBACK AMPLIFIERS AND OSCILLATORS	9

Advantages of negative feedback - Voltage/current, series/shunt feedback. Positive feedback –Bark hausen criterion for oscillation - Phase shift - Wein Bridge – Hartley – Colpitts and crystal oscillators.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze PN junctions in semiconductor devices under various conditions
CO2	Understand the Characteristics of current flow in BJT with CB,CE and CC configurations
CO3	Realize the characteristics of MOS and FET amplifier
CO4	Discuss the characteristics of power and display devices.
CO5	Employ the acquired knowledge in design and analysis of feedback amplifiers and oscillators.

TEXT BOOKS

1. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011.
2. Donald A Neaman,"Semiconductor Physics and Devices", Third Edition,TataMcGrawHillInc.2007.

REFERENCES

1. Robert L. Boylestad and Louis Nasheresky,—Electronic Devices and Circuit Theory,10th Edition, Pearson Education / PHI, 2008
2. David A.Bell, —Electronic Devices and Circuits, Fifth Edition, Oxford University Press, 2008.
3. Salivahanan. S, SureshKumar. N, Vallavaraj.A, —Electronic Devices and circuits, Third Edition, TataMcGraw-Hill, 2008.
4. Malvino, Electronic Devices and Circuits, PHI, 2007.

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191EE221 / ELECTRIC CIRCUIT ANALYSIS			2	2	0	3

COURSE OBJECTIVES

- ✓ To introduce electric circuits and its analysis
- ✓ To impart knowledge on solving circuit equations using network theorems
- ✓ To introduce the phenomenon of resonance in coupled circuits
- ✓ To educate on obtaining the transient response of circuits
- ✓ To introduce Phasor diagrams and analysis of three phase circuit

SYLLABUS

UNIT - I	DC, AC FUNDAMENTALS	9

Ohm's Law – Series Parallel resistive circuits– Voltage and Current Division Technique, Source Transformation, Star/Delta Transformation, AC Waveforms – Standard Terminologies and Parameters–Inductance, Capacitance, Impedance, Admittance and Susceptance – Phasor diagram– Illustrative Examples

UNIT - II	NETWORK THEOREMS	9

Mesh and Nodal Analysis, Network theorems–Superposition–Thevenin–Norton–Maximum Power Transfer-Millman – Maximum Power Transfer – Substitution Theorem–Illustrative Examples

UNIT - III	ANALYSIS OF THREE PHASE CIRCUITS	9

Three Phase 3 wire and 4 wire circuits with Star and Delta Connected loads – Balanced and Unbalanced Circuits–Phasor diagram– Power triangle –Power and Power fact or measurements– Problems

UNIT - IV	RESONANCE AND COUPLED CIRCUITS	9

Resonance circuits-Tank Circuits-Mutual Inductance–Coefficient of Coupling-Dotrules–Tuned Circuits

UNIT - V	TRANSIENT ANALYSIS	9

Step and sinusoidal response for RL, RC& RLC circuits for DC and AC inputs

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Classify various elements and its need.
CO2	Impart knowledge on solving circuits using network theorems.
CO3	Analyze three phase circuits.
CO4	Explain the phenomenon of resonance in coupled circuits.
CO5	Distinguish the transient response and steady state response of circuits.

TEXT BOOKS

1. A.Sudhakar,S.P.Shyammohan,"Circuits&Networks",TataMcGrawHill,thirdEdition, 2015.
2. William H. Hayt, Jr, Jack E.Kemmerly and Steven M. Durbin,"Engineering circuits Analysis",TMH publishers, 8th edition, New Delhi, (2015).
3. Paranjothi SR,"Electric Circuits Analysis",New Age International Ltd.,NewDelhi,(2012)

REFERENCES

1. Charles K.Alexander, Mathew N.O.Sadik,"Fundamentals of Electric Circuits" TataMcGraw–Hill,, 2017.
2. Problems and Solutions of Electrical Circuit Analysis, R.K.Mehta&A.K.Mal, CBS Publishers, 2015
3. C.L.Wadhwa,"Electric Circuit Analysis",New Age International(P)Ltd., Second Edition. 2009.
4. Joseph A.Edminister, Mahmood Nahri, "Electric circuits", Schaum's Series, TataMcGraw–Hill, New Delhi, 2009.
5. Chakrabarti A,"TextBook of Circuit Theory and Analysis" Prantice Hall Publications, NewDelhi, 2005.

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191CS21A / PROBLEM SOLVING AND PYTHON PROGRAMMING LAB			0	0	2	1

COURSE OBJECTIVES

- ✓ To write, test, and debug simple Python programs.
- ✓ To implement Python programs with conditionals and loops.
- ✓ Use functions for structuring Python programs.
- ✓ Represent compound data using Python lists, tuples, and dictionaries.
- ✓ Read and write data from/to files in Python.

LIST OF EXPERIMENTS

1	Compute the GCD of two numbers.
2	Find the square root of a number (Newton‘s method)
3	Exponentiation(power of a number)
4	Find the maximum of a list of numbers
5	Linear search and Binary search
6	Selection sort ,Insertion sort
7	Merge sort
8	First n prime numbers
9	Multiply matrices
10	Programs that take command line arguments(word count)
11	Find the most frequent words in a text read from a file
12	Simulate elliptical orbits in Pygame
13	Simulate bouncing ball using Pygame **PLATFORM NEEDED** Python3 interpreter for Windows/Linux

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Solve problems using conditionals and loops in Python.
CO2	Develop Python programs by defining functions.
CO3	Represent lists, Tuples and dictionaries for compound data.

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191ME21A / ENGINEERING PRACTICES LABORATORY			0	0	4	2

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)

CIVIL ENGINEERING PRACTICE	
BUILDINGS:	
1	Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.
PLUMBING WORKS:	
1	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
2	Study of pipe connections requirements for pumps and turbines.
3	Preparation of plumbing line sketches for water supply and sewage works.
4	Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5	Demonstration of plumbing requirements of high-rise buildings.
CARPENTRY USING POWER TOOLS:	
1	Study of the joints in roofs, doors, windows and furniture.
2	Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
MECHANICAL ENGINEERING PRACTICES	
WELDING:	
1	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2	Gas welding practice.
BASIC MACHINING	
1	Simple Turning and Taper turning.
2	Drilling Practice.
SHEET METAL WORK	
1	Forming & Bending.
2	Model making – Trays and funnels.
3	Different type of joints.
MACHINE LABORATORY PRACTICES	
1	Study of centrifugal pump.
2	Study of air conditioner.
DEMONSTRATION ON	
1	Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
2	Foundry operations like mould preparation for gear and step cone pulley. Fitting – Exercises – Preparation of square fitting and V-fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICES	
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring.
3	Stair case wiring.
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5	Measurement of energy using single phase energy meter.
6	Measurement of resistance to earth of electrical equipment.
ELECTRONICS ENGINEERING PRACTICE	
1	Study of Electronic components and equipments - Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2	Study of logic gates AND, OR, EX-OR 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.

LIST OF EXPERIMENTS

REQUIREMENTS FOR A BATCH OF 30 STUDENTS		
CIVIL		
S. NO	**DESCRIPTION OF THE EQUIPMENT**	**QUANTITY REQUIRED**
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets
2	Carpentry vice (fitted to work bench)	15 Nos
3	Standard woodworking tools	15 Sets
4	Models of industrial trusses, door joints, furniture joints	5 Each
5	Power Tools: a) Rotary Hammer b) Demolition Hammer c) Circular Saw d) Planer e) Hand Drilling Machine f) Jigsaw	 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos
MECHANICAL		
1	Are welding transformer with cables and holders	5 Nos
2	Welding booth with exhaust facility	5 Nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc.,	5 Nos
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5	Centre lathe	2 Nos
6	Hearth furnace, anvil and smithy tools	2 Nos
7	Moulding table, foundry tools	2 Nos
8	Power Tool : Angle Grinder	2 Nos
9	Study-Purpose items: Centrifugal pump, air-conditioner	One Each
ELECTRICAL		
1	Assorted electrical components for house wiring	15 Nos
2	Electrical measuring instruments	10 Nos
3	Study purpose items: Iron box, fan and regulator, emergency lamp	1 Nos
4	Megger (250V/500V)	1 Nos
5	Power Tools: (a) Range Finder (b) Digital Live-wire detector	 2 Nos 2 Nos
ELECTRONICS		
1	Soldering guns	10 Nos
2	Assorted electronic components for making circuits	50 Nos
3	Small PCBs	10 Nos
4	Multimeters	10 Nos
5	Study purpose items: Telephone, FM radio, low-voltage power supply	
COURSE OUTCOMES On completion of the course, students will be able to		
CO1	Use mechanical and civil engineering equipments to join the structures and perform basic machining operations and fabricate models in sheet metals.	
CO2	Use electrical and electronics engineering equipments to test the respective electrical and electronics components.	

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191EE22A / CIRCUITS AND DEVICES LABORATORY			0	0	4	2

COURSE OBJECTIVES

- ✓ To understand the basic laws of Electrical Engineering
- ✓ To have hand son experience with Simulation
- ✓ To gain concepts of Semi-conductor devices with experiments

LIST OF EXPERIMENTS

1	Verification of Ohm's and Kirchhoff's Law
2	Circuit analysis using Mesh current Method
3	Circuit analysis using Nodal Voltage Method
4	Verification of Theorems
5	Frequency response of RLC Series and Parallel Resonance circuits
6	Power measurement sin 3 phase circuits
7	a. Study of RL, RC, RLC Transient b. Analysis of R, L, and C effects (independently) using MATLAB
8	Characteristics of PN diode, Zener diode
9	a. Analyze of BJ T as an amplifier and switch b. Frequency response characteristics of BJT
10	Characteristics of JFET,MOSFET
11	Phototransistor
12	a. Realization of lag and lead concepts and Measurement with CRO b. Construct and Analyze the operation of rectifier circuits using MATLAB

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Acquires the Simulate electric circuits.
CO2	Understand the circuit theorems and concepts in engineering applications
CO3	Apply the circuit Devices and concepts in engineering applications.

SEMESTER – III

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191MA301 / LINEAR ALGEBRA AND NUMERICAL METHODS			2	2	0	3

COURSE OBJECTIVES

- ✓ To introduce the basic notions of groups, rings, fields which will then be used to solve relatedproblems.
- ✓ To understand the concepts of vector space, linear transformations.
- ✓ To apply the concept of inner product spaces in orthogonalization.
- ✓ To provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

SYLLABUS

UNIT - I	VECTOR SPACES	10

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT - II	LINEAR TRANSFORMATION	9

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations

UNIT - III	INNER PRODUCT SPACES	9

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT - IV	SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS	8

Iterative method Newton - Raphson method for single variable. Solutions of Linear system by Gaussian Gauss – Jordan, Jacobi and Gauss – Seidel methods, Inverse of a matrix by Gauss –Jordan method. Eigen value of a matrix by power and Jacobi methods.

UNIT - V	INTERPOLATION	9

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

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze the vectors in R^n geometrically and algebraically.
CO2	Apply the concepts of Span, Dimension and basics to various vector spaces.
CO3	Apply Gram-Schmidt process to find linearly independent vectors.
CO4	Understand the numerical techniques to find the roots of non-linear equations and solutions for system of linear equations.
CO5	Summarize about the difference operators and use of interpolations.

TEXT BOOKS

1. Grewal B.S., ―Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44th Edition, 2017.
2. Datta, "Numerical Methods for Linear Control Systems" CBS Publishers. Chennai 2005
3. Friedberg, A.H., Insel, A.J. and Spence, L., Linear Algebra, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Lay, D.C., ―Linear Algebra and its Applications, 5th Edition, Pearson Education, 2015.
2. Kolman, B. Hill, D.R., ―Introductory Linear Algebra, Pearson Education, New Delhi, First Reprint, 2009.
3. James, G. ―Advanced Modern Engineering Mathematics, Pearson Education, 2007.
4. 4. O'Neil, P.V., ―Advanced Engineering Mathematics, Cengage Learning, 2007.
5. Yang, "Applied Numerical Methods Using MATLAB" CBS Publishers. Chennai 2005
6. Srinivasan, "Numerical Methods for Engineering" CBS Publishers.Chennai.1994.

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191CS312 / OBJECT ORIENTED PROGRAMMING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand Object Oriented Programming concepts and basic characteristics of Java
- ✓ To know the principles of packages, inheritance and interfaces
- ✓ To define exceptions and use I/O streams
- ✓ To develop a java application with threads and generics classes
- ✓ To design and build simple Graphical User Interfaces

SYLLABUS

UNIT - I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9

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

UNIT - II	INHERITANCE AND INTERFACES	9

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

UNIT - III	EXCEPTION HANDLING AND I/O	9

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

UNIT - IV	MULTI THREADING AND GENERIC PROGRAMMING	9

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

UNIT - V	EVENT DRIVEN PROGRAMMING	9

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

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Acquire knowledge in OOPS concepts and develop Java programs using object oriented features.
CO2	Summarize the concept of inheritance, interfaces and implement using Java Programs.
CO3	Design Java applications using Exceptions and I/O streams.
CO4	Analyze and evaluate the concept of threads and generic classes to develop Java applications.
CO5	Create interactive Java programs using Swings.

TEXT BOOKS

1. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals, 9th Edition, Prentice Hall, 2013.
2. Herbert Schildt, ―Java The complete reference, 8th Edition, McGraw Hill Education, 2011.

REFERENCES

1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
2. Steven Holzner, ―Java 2 Black book, Dream tech press, 2011.
3. Timothy Budd, ―Understanding Object-oriented programming with Java, Updated Edition, Pearson Education, 2000.

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191EE321 / NETWORK ANALYSIS AND SYNTHESIS			2	2	0	3

COURSE OBJECTIVES

- ✓ To understand electrical circuits under transient and steady state conditions.
- ✓ To gain knowledge on two port network representation, High pass and low pass filters andPassive and active circuit Synthesis.
- ✓ To analyze the basic concept of graph theory along the primitive impedance and admittance.

SYLLABUS

UNIT - I	NETWORK FUNCTIONS	9

Introduction-continuous signal their classification- Network Functions for one port & two-port networks, poles and zeroes of network functions, Restrictions on poles and zeroes - locations for driving point functions and transfer functions, Time domain behavior of electrical network from the pole-zeroes plot.

UNIT - II	TWO PORT NETWORK	9

Relationship of two port variables, Short circuit admittance parameters-open circuit impendence parameters-transmission parameters-hybrid parameters-relationship between parameters sets- interconnections of two port networks.

UNIT - III	ELEMENTS OF NETWORKS SYNTHESIS	9

Reliability of one port network – Hurwitz polynomial and properties – Positive and Real function and properties – synthesis of RL, RC and LC networks.

UNIT - IV	NETWORK GRAPH THEORY	9

Network graph - tree and cut sets – tie sets and cut sets schedules – Y shift and I shift – Primitive impedance and admittance matrices, Terminologies used in the graph theory, incidence matrix - cut-set matrix – loop matrix, loop analysis using graph theory - cut set analysis using graph theory.

UNIT - V	DESIGN OF FILTERS	9

Derivation of expression for propagation constant - attenuation constant - phase shift constant- cut-off frequency - characteristics impedance, Design of constant K, M – derived and composite filters, qualitative treatment of active filters, Butterworth and Chebyshev filters.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Outline about the network functions with poles and zero concept.
CO2	Construct two port networks along with hybrid parameters.
CO3	Illustrate the different elements of networks synthesis with positive real functions.
CO4	Infer the concept of network graph theory with primitive impedance and admittance method.
CO5	Acquire knowledge on different types of filters.

TEXT BOOKS

1. Desoer, Ernest S Kuh: Basic circuit theory, McGraw Hill third edition 2011.
2. D Roy Choudhary:Network and systems, New Age International fifth edition 2009.
3. F.F.Kuh: Network Analysis and Synthesis, John Wiley & Second edition 2007.

REFERENCES

1. Sudhakar, A. Shyammohan, “Circuits and Network”, Fourth Edition, 2011, Tata McGraw Hill.
2. “Introduction to Network Synthesis”, Valkenburg, PHI Publication third edition 2008
3. Kelkar, Pandit, “Linear Network Theory”, Pratibha Publication fifth edition 2006
4.“Network Analysis And Synthesis”, Wadhwa, New Age Publication first edition 2004

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191EE322 / INTEGRATED ELECTRONICS			3	2	0	4

COURSE OBJECTIVES

- ✓ To reduce Boolean expressions
- ✓ To understand Combinational and Sequential Circuits
- ✓ To learn about Applications of Op-amp
- ✓ To gain knowledge about Special IC's

SYLLABUS

UNIT - I	NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES	9

Boolean Algebra and laws - Realization using logic gates-Representation of logic functions – SOP and POS forms, Simplification of Boolean expressions - Logic Minimization using K-map- Implementation of 2 input NOR,NAND gates using TTL & CMOS Logic - open collector output - open drain output - Error detection and correction codes (Parity and Hamming code)

UNIT - II	COMBINATIONAL LOGIC CIRCUITS	9

Half adder and Full adder, Subtractor, Multipliers – Multiplexers & De-multiplexers, Encoders, Priority encoder, Decoders, Code converters

UNIT - III	SEQUENTIAL LOGIC CIRCUITS	9

Latches and Flip –Flops (SR, JK, T, D), State Diagrams – Timing Diagrams and state Tables, Sequential Circuit Design, Shift Registers, Synchronous counters (up, down, up-down, mod-N, Ring) - Digital clock.

UNIT - IV	OPERATIONAL AMPLIFIER AND ITS APPLICATIONS	9

Introduction – Classification – IC chip size and circuit complexity, Ideal OP-AMP characteristics – DC characteristics – AC characteristics, differential amplifier, Basic op-amp applications - Inverting and Non inverting amplifiers – summer and Subtractor – Differentiator – Integrator, V/I and I/V converter, Instrumentation amplifier, Precision rectifier, Schmitt Trigger, Multi-vibrators

UNIT - V	SPECIAL IC'S	9

Phase locked loop and its application for frequency multiplication/division and frequency translation, 555 timers IC – Monostable and Astable operation- Application of 555 for pulse width modulation and FSK generator - LM317, IC723 regulator.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Outline about Boolean functions and TTL logic
CO2	Design Combinational circuits
CO3	Solve Sequential circuits
CO4	Analyze the characteristics of op-amp and to function on applications of op-amp
CO5	Make use of Special IC's

TEXT BOOKS

1. M.Morris Mano, Digital Design, Pearson Publication. Fourth edition 2014.
2. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
3. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES

1. Floyd, Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
2. Fiore,"Opamps& Linear Integrated Circuits Concepts & applications", Cengage, 2010.
3. Analog Electronics, L.K.Maheshwari, Laxmi Publications third 2 nd edition 2009.
4. Basic Electronics, B.L. Thareja, S.Chand Publishing fourth edition 2007.
5. Modern Digital Electronics, R.P. Jain, TMH 2nd edition 2007.

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191EE323 / DC MACHINES AND TRANSFORMERS			3	2	0	3

COURSE OBJECTIVES

- ✓ To understand the concepts of electro mechanical energy conversion.
- ✓ To learn about the performance of transformers.
- ✓ To gain about the various losses of DC machines and transformers.
- ✓ To gain knowledge about the construction and working of transformers.
- ✓ To enumerate the different types of testing in DC machines and transformers.

SYLLABUS

UNIT - I	BASIC CONCEPTS OF ROTATING MACHINES	9

Electrical machine types - Introduction to magnetic circuits-Magnetically induced EMF–AC operation of magnetic circuits – Iron losses – Energy in magnetic systems – Single and Multiple excited systems – MMF of distributed windings – Magnetic fields in rotating machines.

UNIT - II	DC GENERATORS	9

Constructional features of DC machine – Principle of operation – EMF equation – Methods of excitation – Types – Characteristics – Armature reaction – Methods of compensation – Commutation – Parallel operation.

UNIT - III	DC MOTORS	9

Principle of operation – Back EMF – Torque equation – Types – Speed-Torque characteristics –Starters – Speed control of DC series, shunt and compound motors – Losses and efficiency – Permanent Magnet DC motors.

UNIT - IV	TRANSFORMERS	9

Principle of operation – Constructional features of single phase and three phase transformers – EMF equation – Phasor diagram – Equivalent circuit – Regulation –Three phase transformer connections – Parallel operation of single phase and three phase transformer – Auto transformers.

UNIT - V	TESTING OF DC MACHINES AND TRANSFORMERS	9

Testing of DC machines – Brake test, Swinburne's test, Retardation test, Hopkinson's test – Testing of transformer – polarity test, load test, open circuit and short circuit test, Sumpner's test – All day efficiency – Losses and efficiency – Condition for maximum efficiency

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Relate the concepts of Electromechanical Energy Conversion.
CO2	Demonstrate the working principles of DC machines and their applications.
CO3	Illustrate about speed control techniques.
CO4	Analyze about the constructional details and working principles of Transformers.
CO5	Evaluate the various losses occurring in DC machines and transformers.

TEXT BOOKS

1. Fitzgerald. A.E., Charles kingselyJr and Stephen D. Umans, "Electric Machinery", Tata McGraw Hill Private Limited, 2013
2. Nagrath. I.J and Kothari. D.P., "Electric Machines", Tata McGraw Hill Private Limited, 2012.
3. Bimbhra. P.S., "Electrical Machinery", Khanna Publishes, 7th Edition, 2011.
4. Theraja. B.L. and Theraja. A.K., "A text book on Electrical Technology", Volume–II, S.Chand and Company Limited, 2009.
5. V.K.Mehta and RohitMehta ., "Principles of Electrical Machines" S.Chand publications.

REFERENCES

1. Sen. P.C., "Principles of Electrical Machines and Power Electronics", John Wiley and Sons, 2014.
2. Murugesh Kumar. K, "Electric Machines", Vikas Publishing House Private Limited, 2010.
3. Irving L. Kosow, "Electric Machinery and Transformers", 2nd Edition, Reprint, Prentice Hall Private Limited, 2007.
4. Stephen J. Chapman, "Electric Machinery Fundamentals", 4th Edition, Tata McGrawHill Private Limited, 2005.
5. Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall Private Limited, 2003.

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	191CS31B / OBJECT ORIENTED PROGRAMMING LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To build software development skills using java programming for real world applications.
- ✓ To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing.
- ✓ To develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1	Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, and type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows: First 100 units - Rs. 1 per unit 101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit > 501 units - Rs. 6 per unit If the type of the EB connection is commercial, calculate the amount to be paid as follows: First 100 units - Rs. 2 per unit 101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit > 501 units - Rs. 7 per unit
2	Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.
3	Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4	Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5	Write a program to perform string operations using ArrayList. Write functions for the following Append - add at end Insert – add at particular index Search List all string starts with given letter
6	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Course Outcomes After the completion of the course, Students will be able to SL.NO STATEMENTS CO1 Discuss on Object Oriented concepts CO2 Develop applications using Object Oriented Programming Concepts CO3 Categorize Advanced Programming Concepts Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7	Write a Java program to implement user defined exception handling.
8	Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9	Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10	Write a java program to find the maximum value from the given type of elements using a generic function.
11	Design a calculator using event-driven programming paradigm of Java with the following options. Decimal manipulations Scientific manipulations
12	Develop a mini project for any application using Java concepts

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Discuss on Object Oriented concepts.
CO2	Develop applications using Object Oriented Programming Concepts.
CO3	Categorize Advanced Programming Concepts.

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191EE32A / DC MACHINES AND TRANSFORMERS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To study the performance of DC generators and Motors
- ✓ To apply the speed control techniques in DC shunt motor.
- ✓ To gain knowledge about transformers under OC and SC condition.

LIST OF EXPERIMENTS

1	Study of DC starters
2	Open circuit and load characteristics of self – excited DC shunt generators
3	Open circuit and load characteristics of separately– excited DC shunt generators
4	Load characteristics of DC compound generator
5	Load characteristics of DC shunt and compound motor
6	Load characteristics of DC series motor
7	Swinburne's test and speed control of DC shunt motor
8	Hopkinson's test on DC motor–Generator set
9	Load test on single phase transformer
10	Open circuit and short circuit tests on single phase transformer
11	Sumpner's test on transformers
12	Separation of no-load losses in single phase transformer
13	Study of Parallel operation of single-phase transformer

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Summarize the performance of DC generators and Motors.
CO2	Apply the speed control techniques.
CO3	Examine about regulation of transformers.

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191EE32B / INTEGRATED CIRCUITS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To design and verify various digital systems
- ✓ To verify the applications of Op-amp
- ✓ To work with Timer and PLL

LIST OF EXPERIMENTS

1	Implementation of Boolean Functions, Adder and Subtractor circuits.
2	Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3	Encoders and Decoders
4	Parity generator and parity checking
5	Counters: Design and implementation of 3-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 suitability IC's
7	Study of multiplexer and de multiplexer
8	Application of Op-Amp: a. Inverting and non-inverting amplifier b. Adder and Differential amplifier c. Integrator and Differentiator d. Comparator and Schmitt trigger
9	Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation
10	Voltage to frequency characteristics of NE/ SE 566 IC

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Design the various experimental setup circuits of combinational systems.
CO2	Analyze an inverting and Non Inverting amplifier, adder, comparator, integrator and differentiator using op – amplifier.
CO3	Examine the characteristics of voltage controlled oscillator using NE/SE 566 IC and Design the variability voltage regulator using LM317 IC.

SEMESTER – IV

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191MA404 / FOURIER SERIES AND TRANSFORMS			2	2	0	3

COURSE OBJECTIVES

- ✓ To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- ✓ To acquaint the student with Fourier transform techniques used in wide variety of situations.
- ✓ To develop Z transform techniques for discrete time Systems

SYLLABUS

UNIT - I	**FOURIER SERIES**	**9**

Dirichlet's conditions – General Fourier series – Change of Interval - Odd and even functions.

UNIT - II	**HALF RANGE SINE SERIES AND HARMONIC ANALYSIS**	**9**

Half range sine series –Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT - III	**FOURIER TRANSFORMS**	**9**

Statement of Fourier integral theorem – Fourier transforms pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions.

UNIT - IV	**PARSEVAL'S IDENTITY FOR F- TRANSFORMS**	**9**

Convolution Theorem for F- Transforms – Parseval's Identity for F- Transforms – Transforms of simple functions

UNIT - V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS**	**9**

Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Construct Fourier series for different periodic functions and to evaluate infinite series.
CO2	Find Half-Range Fourier series for the given periodic function.
CO3	Determine Fourier Transform and inverse transform and understand the fundamental properties.
CO4	Apply convolution theorem to find the product of Fourier transform.
CO5	Analyze the discrete signals using Z-transform.

TEXT BOOKS

1. Grewal. B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2017

REFERENCES

1. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company Limited, NewDelhi, 2008.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
3. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191EE421 / ELECTROMAGNETIC THEORY			3	0	0	3

COURSE OBJECTIVES

- ✓ To analyze the basic mathematical concepts related to electromagnetic waves and vector fields
- ✓ To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- ✓ To understand the concepts of magneto-statics, magnetic flux density, scalar and vector potential.
- ✓ To impart knowledge on the concepts of Faraday's law, induced EMF and Maxwell's equation.

SYLLABUS

UNIT - I	VECTOR ANALYSIS	9

Scalar – vector - vector addition - subtraction and multiplication, Coordinate Systems - Gradient – Divergence - differential elements – Curl, divergence and stokes theorem, Electric field intensity - electric flux density - Coulomb's Law – Gauss's law.

UNIT - II	ELECTROSTATICS	9

Electric potential – Electric field and electric potential - Uniform and Non - Uniform field, Electric field in free space - conductors - multiple dielectrics and field behavior at the interfaces - Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density.

UNIT - III	MAGNETOSTATICS	9

Magnetic field intensity– Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop - infinite sheet of current, Magnetic flux density (B) – B in free space potential – conductor - magnetic materials – Magnetization - Magnetic field in multiple media – scalar and vector Poisson's Equation, Energy density.

UNIT - IV	ELECTRODYNAMIC FIELDS	9

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT - V	ELECTROMAGNETIC WAVES	9

Electromagnetic wave generation and equations – Wave parameters – velocity – Waves in free space - lossy and lossless dielectrics - conductors- skin depth - Poynting vector – Plane wave reflection and refraction – Standing Wave.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Demonstrate the basic mathematical concepts related to electromagnetic waves and vector fields.
CO2	Apply the knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
CO3	Infer the different concepts of magneto-statics and summarize the magnetic flux density with scalar and vector potential.
CO4	Illustrate Maxwell's equations in differential and integral forms.
CO5	Enumerate the electromagnetic wave equations for the problems relating to uniform plane.

TEXT BOOKS

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition Oxford University Press Inc. First India edition, 2016.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009.
3. K.A. Gangadhar, P.M. Ramanthan' Electromagnetic Field Theory (including Antennas and wave propagation', 16th Edition, Khanna Publications, 2007.

REFERENCES

1. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
2. Joseph. A. Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory Fundamentals", Cambridge University Press; Second Revised Edition, 2009.

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191EE422 / CONTROL SYSTEMS			2	2	0	3

COURSE OBJECTIVES

- ✓ To introduce the components and their representation of control systems
- ✓ To learn various methods for analyzing the time response, the frequency response and stability of the systems
- ✓ To learn the various approach for the state variable analysis

SYLLABUS

UNIT - I	SYSTEMS COMPONENTS AND THEIR REPRESENTATION	9

Introduction to the control system – Terminology and Basic Structure – Feed forward and Feedback control theory – Electrical and Mechanical system Transfer Function Models, Block diagram Models, Signal flow graphs models, DC and AC servo Systems – Synchros

UNIT - II	TIME DOMAIN ANALYSIS	9

Introduction – Performance specification – Transient Response Specification in terms of Pole Location – Steady state error constants and system – Type number - Introduction to Design and Compensation – Characteristics of Proportional mode of control – Characteristics of Integral mode of control – Characteristics of Derivative mode of control – PID Controllers, Time response analysis using MATLAB

UNIT - III	FREQUENCY DOMAIN ANALYSIS AND COMPENSATOR DESIGN	9

Closed loop frequency response – Performance specification in frequency domain – Frequency response of standard second order system – Bode Plots – Polar Plot – Cascade lead compensation – Cascade lag compensation – Cascade lag-lead compensation– Design using bode plots, Frequency response analysis using MATLAB

UNIT - IV	S DOMAIN ANALYSIS AND SYSTEM STABILITY	9

Concept of stability – Bounded Input Bounded Output stability – Routh stability criterion – Relative stability – Root locus concept – Guidelines for sketching root locus – Nyquist stability criterion, Nyquist and Root locus using MATLAB.

UNIT - V	STATE VARIABLE APPROACH	9

State variable representation – Conversion of state variable models to transfer functions – Conversion of transfer functions to state variable models – Solution of state equations – Concepts of Controllability and Observability – Stability of linear systems – Equivalence between transfer function and state variable representations – State space analysis using MATLAB.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Discuss about Systems.
CO2	Examine time response analysis of LTI systems.
CO3	Solve frequency domain analysis of control systems.
CO4	Analyze the stability of the system in s-domain.
CO5	Develop various approaches with state space representation and to solve transfer function model.

TEXT BOOKS

1. Nagrath I.J and Gopal M., "Control Systems Engineering", New Age International Publishers, 5thEdition (Reprint), 2016.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2013.
3. S.K.Bhattacharya, "Control System Engineering", 3rd Edition, Pearson, 2013
4. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.

REFERENCES

1. Salaivahanan. S, Rengaraj. R, Venkata krishnan. G. R., "Control Systems Engineering", Pearson India Education Services Pvt. Ltd., 2015.
2. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.
3. Richard.C. Dorf and Robert H. Bishop, "Modern Control Systems", Addidon – Wesley, 2011.
4. Benjamin C. Kuo, "Automatic Control systems", Pearson Education, New Delhi, 2009.

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191EE423 / AC ROTATING MACHINES			3	0	0	3

COURSE OBJECTIVES

- ✓ To impart the knowledge on fundamentals of AC rotating machines and constructional details.
- ✓ To understand about the principle of operation of 1 phase induction motor.
- ✓ To analyze and select machine for specific application.

SYLLABUS

UNIT - I	ASYNCHRONOUS MACHINES	9

Three Phase Induction Motor – Types – Construction – Working Principle – Torque-Slip Characteristics – Equivalent Circuit – Circle Diagram – Applications, Single Phase Induction Motor – Types – Construction – Working principle – Equivalent Circuit – Applications.

UNIT - II	SYNCHRONOUS GENERATORS	9

Alternator – Types – Construction – working principle – Characteristics – emf equation –Testing–Parallel operation – Armature Reaction – Voltage Regulation – EMF, MMF and ZPF methods – Two Reaction Theory–Applications.

UNIT - III	SYNCHRONOUS MOTOR	9

Starting Methods – Working Principle – V and inverted V-Curves – Power developed in Synchronous motor – Characteristics– Voltage and Power Factor control – Hunting – Synchronous Condenser.

UNIT - IV	STARTERS AND SPEED CONTROL METHODS	9

Types of Starters – DOL – Rotor resistance starters – Autotransformer and Star-delta starters – Significance of starters– Comparison, Speed Control – Voltage control – frequency control – pole changing method – Cascaded Connection, Braking – Plugging – Dynamic braking – Regenerative braking.

UNIT - V	SPECIAL MACHINES	9

Linear Induction Motor, Hysteresis Motor, Eddy Current Motor, Brushless DC motor, Induction Generator, AC Series Motor.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Explain about the fundamentals of AC rotating machines.
CO2	Demonstrate about the operating principle of Induction Motor.
CO3	Examine the performance of Synchronous Machines.
CO4	Classify the different Starting and speed control techniques.
CO5	Analyze and select machines for specific application.

TEXT BOOKS

1. Bimbhra. P.S., "Electrical Machinery", Khanna Publishes, 7th Edition, 2011.
2. Nagrath. I.J and Kothari. D.P., "Electric Machines", Tata McGraw Hill Private Limited, 2010.
3. Theraja. B.L. and Theraja. A.K., "A text book on Electrical Technology", Volume– II, S.Chand and Company Limited, 2009

REFERENCES

1. Electrical Machines - II, GC Garg, (ISBN: 978-93-86173-60-7), Khanna Book Publishing, Delhi, 2018.
2. M.N.Bandopathy, Electrical Machines, Theory and Practices, PHI Learning PVT Ltd., New Delhi, 2009.
3. The Performance & Design of Alternating Current Machines, Say, CBS Publishers 2002.

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191EE424 / MICROPROCESSORS AND MICROCONTROLLERS			3	0	0	3

COURSE OBJECTIVES

- ✓ To impart knowledge on Architecture of 8051 & PIC Microcontroller.
- ✓ To learnSimple applications development with programming 8051 & PIC microcontrollers.
- ✓ To gain knowledge about Addressing modes, instruction set & use of interrupt.

SYLLABUS

UNIT - I	INTRODUCTION	9

Introduction to Microprocessor and Microcontroller – Evolution, Architecture of Microprocessor -Von Neumann and Harvard architecture – CISC and RISC, Overview of 16/32/64-bit Microprocessors and Microcontrollers – Applications of Microprocessors and Microcontrollers

UNIT - II	8051 MICROCONTROLLER	9

8051 Architecture – Pin details, Timing Diagram, Memory organization, Parallel Ports, Counters/Timers – Interrupts - Serial port, Addressing modes-Instruction set of 8051-Basic Assembly language Programming- Look up tables – subroutines, Timer and serial port programming.

UNIT - III	8051 INTERFACING WITH PERIPHERALS USING EMBEDDED 'C'	9

Introduction to IDE, Embedded C Data Types-Programming structure, Matrix Keyboard-LCD-DAC –ADC – 7-segment LED Display.

UNIT - IV	SERIAL COMMUNICATION	9

RS-232-RS- 485, Inter-integrated Circuit (I2C), Universal Serial Bus (USB) ,CAN

UNIT - V	INTRODUCTION TO PIC MICROCONTROLLERS	9

PIC 16F877 microcontroller – Architecture On chip, ADC-Capture/Compare/PWM Module - I 2C – SPI – Watch dog timer

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Apply the programming knowledge of Microprocessor and Microcontroller to perform various tasks.
CO2	Make use of techniques, skills and ability to interface microprocessor with various devices.
CO3	Analyze linear and digital electronic circuits.
CO4	Identify and formulate the ways to effectively utilize microcontroller peripherals.
CO5	Develop the Application systems with Microprocessor and Microcontroller concepts.

TEXT BOOKS

1. Muhammed Ali Mazidi, Janice GillispieMazidi, Rolin D Mckinlay "The 8051 Microcontroller and Embedded Systems", Pearson Education India, New Delhi, 2011.
2. Ramesh S Gaonkar, —"Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, Prentice Hall of India, New Delhi, 2011.
3. J John B.Peatman, "Design with PIC Microcontrollers", Pearson Education, 2002.

REFERENCES

1. P.S.Manoharan, P.S.Kannan, "Microcontroller based system design", Scitech Publications Pvt. Ltd., Chennai, 2007.
2. K Kenneth.J. Ayala, "The 8051 Microcontroller, Architecture, Programming & Applications (third edition)", Penram International, India (2004).
3. A.K Ray,K M Bhurchandi,"Advanced Microprocessors and Peripherals", Tata Mcgraw Hill Education,2nd Edition 2006.
4.https://www.nxp.com/docs/en/data-sheet/LPC2141_42_44_46_48.pdf

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191EE425 / MEASUREMENT AND INSTRUMENTATION			3	0	0	3

COURSE OBJECTIVES

- ✓ To gain knowledge about Errors in Measurements
- ✓ To understand the working of Analog and Digital Meters
- ✓ To learn comparison methods of Measurements

SYLLABUS

UNIT - I	INTRODUCTION	9

Role and needs of instrumentation – Classification - Selection of instruments – Functional elements of an instrument, Static and dynamic characteristics, Errors in measurement – Statistical evaluation of measurement data, Standards and calibration.

UNIT - II	ANALOG CURRENT AND VOLTAGE MEASUREMENT	10

D'Arsonval Galvanometer, Moving iron – attraction and repulsion type instruments, Moving coil instruments – Permanent magnet moving coil instruments - Dynamometer type moving coil Instruments, Torque equations and errors, Extension of ranges – use of shunts, Instrument Transformers.

UNIT - III	MEASUREMENT OF POWER AND ENERGY	9

Dynamometer type wattmeter – Torque expression – Errors, Energy meters – Calibration of energy meters, Measurement of power, Instrument Transformers, Maximum demand indicator, Power factor meter, Synchroscope.

UNIT - IV	MEASUREMENT OF R-L-C	8

Resistance measurement – Kelvin double bridge – Wheatstone bridge – substitution method - Loss of charge method - Guard Wire method, Measurement of inductance and capacitance – Maxwell – Anderson – Schering Bridge. Measurement of Earth resistance – Megger, Electrostatic and Electromagnetic Interference – Grounding Techniques.

UNIT - V	DIGITAL MEASURING DEVICES AND DISPLAY DEVICES	9

Electronic voltmeter – Digital voltmeter of ramp and integrating types, Digital Multimeter, Digital three phase Real power and Energy measurement- Harmonic Distortion Analyzer, Function Generator, Dual channel Oscilloscope, Digital storage Oscilloscope, A/D – D/A Converters, Display Devices – Printers - LED – LCD, Introduction to recent developments in sensors – SMART sensors – Nano sensors

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Summarize the basic blocks of Instrumentation.
CO2	Examine the operation of Voltage and current Measuring Instruments.
CO3	Infer the operation of meters to measure Power and Energy.
CO4	Select suitable bridges to measure passive elements.
CO5	Perceive digital measuring systems.

TEXT BOOKS

1. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria& Sons, Delhi, 2013.
2. Sawhney A K, —"A Course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai & Sons, New Delhi, 2011.
3. H.S. Kalsi, "Electronic Instrumentation", McGraw Hill, III Edition 2010.

REFERENCES

1. David A. Bell, —"Electronic Instrumentation and Measurements", Oxford University Press, New Delhi, 2012.
2. Doeblin E O and Dhanesh N Manik, —"Measurement Systems", McGraw-Hill, New Delhi, 2012.
3. Rangan C S, Sharma G R, Mani V S, "Instrumentation Devices and Systems', Tata McGraw-Hill, New Delhi, 2004

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191EE42A / AC ROTATING MACHINES LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To obtain the regulation of Alternators by various methods
- ✓ To predetermine the efficiency of various machines
- ✓ To gain knowledge from Equivalent circuits

LIST OF EXPERIMENTS

1	Study of AC Motor Starters
2	Regulation of Three Phase Alternator by EMF and MMFmethods
3	Regulation of Three Phase Alternator by ZPF and ASA methods
4	Regulation of Three Phase Salient Pole Alternator by Slip test
5	V and Inverted V curves of Three Phase Synchronous Motor
6	Load test on Three Phase Induction Motor
7	Predetermination of performance characteristics of three phase induction motor by circle diagram and equivalent circuit.
8	Separation of No–load losses of Three Phase Induction Motor
9	Load test on Single Phase Induction Motor
10	Equivalent Circuit of Single-Phase Induction Motor
11	Study of Parallel operation of two Alternators

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Inspect, connect and run Single and Three phase Induction motors, Synchronous and Alternators
CO2	Determine the losses of the machines
CO3	Select Starters for particular machines

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191EE424B / MICROPROCESSORS AND MICROCONTROLLERS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To execute embedded C programming
- ✓ To implement microcontroller and its applications
- ✓ To provide in depth knowledge of 8051 and MSP 430 assembly language programming

LIST OF EXPERIMENTS

1	Simple arithmetic operations: addition / subtraction / multiplication / division.
2	Programming with control instructions: (i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions. (iii) Hex / ASCII / BCD code conversions.
3	Interface Experiments: with 8085 (i) A/D Interfacing. (ii) D/A Interfacing
4	Traffic light controller. 5 I/O Port / Serial communication
5	Read a key, interface display
6	Demonstration of basic instructions with 8051 Micro controller execution, including: Conditional jumps &looping, Calling subroutines.
7	Programming I/O Port and timer of 8051 study on interface with A/D & D/A Study on interface with stepper motor.
8	Programming using PIC: Timers/ Interrupts/ Serial port programming
9	I/O Interfacing using PIC: /PWM Generation/ Motor Control/ADC/DAC / LCD/ RTC Interfacing/ Sensor Interfacing
10	Interfacing 8051 with stepper motor

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Develop programming for basic operations.
CO2	Interface Processors with real time systems.
CO3	Apply concepts for Serial Communication.

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191MC46A / INTERNSHIP 1			0	0	0	0

COURSE OBJECTIVES

- ✓ To develop the skills in cutting edge technologies in the industry
- ✓ To acquire knowledge to work smooth in industry environment
- ✓ To get through the placement interviews

DEMONSTRATION

The students may undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

The Internship is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. An Internship report is required at the end of the semester. The Internship training is evaluated based on oral presentation and the Internship report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Acquire knowledge about the Industry environment.
CO2	Apply the skills to the carriers.
CO3	Develop skills in teamwork.

SEMESTER – V

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE511 / EMBEDDED SYSTEM			3	0	0	3

COURSE OBJECTIVES

- ✓ To introduce the Building Blocks of Embedded System
- ✓ To Educate in Various Embedded Development Strategies
- ✓ To Introduce Bus Communication in processors, Input/output interfacing.
- ✓ To impart knowledge in various processor scheduling algorithms.
- ✓ To introduce Basics of Real time operating system and example tutorials todiscuss on one real time Operating system tool

SYLLABUS

UNIT - I	INTRODUCTION TO EMBEDDED SYSTEMS	9

Introduction to Embedded Systems - The build process for embedded systems - Structural units in Embedded processor , selection of processor & memory devices, DMA, Timer and Counting devices - Watchdog Timer - Real Time Clock, Incircuit emulator, Target Hardware Debugging - Embedded Product Development Life Cycle.

UNIT - II	EMBEDDED NETWORKING	9

Embedded Networking: Introduction, I/O Device Ports & Buses – Serial Bus communication protocols - RS232 standard – RS422 – RS485, CAN Bus - Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C), need for device drivers.

UNIT - III	INTRODUCTION TO EMBEDDED WIRELESS TECHNOLOGIES	9

Introduction of Wireless Connectivity, Comparison of Wireless Technologies – WiFi, Zigbee, Bluetooth, LoWPAN, Network Topology and Range, Different Ranges and Applications of Personal – Local - Neighborhood and wide area networks, Internet of Things (IoT) and its applications.

UNIT - IV	RTOS BASED EMBEDDED SYSTEM DESIGN	9

Introduction to basic concepts of RTOS – Task - process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication- shared memory - message passing- Interprocess Communication – synchronization between processes - semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT - V	EMBEDDED SYSTEM DESIGN APPLICATION DEVELOPMENT	9

Case Study of Washing Machine - Automotive Application - Smart card System Application - ATM machine – Audio player- Video accelerator - Digital camera, Practical Part: DC motor speed control and display of speed - Stepper motor speed control and display of speed - Temperature measurement and Display - Measurement of power and energy - LED illumination control using PWM, Data communication using Ethernet / USB/ CAN - Wireless data communication using Bluetooth / Zigbee module - Measurement of position and pressure.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Tell about internal blocks of Processor.
CO2	Explain the communication buses adopted for Embedded Systems.
CO3	List the concepts of wireless technologies.
CO4	Inspect the multi-tasking ability of Processor.
CO5	Develop Embedded system applications.

TEXT BOOKS

1. Rajkamal, 'Embedded System-Architecture, Programming, Design', McGrawHill, 2013
2. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
3. Peckol, "Embedded system Design", JohnWiley&Sons, 2010

REFERENCES

1. EliciaWhite,"Making Embedded Systems",O'Reilly Series,SPD,2011
2. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009
3. Shibu.K.V, "Introduction to Embedded Systems", TataMcgraw Hill,2009
4. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007
5. TammyNoergaard, "Embedded Systems Architecture", Elsevier, 2006
6. Refer Datasheet, Technical Documents, and Application notes

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE521 / ANALOG ELECTRONICS AND APPLICATIONS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the methods of biasing transistors
- ✓ To design and analyze multistage and differential amplifier circuits.
- ✓ To analyze the frequency response of amplifiers
- ✓ To explore the VI characteristics of various amplifiers
- ✓ To understand the internal building blocks of power supply

SYLLABUS

UNIT - I	BIASING OF DISCRETE BJT, FET AND MOSFET	9

BJT– Need for biasing - DC Load Line and Bias Point – Various biasing methods of BJT – Bias Circuit Design - Thermal stability - Stability factors - Bias compensation techniques using Diode, Thermistor– Various biasing methods of JFET and MOSFET

UNIT - II	MULTI STAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIERS	9

Darlington Emitter follower, Bootstrapped Darlington circuit, Cascode Connections, Cascade connections, , Band width of multistage amplifiers, Concept of gain bandwidth product, Distortion in Amplifiers, Differential amplifier using BJT - CMRR

UNIT - III	FREQUENCY RESPONSE OF AMPLIFIERS	9

Amplifier frequency response – Frequency response of transistor amplifiers with circuit capacitors– BJT frequency response – short circuit current gain - cut off frequency – f_α, f_β and unity gain bandwidth – Miller effect - frequency response of FET - High frequency response of transistor circuits - Transistor Switching Times.

UNIT - IV	POWER AMPLIFIERS	9

Classification - Class A/B/AB/C - single ended and Push-pull configuration - Power dissipation, output power and conversion efficiencies - Complementary-symmetry power amplifiers – MOSFET power amplifier - Distortions – Eliminations of Distortion

UNIT - V	RECTIFIERS, FILTERS AND REGULATORS	9

Functional block diagram of power supply-Half wave and Full wave Rectifiers - Ripple factor, Regulation, Rectification efficiency, TUF - Filters - L, C and π type filters - Ripple factor and regulation - Voltage Regulators - Series and Shunt Voltage Regulators - Current limiting and protection circuits-Switched Mode Power Supplies - Troubleshooting and Fault Analysis

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Acquire the fundamental concepts of Analog Electronic circuits.
CO2	Design and analysis of multistage amplifiers and the effects of coupling.
CO3	Analyze frequency response of an amplifier.
CO4	Summarize the different types of power amplifiers.
CO5	Infer about various rectifiers, filters and regulators.

TEXT BOOKS

1. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, McGraw Hill Education (India) Private Ltd., 2010.
2. Boylestad L Robert and Nashelsky Louis, ―Electronic Devices and circuits, Prentice Hall of India, New Delhi, 2009.

REFERENCES

1. Floyd, Electronic Devices, Ninth Edition, Pearson Education, 2012.
2. David A Bell, ―Electronic Devices and Circuits‖, Prentice Hall of India, New Delhi, 2008.
3. Microelectronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, Sixth Edition.
4. Integrated Electronics- J. Millman and C.C. Halkias, Tata Mc Graw- Hill, 1972.

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE522 / POWER ELECTRONICS			3	0	0	3

COURSE OBJECTIVES

- ✓ To study the constructional structures of Power semi-conductor devices
- ✓ To calculate and compare output average expressions for various converters
- ✓ To study about protection circuits

SYLLABUS

UNIT - I	POWER SEMI - CONDUCTOR DEVICES	9

Introduction- Power diodes-construction – types, forward and reverse characteristics, Power BJTs – construction-static characteristics-switching characteristics, Thyristors – construction and static characteristics – Two transistor analogy, Power MOSFETs- Power IGBTs- structure and operation- static and switching characteristics

UNIT - II	AC TO DC CONVERTERS	9

Review of Uncontrolled Rectifiers, 1-pulse, 2-pulse, 3-pulse and 6-pulseconverters with R, RL and FWD, performance parameters – Effect of source inductance–Applications-light dimmer, Excitation system, Solar PV systems

UNIT - III	DC TO AC CONVERTERS	9

Single Phase and Three Phase Voltage Source Inverters, Current source inverter, PWM Schemes, Frequency and Voltage Control, Applications-Induction heating, UPS.

UNIT - IV	DC-DC & AC-AC CONVERTERS	9

Buck, Boost & Buck-Boost Converters-Types of choppers-A, B, C, D and E-Applications-Battery operated vehicles, AC voltage controller and Cyclo converter-Applications –Welding

UNIT - V	PROTECTION AND DRIVER CIRCUITS	9

Triggering and commutation circuit for SCR in Rectifiers-Commutation circuit for DC-DC converters, Rectifiers, Introduction to Driver and snubber circuits-Performance parameters of rectifiers

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Identify the device performance based on its Characteristics.
CO2	Explain various types of Rectifiers.
CO3	Construct Inverter circuits.
CO4	Examine chopper circuits for various quadrants of operation.
CO5	Summarize about protection, commutation and Driver systems.

TEXT BOOKS

1. M D Singh and K B Khanchandani, Power Electronics, Tata McGraw-Hill, 2008.
2. P.S. Bimbra, Power Electronics- Khanna Publishers, 3rd Edition, 2004
3. Ned Mohan, Tore M. Undeland and William P.Robbins, Power Electronics: Converters, Applications and Design, John Wiley and Sons, 2003.
4. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

REFERENCES

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. L. Umanand, Power Electronics: Essentials and Applications- Wiley India, 2009
3. V.R.Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', Oxford University Press, 1st Edition, 2005.
4. M.H. Rashid, Power Electronics: Circuits, Devices and Application, second edition, Prentice Hall of India, 2004.
5. Vedam Subramaniam, 'Power Electronics', New Age International (P) Ltd Publishers, 2001

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE523 / TRANSMISSION AND DISTRIBUTION			3	0	0	3

COURSE OBJECTIVES

- ✓ To study the structure of electric power system, EHVAC, HVDC transmission and FACTs.
- ✓ To develop expressions for the computation of transmission line parameters.
- ✓ To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- ✓ To analyze the voltage distribution in insulator strings to improve the efficiency, and to studythe types, construction of cables and methods to improve the efficiency.
- ✓ To study about distribution systems, types of substations and calculations of voltage at a point on the given type of distribution System.

SYLLABUS

UNIT - I	INTRODUCTION	9

Introduction - Structure of Electric Power System –Advantages of higher operating voltage. Different Operating Voltages of Generation, Transmission, and Distribution, Introduction to EHV AC Transmission, HVDC Transmission and FACTs.

UNIT - II	TRANSMISSION LINE PARAMETERS	9

Electrical constants - Resistance, Inductance and capacitance of Single and 3 Phase lines - Effects of earth on capacitance - Skin effect - Proximity effect - Transposition - Bundled conductors –Typical Configuration of Line Supports and Conductor Types. Corona -Factors affecting corona

UNIT - III	MODELLING AND PERFORMANCE OF TRANSMISSION LINES	9

Short and medium transmission lines - Phasor diagrams - Nominal T and Pi methods - Line regulation - Efficiency. Rigorous solution for long line - ABCD constants - Ferranti effect – Tuned power lines - Surge impedance and surge impedance loading.

UNIT - IV	LINE INSULATORS & CABLES	9

Insulators - Types - Potential distribution over a string of suspension insulators - Methods of increasing string efficiency -Testing of insulators – Stress and Sag in overhead lines – causes.

Cables: Construction & types- Capacitance and insulation resistance - Sheath effects - Grading – Stresses –Comparison between overhead lines and underground cables.

UNIT - V	DISTRIBUTION SYSTEMS	9

Substations and its Types – Typical Key Diagram of a 11kV / 400V Substation, Feeders, distributors and service main - Radial and ring main systems - Calculation of voltage in distributors with concentrated and distributed loads-AC single phase and three phase systems.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze the basic structure of Electric Power system.
CO2	Evaluate the computation of Transmission Line parameters.
CO3	Determine the equivalent circuit for different transmission line based on distance.
CO4	Examine the voltage distribution in Insulator string.
CO5	Summarize about the types of sub-stations.

TEXT BOOKS

1. Mehta V K, Rohit Mehta, "Principles of Power Systems", S.Chand& Co., New Delhi, 2011
2. C.L.Wadwa, “Electrical Power system” New Age International, 6th Edition – 2010
3. Duncan Glover J, Mulukutla S. Sarma, Thomas Jeffrey Overbye, Thomas J. Overbye,”Power System Analysis and Design”, Thomson Learning, New Delhi, 2008
4. C.L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, New Age International Publishers, Second Edition, 2006

REFERENCES

1. Soni M L, Gupta P V, Bhatnagar U S and Chakrabarthi A, "A Text Book on Power System Engineering", Dhanpat Rai & Co., New Delhi, 2013
2. Uppal S L, "Electrical Power Systems ", Khanna Publishers, New Delhi, 2009
3. Kothari D P and Nagrath J, “Power System Engineering”, Tata McGraw-Hill, New Delhi, 2008
4. S.N. Singh, “Electric Power Generation, Transmission and Distribution”, Prentice Hall of India, ISBN – (978-81-203-36508), Second edition 2008

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE51A / EMBEDDED LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To understand the basic of Embedded systems
- ✓ To have hands on experience with Software

LIST OF EXPERIMENTS

1	Study of ARM evaluation system
2	Interfacing ADC and DAC
3	Interfacing LED and PWM
4	Interfacing real time clock and serial port
5	Interfacing keyboard and LCD
6	Interfacing EPROM and interrupt
7	Mailbox
8	Interrupt performance characteristics of ARM and FPGA
9	Flashing of LEDS
10	Interfacing stepper motor and temperature sensor
11	Implementing zigbee protocol with ARM.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Write programs in ARM for specific applications.
CO2	Interface various peripherals using ARM processors.
CO3	Rule on Hardware control using Embedded Software's.

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE52A / CONTROL AND INSTRUMENTATION LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To understand about the necessity of control systems.
- ✓ To understand the concepts of bridge networks and signal conditioning circuits.

LIST OF EXPERIMENTS

1	Measurement of displacement measurement using LVDT.
2	Study of DC and AC bridges
3	Measurement of Strain in a cantilever beam using strain gauges
4	Measurement of Temperature(Thermistor / RTD)
5	Study of P, PI and PID controllers in feedback system.
6	Signal Conditioning (a) Instrumentation Amplifier (b) Analog to Digital and Digital to Analog converters (ADC and DACs)
7	Measurement of Flow
8	Measurement of Pressure
9	Synchro Transmitter- Receiver and Characteristics

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand control theory and apply them to electrical engineering problems.
CO2	Examine the basic concepts of bridge networks and transducers.
CO3	Interpret the basics of signal conditioning circuits.

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191MC56A / CIRCUIT SIMULATION LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To understand the basic laws of Electrical Engineering
- ✓ To have hands on experience with Simulation
- ✓ To gain concepts of Semi-conductor devices with simulation

LIST OF EXPERIMENTS

1	Verification of Ohm's and Kirchhoff's Law
2	Circuit analysis using Mesh current Method
3	Circuit analysis using Nodal Voltage Method
4	Verification of Theorems
5	Analysis of R, L, and C effects (independently) using MATLAB
6	Construct and Analyze the operation of rectifier circuits using MATLAB
7	Simulation of Thyristor Switch
8	Simulation of Single-phase Full wave Bridge Rectifier
9	Simulation of Single-phase Half Bridge Inverter
10	Simulation of Single-phase Full Bridge Inverter

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Recall basic law of Electric Circuits using simulation.
CO2	Inspects systems with various simulation parameters.
CO3	Interpret Circuit simplification concepts using simulation.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191HS601 / INDUSTRIAL MANAGEMENT AND ECONOMICS			3	0	0	3

COURSE OBJECTIVES

- ✓ To impart the knowledge on fundamental of Industrial Management and Economics.
- ✓ To understand about the theory and demand of supply.
- ✓ To analyze the Indian financial system.

SYLLABUS

UNIT - I	MODERN CONCEPT OF MANAGEMENT	9

Concept of Management - Functions of management-Planning-Organizing- Staffing-Directing- Motivating- Communicating- Coordinating- Controlling-Organizational structures- Line and staff functional relationships- Span of control- Delegation- Management by Objectives.

UNIT - II	PERSONNEL MANAGEMENT	9

Objectives and functions of Personnel Management- Recruitment and Selection- Training and Development -Labour Welfare- Industrial Disputes-Trade Unions- Quality circles. Formation of Companies: Proprietary – Partnership-Joint stock companies- Public Sector – Private Sector.

UNIT - III	MARKETING MANAGEMENT	9

Marketing Definition - Marketing Mix – Product – Price – Place – Promotion - Market research- Segmentation – Targeting – Positioning – Production Concept – Product Concept – Selling Vs Marketing – Advertisement and Sales Promotion.

UNIT - IV	THEORY OF DEMAND AND SUPPLY	9

Law of demand and supply- Pricing Mechanism- Factors of production- Land, Labour, capital and organization- National Income - Taxation- Direct and Indirect Taxes - Progressive and Regressive – Inflation-Causes and consequences – Supply Chain Management.

UNIT - V	INDIAN FINANCIAL SYSTEM	9

Reserve bank of India: Functions- Commercial banking system-Development financial institutions- Investment institutions- Insurance companies- Indian capital market- Stock market - Role of the public sector- Privatization- Multinational corporations and their impact on the Indian economy.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand modern concept of management
CO2	Analyse the Recruitment and Selection process
CO3	Suggest market research concepts
CO4	Summarize the Direct and indirect tax details
CO5	Learn Indian financial system

TEXT BOOKS

1. Agarwal.A.N, Agarwal.M.K," Indian economy ", New Age International Publishers, 2019
2. Khanna.O.P," Industrial Engineering and Management ", Dhanpat Rai Publications, 2018.

REFERENCES

1. Philip Kotler,Keven Lane Keller," Marketing Management",Pearson,2017.
2. Ahuja.K.K, "Industrial Management and Organizational Behaviour", Khanna Publishers, 1998.
3. Dewett.K.K," Modern economic theory",Shyam Lal charitable trust,1995.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE621 / DIGITAL SIGNAL PROCESSING			3	0	0	3

COURSE OBJECTIVES

- ✓ To classify signals and systems and its mathematical representation.
- ✓ To analyze the discrete time systems.
- ✓ To study various transformation techniques and computation.
- ✓ To study about filters and design for digital implementation.
- ✓ To study about a programmable digital signal processor and quantization effects.

SYLLABUS

UNIT - I	INTRODUCTION	9

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

UNIT - II	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 – Analysis of L TI Systems in z-domain. Introduction to two-dimensional z-transform.

UNIT - III	DISCRETE FOURIER TRANSFORM AND COMPUTATION	9

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

UNIT - IV	DESIGN OF DIGITAL FILTERS	9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – 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.

UNIT - V	DIGITAL SIGNAL PROCESSORS	9

Architecture – Features – Addressing Formats – Functional modes – Instruction Set– Quantization error-Finite word length effects in designing digital filters.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Acquire knowledge on Signals and systems & their mathematical representation.
CO2	Understand and analyze the discrete time systems.
CO3	Analyze the transformation techniques & their computation.
CO4	Understand the types of filters and their design for digital implementation
CO5	Acquire knowledge on programmability digital signal processor & quantization effects

TEXT BOOKS

1. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2018
2. Lonnie C.Ludeman,"Fundamentals of Digital Signal Processing", Wiley, 2017.
3. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2015.
4. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, "Discrete – Time Signal Processing", Pearson Education, New Delhi, 2013.

REFERENCES

1. Dimitris G.Manolakis, Vinay K. Ingle, applied Digital Signal Processing, Cambridge, 2018
2. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2014
3. Poorna Chandra S, Sasikala. B, Digital Signal Processing, Vijay Nicole/TMH, 2013.
4. SenM.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson, 2013
5. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2013.
6. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning, 2012.
7. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE622 / POWER SYSTEM ANALYSIS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand and develop Y_{bus} and Z_{bus} matrices.
- ✓ To understand and apply iterative techniques for power flow analysis.
- ✓ To model and carry out short circuit studies on power system.
- ✓ To model and analyze stability problems in power system.
- ✓ To model the power system under steady state operating condition.

SYLLABUS

UNIT - I	POWER SYSTEM NETWORK MATRICES	9

Power system components, representation - Single line diagram - per unit quantities, per unit impedance diagram, per unit reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters - Representation of off-nominal transformer - Formation of bus admittance matrix of large power network - Formation of Y_{bus}: Direct and Singular Transformation Methods- Formation of Z_{bus}, Numerical Problems.

UNIT - II	POWER FLOW STUDIES	9

Introduction - Bus classification - Formulation of Power Flow problem in real and polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

UNIT - III	SYMMETRICAL FAULT ANALYSIS	9

Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine (On No Load), Short Circuit of a Loaded Synchronous Machine, Selection of Circuit Breakers. Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem – Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level – Current limiting reactors.

UNIT - IV	UNSYMMETRICAL FAULT ANALYSIS	9

Introduction- Symmetrical components - Sequence impedances - Sequence networks - Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults - unsymmetrical fault occurring at any point in a power system - computation of post fault currents in symmetrical component and phasor domains.

UNIT - V	POWER SYSTEM STABILITY ANALYSIS	9

Introduction, Dynamics of a Synchronous Machine, Power Angle Equation Salient and Non – Salient pole Synchronous Machines, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability. Classification of power system stability –Swing equation – Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time Classical step-by-step solution of the swing equation – modified Euler method.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Develop the Y_{bus} and Z_{bus} matrices.
CO2	Understand and apply iterative techniques for power flow analysis.
CO3	Model and understand various power system components and carry out power flow, short circuit.
CO4	Model and analyze stability problems in power system.
CO5	Model the power system under steady state operating condition.

TEXT BOOKS

1. John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Grew Hill Education (India) Private Limited, New Delhi, 2015
2. HadiSaadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010
3. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008

REFERENCES

1. J. Duncan Glover, MulukutlaS.Sarma, Thomas J. Overbye, 'Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012
2. Kundur P., 'Power System Stability and Control', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010
3. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007
4. Gupta B.R., 'Power System - Analysis and Design', S. Chand Publishing, 2001

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE623 / SOLID STATE DRIVES			3	0	0	3

COURSE OBJECTIVES

- ✓ To apply power electronic converters to control the speed of DC motors.
- ✓ To describe the operation and performance of AC motor drives.
- ✓ To design the current and speed controllers for a closed loop solid state DC motor drives.

SYLLABUS

UNIT - I	DYNAMICS OF ELECTRICAL DRIVES	9

Parts and choice of Electric drives – Advantages of solid-state electric drives – Equations governing motor load dynamics, Equivalent values of drive parameters, load with rotational motion, loads with translational motion – steady state stability – multi quadrant dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics–Selection of motor power rating.

UNIT - II	DC MOTOR DRIVES	9

Steady state analysis of the single and three phase fully controlled and half controlled rectifier fed separately excited DC motor drive – continuous and discontinuous conduction – Time ratio and current limit control – 4 quadrant operation of converter /chopper fed drive-Applications.

UNIT - III	INDUCTION MOTOR DRIVES	9

Stator voltage control – V/f control – Static control of Rotor Resistance - qualitative treatment of slip power recovery drives - closed loop control - Vector control-Different types of braking, dynamic, regenerative and plugging - Applications.

UNIT - IV	SYNCHRONOUS MOTOR DRIVES	9

V/f control and self-control of synchronous motor: Margin angle control and power factor control - Three phase voltage/current source fed synchronous motor - Applications.

UNIT - V	DESIGN OF CONTROLLERS FOR DRIVES	9

Modes of operation, speed control and drive classifications - Transfer function for DC motor / load and converter – closed loop control with curr.ent and speed feedback – armature voltage control and field weakening mode – Design of controllers, current controller and speed controller-converter selection and characteristics.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Illustrate the steady state operation and transient dynamics of a motor load system.
CO2	Compare the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
CO3	Demonstrate the VSI fed of Induction Motor drives.
CO4	Distinguish the different control strategies of Synchronous Motor drives.
CO5	Analyze the current and speed controllers for a closed loop solid state DC motor Drive.

TEXT BOOKS

1. V.Sekar,"Solid State Drives",SIA Publishers,First Edition,2020
2. Vedam Subramanyam, "Electric Drives Concepts and Applications", Second Edition, McGraw Hill, 2016.
3. Bimal K.Bose. "Modern Power Electronics and AC Drives", Pearson Education, 2002.

REFERENCES

1. Theodore Wildi, "Electrical Machines, Drives and power systems", 6th edition, Pearson Education, 2015.
2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System", Elsevier, 2012.
4. P.K.SEN, "Electric drives" PHI, 2012.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE62A / POWER SYSTEMS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To provide better understanding of power system analysis through digital simulation.
- ✓ To have hands on experience with power system analysis.
- ✓ To find out the types of fault in the power system.

LIST OF EXPERIMENTS

1	Equivalent circuit of a Transmission lines.
2	Determination of voltage and power at the sending end, voltage regulation using medium line model.
3	Determination of line performance when loaded at receiving end.
4	Formation of bus Admittance matrix.
5	Load flow Solution using Gauss Seidel Method.
6	Load flow solution using Newton Raphson method in Rectangular Coordinates.
7	Optimal Economic Dispatch with Losses and without Losses.
8	Three phase short circuit analysis in a Synchronous Machine.
9	Unsymmetrical Fault Analysis.
10	Z bus Building Algorithm.
11	Load Frequency control of a single area system.
12	Load frequency control of two area systems.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Inspect Transformer operation using Medium line model.
CO2	Analyze load flow solution using various methods.
CO3	Deduct short circuit fault analysis.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE62B / POWER ELECTRONICS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To understand the basic circuits of semi-conductor devices.
- ✓ To have hands on experience with Rectifiers, Inverters and choppers.

LIST OF EXPERIMENTS

1	Generation of gate pulse using R,RC and UJT circuits
2	Characteristics of MOSFET and IGBT
3	Characteristics of SCR and TRIAC
4	Half controlled and fully controlled rectifier
5	Step down and step up MOSFET based choppers
6	AC Voltage controllers
7	IGBT based single phase PWM inverter
8	IGBT based three phase PWM inverter
9	Characteristics of PMBLDC motor
10	Simulation of three phase semi converter, three phase full converter, DC-DC converter and AC voltage controller circuits.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Outline about semi-conductor devices
CO2	Design circuits, and to function effectively as an individual or in team to demonstrate the circuits
CO3	Relate various power electronic devices with their characteristics

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191MC66A / INTERNSHIP 2			0	0	0	0

COURSE OBJECTIVES

- ✓ **To develop the skills in cutting edge technologies in the industry**
- ✓ **To acquire knowledge to work smooth in industry environment**
- ✓ **To get through the placement interviews**

DEMONSTRATION

The students may undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

The Internship is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. An Internship report is required at the end of the semester. The Internship training is evaluated based on oral presentation and the Internship report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	**Acquire knowledge about the Industry environment.**
CO2	**Apply the skills to the carriers.**
CO3	**Develop skills in teamwork.**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191HS701 / PROFESSIONAL ETHICS IN ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

SYLLABUS

UNIT - I	HUMAN VALUES	9

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT - II	ENGINEERING ETHICS	9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT - III	ENGINEERING AS SOCIAL EXPERIMENTATION	9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT - IV	SAFETY, RESPONSIBILITIES AND RIGHTS	9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT - V	GLOBAL ISSUES	9

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Create an awareness on Engineering Ethics and Human Values
CO2	Instill Moral , Social Values and Loyalty
CO3	Apply ethics in society
CO4	Appreciate the rights of others
CO5	Discuss the ethical issues related to engineering

TEXT BOOKS

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

REFERENCES

1. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" McGraw Hill education, India Pvt. Ltd.,New Delhi 2013.
2. World Community Service Centre, " Value Education", Vethathiri publications, Erode,2011
3. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage learning 2009.
4. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi,2003
6. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford 2001

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE721 / HIGH VOLTAGE ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the various types of over voltages in power system and protection methods.
- ✓ Learn the nature of breakdown mechanism in solid, liquid and gaseous dielectrics.
- ✓ Learn the various methods for generating over voltages in laboratories.
- ✓ Learn the various methods form measuring over voltages in laboratories.
- ✓ To know the various testing procedures conducted on power apparatus and insulation coordination.

SYLLABUS

UNIT - I	OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS	9

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

UNIT - II	DIELECTRIC BREAKDOWN	9

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

UNIT - III	GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS	9

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

UNIT - IV	MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS	9

Measurement of high direct current voltages, measurement of high alternating and impulse voltages, measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

UNIT - V	TESTING OF MATERIALS AND ELECTRICAL APPARATUS	9

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Classify the various types of over voltages in power system and protection methods.
CO2	Distinguish the nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
CO3	Describe the Generation of over voltages in laboratories
CO4	Distinguish the various types of measurement of over voltages.
CO5	Discuss on Testing of power apparatus.

TEXT BOOKS

1. S.Naidu and V. Kamaraju, High Voltage Engineering, Tata McGraw Hill, Fifth Edition, 2013.
2. C.L. Wadhwa, High voltage Engineering, New Age International Publishers, Third Edition, 2010.
3. E. Kuffel and W.S. Zaengl, J.Kuffel, High voltage Engineering fundamentals, Newnes Second Edition Elsevier , New Delhi, 2005

REFERENCES

1. R. S. JHA, "High Voltage Engineering", DHANPAT RAI & SONS 2014.
2. Subir Ray, An Introduction to High Voltage Engineering PHI Learning Private Limited, New Delhi, Second Edition, 2013.
3. L.L. Alston, High Voltage Technology, Oxford University Press, First Indian Edition, 2011.
4. Mazen Abdel -Salam, Hussein Anis, Ahdab A-Morshedy, RoshdayRadwan, High Voltage Engineering -Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE722 / PROTECTION AND SWITCHGEAR			3	0	0	3

COURSE OBJECTIVES

- ✓ To give a broad coverage on all types of protective relays.
- ✓ To impart the knowledge on fundamental of circuit breakers.
- ✓ To provide a strong background for working in a practical power system protection.
- ✓ To understand about the electrical apparatus protection
- ✓ To analyze the earthing types and its details.

SYLLABUS

UNIT - I	INTRODUCTION	7

Principles and need for protective schemes – nature and cause of faults – types of fault – three phase short circuit of an alternator – generator reactance – short circuit capacity– current limiting reactors

UNIT - II	PROTECTIVE RELAYS	10

Definition–Requirement of relays–General classification–Principle of operation– types– characteristics– Torque equation– Relaying Schemes– Relay Co-ordination– IDMT relays– Non-directional and directional over current IDMT relays – Earth fault relays– Introduction to static relays – Microprocessor and computer based protective relaying

UNIT - III	APPARATUS AND LINE PROTECTION	10

Apparatus protection – Line Protection – Distance, Differential protection and Carrier current protection. Generator protection – protection against abnormal condition, stator and rotor protection Transformer Protection – Incipient fault–Differential protection, Feeder and Bus bar protection–Microprocessor based protective schemes.

UNIT - IV	EARTHING AND INSULATION CO-ORDINATION	10

Solid, resistance and reactance Earthing – Arc suppression coil – Earthing transformers – Introduction to IEC standards for earthing (TT, TN, IT) – Earth wires – Insulation co-ordination: Definition – Determination of line insulation – Insulation levels of sub-station equipment – Co-ordination amongst items of substation equipment – Introduction to Indian Electricity rules.

UNIT - V	SURGE AND SURGE PROTECTION	8

Causes of over voltages – Lightning phenomenon – Traveling waves on transmission lines – Over voltage due to lightning – Protections against lightning – Lightning arresters – Types – Lightning arrester selection – Surge absorbers.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the types of faults.
CO2	Analyze the concepts of relays and its types.
CO3	Inspect the protective schemes for power system.
CO4	Outline the concepts of Earthing.
CO5	Summarize the Lightning protection

TEXT BOOKS

1. Badri Ram and Vishwakarma D N , ―Power System Protection and Switchgear Tata McGraw-Hill, New Delhi , 2011.
2. Ravindranath B and Chander M, ―Power System Protection and Switchgear, New Age International, New Delhi, July 2011

REFERENCES

1. Soni M L, Gupta P V, Bhatnagar U S and Chakrabarti A, "A Text Book on Power Systems Engineering", DhanpatRai& Co., New Delhi, 2013.
2. Sunil S Rao, "Switchgear Protection and Power Systems", Khanna Publishers, New Delhi, 2012.
3. Y.G. Paithankar and S.R. Bhide, Fundamentals of Power System Protection, PHI Learning Private Limited, New Delhi, 2010.
4. C.L. Wadhwa, 'Electrical Power Systems', Wiley-Blackwell, 6th Edition, 2007.
5. Cooper bus man Application note

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE72A / RENEWABLE ENERGY SYSTEMS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To train the students in Renewable Energy Sources and technologies.
- ✓ To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- ✓ To recognize current and possible future role of Renewable energy sources.

LIST OF EXPERIMENTS

1	Simulation study on Solar PV Energy System.
2	Experiment on VI-Characteristics and Efficiency of 1kWpSolar PV System
3	Experiment on Shadowing effect and diode based solution in1kWpSolar PV System
4	Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System
5	Simulation study on Wind Energy Generator
6	Experiment on Performance assessment of micro Wind Energy Generator
7	Simulation study on Hybrid (Solar-Wind) Power System
8	Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System
9	Simulation study on Hydel Power
10	Experiment on Performance Assessment of 100W Fuel Cell
11	Simulation study on Intelligent Controllers for Hybrid Systems.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Simulate Solar PV Energy , wind energy, Hybrid system
CO2	Analyse the performance of renewable energy systems
CO3	Design renewable energy system

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE77A / PROJECT WORK PHASE I			0	0	4	2

COURSE OBJECTIVES

- ✓ To develop their own innovative prototype of ideas.
- ✓ To train the students in preparing project reports and examination.

LIST OF EXPERIMENT

1	Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The Head of the Institutions shall constitute a review committee for project work for each branch of study. There shall be three reviews during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be reduced for 30 marks and rounded to the nearest integer. The project report shall carry a maximum 20 marks. The project report shall be submitted as per the approved guidelines as given by the Controller of Examinations. Same mark shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	On Completion of the project work phase I students will be in a position to take up their final year project work phase II.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE87A / PROJECT WORK PHASE II			0	0	20	10

COURSE OBJECTIVES

- ✓ To develop their own innovative prototype of ideas.
- ✓ To train the students in preparing project reports and examination.

LIST OF EXPERIMENT

1	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. The Head of the Institutions shall constitute a review committee for project work for each branch of study. There shall be three reviews during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be reduced for 30 marks and rounded to the nearest integer. The project report shall carry a maximum 20 marks. The project report shall be submitted as per the approved guidelines as given by the Controller of Examinations. Same mark shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

PROGRAM ELECTIVES – I

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191HS531/ PRINCIPLES OF MANAGEMENT			3	0	0	3

COURSE OBJECTIVES

- ✓ To impart the knowledge on the functions and principles of Management
- ✓ To understand the application of the principles in an organization
- ✓ To analyze Managerial functions like planning, organizing, staffing, leading & controlling and have some basic knowledge on international aspect of management

SYLLABUS

UNIT - I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9

Definition of Management – Science or Art - Evolution of Management – Scientific, human relations, system and contingency approaches – Types of managers - Managerial roles and skills – Henry Fayol's 14 Principles - Current trends and issues in Management.

UNIT - II	PLANNING	9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Policies – Planning premises – Strategic Planning – Planning Tools and Techniques – Decision making steps and process.

UNIT - III	ORGANIZING	9

Nature and purpose – Formal and informal organization – Organizational chart – Organization structure – types – Line and staff authority – Departmentalization – Delegation of authority –Centralization and Decentralization – Job Design

UNIT - IV	DIRECTING	9

Individual and group behaviour – Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – Types and theories of leadership –Communication – Process of communication – Barriers in communication – Communication and IT.

UNIT - V	CONTROLLING	9

Process of controlling – Budgetary and non-budgetary control techniques – Role of computers and IT in controlling process – Productivity management – Cost Control - Purchase Control – Maintenance Control - Quality Control - Planning operations – reporting.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Summarize the evolution of management thoughts and various challenges of managerial activities in a global.
CO2	Explain the types of Planning and Decision making at various levels management in the Organizations.
CO3	Discuss various types of Organization structure.
CO4	Explain the elements in Direction.
CO5	Generalize various Controlling techniques to maintain standards in Organizations.

TEXT BOOKS

1. Stephen P. Robbins & Mary Coulter — "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009
2. JAF Stoner, Freeman R.E and Daniel R Gilbert — "Management", Pearson Education, 6th Edition, 2004.

REFERENCES

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter — "Fundamentals of Management", Pearson Education, 7th Edition, 2011.
2. Robert Kreitner&MamataMohapatra — "Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich — "Essentials of Management" Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN— "Principles of Management", Tata McGraw Hill, 1999.

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE531 / COMMUNICATION ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To study the various analog and digital modulation techniques.
- ✓ To study the principles behind information theory and coding.
- ✓ To study the various digital communication techniques.

SYLLABUS

UNIT - I	ANALOG MODULATION	9

Amplitude Modulation — AM, DSBSC, SSBSC, VSB — PSD, modulators and demodulators — Angle modulation — PM and FM — PSD, modulators and demodulators — Superheterodyne receivers

UNIT - II	PULSE MODULATION	9

Low pass sampling theorem — Quantization — PAM — Line coding — PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder — Time Division Multiplexing, Frequency Division Multiplexing

UNIT - III	DIGITAL MODULATION AND TRANSMISSION	9

Phase shift keying — BPSK, DPSK, QPSK — Principles of M-ary signaling M-ary PSK & QAM — Comparison, ISI — Pulse shaping — Duo binary encoding — Cosine filters — Eye pattern, equalizers

UNIT - IV	INFORMATION THEORY AND CODING	9

Measure of information — Entropy — Source coding theorem — Shannon– Fano coding, Huffman Coding, LZ Coding — Channel capacity — Shannon-Hartley law — Shannon's limit — Error control codes — Cyclic codes, Syndrome calculation — Convolution Coding, Sequential and Viterbi decoding

UNIT - V	SPREAD SPECTRUM AND MULTIPLE ACCESS	9

PN sequences — properties — m-sequence — DSSS — Processing gain, Jamming — FHSS — Synchronisation and tracking — Multiple Access — FDMA, TDMA, CDMA

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Describe the concepts of amplitude modulation system.
CO2	Summarize the concepts of digital modulation system.
CO3	Illustrate about digital modulation and transmission.
CO4	Examine the concepts of Information theory and coding.
CO5	Discuss about spread spectrum and multiple access.

TEXT BOOKS

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" 3/e, TMH 2007
2. S. Haykin "Digital Communications" John Wiley 2005

REFERENCES

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd edition, Oxford University Press, 2007
2. B.Sklar, Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.
3. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH 2006

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE532 / DIGITAL INSTRUMENTATION			3	0	0	3

COURSE OBJECTIVES

- ✓ Introduction to the various types of digital instruments
- ✓ Provision of opportunities to develop basic skills in the design of electronic Equipment
- ✓ To introduce different peripheral interfaces to embedded system bus technique.
- ✓ Familiarize with different protocols and network components.
- ✓ Providing insight into the various digital data transmission techniques used in the industrial processes

SYLLABUS

UNIT - I	INTRODUCTION	9

Digital voltmeter - dual slope- successive approximation types; Digital measurement of time interval, phase, period, frequency, ratio of two Frequencies; Digital LCR meter; Digital alpha numeric display.

UNIT - II	INTERFACING AND DATA TRANSMISSION	9

Data transmission systems, 8086 Microprocessor based system design, Time Division Multiplexing (TDM), Digital Modulation– Pulse Modulation, Pulse Code Format – Interface systems and standards, Communications.

UNIT - III	INSTRUMENTATION BUS	9

Introduction, Modem standards, Basic requirements of Instrument, Bus standards, Bus communication, interrupt and data handshaking, Interoperability, Inter changeability for RS-232, USB, RS-422, RS-485.

UNIT - IV	PARALLEL PORT BUSES	9

Field bus, Mod bus, IEEE-488, VXI, Network buses– Ethernet, TCP/IP protocols; CAN bus- Basics, Message transfer, Fault confinement.

UNIT - V	CURRENT TRENDS IN DIGITAL INSTRUMENTATION	9

Introduction to special function add on cards – Resistance card – Input and output cards – Counter, test and time of card and digital equipment construction with modular designing; interfacing to microprocessor- Computer aided software engineering tools (CASE) – Use of CASE tools in design and development of automated measuring systems – Interfacing IEEE cards – Intelligent and programmable instruments using computers.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand various types of digital instruments.
CO2	Summarize about the interfacing and data transmission.
CO3	Illustrate about the Instrumentation bus.
CO4	Describe about the parallel port bus.
CO5	Discuss about the current trends in digital instrumentation.

TEXT BOOKS

1. H S Kalsi, “Electronic Instrumentation”, 2nd Edition, Tata McGraw-Hill, 2012.
2. A.J. Bouwens, “Digital Instrumentation”, TATA McGraw-Hill Edition, 1998.
3. Doebelin, ‘Measurement System, Application & Design’, IV Ed, McGraw-Hill, 1990

REFERENCES

1. N. Mathivanan, “Microprocessors, PC Hardware and Interfacing”, Prentice-Hall India, 2005
2. Joseph J. Carr, “Elements of Electronic Instrumentation and Measurements”, 3rd Edition, Pearson Education, 2003.
3. Jonathan W Valvano, “Embedded Microcomputer Systems”, Asia Pvt. Ltd., Brooks/Cole, Thomson, 2001.
4. Buchanan, “Computer Busses”, Arnold, London, 2000

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE533 / ELECTRICAL MACHINE DESIGN			3	0	0	3

COURSE OBJECTIVES

- ✓ To impart the knowledge on Magnetic circuit parameters.
- ✓ To understand the designing of DC machines.
- ✓ To understand designing of AC machines.
- ✓ To understand the importance of Computer aided design.

SYLLABUS

UNIT - I	DESIGN OF FIELD SYSTEM AND ARMATURE	9

Major considerations in Electrical machine design-Materials for Electrical apparatus-Design of Magnetic circuits-Magnetizing current-Flux leakage-Leakage in armature.

UNIT - II	DESIGN OF TRANSFORMERS	9

Construction-KVA output for single and three phase transformers-Overall dimensions-Design of yoke, core and winding for core and shell type transformers- Estimation of No load current-Temperature rise in transformers-Design of tank and cooling tubes of transformers-Programming with software

UNIT - III	DESIGN OF DC MACHINES	9

Construction-Output equations-Main dimensions-Choice of specific loadings-Selection of number of poles-Design of armature-Design of armature main dimensions-Design of field winding using computer program

UNIT - IV	DESIGN OF INDUCTION MOTORS	9

Construction-Output equation of Induction motor-Main dimensions-Choice of specific loadings-Design of Squirrel cage rotor and wound rotor- Magnetizing current-short circuit current- Design of slip ring rotor using program

UNIT - V	DESIGN OF SYNCHRONOUS MACHINES	9

Output equations-Choice of specific loadings-Design of salient pole machines-Short circuit ratio-Armature design-Estimation of air gap length-Design of rotor-Design of damper winding-Determination of full load field MMF-Design of field winding - Programming for design of stator main dimensions

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Learn the design concepts of Electrical Machine.
CO2	Understand the Design aspects of transformers
CO3	Illustrate the functionality of each and every component employed in DC machines
CO4	Summarize the stator and rotor design aspects of induction motors.
CO5	Design overall dimensions of synchronous machine & cooling of synchronous generator.

TEXT BOOKS

1. M.V.Deshpande ‘Design and Testing of Electrical Machines ’PHI learning Pvt Lt, 2011.
2. Sen S.K., Principles of Electrical Machine designs with Computer Programmes’. Oxford and IBH Publishing Co.Pvt ltd., New Delhi, second edition, 2009.
3. Sawhney.A.K, ‘A course in Electrical Machine Design’, Dhanper Rai & sons, New Delhi, Fifth edition, 2004

REFERENCES

1. V.Rajini, V.S Nagarajan, ‘Electrical Machine Design,’Pearson, 2017.
2. K.M.Vishnumurthy ‘Computer aided design of Electrical Machines’ B.S Publicatins, 2008.
3. A Shanmugasundaram, G.Gangadharan, R.Palani’Electrical Machine Design Data Book’,New Age International Pvt Ltd., Reprint 2007
4. ‘Electrical Machine Design,’ Balbir Singh, Vikas Publishing House Private Limited, 3rd edition,New Delhi, Reprint 2006.

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE534 / THEORIES OF POWER PLANT			3	0	0	3

COURSE OBJECTIVES

- ✓ Understand the Basics of power plants & types of power plant with the various handling techniques involved for the entire operation.
- ✓ Understand the working of thermal power plants with the various handling techniques involved for the entire operation.
- ✓ Analyze the working of Hydro, Diesel power plant and its applications.
- ✓ Analyze the various type gas power plant and basics of the Nuclear Engineering with different types of reactors used in line with the safety measures.
- ✓ Validate the environmental impact and power plant safety of various power plants.

SYLLABUS

UNIT - I	INTRODUCTION TO POWER PLANT	9

Introduction to power plant- Indian Energy scenario- Location of power plant- Choice of Power plant- Classification of power plant- Terminology used in power plant: Peak load, Base load, Load factor, Load curve- Various factor affecting the operation of power plant - Performance and operating characteristics of power plant.

UNIT – II	THERMAL POWER PLANT	9

Role of thermal power plant in current power generation scenario- Selection site for thermal power plant- General lay out of a thermal power plant- Fuels used in thermal power plant- Fuel handling layout and its methods, stages in coal handling storage- Fuel Burning-Stoker firing, Pulverized fuel burning- Pulverization of coal- Ash handling system- Gravity system, pneumatic or vacuum system, electrostatic precipitation (ESP) system- Ash disposal Management and its utilization.

UNIT - III	HYDRO AND DIESEL POWER PLANT	9

Introduction to Hydroelectric power plant- Selection of sites for hydro electric power plant- General layout of Hydro electric power plant and its working- Classification of hydro plant- Advantages and disadvantages of hydro electric power plant- The layout of diesel power plant- Components and the working of diesel power plant- Advantages and disadvantages of diesel power plant.

UNIT - IV	GAS TURBINE PLANT AND NUCLEAR POWER PLANTS	9

Gas turbine power plant-Schematic diagram, components and its working- Combined cycle power generation- Combined gas and steam turbine power plant operation- Introduction to Nuclear power- Working of a nuclear power plant- Thermal fission Reactors- PWR, BWR and gas cooled reactors- Advantages and Disadvantages of Nuclear power plant.

UNIT - V	ENVIRONMENTAL IMPACT AND POWER PLANT SAFETY	9

Social and Economical issues of power plant - Greenhouse effect - Air, water, Thermal pollution from power plants - Radiations from nuclear power plant effluents -Plant safety concept- Safety policy to be observed in power plants- Safety practices to be observed in boiler operation

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Infer the importance and basic knowledge of various power plant.
CO2	Demonstrate the knowledge on the concepts of thermal power plant and their applications.
CO3	Summarize the different concepts of hydro and diesel power plant with the protection and various system for an application.
CO4	Suggest and apply various application and concepts gas turbine plant and nuclear power plants
CO5	Infer the different aspects on environmental impact and power plant safety with social and economical issues of power plant.

TEXT BOOKS

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES

1. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
2. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EE535 / VISUAL LANGUAGES AND APPLICATIONS			3	0	0	3

COURSE OBJECTIVES

- ✓ To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- ✓ To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++. To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- ✓ To study about the integrated development programming event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.
- ✓ To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

SYLLABUS

UNIT - I	FUNDAMENTALS OF WINDOWS AND MFC	9

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy - Document/View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor.

UNIT - II	RESOURCES AND CONTROLS	9

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus.

UNIT - III	DOCUMENT / VIEW ARCHITECTURE	9

The inexistence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window–Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in app wizard.

UNIT - IV	FUNDAMENTALS OF VISUAL BASIC	9

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.
Variables: Declaration – Types – Converting variable types – User defined data types - Lifetime of a variable. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures.

UNIT - V	DATABASE PROGRAMMING WITH VB	9

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Table def object, Query Object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	To acquire the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
CO2	To infer the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
CO3	To attain basic concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization
CO4	To assimilate the integrated development programming, event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.
CO5	To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

TEXT BOOKS

1. Kang Zhang "Visual Languages and Applications", University of Texas at Dallas Richardson TX. Edition 2011
2. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors [P] Ltd, Reprinted 2002.
3. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCES

1. Herbert Schildt, 'MFC Programming from the Ground Up', Second Edition, Tata McGraw Hill, reprinted 2004.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', Tata McGraw Hill, Reprinted 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

PROGRAM ELECTIVES - II

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE631 / COMPUTER AIDED DESIGN FOR ELECTRICAL APPARATUS			3	0	0	3

COURSE OBJECTIVES

- ✓ To introduce the importance of computer aided design method.
- ✓ To provide basic electromagnetic field equations and the problem formulation for CAD applications.
- ✓ To get familiarized with Finite Element Method as applicable for Electrical Engineering.
- ✓ To introduce the organization of a typical CAD package for DC machines.
- ✓ To introduce Finite Element Method for the design of Transformer.

SYLLABUS

UNIT - I	CONCEPT OF COMPUTER-AIDED DESIGN	9

Introduction-Computer Aided Design; Explanation of details of flow chart- Input data to be fed into the program-Applicable constraints Max or Minimum permissible limits-Output data to be printed after execution of program.

UNIT - II	BASIC CONCEPTS OF DESIGN	9

Introduction-Output coefficient-Importance of specific loadings-Electrical Materials-Magnetic circuit calculations-General procedure for calculation of Amp-Turns-Heating and Cooling-Standard ratings of Electrical machines-Quantity of cooling medium.

UNIT - III	APPLICATION OF FINITE ELEMENT METHOD IN DESIGN	9

Introduction; Basics of Finite element-Shape functions- Single element computation-Assembly of elemental coefficient matrix -Application of FEM technique for design problems-Use of open source FEM software for 2D design -Computation of electrostatic field for various geometry-skin and proximity effect in conductors

UNIT - IV	COMPUTER AIDED DESIGN OF DC MACHINES	9

Introduction-Flowcharts and programs for computer aided design of DC machines- 2D FEM open source software based DC machine part design

UNIT - V	COMPUTER AIDED DESIGN OF TRANSFORMERS	9

Introduction- Flowcharts and programs for computer aided design of transformers-2D FEM open source software based transformer part design

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	To understand the fundamentals concepts of CAD usage in Electrical Apparatus
CO2	To infer the concepts of magnetic loading parameters.magentic materials and rating of machines.
CO3	To understand the FEM software uses in 2D design and various effect of conductors
CO4	Design of DC machine using FEM open source software
CO5	Demonstrate the transformer design using the CAD

TEXT BOOKS

1. K M Vishnu Murthy , ' Computer aided design of electrical machines 2015', B S Publications
2. Maurya, Jallan, Shukla, Kataria , 'Computer aided design of electrical machines' publication 2014
3. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, Yes DEE publishers, Indian reprint, 2007.
4. Nicola Bianchi, CRC Taylor & Francis, 'Electrical Machine Analysis using Finite Elements', 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, 1986.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE632 / FUNDAMENTALS OF NANO - SCIENCE			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn about basis of Nano material science and their properties.
- ✓ To know the preparation methods of Nano materials.
- ✓ To familiar with the types and applications of Nano materials.

SYLLABUS

UNIT - I	INTRODUCTION	9

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nano structured materials-nano particles-quantum dots, nano wires-ultra-thin films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.

UNIT - II	GENERAL METHODS OF PREPARATION	9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultra sonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE

UNIT - III	NANO MATERIALS	9

Nano forms of Carbon-Buckminster fullerene-graphene and carbon nano tube, Single wall carbon Nano tubes (SWCNT) and Multi wall carbon nano tubes (MWCNT)-methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-Nano metal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nano alumina, CaO, AgTiO2, Ferrites, Nano clays-functionalization and applications

UNIT - IV	CHARACTERIZATION TECHNIQUES	9

X-ray diffraction technique, Scanning Electron Microscopy-environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM,STM, SNOM, ESCA, SIMS-Nano indentation

UNIT - V	APPLICATIONS	9

Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nano crystal, Nano biotechnology: nano probes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bio imaging-Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)-Nano sensors, nano crystalline silver for bacterial inhibition, Nano particles for sun barrier products-In Photostat, printing, solar cell, battery

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the basics of Nano materials and their properties
CO2	Summarize the methods of preparation of Nano materials
CO3	Explain the different forms of Nano materials
CO4	Identify the characterization Techniques
CO5	Describe the various applications of Nano materials

TEXT BOOKS

1. Dr. P. Alli, T. Grace Shalini, C. B. Selvalakshmi , K. Santha Sheela ,"Fundamentals of Nano Science", Technical Publications,2021
2. Gabor L. Hornyak, John J. Moore, H.F. Tibbals, Joydeep Dutta," Fundamentals of Nanotechnology", CRC Press,2018.
3. Charles P.Poole, Jr.Frank J.Owens, "Introduction to Nanotechnology", Wiley India Pvt. Ltd., 2010.

REFERENCES

1. William Illsey Atkinson,"Nanotechnology", JAICO Publishing House, 2009.
2. T.Pradeep,"NANO the Essentials- Understanding Nanoscience and Nanotechnology", Tata Mc Graw- Hill Publishing company Limited, 2009.
3. Mark Rather, Daniel Ratner,"Nanotechnology a Gentle Introduction to the next Big Idea", Pearson Education, 2009.
4. Akhlesh Lakhtakia, "The HandBook of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE633 / HUMAN RIGHTS AND DUTIES: CONCEPTUAL PERSPECTIVES			3	0	0	3

COURSE OBJECTIVES

- ✓ To sensitize the Engineering students to various aspects of Human Rights.
- ✓ To understand about the theories of Human Rights and UN Laws
- ✓ To familiarize about Human Rights in India.

SYLLABUS

UNIT - I	FOUNDATIONS OF HUMAN RIGHTS	9

Definition, scope and Concept of Human Rights – Classification of Rights – Natural, Moral and Legal Rights

UNIT - II	DEVELOPMENT OF HUMAN RIGHTS	9

Development of Human Rights and Origin of United Nations Organization, Development of Human rights in India – National Human Rights Commission, State Human Rights Commission, National Commission for SC/St, Women and Children

UNIT - III	HUMAN RIGHTS AND DUTIES UNDER INDIAN CONSTITUTION	9

Constitution of India – Preamble, Fundamental Duties ; Directive Principles of State Policy, Emergency Provisions in Indian Constitution

UNIT - IV	PERSPECTIVES OF RIGHTS AND DUTIES	9

Rights: Inherent-Inalienable-Universal- Individual and Groups, Nature and concept of Duties, Interrelationship of Rights and Duties

UNIT - V	HUMAN RIGHTS OF DISADVANTAGED PEOPLE	9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disability persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	An understanding of the principles and institutions of international human rights law, including their origins, assumptions, contents, limits and potential.
CO2	It will help students to understand the importance of the fundamental principle, its concept, Concern and Source of international obligations for Human Rights. As well as Capacity to exercise rights and comply with obligations under International law with international norms and standards for human rights and Duties.
CO3	An improved ability to think analytically about the implementation and development of international human rights law and to apply this body of law in your own professional and national setting.
CO4	Student(s) able to work in conjunction with human rights specialists and other scholars in expanding knowledge about human rights as well as promoting respect for the values they embody and symbolise.
CO5	An improved ability to conduct research on international human rights law and Duties.

TEXT BOOKS

1. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014
2. Anuradha Kumar, Encyclopedia of Human Rights Development of under Privilege, New Delhi: Sarup, 2002
3. P.L. Mehata, NeenaVerma - Human Rights Under The Indian Constitution

REFERENCES

1. James Griffin," On Human Rights", OUP UK Publishers, 2009
2. Kaushuk Vijay, Women Movement and Human Rights Jaipur Pomta Publications – 1999

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE634 / MICROCONTROLLER BASED SYSTEM DESIGN			3	0	0	3

COURSE OBJECTIVES

To impart knowledge about the following topics:

- ✓ Architecture of PIC microcontroller
- ✓ Interrupts and timers
- ✓ Peripheral devices for data communication and transfer
- ✓ Functional blocks of ARM processor
- ✓ Architecture of ARM processors

SYLLABUS

UNIT - I	INTRODUCTION TO PIC MICROCONTROLLER	9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT - II	INTERRUPTS AND TIMER	9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings

UNIT - III	PERIPHERALS AND INTERFACING	9

I2C Bus for Peripherals Chip Access– Bus Operation-Bus subroutines– Serial EEPROM— Analog to Digital Converter–UART-– Data handling circuit–Initialization - LCD and keyboard Interfacing

UNIT - IV	INTRODUCTION TO ARM PROCESSOR	9

Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems

UNIT - V	ARM ORGANIZATION	9

5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the concepts of Architecture of PIC microcontroller
CO2	Acquire knowledge on Interrupts and timers
CO3	Understand the importance of Peripheral devices for data communication
CO4	Understand the basics of sensor interfacing
CO5	Acquire knowledge in Architecture of ARM processors

TEXT BOOKS

1. P. S. Manoharan "Microcontroller Based System Design" Scitech Publications (India) Pvt Ltd (3 August 2015)
2. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2012
3. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2007

REFERENCES

1. Charles Greg Osborn "Embedded Microcontrollers and Processor Design "Pearson Education (1 January 2011)
2. Designing Embedded Systems With Pic® Microcontrollers: Principles And Applications, 2Nd Edition by Wilmshurst, January 2010
3. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007
4. Muhammed Ali Mazidi, Janice Gillies Pie Mazidi, "The 8051 Microcontroller and Embedded Systems"– Pearson EducationAsia. 2004

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE635 / SMPS AND UPS			3	0	0	3

COURSE OBJECTIVES

- ✓ To acquire knowledge in the design of Switch Mode Power Supplies and Uninterrupted Power Supplies
- ✓ To know the principle and operation of SMPS, UPS
- ✓ To learn the testing of SMPS and UPS

SYLLABUS

UNIT - I	DC-DC CONVERTERS	9

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters

UNIT - II	SWITCHING MODE POWER CONVERTERS	9

Analysis and state space modeling of fly back, Forward, Luo, Half bridge and full bridge converters– control circuits and PWM techniques.

UNIT - III	RESONANT CONVERTERS	9

Introduction– classification– basic concepts– Resonant switch– Load Resonant converters– ZVS, Clamped voltage topologies– DC link inverters with Zero Voltage Switching– Series and parallel Resonant inverters– Voltage control.

UNIT - IV	AC-AC CONVERTERS WITH AND WITHOUT DC LINK	9

Single phase and three phase inverters, control using various (Sine PWM, SVPWM and an advanced modulation) techniques, various harmonic elimination techniques– Multilevel inverters – Types: Diode clamped– Flying capacitor– Cascaded types– Applications.

UNIT - V	POWER CONDITIONERS, UPS & FILTERS	9

Introduction– Power line disturbances– Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Selection of capacitors– Design of inductor and transformer for PE applications.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand step up and step down converters
CO2	Analyse the Switching mode power supplies
CO3	Describe the resonant converters concepts and voltage control techniques
CO4	Demonstrate various AC-AC converters
CO5	Design of inductor and transformer for power electronics applications

TEXT BOOKS

1. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2011.
2. Simon Ang, Alejandro Oliva, Power-Switching Converters, Third Edition, CRC Press, 2011.
3. Kjeld Thorborg, Power Electronics -In theory and Practice, Overseas Press, First Indian Edition 2005.

REFERENCES

1. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2018.
2. Erickson, Robert W, Fundamentals of Power Electronics, Springer, second edition, 2010
3. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design-Third Edition- John Wiley and Sons- 2007.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191EE636 / SPECIAL ELECTRICAL MACHINES			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the working principle and construction of stepper motor,
- ✓ To know various design of power controllers on Switched reluctance motor
- ✓ To learn, understand the construction and characteristics of synchronous reluctance motor.
- ✓ Design of magnetic circuit analysis and principle of operation of permanent magnet brushless dc motors
- ✓ Analysis EMF and Volt-Ampere equation of permanent magnet synchronous motors.

SYLLABUS

UNIT - I	STEPPER MOTORS	9

Constructional features – Principle of operation – Variable reluctance motor –Characteristics – Drive circuits – Microprocessor based control of stepper motors- Closed loop control – Applications.

UNIT - II	SWITCHED RELUCTANCE MOTORS	9

Constructional features – Principle of operation – Torque prediction – Power controllers – Microprocessor based control – Characteristics - Applications.

UNIT - III	SYNCHRONOUS RELUCTANCE MOTORS	9

Constructional features– Types-Axial and Radial air gap motors– Operating principles – Voltage and Torque Equations – Motor characteristics - Torque angle Characteristics– Speed –torque characteristics - Phasor diagram – Applications.

UNIT - IV	PERMANENT MAGNET BRUSHLESS D.C. MOTORS	9

Commutation in DC motor – Mechanical and electronic commutator - Principle of operation – Types – Hall Sensors – Optical Sensors – Magnetic circuit analysis – EMF and torque equation – Motor characteristics – Microprocessor based control – Applications.

UNIT - V	PERMANENT MAGNET SYNCHRONOUS MOTORS	9

Principle of operation – EMF and torque equations – Phasor diagram – Power controllers - Volt-ampere requirements – Torque speed characteristics - Microprocessor based control – Applications.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Differentiate the types of stepper motor, compare the construction ,Associate the principle of operation, performance of stepping motor
CO2	Compare the construction; Associate the principle of operation & performance of SRM.
CO3	Distinguish the types of synchronous reluctance motor. Compare the principle of operation and performance of synchronous reluctance motor
CO4	Distinguish the construction, principle of operation, performance of BLDC motor
CO5	Distinguish the construction, principle of operation, performance of PMSM

TEXT BOOKS

1. Gopal K.Dubey,"Fundamentals of Electrical Drives", Narosa Publishing House Pvt. Ltd.,New Delhi, Second edition, 2015.
2. Bimal K.Bose, "Modern Power Electronics and AC Drives", Prentice Hall, New Delhi, 2005.

REFERENCES

1. Janardanan E.G., "Special Electrical Machines", PHI Learning Private Limited, 2015.
2. Krishnan R., "Permanent Magnet Synchronous and Brushless DC Motor Drives", CRC Press, New York, 2010.
3. Krishnan R., "Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application", CRC Press, New York, 2009
4. K.Venkataratnam, "Special Electrical Machines", University Press (India) Pvt. Ltd., 2009.
5. Theodore wildi., "Electrical machines Drives and Power systems", 6th edition, Pearson Education india Pvt ltd, 2006.

PROGRAM ELECTIVE – III

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE731 / ALTERNATIVE ENERGY SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ Able to understand the concept , working and applications of biogas and biomass
- ✓ Able to understand the concept , working and applications of ocean energy
- ✓ Able to understand the concept , working and applications of MHD and geothermal energy
- ✓ Able to understand and analyze energy management techniques

SYLLABUS

UNIT - I	BIOGAS AND BIOMASS	9

Introduction,-types of biogas plants,-biogas generation- factors affecting biogas generation,-design consideration,-advantages and disadvantages site selection,-applications, scope of biogas energy in India, biomass energy, energy plantation, gasification, types and application of gasifiers, design of gasifiers

UNIT - II	OCEAN ENERGY	9

Introduction- OTEC principle,-open cycle OTEC system,-closed cycle, hybrid cycle,-site selection. Energy from tides estimation of tidal power- tidal power plants, single basin, double basin, site requirements, advantages and imitations, wave energy, wave energy conversion devices, advantages and Disadvantages, small scale hydro power.

UNIT - III	GEOTHERMAL ENERGY	9

Introduction, -vapour dominated system-liquid dominated system, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications, geothermal energy in India: prospects.

UNIT - IV	MHD POWER PLANTS	9

Introduction-Principle of MHD power generation-open cycle plant- closed cycle plant, liquid metal system, advantages of MHD plants.

UNIT - V	ENERGY MANAGEMENT	9

Energy economics, energy audit, energy conservation, cogeneration, waste heat recovery, concept of total energy system, combined cycle plant, energy management, scope of alternate energy sources in India.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the concept , of biogas and biomass
CO2	Understand the concept , working of ocean energy
CO3	Understand the concept ,of MHD power plants
CO4	Understand the concept of Geothermal Energy
CO5	Understand and analyze energy management techniques

TEXT BOOKS

1. Renewable energy sources and emerging technologies d.p kotahari k.csingal , rakeshrajan 2016 2nd edition.
2. N.K. Giri ,"Alternate Energy (Sources, Applications and Technologies)",Khanna Publishers,first Edition 2012
3. D. Mukherjee, S..ChakrabartiNew Age International, 2004 - Renewable energy sources
4. Felix A. Farret, M. Godoy Simoesjohn Wiley & Sons, 20-Apr-2-Alternative Source Of Energy

REFERENCES

1. G.D.Rai, "Non Conventional Energy Sources", Standard Publishers Distributor, 2011 1st edition.
2. N K Bansal , "Non-Conventional Energy Resources",Vikas Publishing,2014
3. https://www.amazon.in/Integration-Alternative-Sources-Energy-Wiley-ebook/dp/B000W3WIWI
4. E-BOOOK http://nptel.ac.in/courses/112104225/22

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE732 / ELECTRIC ENERGY GENERATION UTILIZATION AND CONSERVATION			3	0	0	3

COURSE OBJECTIVES

- ✓ To study the generation, conservation of electrical power and energy efficient equipments.
- ✓ To understand the principle, design of illumination systems and energy efficiency lamps.
- ✓ To study the methods of industrial heating and welding.
- ✓ To understand the electric traction systems and their performance.
- ✓ To know the various testing procedures of mater conducted on power apparatus

SYLLABUS

UNIT - I	ELECTRIC DRIVES AND TRACTION	9

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services traction generator set, traction motors, power transformers - characteristic features of traction motor - systems of railway electrification - electric braking

UNIT - II	ILLUMINATION	9

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

UNIT - III	HEATING AND WELDING	9

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

UNIT - IV	ENERGY CONSERVATION AND ITS IMPORTANCE	9

Energy conservation act 2001 and its Features-Review of Industrial Energy Conservation-Energy conservation in electrical Industries

UNIT - V	DOMESTIC UTILIZATION OF ELECTRICAL ENERGY	9

House wiring - working principle of air conditioning system, Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing system for Domestic, Industrial and Substation.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Ability to choose suitable electric drives for different applications
CO2	Ability to design the illumination systems for energy saving
CO3	Ability to demonstrate the utilization of electrical energy for heating and welding purposes
CO4	To illustrate the need for energy conservation and to simulate three phase power control
CO5	Ability to do electric connection for any domestic appliance like refrigerator, battery charging circuit for a specific household application.

TEXT BOOKS

1. N.V. Suryanarayana, “Utilisation of Electric Power”, Wiley Eastern Limited, New Age International Limited, 1994 & Second Edition 2017 Feb.
2. J.B.Gupta, “Utilisation Electric power and Electric Traction”, S.K.Kataria and sons, 2000 2012th Edition, 2013, January.
3. G.D.Rai,”Non-Conventional Energy sources”,Khanna publications Ltd.,New Delhi 1998
4. D.P.Kothari, K.C.Singal, Rakesh Ranjan, “Renewable Energy Sources and Emerging Technologies”, PHI Learing Private Limited, 3rd Edition 2022.
5. Industrial Energy Conservation, Volume I-II, S C Bhatia, Sarvesh Devraj, Energy conservation and Managment by Akshay A pujara1st edition, June 2018.

REFERENCES

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications 2nd Edition 2016.
2. H.Partab, Art and Science of Utilisation of Electrical Energy”, Edition, Dhanpat Rai and Co., New Delhi-2004.
3. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, New Age international Pvt.Ltd., 3rd Edition, 2015 January.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE733 / ELECTRIC TRACTION			3	0	0	3

COURSE OBJECTIVES

- ✓ To distinguish different traction systems and latest trends in traction systems.
- ✓ To differentiate services of control traction motors based on speed time curve.
- ✓ To use various traction system auxiliaries
- ✓ To control different types of traction motors system
- ✓ To use various methods of future trends in traction applicable to traction motors

SYLLABUS

UNIT - I	INTRODUCTION	9

Definition and features of traction, Classification of traction systems, Types and choice of track electrification systems, Review of characteristics and suitability of traction motors, Transmission of drive and auxiliary equipment, Loco wheel arrangement and riding qualities, Train lighting system

UNIT - II	CONTROL OF TRACTION MOTORS	9

Speed time curves and speed distance curves, Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion, control of traction motors- rheostatic control- series parallel control- drum controllers, constant current systems, multiple unit control, thyristor and feedback controls, Magnetic levitation suspension systems.

UNIT - III	TRACTION SYSTEMS	9

Steam, diesel, diesel-electric, Battery and electric traction systems, General arrangement of D.C., A.C. - 1-phase,3-phase, Composite systems- Choice of traction system - Diesel Electric.

UNIT - IV	TRACTION MOTORS AND THEIR CONTROL	9

Features of traction motors -Significance of D.C. series motor as traction motor - A. C. Traction motors-single phase, Three phase, Linear Induction Motor - Comparison between different traction motors - Series-parallel control -Open circuit- Shunt and bridge transition,PWM control of induction motors - different types of electric braking system.

UNIT - V	FUTURE TRENDS IN TRACTION	9

Energy conservation in Electric traction, Indian present scenario in electric traction -Metro - Magnetic levitation - Levitation Schemes, Present Scenario, High speed traction.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Classify the traction system and review the characteristics of traction motors
CO2	Select suitable speed controller for traction motors.
CO3	Analyze the steam, diesel and electric traction system
CO4	Distinguish the features and significance of DC traction motor and AC traction motor
CO5	Discuss about energy conservation and present scenario in electric traction

TEXT BOOKS

1. R. B. Brooks. Sir Isaac Pitman & sons, ‘Electric Traction Hand Book ‘ ,ltd. London. 2019.
2. J. Upadhya, ‘Electric Traction’, Allied Publisher Limited, New Delhi, 2000.

REFERENCES

1. H. Pratap; DhanpatRai& Sons, ‘Modern Electric Traction’, New Delhi, 2017.
2. J. Upadhyay S. N. Mahendra, ‘Electric Traction’, Allied Publishers Ltd. 2011.
3. A.T. Dover; Mcmillan DhanpatRai& Sons, ‘Electric Traction’, New Delhi, 2005.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE734 / ENERGY RESOURCES AND UTILIZATION			3	0	0	3

COURSE OBJECTIVES

- ✓ Understand the different power generation methods, its economics and global energy situation.
- ✓ Understand different types of power plant, and its functions and their flow lines and issues related to them.

SYLLABUS

UNIT - I	INTRODUCTION	9

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilization – Renewable Energy Scenario in Tamilnadu, India and around the World – Potentials – Achievements/Applications – Economics of renewable energy systems

UNIT - II	POWER FROM RENEWABLE ENERGY	9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT - III	POWER FROM NON RENEWABLE ENERGY	9

Diesel, Gas turbine and combined cycle power plants – Thermal power plant: Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Nuclear power plant: Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT - IV	UTILIZATION OF ELECTRICAL POWER	9

Heating and welding-Electrolytic Electro – Metallurgical Process-Illumination-Braking-Electric Traction Systems and Power Supply-Electric Traction Systems and Power Supply-Electric Vehicles-Hybrid Electric Vehicles

UNIT - V	ELECTRICAL SAFETY, WIRING	9

Safety measures in electrical system- types of wiring- wiring accessories-staircase, fluorescent lamps & corridor wiring- Basic principles of earthing-Types of earthing- Simple layout of generation, transmission & distribution of power.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the concepts of Energy scenarios.
CO2	Analyze the different types of renewable energy sources.
CO3	Inspect the different types of conventional energy sources.
CO4	Outline the electrical power utilization.
CO5	Summarize the electrical safety measures.

TEXT BOOKS

1. Rai. G.D., "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. Power System Engineering A. Chakrabarti et al DhanpatRai and Co 2 nd Edition, 2010
3. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.
4. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.
5. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt. Ltd, 2003

REFERENCES

1. Utilization of Electric Power and Electric Traction G.C. Garg Khanna Publishers 9th Edition, 2014
2. Utilization, Generation and Conservation of Electrical Energy Sunil S Rao Khanna Publishers 1st Edition, 2011
3. H. Partab, 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai and Co, New Delhi, 2004
4. E. Openshaw Taylor, 'Utilization of Electrical Energy in SI Units', Orient Longman Pvt. Ltd, 2003
5. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE735 / MODERN POWER CONVERTERS			3	0	0	3

COURSE OBJECTIVES

- ✓ Switched mode power supplies
- ✓ Matrix Converter
- ✓ Soft switched converters

SYLLABUS

UNIT - I	SWITCHED MODE POWER SUPPLIES (SMPS)	9

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT - II	AC-DC CONVERTERS	9

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor reduced input current harmonic distortion. improved efficiency with and without input-output isolation. performance indices design examples

UNIT - III	DC-AC CONVERTERS	9

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

UNIT - IV	AC-AC CONVERTERS WITH AND WITHOUT DC LINK	9

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as AC-DC converters; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT - V	SOFT-SWITCHING POWER CONVERTERS	9

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the concept of DC power supplies and its classification.
CO2	Analyse the working principles of AC-DC Converters.
CO3	Analyse the working principles of DC-AC Converters.
CO4	Evaluate and analyse an AC-AC Converters with and without DC link.
CO5	Inspect the performances of soft switching and hard switching power converters.

TEXT BOOKS

1. L. Umanand, Power Electronics: Essentials & Applications, John Wiley and Sons, 2009.
2. Control in Power Electronics- Selected Problem, Marian P.Kazmierkowski, R.Krishnan and FredeBlaabjerg, Academic Press (Elsevier Science), 2002.
3. Agarwal ,Power Electronics: Converters, Applications, and Design, 3rd edition, Jai P, Prentice Hall,2000

REFERENCES

1. Krein Philip T, Elements of Power Electronics, Oxford University press, 2008
2. Advanced DC/DC Converters, Fang Lin Luo and Fang Lin Luo, CRC Press, NewYork, 2004.
3. Power Electronic Circuits, Issa Batarseh, John Wiley and Sons, Inc.2004

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE736 / POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ To provide knowledge about the stand alone and grid connected renewable energy systems.
- ✓ To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- ✓ To analyse and comprehend the various operating modes of solar energy systems.
- ✓ To design and comprehend the various operating modes of wind electrical generators.
- ✓ To develop maximum power point tracking algorithms.

SYLLABUS

UNIT - I	INTRODUCTION	9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources ocean, Biomass, Hydrogen energy systems : operating principles and characteristics of: Solar PV, Fuel cells, wind electrical systems-control strategy, operating area

UNIT - II	ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION	9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT - III	POWER ELECTRONICS IN SOLAR PV SYSTEMS	9

Photo Voltaic(PV): cell, module, array and panel, Home solar PV system, Components of a home solar system, Types of batteries used in solar PV system, Charge Controller, Signal Conditioner Inverter Power Electronic Devices Used In a solar PV system, Power configuration for grid-connected PV systems: central, string and module inverters configuration.

UNIT - IV	POWER ELECTRONICS IN WIND POWER PLANTS	9

Wind energy basics: wind requirement and in windy site, Aerodynamics of Wind power Plants: stall, active stall and pitch control , Direct, Geared and Semi Geared wind power plants , Stand alone operation of fixed and variable speed wind energy conversion systems - Power electronic circuits: Soft starters, Back-to-back converters, Multi-level converters

UNIT - V	HYBRID RENEWABLE ENERGY SYSTEMS	9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the concepts of environmental impacts of renewable energy generation.
CO2	Analyze the different types electrical machines used in renewable energy conversion
CO3	Inspect the usage of power electronics in solar PV systems.
CO4	Inspect the usage of power electronics in Wind power plants.
CO5	Analyze the hybrid power generation

TEXT BOOKS

1. Renewable Energy, Power for a sustainable future, Godfrey Boyle, 3rdEdn., , Oxford University Press, 2012
2. S.N.Bhadra, D. Kastha, & S. Banerjee “Wind Electricaal Systems”, Oxford University Press, 2009
3. Rashid .M. H “power electronics Hand book”, Academic press, 2001
4. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993

REFERENCES

1. Rai, G.D., Solar Energy Utilization, Khanna Publishers, N. Delhi, 2010.
2. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi.2009
3. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.

PROGRAM ELECTIVE – IV

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE831 / ENERGY EFFICIENCY IN BUILDINGS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand various Heating and Cooling loads used in buildings.
- ✓ To gain knowledge on Energy conscious building design.
- ✓ To analyze the mass effect Design guidelines.
- ✓ To Adopt Intelligent building design principles.
- ✓ To gain knowledge on energy efficient building software.

SYLLABUS

UNIT - I	INTRODUCTION	9

Climate and shelter – Historic buildings – Modern architecture – Examples from different Climate zones – Thermal comfort – Solar geometry and shading – Heating and cooling loads- Energy estimates and site planning – Integrative Modeling methods and building simulation.

UNIT - II	ENERGY CONSCIOUS BUILDING	9

Principles of Energy conscious building design – Energy conservation in buildings – Day Lighting – Water heating and photovoltaic systems – Advances in thermal insulation – Heat Gain/loss through building components – Solar architecture

UNIT - III	BUILDING HEATING & COOLING	9

Passive solar heating – Direct gain – Thermal storage wall – Sunspace – Convective air loop Passive cooling – Ventilation – Radiation – Evaporation and Dehumidification – Mass effect Design guidelines.

UNIT - IV	ENERGY CONSERVATIVE BUILDINGS	9

Energy conservation in building – Air conditioning – HVAC equipments – Computer packages for thermal design of buildings and performance prediction – Monitoring and instrumentation of passive buildings – Control systems for energy efficient buildings – Illustrative passive buildings-Integration of emerging technologies – Intelligent building design principles

UNIT - V	SOFTWARE AND CASE STUDIES	9

Building Software and Efficient building case studies

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand Qualitative and Quantitative approach to improve efficiency of the buildings.
CO2	Understand the use of various building related softwares for bettering indoor environment.
CO3	Apply various concepts of Heat transfer in estimating the building cooling load.
CO4	Discuss various energy conservation technics
CO5	Evaluate and analysis case studies

TEXT BOOKS

1. Energy Conservation in Buildings, First Edition, O.P.Jakhar, Khanna Books Publishers,2019
2. J.K. Nayak and J.A. Prajapati, Handbook on Energy Conscious Buildings, Solar Energy Control MNES, 2006.
3. Energy Conservation Building Codes 2006; Bureau of Energy Efficiency.

REFERENCES

1. M.S. Sodha, N.K., Bansal, P.K. Bansal, A. Kumar and M.A.S. Malik., Solar Passive Building, Science and Design, Pergamon Press, 1986.
2. R.W. Jones, J.D. Balcomb, C.E. Kosiewiez, G.S. Lazarus, R.D. McFarland and W.O. Wray, Passive Solar Design Hanbook, Vol.3, Report of U.S. Department of Energy (DOE/CS-0127/3), 1982.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE832 / HVDC TRANSMISSION			3	0	0	3

COURSE OBJECTIVES

- ✓ This subject deals with the importance of HVDC transmission, analysis of HVDC converters, Faults and protection. It also deals with Reactive power control and Power factor improvements of the system.

SYLLABUS

UNIT - I	BASIC CONCEPTS	9

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT - II	ANALYSIS OF HVDC CONVERTERS	9

Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance.

UNIT - III	CONVERTER & HVDC SYSTEM CONTROL	9

Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

UNIT - IV	REACTIVE POWER CONTROL IN HVDC	9

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

UNIT - V	POWER FLOW ANALYSIS IN AC/DC SYSTEMS	9

Modelling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Choose intelligently AC and DC transmission systems for the dedicated application(s).
CO2	Identify the suitable two-level/multilevel configuration for high power converters.
CO3	Select the suitable protection method for various converter faults.
CO4	Identify suitable reactive power compensation method.
CO5	Understand the basic control of HVDC system and its limitation, features and implementation.

TEXT BOOKS

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers,2012
2. Padiyar, K.R., HVDC Power Transmission System, New Age International (P) Limited, Publishers (2008).
3. S. Rao EHVAC and HVDC Transmission Engineering and Practice -Khanna publication, 1990.

REFERENCES

1. Arrillaga, J., HVDC Transmission, IEE Press (2007).
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE833 / INDUSTRIAL AUTOMATION			3	0	0	3

COURSE OBJECTIVES

- ✓ To impart the knowledge on fundamental of Industrial Automation.
- ✓ To understand about the principle of operation of PLC and SCADA.
- ✓ To familiarize with HMI.
- ✓ To understand the concept and application of PLC AND SCADA.

SYLLABUS

UNIT - I	INTRODUCTION	9

Industrial Versions - Control elements of Industrial Automation- IEC/ ISA Standards for Control Elements – Selection criteria for control elements- Construction of Relay Ladder logic with different control elements- Need for PLC - PLC evolution.

UNIT - II	PROGRAMMABLE LOGIC CONTROLLERS	9

Architecture of PLC - Types of PLC – PLC modules, PLC Configuration -Scan cycle - Capabilities of PLC- Selection criteria for PLC – PLC Communication with PC and software- PLC Wiring- Installation of PLC and its Modules.

UNIT - III	PROGRAMMING OF PLC	9

Types of Programming – Bit Instructions -Timers and counters– PLC arithmetic functions PTO / PWM generation- High Speed Counter – Analog Scaling – Encoder Interfacing- Servo drive control – Stepper Motor Control

UNIT - IV	SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)	9

Overview – Developer and runtime packages – architecture – Tools – Tag – Internal &External graphics, Alarm logging – Tag logging – Trends – history– Report generation. Communication Protocols of SCADA –Proprietary and Open Protocols. OLE/OPC – DDE – Server/Client - Interfacing of SCADA with PLC and other field devices.

UNIT - V	HMI SYSTEMS , APPLICATIONS OF PLC & SCADA	9

Necessity and Role in Industrial Automation, Text display - operator panels - Touch panels - Panel PCs - Integrated displays, interfacing PLC to HMI, Case studies of Machine automation, Process automation

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand Ladder logic and PLC
CO2	Explain the PLC in details
CO3	Describe the programming of PLC
CO4	Summarize Supervisory Control and Data Acquisition
CO5	Discuss the applications of PLC & SCADA

TEXT BOOKS

1. W Bolton, “Programmable logic controllers‖”, Elsevier Ltd, 2015
2. Frank Industrial Automation: Hands On Hardcover McGraw-Hill Education; Illustrated edition (16 July 2013)
3. Frank D Petruzella,” Programmable logic controllers”, McGraw-Hill, 2011.

REFERENCES

1. “Win C software manual”, Siemens, 2013
2. John W Webb & Ronald A Reis, “Programmable logic controllers: Principles and Applications”, Prentice Hall India, 2011
3. “RS VIEW 32 Software Manual”, Allen Bradley, 2010
4. W. Bolton, “Mechatronics”, Pearson Education, 2009
5. John R Hackworth and Fredrick D Hackworth Jr., “Programmable Logic Controllers: Programming Methods and Application”, Pearson Education, 2006.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE834 / INTELLECTUAL PROPERTY RIGHTS			3	0	0	3

COURSE OBJECTIVES

- ✓ To give an idea about Intellectual Property Rights
- ✓ To impart the knowledge on registration of IPRs and its enforcement
- ✓ To understand about the Digital products and law

SYLLABUS

UNIT - I	INTRODUCTION	9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR

UNIT - II	REGISTRATION OF IPRs	9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT - III	AGREEMENTS AND LEGISLATIONS	9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act

UNIT - IV	DIGITAL PRODUCTS AND LAW	9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT - V	ENFORCEMENT OF IPRs	9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the basics of Intellectual Property Rights
CO2	Demonstrate the registration of IPRs in India and Abroad
CO3	Discuss the agreements and legislations of IPR
CO4	Summarize the various IP laws
CO5	Suggest enforcement measures of IPRs

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Publications, New Delhi,2002

REFERENCES

1. Derek Bosworth and Elizabeth Webster, "The Management of Intellectual Property", Edward Elgar Publishing Ltd., 2013.
2. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
3. Prabuddha Ganguli," Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE835 / POWER SYSTEMS OPERATION AND CONTROL			3	0	0	3

COURSE OBJECTIVES

- ✓ Significance of power system operation and control.
- ✓ Real power-frequency interaction and design of power-frequency controller.
- ✓ Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- ✓ Economic operation of power system.
- ✓ SCADA and its application for real time operation and control of power systems

SYLLABUS

UNIT - I	PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL	9

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

UNIT - II	REAL POWER - FREQUENCY CONTROL	9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

UNIT - III	REACTIVE POWER – VOLTAGE CONTROL	9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

UNIT - IV	ECONOMIC OPERATION OF POWER SYSTEM	9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT - V	COMPUTER CONTROL OF POWER SYSTEMS	9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the day-to-day operation of electric power system
CO2	Analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand
CO3	Understand the significance of power system operation and control
CO4	Acquire knowledge on real power-frequency interaction
CO5	Design SCADA and its application for real time operation

TEXT BOOKS

1. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.
2. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
3. AbhijitChakrabarti and SunitaHalder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010

REFERENCES

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

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE836 / POWER SYSTEM TRANSIENTS			3	0	0	3

COURSE OBJECTIVES

- ✓ Generation of switching transients and their control using circuit – theoretical concept.
- ✓ Mechanism of lighting strokes and the production of lighting surges.
- ✓ Propagation, reflection and refraction of travelling waves.
- ✓ Voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

SYLLABUS

UNIT - I	INTRODUCTION AND SURVEY	9

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

UNIT - II	SWITCHING TRANSIENTS	9

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

UNIT - III	LIGHTNING TRANSIENTS	9

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

UNIT - IV	TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS	9

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves

UNIT - V	TRANSIENTS IN INTEGRATED POWER SYSTEM	9

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

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Acquire knowledge on generation of switching transients and their control
CO2	Analyze the mechanism of lighting strokes
CO3	Understand the importance of propagation, reflection and refraction of travelling waves.
CO4	Find the voltage transients caused by faults
CO5	Understand the concept of circuit breaker action, load rejection on integrated power system

TEXT BOOKS

1. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.
2. PritindraChowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2ndEdition, 1991.

REFERENCES

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', McGraw Hill, Fifth Edition, 2013
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE837 / REAL TIME SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ Develop an understanding of various Real Time systems Application
- ✓ Obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- ✓ Get in-depth hands-on experience in designing and developing a real operational system.

SYLLABUS

UNIT - I	REAL TIME SYSTEMS	9

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronization.

UNIT - II	BASICS OF REAL-TIME CONCEPTS	9

Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel

UNIT - III	INTER-PROCESS COMMUNICATION	9

Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion, PIPES MEMORY MANAGEMENT:- Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection.

UNIT - IV	REAL TIME DATABASES	9

Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two-phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time System.

UNIT - V	REAL TIME MODELING AND CASE STUDIES	9

Petrinets and applications in real-time modeling, Air traffic controller system – Distributed air defense system

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Outline the concepts of embedded systems
CO2	Acquire the basic concepts of real time operating system design
CO3	Understand the concept of inter-process communication
CO4	Analyze the database for hard real time system
CO5	Apply the real time modeling concept in real time application

TEXT BOOKS

1. Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2012.
2. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011
3. C.M. Krishna, Kang G. Shin, “Real Time Systems”, Tata McGraw - Hil, 1997.

REFERENCES

1. C.M. Krishna, Kang G. Shin, “Real Time Systems”, Tata McGraw - Hil, 2010.
2. Giorgio C. Buttazzo , “Hard real-time computing systems: predictable scheduling algorithms and applications” , Springer, 2008.

PROGRAM ELECTIVE – V

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE838 / ELECTRICAL AND HYBRID VEHICLES			3	0	0	3

COURSE OBJECTIVES

- ✓ To impart the knowledge on Electric Vehicles
- ✓ To understand about the principle of operation of Electric Propulsion Systems
- ✓ To familiarize about Energy Storage Devices and Hybrid Solar Vehicles

SYLLABUS

UNIT - I	ELECTRIC VEHICLES - INTRODUCTION	9

Architecture of an electric vehicle, essentials and performance of electric vehicles – Traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations

UNIT - II	HYBRID VEHICLES	9

Hybrid electric drive trains - Concepts, architecture, design, control strategies, merits and demerits.

UNIT - III	ELECTRIC PROPULSION SYSTEMS	9

DC motor drives, induction motor drives, permanent magnet motor drives and switched reluctance motor drives.

UNIT - IV	ENERGY STORAGE DEVICES	9

Electrochemical batteries – Reactions, thermodynamic voltage, lead-acid batteries, nickel based batteries, lithium based batteries, flywheel and ultra-capacitors, Battery management systems.

UNIT - V	HYBRID SOLAR VEHICELS	9

Fuel cell thermodynamics, operating principle, fuel cell technologies, fuel reforming, hydrogen production and storage Photovoltaic cell, maximum power point tracking, solar powered accessories, hybrid solar vehicles.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the concepts of electric vehicles.
CO2	Analyze the concepts of hybrid vehicles.
CO3	Inspect the Propulsion Systems for electric vehicles
CO4	Analyze the working of energy storage devices
CO5	Understand the concepts hybrid solar vehicles

TEXT BOOKS

1. Iqbal Husain,"Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2011.
2. MehrdadEhsani, YiminGao, sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2009.

REFERENCES

1. MehrdadEhsani, YiminGao, sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2009.
2. AuliceScibioh M. and Viswanathan B., "Fuel Cells – Principles and Applications", University Press, India, 2006.
3. Barbir F, "PEM Fuel Cells: Theory and Practice", Elsevier, Burlington, 2005.
4. James Larminie and John Loury, "Electric Vehicle Technology-Explained", John Wiley & Sons Ltd., 2003.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE839 / ELECTRICAL ENERGY MANAGEMENT & AUDIT			3	0	0	3

COURSE OBJECTIVES

- ✓ To impact concepts behind economic analysis and Load management.
- ✓ To understand about the Energy management on various electrical equipments and metering.
- ✓ To analyze the concept of lighting systems and cogeneration.

SYLLABUS

UNIT - I	INTRODUCTION	9

Basics of Energy – Need for energy management – Energy accounting – Energy monitoring, targeting and reporting - Energy audit process.

UNIT - II	ENERGY MANAGEMENT FOR MOTORS AND COGENERATION	9

Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration –Feasibility of cogeneration – Electrical interconnection.

UNIT - III	LIGHTING SYSTEMS	9

Energy management in lighting systems – Task and the working space - Light sources –Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

UNIT - IV	METERING FOR ENERGY MANAGEMENT	9

Metering for energy management – Units of measure - Utility meters – Demand meters –Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

UNIT - V	ECONOMIC ANALYSIS AND MODELS	9

Economic analysis – Economic models - Time value of money - Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques –Utility monitoring and control system – HVAC and energy management – Economic justification

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the process of Energy audit.
CO2	Analyze the concepts of energy management for machines
CO3	Analyze the concepts Energy management in lighting systems
CO4	Analyze the concepts of Metering for energy management
CO5	Understand the Economic analysis for electrical systems

TEXT BOOKS

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, "Guide to Energy Management", Fifth Edition, The Fairmont Press, Inc., 2006

2. Eastop T. D & Croft D. R," Energy Efficiency for Engineers and Technologists", Longman Scientific & Technical, ISBN-0-582-03184, 1990.

REFERENCES

1. International Copper Association India," Electricity in buildings good practice guide", McGraw-Hill Education, 2017
2. Rajiv Shankar , 'Energy Auditing in Electrical utilities' ,2015
3. Amit K. Tyagi, "Handbook on Energy Audits and Management", TERI, 2003.
4. Reay D.A, "Industrial Energy Conservation", First Edition, Pergamon Press, 1977
5. "IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities", IEEE, 1996.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191ES8310 / EMBEDDED CONTROL OF ELECTRIC DRIVES			3	0	0	3

COURSE OBJECTIVES

- ✓ To study about Embedded control microprocessor control drives
- ✓ Series and parallel functions of SCRs, Programmable triggering methods of SCR
- ✓ To learn about the mc68hc11 microcontroller
- ✓ To study of converters and inverters
- ✓ To learn about micro control application and motor control

SYLLABUS

UNIT - I	INTRODUCTION	9

Embedded systems and their characteristics, review of micro – processors, MPU design options, Instruction sets – CISC and RISC – instruction pipelining, the microcontroller – its applications and environment. 16 bit microcontroller – Intel 8096 CPU structure, register file.

UNIT - II	AC AND DC ELECTRIC DRIVES	9

Introduction – classification of electric drives – dynamic conditions of a drive system – stability considerations of electrical drives – dc choppers, inverters, cyclo converter, ac voltage controllers, stepper motor.

UNIT - III	MC68HC11 MICROCONTROLLER	9

Architecture memory organization - addressing modes - instruction set - programming techniques - simple programs. I/O ports - handshaking techniques - reset and interrupts - serial communication interface – serial peripheral interface - programmable timer - analog / digital interfacing - cache memory, Timers - interrupts I/O ports - I2C bus for peripheral chip access - A/D converter.

UNIT - IV	CLOSED LOOP CONTROL OF ELECTRICAL DRIVES	9

Drive considerations – control system components – mathematical preliminaries – Nyquist stability criterion – Assessment of relative stability using Nyquist criterion – closed loop frequency response – sensitivity analysis in frequency domain – PID controllers – feedback compensation, robust control system design

UNIT - V	SYSTEM DESIGN USING MICROCONTROLLERS APPLICATIONS	9

Introduction – Interfacing LCD display - keypad interfacing - A.C. load control - PID control of D.C. motor - stepper motor control - brush less D.C. motor control dedicated hardware system versus microcontroller control – application areas and functions of microcontroller– control system design of microcontroller based variable speed drives – applications in textile mills, steel rolling mills, cranes and hoist drives, cement mills, paper mills, centrifugal pumps, turbo compressors.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the basics of various micro controllers
CO2	Describe about AC and DC electric drives
CO3	Demonstrate the MC68HC11 Micro controller in all aspects
CO4	Design closed loop control of electrical drives
CO5	Explain various micro controller applications

TEXT BOOKS

1. John. B. Peatman, "Design with PIC Microcontrollers ", Pearson Education, Asia 2008
2. Vedam Subrahmanyam, "Electric drives – concepts and applications", Tata McGraw Hill publishing company limited, New Delhi, 2003 edition.
3. Michael Khevi, 'The M68HC11 Microcontroller Applications in Control, Instrumentation and Communication', Prentice Hall, 1997

REFERENCES

1. Nagrath. I. J, Gopal. M, "Control Systems Engineering", New age international publishers, third edition2014
2. Gopal. M, "Control System Principles and Design", Tata McGraw Hill publishing company limited, New Delhi, second edition. 2007
3. Mohammed. A. El-sharkawi, "Fundamentals of Electrical drives", Thomson learning, A division of Thomson learning lin., 2001 edition.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE8311 / FLEXIBLE AC TRANSMISSION SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ Explain the necessity of FACTS and custom power devices
- ✓ Describe the performance and applications of various shunt type FACTS controllers
- ✓ Describe the performance and applications of various series type FACTS controllers
- ✓ Explain the performance and applications of hybrid FACTS devices
- ✓ Explain the functioning of custom power devices

SYLLABUS

UNIT - I	Introduction	9

Introduction - Need for FACTS controllers- Concept of FACTS controllers

UNIT - II	Static Shunt Compensation	9

Static Shunt Compensators - SVC and STATCOM -operation and control of TSC, TCR, STATCOM - Compensator Control – Comparison between SVC and STATCOM – Applications of shunt compensators and TCBR

UNIT - III	Static Series Compensation	9

TSSC, TCSC and SSSC - operation and control – Control schemes for series compensators - SSR and its damping - static voltage and phase angle regulators - TCVR and TCPAR - operation and control

UNIT - IV	UPFC and IPFC	9

The Unified Power Flow Controller - operation, comparison with other FACTS devices - control of P and Q - dynamic performance - Interline Power Flow Controller

UNIT - V	Custom power devices	9

Power Quality issues & custom power devices – Distribution STATCOM – Dynamic Voltage restorer – Unified Power Quality Conditioner – Applications of custom power devices.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Explain the necessity of FACTS and custom power devices
CO2	Describe the performance and applications of various shunt type FACTS controllers
CO3	Describe the performance and applications of various series type FACTS controllers
CO4	Demonstrate the performance and applications of UPFC and IPFC
CO5	Discuss the functioning of custom power devices

TEXT BOOKS

1. K. R. Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, 2 nd Edition, 2016.
2. R. Mohan Mathur, Rajiv K. Varma. Thyristor-Based FACTS Controllers for Electrical Transmission Systems, Wiley & IEEE Press, 2002.
3. N.G. Hingorani, L. Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, Wiley & IEEE Press, 1999.
4. T.J.E Miller, Reactive Power Control in Electric Systems, New Age International, New Delhi, 1994.

REFERENCES

1. Dr Ashok S & K S Suresh Kumar “FACTS Controllers and applications” course book for STTP, 2003.
2. G.T. Heydt: Electric Power Quality, 2nd edition, Stars in a Circle Publications, 1994.
3. Sankaran C, “Power Quality”, CRC press special Indian edition 2009.
4. Arindam Ghosh and Gerald Ledwich: Power Quality Enhancement using Custom Power Devices, Kluwer Academic Publishers, 2002.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE8312 / MICRO ELECTRO MECHANICAL SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices
- ✓ To educate on the rudiments of Micro fabrication techniques.
- ✓ To introduce various sensors and actuators
- ✓ To understand different materials used for MEMS
- ✓ To educate on the applications of MEMS

SYLLABUS

UNIT - I	INTRODUCTION	9

Intrinsic Characteristics of MEMS, Energy Domains and Transducers- Sensors and Actuators, Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS, Semiconductor devices – Stress and strain analysis –Flexural beam bending- Torsional deflection

UNIT - II	SENSORS AND ACTUATORS-I	9

Electrostatic sensors – Parallel plate capacitors – Applications, Inter-digitated Finger capacitor –Comb drive devices – Micro Grippers – Micro Motors, Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications, Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT - III	SENSORS AND ACTUATORS-II	9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements –Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators –piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors..

UNIT - IV	MICROMACHINING	9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies -Basic surface micro machining processes, Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods, LIGA Process - Assembly of 3D MEMS –Foundry process.

UNIT - V	POLYMER AND OPTICAL MEMS	9

Polymers in MEMS– Polimide - SU-8, Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene –Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS –Lenses and Mirrors – Actuators for Active Optical MEMS.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze the rudiments of micro fabrication technique by reviewing the concept of semiconductors and solid mechanics
CO2	Interpret the operation, fabrication techniques and applications for various sensors and actuators.
CO3	Apply the sensors and actuators in different applications
CO4	Classify various process of micromachining.
CO5	Impart on the concepts of Polymer and optical MEMS.

TEXT BOOKS

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012
2. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill,New Delhi, 2002
3. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000

REFERENCES

1. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application,"Springer, 2010
2. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002
4. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001
5. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE8313 / POWER QUALITY			3	0	0	3

COURSE OBJECTIVES

- ✓ To introduce the power quality problem
- ✓ To educate on production of voltages sags, over voltages and harmonics and methods of control.
- ✓ To study overvoltage problems
- ✓ To study the sources and effect of harmonics in power system
- ✓ To impart knowledge on various methods of power quality monitoring.

SYLLABUS

UNIT - I	INTRODUCTION TO POWER QUALITY	9

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT - II	VOLTAGE SAGS AND INTERRUPTIONS	9

Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT - III	OVER VOLTAGES	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.

UNIT - IV	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.

UNIT - V	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.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand and analyze power system operation, stability, control and protection.
CO2	Discuss voltage interruptions in detail
CO3	Summarize various causes of over voltages
CO4	Explain about Harmonics in power systems
CO5	Suggest suitable power quality monitoring devies

TEXT BOOKS

1. Eswald.F.Fudis and M.A.S.Masoum, "Power Quality in Power System and Electrical Machines," Elseviar Academic Press, 2013.
2. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', Wiley, 2011.
3. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.WayneBeaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.(For Chapters1,2,3, 4 and 5).

REFERENCES

1. G.J.Wakileh, "Power Systems Harmonics – Fundamentals, Analysis and Filter Design," Springer 2007.
2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and 5)

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191EE8314 / POWER SYSTEM STABILITY			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the fundamental concepts of stability of power systems and its classification.
- ✓ To expose the students to dynamic behaviour of the power system for small and large disturbances.
- ✓ To understand and enhance the stability of power systems

SYLLABUS

UNIT - I	INTRODUCTION TO STABILITY	9

Power System Stability: Definition, Causes, Nature and Effects of disturbances, -classification of stability-synchronous machine representation- Basic assumptions made in stability studies- classical model load-modeling of excitation systems-modeling of prime movers.

UNIT - II	SMALL - SIGNAL STABILITY	9

State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, mode shape and participation factor synchronous machine classical model representation-effect of field circuit dynamics-effect of excitation system-small signal stability of multi machine system.

UNIT - III	TRANSIENT STABILITY	9

Swing equation-equal area criterion-solution of swing, Review of numerical integration methods: modified Euler and Fourth Order Runge -Kutta methods, Numerical stability, critical clearing time and angle-effect of excitation system and governors Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned –Multi machine stability –-transient energy function approach.

UNIT - IV	VOLTAGE STABILITY	9

Factors affecting voltage stability-Transmission system characteristics-Generator characteristics- Load characteristics-Characteristics of reactive power compensating Devices- Voltage collapse.– generation aspects - transmission system aspects – load aspects – PV curve – QV curve – PQ curve – analysis with static loads – load ability limit - sensitivity analysis-continuation power flow analysis - instability mechanisms-examples

UNIT - V	ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY	9

Power System Stabilizer –enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, single-pole switching, fast- valving, high-speed excitation systems– enhancement of power system stabilizers – voltage stability enhancement

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the fundamental concepts of stability of power systems and its classification
CO2	Demonstrate the dynamic behaviour of the power system for small and large disturbances
CO3	Discuss about the transient stability
CO4	Summarize the voltage stability aspects
CO5	Describe enhancement of small signal and transient stability

TEXT BOOKS

1. Kundur, P, "Power System Stability and Control", McGraw-Hill International Editions 3rd edition 2019.
2. R.Ramnujam," Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009
3. T.V. Cutsem and C.Vournas, "Voltage Stability of Electric Power Systems", Kluwer publishers, 1998.
4. Power system stability and control ,P. Kundur ; edited by Neal J. Balu, Mark G. Lauby, McGraw-Hill, 1994
5. Anderson, P.M. and Fouad, A.A., "Power System Control and Stability", Galgotia Publications 1994

REFERENCES

1. K.N. Shubhanga,"Power System Analysis" Pearson, 2017
2. EW. Kimbark., "Power System Stability", John Wiley & Sons Limited, New Jersey, 2013
3. Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008
4. Peter W., Saucer, Pai M.A., "Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.
5. Van Cutsem, T. and Vournas, C., Voltage Stability of Electric Power Systems", Kluwer Academic Publishers, 1998
6. SB. Crary., "Power System Stability", John Wiley & Sons Limited, New Jersey, 1955

OPEN ELECTIVE OFFERED BY ELECTRICAL AND ELECTRONICS ENGINEERING FOR OTHER COURSES

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191EE541	Basics of Electric Power Generation	OE	3	0	0	3
2	191EE542	Design, Estimation and Costing of Electrical Systems	OE	3	0	0	3
3	191EE543	Electrical Machines and Applications	OE	3	0	0	3
4	191EE544	Energy Management and Audit	OE	3	0	0	3
5	191EE545	Electrical Power Utilization and Safety	OE	3	0	0	3
6	191EE546	Introduction to Smart Grid	OE	3	0	0	3
7	191EE547	Non-conventional Energy Sources	OE	3	0	0	3
8	191EE548	Power Electronics and Applications	OE	3	0	0	3

OPEN ELECTIVE OFFERED BY OTHER COURSES TO ELECTRICAL AND ELECTRONICS ENGINEERING

OPEN ELECTIVE OFFERED BY BIO-MEDICAL ENGINEERING

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191BM541	Basic Of Bioinformatics	OE	3	0	0	3
2	191BM542	Electronics In Medicine	OE	3	0	0	3
3	191BM543	Introduction To Biomedical Devices	OE	3	0	0	3
4	191BM544	Introduction To Human Anatomy Systems	OE	3	0	0	3
5	191BM545	Principles Of Telemedicine	OE	3	0	0	3

OPEN ELECTIVE OFFERED BY CIVIL ENGINEERING

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191CE541	Advanced Course in Entrepreneurship (should be opted as Open Elective II)	OE	3	0	0	3
2	191CE542	Air Pollution and Control Engineering	OE	3	0	0	3
3	191CE543	Construction Materials and Techniques	OE	3	0	0	3
4	191CE544	Foundational Course on Entrepreneurship (should be opted as Open Elective I)	OE	3	0	0	3
5	191CE545	Disaster Management	OE	3	0	0	3
6	191CE546	Housing Planning and Management	OE	3	0	0	3
7	191CE547	Maintenance, Repair and Rehabilitation of Structures	OE	3	0	0	3
8	191CE548	Municipal Solid Waste Management	OE	3	0	0	3
9	191CE549	Railways, Airports, Docks and Harbors Engineering	OE	3	0	0	3
10	191CE5410	Tall Buildings	OE	3	0	0	3
11	191CE5411	Traffic Engineering and Management	OE	3	0	0	3

OPEN ELECTIVE OFFERED BY ELECTRONICS AND COMMUNICATION ENGINEERING

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191EC541	Cognitive Radio	OE	3	0	0	3
2	191EC542	Computer Networks	OE	3	0	0	3
3	191EC543	Digital Image Processing	OE	3	0	0	3
4	191EC544	Medical Electronics	OE	3	0	0	3
5	191EC545	MEMS and NEMS	OE	3	0	0	3
6	191EC546	Speech Signal Processing	OE	3	0	0	3
7	191EC547	Robotics and Automation	OE	3	0	0	3
8	191EC548	Satellite Communication	OE	3	0	0	3
9	191EC549	Sensors and Transducers	OE	3	0	0	3
10	191EC5410	Telecommunication Network Management	OE	3	0	0	3
11	191EC5411	Wireless Communication	OE	3	0	0	3
12	191EC5412	Wireless Networks	OE	3	0	0	3

OPEN ELECTIVE OFFERED BY INFORMATION AND TECHNOLOGY

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191IT541	Artificial Intelligence	OE	3	0	0	3
2	191IT542	Block-chain Technologies	OE	3	0	0	3
3	191IT543	C# & .Net Programming	OE	3	0	0	3
4	191IT544	Cloud Computing	OE	3	0	0	3
5	191IT545	Database Management Systems	OE	3	0	0	3
6	191IT546	Machine Learning	OE	3	0	0	3
7	191IT547	Mobile Computing	OE	3	0	0	3
8	191IT548	Software Engineering and Design	OE	3	0	0	3

OPEN ELECTIVE OFFERED BY MECHANICAL ENGINEERING

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191ME541	Advanced Materials	OE	3	0	0	3
2	191ME542	Design Thinking	OE	3	0	0	3
3	191ME543	Energy Conservation and Management	OE	3	0	0	3
4	191ME544	Lean Six Sigma	OE	3	0	0	3
5	191ME545	Material Science and Technology	OE	3	0	0	3
6	191ME546	Renewable Energy Sources	OE	3	0	0	3
7	191ME547	Testing of Materials	OE	3	0	0	3

OPEN ELECTIVE OFFERED BY COMPUTER SCIENCE ENGINEERING

S. No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191CS541	Big Data Analytics	OE	3	0	0	3
2	191CS542	Data Warehousing and Data Mining	OE	3	0	0	3
3	191CS543	Grid and Cloud Computing	OE	3	0	0	3
4	191CS544	Human Computer Interaction	OE	3	0	0	3
5	191CS545	Information Security	OE	3	0	0	3
6	191CS546	Information Theory and Coding	OE	3	0	0	3
7	191CS547	Internet-of-Things	OE	3	0	0	3
8	191CS548	Machine Learning Techniques	OE	3	0	0	3
9	191CS549	Multi-Core Architectures and Programming	OE	3	0	0	3
10	191CS5410	Problem Solving and Python Programming	OE	3	0	0	3
11	191CS5411	Soft Computing	OE	3	0	0	3
12	191CS5412	Software Testing	OE	3	0	0	3
13	191CS5413	Software Project Management	OE	3	0	0	3