Course Structure & Curriculum

For
B. Tech. Programme

In
ELECTRICAL ENGINEERING

Department of Electrical Engineering
Motilal Nehru National Institute of Technology Allahabad
Teliarganj, Allahabad-211004, Uttar Pradesh

MOTILAL NEHRU NATIONAL INSTITUTE OF TECHNOLOGY ALLAHABAD

VISION

To establish a unique identity for the institute amongst national and international academic and research organizations through knowledge creation, acquisition and dissemination for the benefit of society and humanity.

MISSION

- To generate high quality human and knowledge resources in our core areas of competence and emerging areas to make valuable contribution in technology for social and economic development of the nation. Focused efforts to be undertaken for identification, monitoring and control of objective attributes of quality and for continuous enhancement of academic processes, infrastructure and ambience.
- To efficaciously enhance and expand, even beyond national boundaries, its contribution to the betterment of technical education and offer international programmes of teaching, consultancy and research.

DEPARTMENT OF ELECTRICAL ENGINEERING

VISION

To produce globally competitive technical manpower with sound knowledge of theory and practice, with a commitment to serve the society and to foster cutting edge research in Electrical Engineering pertaining to the problems currently faced by the country and the world.

MISSION

- Development of state of art lab facilities for research and consultancy.
- Development of relevant content for quality teaching.
- Development of infrastructure and procurement of cutting edge tools/equipment.
- Improving symbiotic relationship with Industry for collaborative research and resource generation.

DEPARTMENT OF ELECTRICAL ENGINEERING

B.TECH IN ELECTRICAL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1	To produce students for Industry, Research, Academic Institutions and Government Organization
PEO2	To produce students who are at par with the world classified institutions and useful to society
PEO3	To generate adequate human resources for employment opportunities in the critically important and dynamic electrical industry and in the context of a socio-economic and sustainable society
PEO4	Uniquely combine practical, hands-on training with cutting-edge research and teaching and also to develop trained manpower with strong knowledge base to undertake and execute sponsored and collaborative research programmes and consultancies to promote long term academia industrial collaboration as well as for generating resources

Mapping of mission statements with the PEOs

Mission statement	**PEO1**	**PEO2**	**PEO3**	**PEO4**
Development of state of art lab facilities for research and consultancy	**3**	**3**	**2**	**3**
Development of relevant content for quality teaching	**2**	**3**	**2**	**3**
Development of infrastructure and procurement of cutting edge tools/equipment	**3**	**2**	**3**	**3**
Improving symbiotic relationship with Industry for collaborative research and resource generation	**3**	**3**	**3**	**3**

CURRICULAR COMPONENTS

Degree Requirements for B. Tech in Electrical Engineering

Category Symbol	Category	Total Credit
BSC	Basic Science Core	34
ESC	Engineering Science Core	44
HSC	Humanities and Social Science Core	17
PEC	Program Engineering Core	123
PEE	Program Engineering Elective	12
OEC	Open Elective Course	8
	Total Credit Required	210

SCHEME OF INSTRUCTION

B.Tech. (Electrical Engineering)

Course Structure

B. Tech. Year-I, Semester-I

Sl. No.	Course Code	Course Name	L	T	P	Credit	Code
1	PH-1101	Physics-I	3	1	-	4	BSC
2	HS-1101/CS-1101	English Language and Composition/Computer Programming	2	1	-	3	HSC/ESC
3	CY-1101/AM-1101	Chemistry/Engineering Mechanics	3	1	-	4	BSC/ESC
4	MA-1101	Mathematics-I	3	1	-	4	BSC
5	ME-1101/1102	Engineering Graphics/Workshop	1	-	3	4	ESC
6	HS-1102/ PH-1151	Communication Skill Workshop/ Physics (Lab)	2 -	- -	- 3	2	HSC/BSC
7	CY-1152/AM-1153	Chemistry (Lab) / Engineering Mechanics (Lab)	-	-	3	2	BSC/ESC
8	HS-1154/CS-1155	Language lab / Computer Programming (Lab)	-	-	3	2	HSC/ESC
		Total	**14**	**4**	**12**	**25**	

B. Tech. Year-I, Semester-II

Sl. No.	Course Code	Subject	L	T	P	Credit	Code
1	PH-1202	Physics-II	3	1	-	4	BSC
2	HS-1201/CS-1201	English Language and Composition/Computer Programming	2	1	-	3	HSC/ESC
3	CY-1201/AM-1201	Chemistry/Engineering Mechanics	3	1	-	4	BSC/ESC
4	MA-1201	Mathematics-II	3	1	-	4	BSC
5	ME-1201/1202	Engineering Graphics/Workshop	1	-	3	4	ESC
6	CE-1201	Environment & Ecology	2	-	-	2	ESC
7	HS-1202/ PH-1251	Communication Skill Workshop Physics (Lab)	2 -	-	- 3	2	HSC
8	CY-1252/AM-1253	Chemistry (Lab) / Engineering Mechanics (Lab)	-	-	3	2	BSC/ESC
9	HS-1254/CS-1255	Language lab / Computer Programming (Lab)	-	-	3	2	HSC/ESC
		Total	**16**	**4**	**12**	**27**	

B. Tech. Year-II, Semester-III

Sl. No.	Course Code	Course name	L	T	P	Credit	Code
1	EE-13101	Basic Electrical Engineering	**3**	**1**		**4**	**PEC**
2	EE-13102	Electrical Measurement and Measuring Instruments (EMMI)	3	1	-	4	PEC
3	##	Principles of Electronics	3	1		4	PEC
4	##	Data Structure and Operating Systems	3	1	-	4	ESC
5	##	Numerical Methods and Statistical Techniques	3	1	-	4	BSC
6	##	Electrical Engineering Material and Devices	3	1	2/2	4	PEC
7	##	Principles of Electronics (Lab)	-	-	3	2	PEC
8	##	Data Structure and Operating Systems (Lab)			3	2	ESC
		Total	**18**	**6**	**08**	**28**	

These course code to be allotted to other department.

B. Tech. Year-II, Semester-IV

Sl. No.	Course Code	Course name	L	T	P	Credit	Code
1	EE-14101	Electrical Machine - I	3	1	-	4	PEC
2	EE-14102	Signals and System	**2**	**1**	**-**	**3**	**PEC**
3	EE-14103	Power System –I	3	1	-	4	PEC
4	##	Digital Electronics	3	1	-	4	PEC
5	##	Electro-Magnetic Theory	2	1	-	3	PEC
6	EE-14104	Network & System	**3**	**1**	**-**	**4**	**PEC**
7	EE-14201	(Basic Electrical Engineering) Lab	**-**	**-**	**3**	**2**	**PEC**
8	EE-14202	EMMI (Lab)	**-**	**-**	**3**	**2**	**PEC**
9	##	Digital Electronics (Lab)	-	-	3	2	PEC
		Total	**16**	**6**	**09**	**28**	

These course code to be allotted to other department.

B. Tech. Year-III, Semester-V

Sl. No.	Course Code	Course name	L	T	P	Credit	Code
1	EE-15101	Electrical Machine II	3	1	-	4	PEC
2	EE-15102	Control System-I	**3**	**1**	**-**	**4**	**PEC**
3	EE-15103	Power System II	3	1	-	4	PEC
4	EE-15104	Power Electronics	**3**	**1**	**-**	**4**	**PEC**
5	##	Principles of Management	**3**	**-**	**-**	**3**	HSC
6	EE-15201	Electrical Machine-I (Lab)	**-**	**-**	**3**	**2**	**PEC**
7	EE-15202	Network and System Lab	**-**	**-**	**3**	**2**	**PEC**
8	EE-15203	Power System – I (Lab)	**-**	**-**	**3**	**2**	**PEC**
9	EE-15204	Power Electronics Lab	**-**	**-**	**3**	**2**	**PEC**
		Total	**15**	**4**	**12**	**27**	

These course code to be allotted to other department.

B. Tech. Year-III, Semester-VI

Sl. No.	Course Code	Course name	L	T	P	Credit	Code
1	EE-16101	Control System - II	**3**	**1**	**-**	**4**	**PEC**
2	EE-16102	Microprocessor & Computer Organization	3	1	-	4	PEC
3	EE-16103	Instrumentation	3	1		4	PEC
4	EE-16104	Power Plant Engineering	3	0		3	PEC
5	##	*Communication System and Networking*	3	1	-	4	ESC
6	##	Communication Skill	0	0	2	0	HSC
7	EE-16201	Control System I Lab	-	-	3	2	PEC
8	EE-16202	Microprocessor & Computer Organization (Lab)	-	-	3	2	PEC
9	EE-16203	Power System - II Lab	**-**	**-**	**3**	**2**	**PEC**
10	EE-16204	Electrical Machine - II Lab	**-**	**-**	**3**	**2**	**PEC**
11	##	Communication System and Networking (Lab)			**3**	**2**	**ESC**
		Total	**15**	**4**	**15**	**29**	

These course code to be allotted to other department.

B. Tech. Year-IV, Semester-VII

Sl. No.	Course Code	Course name	L	T	P	Credit	Code
1	EE-17101	Electric Drives	3	1	-	4	PEC
2	EE-17102	Renewable Energy Sources and Distributed Generation	3	1	-	4	PEC
3	EE-17306 to EE17499	PE01	3	1	0	4	PEE
4	**OE-1781/82**	OE1	3	1	0	4	OEC
5	EE-17201	Control and Instrumentation (Lab)	**-**	**-**	**3**	**2**	**PEC**
6	EE-17601	Project			6	6	PEC
		Total	**12**	**4**	**9**	**24**	

B. Tech. Year-IV, Semester-VIII

Sl. No.	Course Code	Course name	L	T	P	Credit	Code
1	EE-18101	Power System Protection and Switchgear	**3**	**1**	**-**	**4**	**PEC**
2	EE-18301 to EE-18308	PE02	3	1	0	4	PEE
3	EE-18309 to EE-18317	PE03	3	1	0	4	PEE
4	**OE-1881**	OE2	3	1	0	4	OEC
5	EE-18201	Electric Drive and Renewable Energy Lab			**3**	**2**	**PEC**
6	EE-18601	Project			6	6	PEC
		Total	**12**	**4**	**9**	**24**	

List of Professional Electives

Professional Elective I (PE 01)

1. EE 17301 Neural Network and fuzzy System
2. EE 17302 High Voltage Engineering
3. EE 17303 Utilization of Electrical Energy & Electric traction
4. EE 17304 Advanced Semi-Conductor Devices
5. EE 17305 Network Synthesis
6. EE 17306 Virtual Instrumentation

Professional Elective II (PE 02)

1. EE 18301 EHV AC & DC Transmission
2. EE 18302 Electric Vehicle Technology
3. EE 18303 Biomedical-Instrumentation
4. EE 18304 Operation research
5. EE 18305 Conventional & CAD of Electrical Machines
6. EE 18306 Microcontroller & Applications
7. EE 18307 Power System Operation and Control
8. EE 18308 Digital Protection of Power System

Professional Elective III (PE03)

1. EE 18318 Power Quality
2. EE 18319 Modelling and Simulation of Electrical Machines
3. EE 18320 Advance Instrumentation
4. EE 18321 Electrical System Design
5. EE 18322 FACTS
6. EE 18323 Analytical Instrumentation
7. EE 18324 Mechatronics
8. EE 18325 Process Control
9. EE 18326 Distribution Automation

List of Open Electives (OE) Offered by Electrical Engineering Department

- Electrical Safety - EE-17501
- Introduction to Robotics - EE-17502
- Electrical Measurement and Measuring Instruments [EMMI] - EE-18501
- Virtual Instrumentation - EE-18502

Subject List for other department

[Production Engineering] B.Tech._3rd

- EE-13111 Basic Electrical & Electronics
- EE-13210 Basic Electrical and Electronics Lab

[Mechanical Engineering] B.Tech._3rd

- EE-13111 Basic Electrical & Electronics
- EE-13210 Basic Electrical and Electronics Lab

[Chemical Engineering] B.Tech._3rd

- EE-13111 Basic Electrical & Electronics

[Electronics & Communication Engineering] B.Tech._3rd_4th_5th

- EE-13112 Principal of Electrical Engineering & Measurement
- EE-13211 Electrical Engineering & Measurement Lab
- EE-14111 Network & Systems
- EE-15111 Automatic Control System
- EE-15210 Automatic Control System Lab

DETAILED SYLLABUS

BASIC ELECTRICAL ENGINEERING (EE-13101)

UNIT 1 – FUNDAMENTALS OF DC CIRCUITS: (6 Hours)

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis, Ideal sources –equivalent resistor, current division, voltage division, Star-Delta Transformation

UNIT 2 – MAGNETIC CIRCUITS: (6 hours)

Introduction to magnetic circuits, analogy between electrical and magnetic circuit, Simple magnetic circuit with DC and AC excitations-Faraday's laws, induced emfs and inductances, magnetic leakages, B-H curve, hysteresis and eddy current loss, magnetic circuit calculations, mutual coupling

UNIT 3– AC CIRCUITS: (6 hours)

Sinusoids, Generation of AC, Average and RMS values, Form and peak factors, concept of phasor representation, J operator Analysis of R-L, R-C, R-L-C circuits Introduction to three phase systems - types of connections, relationship between line and phase values.

UNIT 4 –SINGLE- PHASE TRANSFORMER: (6 hours)

Principle of operation, construction, emf equation, equivalent circuit, power losses, efficiency, introduction to auto transformer

UNIT 5 – ELECTRICAL MACHINES: (6 hours)

Working principle, construction and applications of DC machines and AC machines, single phase induction motors:Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, Repulsion Motor, split phase, capacitor start and capacitor start & run motors).

UNIT 6 – ELECTRICAL SAFETY, WIRING &INTRODUCTION TO POWER SYSTEM: **(6 hours)**

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.

Text / Reference books

1. Dash. S.S, Subramani. C, Vijayakumar. K, "BasicElectrical Engineering", First edition, Vijay Nicole Imprints Pvt.Ltd,2013

2. V. Deltoro,"Principle of Electrical Engineering" PHI

3. SmarajtGhosh, "Fundamentals of Electrical & Electronics Engineering", Second edition, PHI Learning, 2007.

4. Metha V.K, RohitMetha, "Basic Electrical Engineering", Fifth edition, Chand. S & Co, 2012.

5. Kothari.D.P and Nagrath.I.J, "Basic Electrical Engineering", Second edition, Tata McGraw - Hill, 2009.

6. Bhattacharya.S.K, "Basic Electrical and Electronics Engineering", First edition, Pearson Education, 2011.

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS (EE-13102)

UNIT 1 –PRINCIPLES OF MEASUREMENT AND ERROR ANALYSIS:

Methods of measurement, Characteristics of instruments & measurement systems, Errors in measurement & its analysis.

UNIT 2 –ANALOG INSTRUMENTS:

Classification, Principle of operation of Permanent Magnet Moving Coil (PMMC) and Moving Iron Instruments, Voltmeters & ammeters, Errors in Voltmeter and Ammeters, Range extension, Advantages and disadvantages ,Electrodynamometer Instruments, Power & Energy measurement.

UNIT 3 – ELECTRONIC INSTRUMENTS:

Digital Instruments for measurement of current, voltage, resistance etc., Measurement of frequency & phase, Cathode Ray Oscilloscopes (CRO) –analog and special CRO.

UNIT 4 – POTENTIOMETERS & BRIDGES:

D.C. & A.C. Potentiometers, D.C. & A.C. Bridges, Measurement of inductance and capacitance & quality factor, Measurement of low, medium, high resistances and earth Resistances.

UNIT 5 – INSTRUMENT TRANSFORMERS:

Principle of operation and applications, Current transformer and its error analysis, Potential transformer and its error analysis, Misc. Measurement**,** Frequency & power factor, Harmonic analyser, Power analyser.

UNIT 6–INTRODUCTION TO DAC & ADC SYSTEM:

Analog to Digital Conversion: Ramp, Voltage to Frequency Converter (Integrating type), Dual slope integration Techniques, Digital to Analog Conversion: Weighted Resistor type, R-2R Ladder type, Specification of D/A Converter -Resolution, Accuracy.

Text/ Reference Books:

1. E.W.Golding & F.C.Widdis, "Electrical measurement & measuring instruments," A.H.Wheeler &Co.Pvt. Ltd. India, 2011.
2. A.D.Helfrick& W.D.Cooper, "Electronic Instruments & Measurement Technique" Prentice Hall of India, 2008.
3. David A. Bell, "Electronic Instrumentation & Measurement," Oxford University Press-New Delhi, 3rdEdition, 2013.
4. M.B.Stout, "Basic Electrical measurement," Prentice Hall, 2ndEdition, 1965.
5. H. S. Kalsi, "Electronic Instrumentation," McGraw Hill Education (India) Pvt. Ltd., 3rdEdition, 2010.

PRINCIPLES OF ELECTRONICS (##)

UNIT 1 – DIODES:

Introduction to *pn*diode and its applications as rectifier, rectifier as DC Power Supply, Clamper, Clipper, Voltage multiplier etc., Zener diode and its applications as regulator, Tunnel diode and Varactor diode

UNIT 2 – TRANSISTORS:

Review of Transistor working, characteristics & its parameters, Transistor as an amplifier, Biasing of bipolar junction transistors, *h*-parameters & transistor equivalent circuits, small signal single-stage amplifier, frequency response, concept of feedback

UNIT 3 – JFET AND MOSFET:

Basic construction, working, concept of pinch-off, characteristics of JFET, MOSFET (Enhancement and Depletion), FET as a voltage variable resistor

UNIT 4 – OPERATIONAL AMPLIFIER:

Ideal & non-ideal characteristics, concept of summing junction and virtual ground. Application of operational amplifier as: Adder, Subtractor, Differentiator, Integrator, Multiplier, Unity gain amplifier & Logarithmic amplifier

UNIT 5 –INTRODUCTION TO DIGITAL ELECTRONICS:

Review of number systems, complements, codes, Boolean algebra, Logic gates, Minterm and Maxterms, Canonical and Standard forms, Logic functions & Logic circuits Minimization of Boolean functions using K-map

UNIT 6 – MEASURING INSTRUMENTS:

Working of Cathode Ray Oscilloscope, Power supply, Multimeter and Function generator.

Text/ Reference Books:

1 Robert Boylested and Louis Nashelsky"Electronic devices and circuit theory," Prentice Hall, 11th edition, 2012.

2 Albert Malvino,"Electronic principles," McGraw Hill Education, 7th edition, 2006.

3 Jacob Millman, Chistos C. Halkias, "Integrated Electronics," McGraw Hill education (India) Private Limited, 2nd edition, 2009.

4 Morris Mano, "Digital design," Pearson, 4th edition, 2008.

5 R. P. Jain Modern,"Digital Electronics,"McGraw Hill Education (India) Private Limited, 4th Edition, 2009.

6 A. D. Helfrick and W. D. Cooper,"Modern electronics Instrumentation and Measurement Techniques,"PHI Learning, 2nd edition, 2008.

DATA STRUCTURE AND OPERATING SYSTEMS (##)

UNIT 1 –Basic Computer Architecture, Function and structure of Hardware and Software Components, CPU, ALU, Memory, I/O devices, System Software, Application Software.

UNIT 2– Introduction, Motivation, and Overview of an Operating System with an emphasis on its role as a Manager of Hardware Resources, History of Computer Hardware (including a review of H/W structures) and how Operating Systems Evolved in tandem with the Hardware.

UNIT 3–Programming software (Writing software),Program and Process, Program specifications and design, Abstract data types, Basics of C, Time and space complexity of Programs.

UNIT 4 –Need of Data Structures, Linear and nonlinear Data structure, Stack, Queue, Tree, Graph, B-tree

UNIT 5– Processor and Memory Management, Process Management, Concurrent Process, Semaphores, Fork and Join, CPU Scheduling including Preemptive, and Non-Preemptive, Application of Stack and Queue, Sequential and linked implementation, in designing program for CPU and Disk scheduling, Page Tables, Page Replacement Algorithms.

Text/ Reference Books:

1 Horowitz and Sahni,"Fundamentals of data structures,"Computer Science Press, Reprinted Edition, 1988.
2 Tanenbaum, "Data StructureUsing C," Pearson India, 1st Edition, 1998.
3 Abraham Silberschatz and Peter Galvin,"Operating System Concepts,"John Wiley & Sons, Inc, 9th Edition, 2012

NUMERICAL METHODS AND STATISTICAL TECHNIQUES (##)

UNIT 1 –ALGEBRAIC AND TRANSCENDENTAL EQUATIONS:

Errors in numerical computation and their analysis, Bisection method, Iteration method, Newton-Raphson Method, Method of False Position, rate of convergence, Method for complex root, Muller's Method, Quotient Difference method.

UNIT 2 – INTERPOLATION:

Introduction, Errors in Polynomial interpolation, Finite differences, Decision of errors, Newton's formula for interpolation, Gauss, Sterling, Bessel's, Everett's Formula, Interpolation by unevenly spaced points, Lagrange interpolation formula, Divided Difference, Newton's General interpolation Formula.

UNIT 3 –CURVE FITTING, CUBIC SPLINE & APPROXIMATION:

Introduction, Method of Least Square curve fitting procedures, Fitting a straight line, Curve fitting by sum of exponential, Data fitting with cubic splines, Approximation of functions.

UNIT 4 –NUMERICAL INTEGRATION AND DIFFERENTIATION:

Introduction, Numerical differentiation, Picard Iteration Method of Solution, Numerical integration, Trapezoidal rule, Simpson 1/3 rule, Simpson 3/8 rule, Booles&Weddles rule, Euler-Maclaurin's formula, Gaussian Formula, Numerical evaluation of singular integrals.

UNIT 5 – NUMERICAL LINEAR ALGEBRA:

Numerical techniques for finding solution of system of linear equations and eigen values: Gauss Jordan, Gauss Seidel methods, Power method for estimating eigen values: LU and LL* factorization of matrices.

UNIT 6 – STATISTICAL COMPUTATIONS:

Frequency Chart, Regression Analysis, Least Square fit, Polynomial fit, Linear and Nonlinear Regression, Multiple Regression, Statistical Quality Control Methods.

Text/ Reference Books:

1. C. F. Gerald and P.O.Wheatley, "Applied Numerical Analysis," Pearson Education, 7th Edition, 2004.

2. M.K.Jain, S.R.K.Iyenger and R.K.Jain, "Numerical Methods for Scientific and EngineeringComputation, Wiley Eastern Ltd.," 5th Edition, 2007.
3. S.S Sastry, "Introductory Methods of Numerical Analysis,"PHI Learning, 5th Edition, 2012.
4. S. Rajasekaran, "Numerical Methods for Science and Engineering," S. Chand Publisher, 2nd Edition, 2010.
5. James I. Buchnan and Peter R. Turner, "Numerical Methods and Analysis," McGraw-Hills Inc., 1992.

ELECTRICAL ENGINEERING MATERIALS AND DEVICES (##)

UNIT 1 – INTRODUCTION:

Classification of materials on the basis of energy gap, conductors, semiconductors, dielectrics, superconductors, ferroelectrics, pyro electrics, piezoelectric, perovskites (titanates, zirconates, hafnates) etc.

UNIT 2–ELECTRICAL PROPERTIES AND CONDUCTING MATERIALS:

Mechanism of electrical conduction, electron theories of solids, free electron theory, Factors affecting electrical conductivity, Wiedemana-Franz law, Lorentz number, thermoelectric properties, characteristics, properties and examples of high voltage conducting materials, high and low resistance materials. Contact fuse and filament materials. Conductors, cable & wire materials, Solder, sheathing, and sealing materials. Electrical properties of these materials, Related calculations.

UNIT 3 –ELECTRONIC PROPERTIES AND SEMICONDUCTING MATERIALS:

Energy band theory, Brillouin zone theory, Fermi energy level, effective mass, concept of doping, energy diagrams, types of semiconductors, semiconductor compounds and alloys and their properties. structures of semiconductors, amorphous semiconductor, Junction properties, materials for different devices. Related calculations.

UNIT 4 –SUPERCONDUCTIVITY AND SUPERCONDUCTING MATERIALS:

Concept of superconductivity, Phenomenon, properties of superconductors, Meissner effect, Critical magnetic field & critical temperature.Types of superconducting materials. Type I& II superconductors, Silsbee rule. Mechanism of superconduction.BCS theory, Debye temperature. London's &Glag theories, High temperature ceramic superconductors, applications: NMR, Maglev, MHO etc., recent advances. Related calculations.

UNIT 5 –DIELECTRIC PROPERTIES AND INSULATING MATERIALS:

Dielectric constant, dielectric strength and dielectric loss.Polarizability, mechanism of polarization, factors affecting polarization, polarization curve and hysteresis loop, types of dielectric materials-solid, liquid and gaseous types; natural and synthetic types. Characteristic, properties, and applications of different types of mica, transformation oil, vacuum etc. Behavior of polarization under impulse and frequency switching.Ferroelectrics, piezoelectric, pyroelectrics, electrostriction effect.Clausius -Mosotti equation. Related calculations.

UNIT 6 –MAGNETIC PROPERTIES AND MAGNETIC MATERIALS:

Origin of magnetism, basic terms and properties.Types of magnetic materials.Introduction to dia, para, ferro, antiferro and ferrimagnetic materials, Curie temperature.Laws of magnetic materials. Domain theory, Domain growth and domain wall rotation, Magnetic anisotropy. Magnetostriction & its mechanism. Ferrites, spinels & garnets.

Ferromagnetic domains, magnetic hystersis. Magnetoplumbite, hexaferrite.Magnetic hysteresis loop, hysteresis loss.Hard and soft magnetic materials.Textured magnetic materials, Oxide magnetic materials. Magnetic tape, Magnetic bubble, Magnetic glasses, Colossal magneto-resistance. High energy hard magnetic materials, Commercial magnetic materials such as Supermalloy, Alnico, Cunife, Cunico etc., Conventional and non-conventional applications, characterisation of magnetic materials, Recent developments. Related calculations.

UNIT 7 –OPTICAL AND OPTOELECTRONIC MATERIALS:

Optical properties, Solar cell, Principles of photoconductivity. simple models, effect of impurities. Principles of luminescence, types; semiconductor lasers; LED materials, binary, ternary photoelectronic materials, effect of composition on band gap, crystal structure and properties. LCD materials, photo detectors, application of photoelectronic materials, introduction to optical fibers, light propagation, electro-optic effect, Kerr effect, Pockel's effect.

UNIT 8 –RECENT ADVANCES. DEVELOPMENTS AND RESEARCHES:

Spintronics: materials and devices, Diamond semiconductors, Ferromagnetic semiconductors, Giant magneto- resistance (GMR), Left handed materials, Left and right handed (LH & RH) composite materials, Diluted magnetic semiconductor etc.

UNIT 9 –FABRICATION OF ELECTRONIC AND OPTO-ELECTRONIC DEVICES:

Methods of crystal growth, zone refining

UNIT 10 – TERM PAPER:

On application/recent advances based on literature survey and/or lab/industry visit(s)

Text/ Reference Books:

1. L. Solymar, and D. Walsh, “Electrical Properties of Materials,” Oxford University Press, USA, 2004. ,

2. David C. Jiles, “Introduction to the Electronic Properties of Materials,” Taylor and Francis CRC Press, 2001.
3. D.C. Jiles, “Introduction to Magnetism and Magnetic Materials,” Springer, 1990.
4. K.M. Gupta, “Electrical Engineering Materials,”Umesh Publication, Delhi, 3rd Edition, 2005.
5. B. D. Cullity, “Introduction to Magnetic Materials,” Addison-Wesley publishing company, California, London, 1972.
6. Goldman, “Modem Ferrite Technology,” Van Nostrand, New York, 1990.
7. J. P. Jakubovics, “Magnetism and Magnetic Materials,” Institute of Materials, London, 1994.
8. Rolf E. Hummel, “Electronic Properties of Materials,” Springer, 2004.
9. Safa O. Kasap, “Principles of Electronic Materials and Devices,” McGraw-Hill, 2005.
10. Irene, “Electronic Materials Science,” Wiley-Interscience, 2006.
11. Jasprit Singh, “Smart electronic materials: Fundamentals and Applications,”Cambridge University Press, 2005.
12. M.E. Lines, and A.M. Glass, “Principles and Applications of Ferroelectrics and Related Materials,” Oxford University Press, USA, 2001.
13. A.J.Dekker, 'Solid State Physics', Macmillan India, 1995.
14. C. Robert and O' Handley, “Modem Magnetic Materials: Principles and Applications,” Wiley-Interscience,1999.

PRINCIPLES OF ELECTRONICS (LAB) (##)

Experiment 1: Familiarization to basic test and measuring instruments like Cathode Ray Oscilloscope (CRO), Function Generator, Power supply, Bread board etc.

Experiment 2: To measure the frequency and amplitude of various waveforms using CRO.

Experiment 3: To verify the truth tables of different logic gates by using ICs and implement different logic gates using IC 7400.

Experiment 4: To study the *pn*junction diode characteristics under forward and reverse bias conditions.

Experiment 5: To study the application of a zener diode as voltage regulator.

Experiment 6: To determine the ripple factor of Half-Wave and Full-wave (Bridge) rectifiers.

Experiment 7: To observe the clipping wave forms in different clipping configurations.

Experiment 8: To observe the clamping wave forms in different clamping configurations.

Experiment 9: To determine the CE (Common Emitter) characteristics of a given BJT.

Experiment 10: To plot the drain and transfer characteristics of a given FET and to find drain resistance.

Experiment 11: To verify the addition and subtraction operation using op-amp 741.

DATA STRUCTURE AND OPERATING SYSTEMS (LAB) (##)

Experiment 1:

a) Write a program to implement linear search in a single dimensional array.

b) Write a program to implement linear search in a 2- dimensional array, when array is stored in a row major order.

c) Write a program to implement linear search in a 2- dimensional array, when array is stored in a column major order.

Experiment 2:

a) Write a program to implement binary search using iteration.

b) Write a program to implement binary search using resursion.

Experiment 3:

a) Write a program to implement bubble sort and insersion sort.

b) Write a program to implement Merge Sort.

Experiment 4: Write a program to implement Quick Sort.

Experiment 5:

a) Write a program to implement a singly link list.

b) Write a program to implement a doubly link list.

c) Write a program to reverse a doubly link list.

Experiment 6: Write a program to implement a binary search tree.

Experiment 7: Write a program to simulate preorder, inorder and postorder traversal over a binary search tree.

Operating Systems

Experiment 8: Write a program to implement

(a) Creation of file (b) Read contents of a file (c) Write to a file (d) Link and unlink a file

(e) Copy file(f) Read contents of a file in a reverse order

Experiment 9: Write a program to simulate the following CPU Scheduling Algorithms:

(a) FCFS (b) SJF (c) Priority (d) Round Robin

Experiment 10: Write a program to simulate Bankers algorithm for Deadlock Avoidance.

Experiment 11: Write a program to simulate the following Page Replacement Algorithms:

(a) FIFO (b) LRU

ELECTRICAL MACHINE-1 (EE-14101)

UNIT 1 – TRANSFORMER:

Equivalent circuits (Exact and approximate), OC & SC test, Voltage regulation, Separation of hysteresis and eddy current losses, All-day efficiency, Parallel operation (conditions, equal and unequal voltage turn ratio), Division of load between parallel transformers, Polarity test, Sumpner's test. , Three-phase transformers: Connections

UNIT 2 – ELECTROMECHANICAL ENERGY CONVERSION:

Principles of electromechanical energy conversion, Singly- and multiply-excited systems- Energy, co-energy, Determination of Torque/Forces from energy/co-energy

UNIT 3 – BASICS OF ROTATING MACHINES:

-Introduction to AC machine- Stator & rotor (cylindrical and salient), DC machines- Field & Armature, Flux lines due to field and stator excitation, Windings layout, connections, Armature windings- Simplex-Lap and wave types.

UNIT 4 – DC MACHINES:

Construction details, Speed and voltage expression, Torque production in D.C. machines, Types according to excitation (with circuit representation and equations), Magnetization curve- effect of field resistance and speed, Series, shunt and compound machines: DC generator & DC motor- Characteristics, Speed control and starting methods, Efficiency, Armature reaction: reduction and compensation, Commutation action, Testing of DC machines: Hopkinson's test, Swinburne's test

UNIT 5– POLY PHASE INDUCTION MACHINE:

Construction features, Production of rotating magnetic field, Phasor diagram, Equivalent circuit, Torque and power characteristics, Torque – slip characteristics, No-load and blocked Rotor Test, Power flow, losses and efficiency Starting and speed control (With and without EMF injection in the rotor circuit), Deep bar and double cage induction motors, Cogging and crawling

Text/ Reference Books:

1. E. Fitzgerald, Charles Kingsle, and Jr. Stephen D. Umans, "Electric Machinery," Tata McGraw Hill, 7th Edition, 2013.

2. Stephen J Chapman, "Electrical Machinery and Power System Fundamentals,"McGraw-Hill Higher Education, 1st Edition, 2001.
3. P.S. Bhimbhra, "Generalized Theory of Electrical Machines," Khanna Publications, New Delhi, 5th Edition, 2014.
4. J. Nagrath, D. P. Kothari, "Electric Machines," TMH Publications, New Delhi, 4th Edition, 2010
5. G. K. Dubey, "Fundamental of Electrical Drives," Narosa Publishing House, New Delhi, 2nd Edition, 2011.

SIGNALS AND SYSTEM (EE-14102)

UNIT 1–Classification of signals and systems; Continuous-time and discrete-time signals: exponential and sinusoidal signals, unit impulses and unit step functions; Continuous-time and discrete-time systems; Basic system properties.

UNIT2– Continuous-time and discrete-time LTI systems; Properties of LTI systems; Unit step response of an LTI system; Causal LTI systems described by differential and difference equations.

UNIT3– Analysis and characterisation of LTI systems using Laplace transform; Continuous-time Fourier transform of aperiodic and periodic signals; Properties of continuous-time Fourier transform.

UNIT4– Representation of continuous-time signals by its samples; The sampling theorem; Reconstruction of sampled signals; The aliasing effect; Discrete-time processing of continuous-time signals.

UNIT5–Thez-transform and its properties; Analysis and characterisation of LTI systems using z-transform;Discrete-time Fourier transform of aperiodic and periodic signals; Properties of discrete-time Fourier transform; The discrete Fourier transform; Introduction to linear feedback systems.

Books/References:

1. A. V. Oppenheim, A. S. Wilsky and H. Nawab, "Signals & Systems," 2nd Edition, Prentice-Hall, 1997.
2. Simon Haykin and Barry Van, "Signals & Systems," 2nd Edition, Wiley, 2007.
3. H. P. Hsu, "Signals & Systems," 2nd Edition, Schaum's Outline Series, 2009.

POWER SYSTEM –I (EE-14103)

UNIT 1–INTRODUCTION TO POWER SYSTEM:

Single line diagram of power system, Brief Description of Power system elements such as Synchronous Machine, Transformer; Busbar, Circuit Breaker etc., Per unit system and their application to power system network, Different kinds of supply system and their comparison; Choice of transmission voltage, conductor size, Kelvin's law

UNIT 2 –TRANSMISSION LINES:

Conductor materials, types of conductors, Parameters-Resistance, Inductance and capacitance of lines, Current distortion effects-Skin, Proximity etc., Mathematical Analysis of transmission lines., Interference with communication lines, Reduction methods.

Mechanical Design: Main components of overhead line, line supports, sag, stringing chart,vibrations

Insulators: types, material, potential distribution, string efficiency, methods of improvement of string efficiency, causes of failure, testing of insulators.

Corona: formation, critical disruptive voltage, visual disruptive voltage, power losses, factors affecting corona, reduction methods.

UNIT 3 – CABLES:

Types and applications, construction, Potential distribution; Equalizing the potential, Insulation Resistance, Capacitance of single phase and three phase cables, Dielectric Loss

UNIT 4 –LOAD FLOW ANALYSIS:

Complex power,Y bus and Z bus formulation, Load flow analysis-Newton Raphson and fast decoupled methods, Methods of voltage control

UNIT 5 –POWER SYSTEM STABILITY:

Dynamic stability, transient stability, equal-area criterion, Numerical Solution and improvement of system stability for single machine and multi machine

UNIT 6 –NEUTRAL GROUNDING:

Necessity and methods of neutral grounding, Grounding Practice

Text/ Reference Books:

1. John.J.Grainger & W. D. Stevenson,"Power System analysis," McGraw Hill, 1st Edition, 1994.
2. D.P.Kothari, & I. J. Nagrath,"Modern Power System Analysis,"Tata McGraw-Hill Publishing Company Limited, New Delhi, 4th Edition, 2011.
3. C.L.Wadhwa,"Electric Power System," New Age International Ltd., 6th Edition, 2010.
4. PrabhaKundur,"Power system stability and control," McGraw Hill Education,1st Edition, 2006.
5. Hadi Sadat,"Power System analysis,"McGraw- Hill, Second edition, 2002.
6. Stephen J. Chapman, "Electric Machinery and Power System Fundamentals," McGraw Hill, New York, 2002.

NETWORKS AND SYSTEMS (EE-14104)

UNIT 1 –GRAPH THEORY:

Graph of a network, Definitions, Tree, Co tree, Link, basic loop and basic cut set, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analyses. (7)

UNIT 2 –NETWORK CLASSIFICATION & INTRODUCTION TO CONTINUOUS TIME SIGNALS AND SYSTEMS:

UNIT Step, ramp and impulse signals, Example of each signal, Differential Equation formulation of linear time invariant continuous system, Responses for unit step, ramp, square pulse and impulse function

UNIT 3 – REVIEW OF LAPLACE TRANSFORM:

Initial value and Final Value Theorem, Properties and solution of differential equation using LT, Time domain analysis of LTI network using Laplace transform, Waveform Synthesis, LT of Complex waveforms, Concept of Transform Impedance, Voltage ratio, Transfer function, Relation between impulse response and system function.

UNIT 4 – NETWORKS THEOREMS:

Thevenin's and Norton's Theorem, Maximum power transfer Theorem, Superposition Theorem, Telligen's Theorem, Milliman's Theorem, Reciprocity theorem, Compensation theorem

UNIT 5 –CONCEPTS OF POLES AND ZEROS:

Relation between locations of Poles, time response and stability, frequency response and bode plots, interrelation between frequency response and time response, convolution integral.

UNIT 6 – TWO PORT NETWORKS:

Two port network parameters (z, y, T, T , h, g), Symmetrical & Reciprocal networks, Inter-conversion of two port network parameters, Interconnection of two port networks, Ladder networks, T-M transformation, Image & characteristic impedance. Network functions: Driving point and Transfer functions.

UNIT 7 – POSITIVE REAL FUNCTION:

Definition and properties and testing, Synthesis of LC, RL & RC circuits using Cauer and Foster s first and second form.

Text/ Reference Books:

1. M.E. Van Valkenberg,"Network Analysis," Prentice Hall of India, 3rd Edition, 2014.
2. D. Roy Choudhary, "Networks & Systems," New Age International,2nd Edition, 2013.
3. W. H. Haytand J. E. Kemmerly, "Engineering circuit Analysis," Tata McGraw-Hill,8th Edition, 2013.

A Chakrabarti& S. Bhadra,"Network Analysis And Synthesis,"McGraw Hill education, 1st Edition, 2009.

DIGITAL ELECTRONICS (##)

UNIT 1 –COMBINATIONAL LOGIC:

Introduction, Design Procedure, Adders, Subtractors, Code Converters, Magnitude Comparator, BCD to Seven Segment decoder, Parity generator and Checker, Decoders, Encoders, Multiplexers, Demultiplexers, ROMs, Design of the circuits using Decoders, Multiplexers, ROMs.

UNIT 2 –PROGRAMMABLE LOGIC DEVICES:

Programmable Logic Array (PLA), Programmable Array Logic (PAL), Design of the circuits using PLA and PAL, Field Programmable Gate Array (FPGA).

UNIT 3 – SEQUENTIAL LOGIC:

Introduction, Flip-Flops, Flip-Flop Excitation Tables, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Race Around Condition, Master-

Slave flip-flops, Conversion design of flip-flops.

UNIT 4 –Design of synchronous & ripple counters, Mod-k or Divide-by-k counters, Decade counter, BCD Counter, UP/DOWN Counters, Lock Out problem, Design with State Equations.

UNIT 5 –Shift register, Serial to Parallel Converter, Parallel to Serial Converter, Ring counters, Twisted-ring counter, Sequence Generator.

UNIT 6–TIMING CIRCUITS:

Multi-vibrators (Mono-stable and, A-stable,)

UNIT 7 – LOGIC FAMILIES:

Characteristics of Digital ICs, DTL, TTL, ECL, MOS Logic & CMOS Logic, Calculation of noise margins and fan-out

UNIT 8 – INTRODUCTION TO VHDL:

Basics, Simulation of Multiplexers, Demultiplexersetc

Text/ Reference Books:

1. M. Morris Mano,"Digital Design," Prentice Hall,4th Edition, 2008.
2. R. P. Jain, "Modern Digital Electronics,"TMH, 4th Edition, 2009.
3. Taub and Schilling, "Digital Integrated Electronics,"Mcgraw Hill, 1st Edition, 2010
4. Sandige,"Digital concept Using standard ICs," PHI, 2nd Edition, 2006.
5. R. J. Tocci, "Digital Systems, Principles and Applications,"Prentice Hall, 11th Edition, 2010.

ELECTRO-MAGNETIC THEORY (##)

UNIT 1 −INTRODUCTION:

Review of scalar and vector field, Vector representation of surface, Physical interpretation of gradient**,** divergence and curl, Divergence theorem, Stokes theorem, Different coordinate systems.

UNIT 2 − ELECTROSTATIC FIELDS:

Electric field due to point, surface and volume charges, Electrostatic potential for different charge distributions, Gauss's law, Solution of Laplace's and Poisson's equation in one dimension, Method of images applied to plane boundaries, Electric flux density, Boundary conditions, Capacitance, Electrostatic energy.

UNIT 3 −MAGNETOSTATIC FIELDS:

Biot- Savart's law , Ampere's law, magnetic flux density, Boundary conditions,Faraday's law, Energy stored in magnetic field, Scalar and Vector Magnetic Potential.

UNIT 4 − TIME VARYING ELECTROMAGNETIC FIELDS:

Continuity equation, Displacement current, Maxwell's equations in point form and integral form, Retarded potential, Plain wave equation and it's solution in conducting and non conducting media, Phase velocity, Group velocity, Plane waves in lossy dielectrics, Propagation in good conductors: skin effect, impedance of conducting medium, Polarization, Reflection and Refraction of plain waves at plain boundaries, Poynting Vector, Poynting theorem and power considerations.

UNIT 5 − TRANSMISSION LINES:

Transmission line equations, parameters- primary and secondary constants, Analogy of transmission lines with8e.m. waves, determination of α, β, γ and vp ,characteristics impedance, Input impedance of a lossless line, open and short circuited lines, distortion less lines, reflection coefficient and standing wave ratio, matched transmission line, Impedance matching, Smith chart and its applications.

UNIT 6 − COMPUTATIONAL ELECTROMAGNETICS:

Finite element method (FEM) and Finite difference time domain method (FDTD)

Text/ Reference Books:

1. William Hayt, "Engineering Electromagnetics," Tata McGraw Hill, 7thEdition, 2012.
2. Matthew N.O. *Sadiku*, "Elements of Electromagnetics," Oxford University Press, 5thEdition, 2010.
3. J.D. Kraus, "Electromagnetics," McGraw Hill, 4thEdition, 1991.
4. LeventSevgi, "Complex Electromagnetic Problems and Numerical Simulation Approaches," IEEE Press and John Wiley, New York, 2003.
5. E. C. Jordan and K. G. Balmain, "Electromagnetic waves and Radiating Systems," PHI, 2ndEdition, 2011.

BASIC ELECTRICAL ENGINEERING LAB (EE-14201)

Experiment 1 Verification of Kirchoff Current Law

Experiment 2 Verification of KirchoffVoltage Law

Experiment 3 Study of series RLC circuit

Experiment 4 Measurement of power in three phase circuit

Experiment 5 Starting of DC motor

Experiment 6 Starting of Induction motor using star delta starter

Experiment 7 Starting of Induction motor using Auto Transformer

Experiment 8 Open circuit and short circuit in single phase induction motor

Experiment 9 Load Test on Single Phase Transformer

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS (EMMI) (LAB) (EE-14202)

Experiment 1: Range Extension of Ammeter & Voltmeter.

Experiment 2: Calibration of

(a) Ammeter for application as Voltmeter and

(b) Voltmeter for application as Ammeter.

Experiment 3: Calibration of a given Sine-Responding Voltmeter for other types of Waveforms (such as Square & Rectangular).

Experiment 4: Measurement of Power in a 1-Phase load using 3-Voltmeter method and its Calibration using Wattmeter.

Experiment 5: Calibration of Wattmeter by Direct-load test.

Experiment 6: Calibration of 3-Phase Energymeter.

Experiment 7: Measurement of Signal Amplitude, Frequency and Phase using C.R.O.

Experiment 8: Measurement of capacitance and inductance using A.C. bridges

Experiment 9: Measurement of Earth-Resistance.

Experiment 10: Measurement of High Resistance using Insulation Tester and its Study.

DIGITAL ELECTRONICS (LAB) (##)

Experiment 1: Verification of operation of Full Adder and Full Subtractor.

Experiment 2: Design & verification of 4-bit binary adder/subtractor using binary adder IC.

Experiment 3: Realization of operation of full adder and full subtractor using IC 74151/74153 MUX.

Experiment 4: Design & verification of full adder and full subtractor using an inverted output 3 to 8 line decoder.

Experiment 5: Design and verification of operation of a BCD Adder using IC 7483.

Experiment 6: Realization of 4 X 1 MUX using basic gates.

Experiment 7: Verification of operation of BCD to Seven segment code conversion using IC 7447.

Experiment 8: Verification of Truth Tables of SR & D Flip flops.

Experiment 9: Verification of Truth Tables of Master Slave JK Flip-Flop.

Experiment 10: Design of MOD-8 UP/Down synchronous counter.

Experiment 11: Design of BCD ripple counter.

Experiment 12: Design of Universal Shift Register.

Experiment 13: Design of a sequential circuit from given state diagram.

Experiment 14: Design and verification of AstableMultivibrator using IC 555.

Experiment 15: Design and verification of MonostableMultivibrator using IC 555.

Experiment 16: Implementation of Basic Combinational and sequential circuits using VSM (Virtual System Modelling)

Experiment 17: Implementation of Basic Combinational and sequential circuits using VHDL

ELECTRIC MACHINE II (EE-15101)

UNIT 1 –SYNCHRONOUS MACHINES:

Construction Features, EMF Equation, Winding Co-efficient, Harmonics in the induced EMF, Equivalent circuit, Power expression for cylindrical and salient pole machines, Losses and efficiency, Synchronous generator characteristics, Active and reactive power control, Single and parallel operation, Performance characteristics, Capability curve, Synchronous Motor,Principle of operation, Starting methods, Speed control

UNIT 2 –PERMANENT MAGNET SYNCHRONOUS MOTORS:

Principle of operation, EMF and torque equations, reactance phasor diagram, Torque speed characteristics, Steady state and dynamic modelling, Field weakening operation, Operation as 120 deg mode.

UNIT 3 –PRECISION MOTORS:

Stepper motors-constructional features, principle of operation, variable reluctance stepper motor, hybrid stepper motor, single and multi-stack configurations, characteristics, drive circuits, applications in control, AC Servomotors-Construction-principle of operation-performance characteristics, (Speed torque) -damped AC servomotors-Drag cup servomotor-applications-DC servomotors-field and armature controlled DC servomotors- permanent magnet armature controlled.

UNIT 4 –RELUCTANCE MOTORS:

Synchronous- constructional features, types, axial and radial air gap motors, operating principle, reluctance phasor diagram, characteristics, comparison between induction and synchronous motor in terms of output torque,Switched Reluctance Motors -constructional features, principle of operation, torque production, Relationship between inductance and rotor position, equivalent circuit,

UNIT 5 –PERMANENT MAGNET BRUSHLESS D.C. MOTORS:

Principle of operation, Types– trapezoidal type-sinusoidal type, Magnetic circuit analysis, EMF and torque equations, Power controllers, Motor characteristics and control.

UNIT 6 –INDUCTION GENERATORS:

Working principle, Power balance relations, Power flow in sub synchronous/super synchronous operation, Equivalent circuit, Application in Wind system for power generation, Steady state analysis of DFIG

Text/Reference Books

1. P.S. Bimhra, "Electrical Machinery," Khanna publishers, 2003.
2. T.J.E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives,"Oxford University Press, 1989.
3. P. P. Acarnley, "Stepping Motors – A Guide to Motor Theory and Practice,"Institution Of Engineering And Technology, 4th Edition, 2002.
4. T. Kenjo and S. Nagamori, "Permanent Magnet and Brushless DC Motors," Oxford University Press, 1985.
5. Kenjo& A. Sugawara, "Stepping Motors and Their Microprocessor Controls,"Clarendon Press, 2nd Edition, 1994.
6. J.Nagrath& D.P.Kothari, "Electrical Machines," TMH Publication,New Delhi, 25th Edition, 2010.
7. P.S.Bimhra, "Generalized theory of Electrical Machine,"Khanna publishers, New Delhi, 5th Edition, 1995.
8. Gopal K.Dubey, "Fundamental of Electrical Drives," Narosa Publishing House, New Delhi, 2nd Edition, 2011.

CONTROL SYSTEM - I (EE-15102)

UNIT 1 − INTRODUCTION TO CONTROL SYSTEM:

Introduction, Closed-loop control versus open-loop control

UNIT 2 − MATHEMATICAL MODELLING OF CONTROL SYSTEMS:

Control hardware and their models, various physical system modeling, Block diagram reduction, Signal flow graph, Basic characteristics of Feedback, Modes of feedback control: proportional, integral and derivative, PID, The performance of Feedback systems

UNIT 3 − TRANSIENT RESPONSE ANALYSIS:

Time response analysis, Concepts of Stability and Routh's Stability Criteria, Steady-state error analysis

UNIT 4 −ROOT-LOCUS ANALYSIS& THE FREQUENCY-RESPONSE METHOD:

Root-locus plots, Rules of constructing Root Loci, Root-locus analysis of control systems

UNIT 5 − FREQUENCY RESPONSE ANALYSIS:

Bode plots, Polar plots, The Nyquist Stability Criterion and Stability Margins, Closed loop frequency response (M & N circles)

UNIT 6 –DESIGN AND COMPENSATION TECHNIQUES:

Design considerations, Lag Compensation, Lead Compensation, Lag-lead Compensation, Compensator Design Using Root-locus and Frequency Response methods

Text/ Reference Books:

1. B.C Kuo., "Automatic Control System," Wiley, 9th edition, 2009.
2. K.Ogata, "Modern Control Engineering," Prentice Hall, 5th edition, 2010.
3. I. J. Nagrath&M. Gopal, "Modern Control Engineering," New Ages International, 5th edition, 2007.
4. R.T Stephani., "Design of Feedback Control Systems," Oxford University Press, 4th edition, 2001.

POWER SYSTEM – II (EE-15103)

UNIT 1 –INTRODUCTION:

Modern power system – Analysis for system planning and operational studies – basic components of a power system, Single phase solution of balanced Three-phase Network, Single line diagram, Simple building algorithms for the formation of Y-Bus matrix and Z- Bus matrix, Per Unit(PU) System, Complex Power, Representation of Loads .

UNIT 2–OPTIMAL SYSTEM OPERATION:

Introduction basic on optimal operation and optimal load flow, Optimal operation of Generation on a Bus Bar, Optimal Unit Commitment, Reliability Considerations, Optimum Generation Scheduling operation and Optimal load flow solution, Optimal Scheduling of Hydrothermal System.

UNIT 3–FAULT ANALYSIS:

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

Introduction to Symmetrical Components Transformation, Phase shift in Star-Delta Transformers, sequence impedance and networks of Power System, Synchronous Machine, Transmission Line, Transformers and Construction of Sequence Network of a Power System .

Unsymmetrical fault analysis – problem formulation, Symmetrical Component analysis of Unsymmetrical Fault using Z-bus impedance matrix(L-G, L-L, L-L-G).

UNIT 4–POWER SYSTEM STABILITY ANALYSIS:

Importance of stability analysis in power system planning and operation, classification of power system stability, angle and voltage stability. Dynamics of Synchronous Machine, Power angle equation, Node Elimination Technique, simple System, Steady State Stability, Transient Stability

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

UNIT 5–ADVANCED TOPICS:

SCADA and Computer control voltage

Expert system applications to power systems.

Text/Reference Books:

1. I.J. Nagrath& D.P. Kothari, "Modern Power System Analysis,"Mcgraw Hill Education, 4th Edition, 2011.

2. Olle. I. Elgerd, "Electric Energy Systems Theory – An Introduction," Mcgraw Hill Education, 2nd Edition, 2001.

3. P. Kundur, "Power System Stability and Control," Mcgraw Hill Education, 1st Edition, 2006.

4. John J. Grainger & W.D. Stevenson Jr., "Power System Analysis,"McGraw Hill Education, 1st Edition, 2003.

5. HadiSaadat, "Power System Analysis," TMH Education Pvt Ltd, 1st Edition, 2002.

POWER ELECTRONICS (EE-15104)

UNIT 1 – INTRODUCTION:

Introduction to Power Electronics, Power Electronics Systems, Role of Power Electronics in the field of electric power control.

UNIT 2 – POWER ELECTRONIC DEVICES:

A Brief Survey of Power Semiconductor Devices:Power Diodes, Thyristor, Diac, Triac, UJT, GTO etc. Construction characteristics and their applications, methods of triggering a SCR. Different firing (R, RC and UJT) circuits, commutation of SCR, converter grade and inverter

grade SCRs, series parallel operation of SCRs, Protection of SCR and GTO thyristor and triggering of GTO thyristor.

UNIT 3 −OTHER POWER ELECTRONICS DEVICES:

Characteristics, operation, constructional details and application of Power Transistor (BJT), MOSFET, IGBT and MCT.

UNIT 4 − CONTROLLED RECTIFIERS:

Phase controlled Rectifiers operation on resistive and inductive loads, use of free-wheeling diode, Single -Phase and Three phase controlled and Fully controlled bridge rectifiers, Semi-converters, Dual converters, Effect of source impedance on converter, Line commuted inverters

UNIT 5 − CHOPPERS:

Principle of operation and control technique of chopper, classification of Choppers, current and voltage waveforms for resistive, inductive and motor loads, Power Transistor and MOSFET based chopper circuits, step up chopper and its application.

UNIT 6 − INVERTERS:

Single-phase and Three-phase (six-step) inverters, voltage and current waveforms, Bridge Inverter, voltage control & PWM strategies of VSI., Series and parallel inverters, Methods of voltage control, and various techniques of phase width modulation. Comparisons of voltage source, current source inverters and their applications.

UNIT 7 −CYCLOCONVERTER:

Single-phase and three-phase Step-up and Step down cycloconverter, full bridge and half bridge configurations.

UNIT 8 − APPLICATIONS:

Static circuit breakers, UPS, Static frequency converter, Power factor control.

Text/ Reference Books:

1. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications," Pearson, 3rd Edition, 2003.
2. G. K. Dubey, S. R. Doradla, A. Joshi & V. P. Sinha, "Thyristorised Power Controllers," New Age International, 2nd Edition, 2012.
3. Krishna Kant and Vineeta Agrawal "Power Electronics," BPB Publications, 2008.
4. P. C. Sen, "Power Electronics," Mcgraw Hill Education, 1stEdition,2001.
5. P. S. Bimbhra, " Power Electronics," Khanna Publishers, 2012.

6. Cyril W. Lander , " Power Electronics," McGraw-Hill, 3rdEdition,1993.
7. Ned Mohan, T. M. Undeland& W. P. Robbin"Power Electronics: Converter, Applications & Design,"Wiley India Pvt Ltd, 3rd Edition, 2010.

PRINCIPLES OF MANAGEMENT (##)

UNIT 1 –INTRODUCTION TO MANAGEMENT:

Definition of Management – Science or Art – Management and Administration, Functions of Management – Types of Business Organization. Levels of management and Managerial skills

UNIT 2 –SCHOOL OF MANAGEMENT THOUGHTS:

Evolution of Management thoughts, classical approach, neo- classical approach, contribution of Taylor, Weber and Fayol, modern approach

UNIT 3 –PLANNING:

Nature & Purpose – Steps involved in Planning ,Objectives, Setting Objectives, Process of Managing by Objectives ,Strategies, Policies & Planning Premises Forecasting Decision-making.

UNIT 4 – ORGANIZING:

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process-Techniques-HRD-Managerial-Effectiveness. **Directing:** Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.

UNIT 5 –CONTROLLING:

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance. Coordination.

UNIT 6 −ORGANISATIONAL BEHAVIOUR:

Organisational change, Conflict Management and Stress Management, **Functional management:** Human Resource Management, Financial management, Marketing Management.

Text/Reference Books:

1. P. C Tripathi &P.N. Reddy, "Principles of Management," Tata McGraw-Hill, 4th Edition , 2008.
2. D.A Decenzo, S.P Robbino, "Personnel and Human Reasons Management," Wiley India Pvt. Ltd, 10thEdition, 2011.
3. J. A. F Stomer, R.E. Freeman and D.R Gilbert, JR. "Management", Pearson Education, 6th Edition, 2003.
4. H. Kooritz& H. Weihrich, "Essentials of Management," Mcgraw Hill Education, 9th 2012.

ELECTRICAL MACHINE-I (LAB) (EE-15201)

Experiment 1: To obtain magnetization characteristic of a DC. Shunt generator.

Experiment 2: To obtain load characteristic of a D.C. shunt generator.

Experiment 3: To obtain speed torque characteristic of a D.C. series motor.

Experiment 4: To obtain speed torque characteristic of a D.C shunt motor.

Experiment 5: Speed control of a DC shunt motor by armature and field control

Experiment 6: To perform polarity & ratio test on a single-phase transformer and Parallel operation of two single-phase transformers.

Experiment 7: To determine efficiency & regulation of a one-phase transformer by O.C. & S.C. Tests.

Experiment 8: To study 3-phase to 2-phase conversion by Scott connection.

Experiment 9: To obtain efficiency & regulation of two single-phase transformers by Sumpner's (back to back) test.

Experiment 10: Determination of equivalent circuit of a three phase induction motor from light running and blocked rotor test.

Experiment 11: Speed control of induction motor by voltage and frequency control

NETWORK SYSTEM (LAB) (EE-15202)

Experiment 1: To verify Thevenin's Theorem.

Experiment 2: To verify Norton's theorem.

Experiment 3: To verify maximum power transfer theorem.

Experiment 4: (a) To verify superposition theorem using D. C. Sources.

(b) To verify superposition theorem using A. C. Sources.

Experiment 5: Transient response of the RC circuit. To study the transient response of the RC circuit with step input with different values of R. To verify the calculated values of different parameters with that of measured values

Experiment 6: Frequency response of RLC series circuits. To study the variation of current and capacitor voltage with change in frequency for RLC series circuit

Experiment 7: To study the variation of current and capacitor voltage with change in frequency for RLC parallel circuit.

Experiment 8: To find out the frequency response of Twin – T Notch Filter.

Experiment 9: To determine z and h parameter of two port networks and compute the other parameter.

Experiment 10: Verification of parameter properties in interconnected two port networks (series, parallel & cascaded).

POWER SYSTEM –I (LAB) (EE-15203)

Experiment 1: Determination of positive, negative and zero sequence impedances of a three phase transformer.

Experiment 2: Determination of ABCD parameters of a transmission line model.

Experiment 3: To calculate the voltage regulation of a transmission line.

Experiment 4: Calculate the string efficiency of a suspension type insulator with and without guard ring.

Experiment 5: To determine the dielectric strength of transformer oil.

Experiment 6: To study the flow of active and reactive power using an inter-connector.

Experiment 7: To study the effect of load power factor on power system stability.

Experiment 8: Determination of R, L and C parameters of a transmission line model and observing the Ferranti effect.

POWER ELECTRONICS (LAB) (EE-15204)

1. To determine the V-I Characteristics of a given silicon controlled rectifier (SCR) device.
2. To determine the V-I Characteristics of a given TRIAC device.
3. To implement the oscillator circuit with uni-junction transistor (UJT) device.
4. To design the firing circuits for SCR using R and RC elements.
5. To test the characteristics of single phase diode-bridge module using R, RL, and RC elements.
6. To test the characteristics of controlled bridge rectifier using single-phase SCR bridge module.
7. To test the isolated gate drivers for transistor–transistor logic (TTL) pulses to the MOSFET bridge module by varying the pulse width.
8. To implement the gate drive for IGBT bridge module as an inverter and study its characteristics.
9. To obtain the dynamic characteristics of BJT, MOSFET, and IGBT on a given study module.
10. To simulate the uncontrolled half-wave and full-wave rectifier using PSPICE software.
11. To simulate the controlled half-wave and full-wave rectifier using PSPICE software.

CONTROL SYSTEM- II (EE-16101)

UNIT 1 −INTRODUCTION-SIGNAL PROCESSING IN DIGITAL CONTROL:

Introduction to digital control systems, Principles of signal conversion, Sampling and reconstruction, Principles of discretization, Impulse andstep invariance, Finite difference approximation, Bilinear transformation

UNIT 2 – MODELS OF DIGITAL CONTROL DEVICES AND SYSTEMS:

Mathematical models discrete time signalsand systems, Transfer function and system response, Stability on the z-domain, Closed loop digitalcontrol systems, System with dead time, Commonly used digital devices, Examples of industrial controlsystems

UNIT 3 −DESIGN OF DIGITAL CONTROL ALGORITHMS:

Transform design of digital controllers, Root locusmethods and frequency domain method

UNIT 4 − CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS:

State variable representation ofcontinuous and discrete time systems, Conversions state variable models to transfer function models,Conversion of transfer function to canonical models, Eigen values and eigenvectors, Solution of stateequations, Sampled continuous-time systems, Controllability and Observability properties

UNIT 5 −DESIGN OF CONTROL SYSTEMS BY STATE VARIABLE METHODS:

Pole-placement design, Observerdesign, Lyapunov Stability analysis

Text/ Reference Books:

1. M.Gopal, "Digital Control and State Variable Methods," Mcgraw Hill Education, 4th edition, 2012.

2. Katsuhiko Ogata, "Discrete-Time Control Systems," PHI Learning Pvt Ltd, 2nd Edition, 2009.

3. B.C.Kuo, "Digital Control System," Oxford University Press, 2nd Edition, 2012.

MICROPROCESSOR& COMPUTER ORGANIZATION (EE-16102)

UNIT 1: Introduction-Introduction to COA, Basic Computer Model, Working Principle, and Main Memory Organization, Microprocessor.

UNIT 2: Organization of Intel 8085 Micro-Processor, Hardware Architecture pin-out diagram, Signals – Memory interfacing – I/O ports and datatransfer concepts – Timing Diagram – Interrupt structure.

UNIT 3: Instruction set of Intel 8085 Micro-Processor & Assembly programming, Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions - stack.

UNIT 4: Introduction to Peripherals, Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – Interfacing with 8085 - A/D and D/A converter interfacing.

UNIT 5: Micro-controller Architecture, Functional block diagram - Instruction format and addressing modes – Timing Diagram Interrupt structure – Timer –I/O ports – Serial communication, Interrupts.

UNIT 6: Application of micro controller, Data Transfer, Manipulation, Control & I/O instructions – Simple programming exercises, key board and display interface – Closed loop control of servo motor- stepper motorcontrol - Washing Machine Control.

UNIT 7: Organization of Intel 8085 Micro-Processor, Hardware Architecture pin-out diagram, Signals– Memory interfacing – I/O ports and data-transfer concepts – Timing Diagram – Interrupt structure.

Text/Reference Books

1. William Stallings, "Computer Organization and Architecture" - PHI, 4th Edition1998.
2. C.Andrew,Tanenbaum, "Structured Computer Organization," Pearson,.5 edition, 2005.
3. R.S. Gaonkar,"Microprocessor Architecture and Programming and Applications with the 8085,"Prentice Hall; 5 edition , 2002
4. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay ,"The 8051 Microcontroller and Embedded systems," Prentice Hall; 2 edition, 2005
5. M. M. R. Mano, Computer System Architecture, 3rd Edition, Prentice Hall, 1994

INSTRUMENTATION (EE-16103)

UNIT 1 − INSTRUMENTATION SYSTEMS:

Role of Instrumentation, Elements of instrumentation system; Use of monitored information; Classification of data acquisition systems; Standards of instrumentation; Calibration; Recent developments.

UNIT 2 −TRANSDUCER INSTRUMENTATION:

Sensors and transducers; Primary sensing elements; Electrical Transducers- characteristics, classification, desirable properties.

UNIT 3 − PASSIVE TRANSDUCERS:

Resistive, inductive, capacitive, frequency generating or modulating type; opto-electronic transducers; ultrasonic transducers; Hall-effect transducers- types, principle, modeling, analysis, industrial applications.

UNIT 4 − ACTIVE AND DIGITAL TRANSDUCERS:

Thermo-electric type, piezoelectric type, electromagnetic type; photo-electric type; digital transducers- types, principle, modelling, analysis, industrial applications, Applications with transducers for common industrial variables- temperature, pressure, flow, level, weight/ load/force, position, speed, acceleration, vibration.

UNIT 5 −ELECTRONIC INSTRUMENTATION:

Analog Signal Conditioning and signal conversion- Transducer bridges- for resistive, reactive transducers; Amplifiers- instrumentation amplifiers, special purpose amplifiers; V/I and I/V signal converters; Precision rectifiers and applications; Active filters- low-pass first, second order types, features and design; Linearization of transducer characteristics for common transducers.

UNIT 6 −DATA CONVERTERS AND DIGITAL SIGNAL CONDITIONING:

Sampling and Hold operations; Digital to analog convertors (DACs)-R/2R , Binary weighted, BCD to analog types; Analog to digital convertors (ADCs)- classifications; Capacitor charging type- VFC, PWM type, dual slope integrator types; Discrete voltage comparison type- counter ramp, successive approx, flash types, Properties and specifications.

UNIT 7 −TELEMETRY AND NETWORKED SYSTEMS:

Types of data telemetry systems- land line, wireless, analog and digital, current, voltage, position, frequency telemetry; Network requirements; Communication interface- types of buses, IEEE 1451 standards; Data acquisition systems- configurations, comparative; Sensor networks and smart transducers.

Text/ Reference Books:

1. D.Patranabis, "Principles of industrial instrumentation," Tata McGraw Hill Education,3rdEdition, 2010.
2. R.G.Seippel,"Transducers, sensors and detectors," Reston Publication, 1983.
3. G Sarma,V.S.V. Mani &C. Rangan, "Instrumentation systems and devices",Tata Mcgraw Hill, 2012.
4. D.F Hoeschele, "Analog-to-Digital and digital –to-analog Conversion Techniques," Wiley-Interscience, 2ndEdition, 1994.
5. D. Roy Chaudhary& S.B Jain – "Linear integrated circuits," New Age International, 4thEdition, 2011.

POWER PLANT ENGINEERING (EE-16104)

UNIT 1 −INTRODUCTION TO POWER PLANTS:

Conventional power plant- Thermal, Hydro, Nuclear, Combined cycle, etc, Non-conventional power plant-Small hydro, wind (on shore/off-shore), fuel cell, PV etc, their layout, Load duration curves, Switchyard.

UNIT 2 −THERMAL POWER PLANT (STEAM BASED):

Study on different sections- fuel and ash handling, Furnace and mechanical strokers, Pulverizers, Steam boiler types and cycles (including fluidized bed), Turbo-generators, Excitation system, Draught, Electrostatic precipitator, Cooling towers

UNIT 3 − NUCLEAR POWER PLANT:

Nuclear energy-Fission and fusion reaction, Types of reactors, pressurized water reactor, waste disposal.

UNIT 4 −HYDRO POWER PLANT:

Different layout- Dam and run-of-river, Main sections- Intake, Tunnel, Surge tank, Penstock, Tail race, Turbine types, Hydro generators, Governors.

UNIT 5 −DIESEL AND GAS TURBINE POWER PLANT:

Types of diesel power plant, components, Selection of engine type, Gas turbines, Open and closed cycles, reheating, Regeneration, Inter-cooling.

UNIT 6 −ECONOMICS OF POWER PLANTS:

Cost of electrical energy- Fixed and operating cost, Tariff rates, Economics of load sharing, Comparison of cost from different power plants, Power plant instrumentation and major Electrical Equipment, Pollution and its control.

Text/ Reference Books:

1. P.K. Nag, "Power plant engineering,"Tata McGraw-Hill Education, 2nd edition, 2002
2. M.M.EI-Wakil , "Power plant Technology,"Tata McGraw-Hill Education, 1984
3. Frederick Tracy Morse, "Power plant engineering and design," D. Van Nostrand company, inc.,1932.
4. F. Beach, "Modern Power Station Practice : Electrical Systems and Equipment," 3rd Edition, Pergamon 1992.
5. Joel Weisman and Roy Eckart , "Modern Power Plant Engineering," Prentice-Hall, 1985
6. R.K. Rajput, "A Textbook of Power Plant Engineering,"Laxmi; 4 edition, 2007.

COMMUNICATION SYSTEM AND NETWORKING (##)

UNIT 1 −INTRODUCTION TO COMMUNICATION SYSTEMS:

Elements of a General Communication System, Modulation, Need for Modulation, Fundamental Limitations of a Communication System, Analog and Digital Signals and Systems, Baseband and Bandpass Communication, Introduction to Radio Communication, Analog Modulation Techniques: Amplitude Modulation, Frequency Modulation and Phase Modulation, Model of a Digital Communication System, Elements of a Digital Communication System, Logarithmic Measure of Information, Entropy and Information Rate, Source Coding, Fixed and Variable Length Code Words, Mutual Information and Channel Capacity of a Discrete Memoryless Channel, Hartley-Shannon Law.

UNIT 2 −PULSE MODULATION AND WAVEFORM CODING TECHNIQUES:

Sampling and Reconstruction of Analog Signals, Types of Pulse Modulation System: PAM, PWM and PPM, Quantization, Encoding, Pulse Code Modulation (PCM), Bandwidth of PCM, Differential PCM, Delta Modulation (DM), Threshold of Coding and Slope Overload, Adaptive Delta Modulation (ADM), ADPCM, Comparison of PCM and DM Line Coding and its Properties, NRZ and RZ Types, Signaling Format for Unipolar, Polar, Bipolar (AMI), and Manchester Coding, Digital Multiplexing.

UNIT 3 −DIGITAL MODULATION TECHNIQUES:

Types of Digital Modulation, Waveforms for Amplitude, Frequency and Phase Shift Keying, Method of Generation and Detection of Coherent and non-coherent Binary ASK, FSK and PSK, Differential Phase Shift Keying (DPSK), Quadrature Modulation Techniques: Quadrature Amplitude Modulation (QAM) and Quadrature Phase Shift Keying (QPSK), Minimum Shift Keying (MSK) – Generation and detection.

UNIT 4 −COMPUTER NETWORKS:

Local Area Networks: LAN architecture, Bus/Tree LANs, Ring LANs, star LANs, wireless LANs. LAN Systems: Ethernet and Fast Ethernet, CSMA/CD, Token Ring and FDDI, 100VG-Any LAN, ATM LAN, Fiber Channel, Wireless LAN Bridges: Bridge Operation, Routing with Bridges, ATM LAN Emulation. Internetworking: Principles of Internetworking, connectionless Internetworking, The Internet Protocol, Routing Protocol, IPv6,ICMPv6.

Text/ Reference Books:

1. Bernard Sklar, "Digital Communications: Fundamentals and Applications," Pearson Education, 2nd Edition, 2001.
2. Behrouz A. Forouzan, "Data Communication & Networking,"Mcgraw-Hill College, 5th Edition, 2012.
3. B.P. Lathi, "Modern Digital and Analog Communication Systems," Oxford University Press, 2nd Edition, 2009.
4. S.Haykin, "Digital Communication," Wiley India Pvt Ltd, 1st Edition, 2010.
5. H. Taub, G. Saha& D. L. Schilling, "Principles of Communication Systems," Mcgraw Hill Education, 4th Edition, 2013.
6. J.G. Proakis, "Digital Communications," McGraw Hill, 4th Edition, 2001.

COMMUNICATION SKILL WORKSHOP (##)

Experiment 1: Art of communication: What is communication, good communication and effective communication, barriers and filters, activity on barriers and filters.

Experiment 2: Body language: verbal and non –verbal behavior interpretation, activity on non-verbal communication.

Experiment 3: Active listening. Active listening quiz.

Experiment 4: Feedback: How to give and receive feedback, Activity on feedback.

Experiment 5: Hidden date of communication: Feelings. Activity on how to handale feelings.

Experiment 6: Practical skills: assertiveness, activity on assertiveness, self-confidence, activity.

Experiment 7: In the world of teams: the team concept, element of teamwork. Team formation, effective team, exercise on team, Team players, activity.

Experiment 8: Discussions, decisions and presentations: Structured and un-structured group discussions. Activity on each.

Experiment 9: Adapting to Corporate life: exercise on grooming and dressing, getting ready for interview.

Experiment 10: Business Etiquette/Dining etiquette.

CONTROL SYSTEM - I (LAB) (EE-16201)

A-EXPERIMENT BASED LABORATORY PRACTICAL

Experiment 1: Determine the transfer function of a separately excited DC generator.

Experiment 2: Obtain the frequency response characteristics of the first and second order active LPF.

Experiment 3: Obtain the graph between output errors and angular position difference of a given potentiometer error detector.

(a) When the excitation is DC.

(b) When the excitation is AC.

Experiment 4: Determine the time response of different order of system using linear system simulator.

(a) Determine the time constant of first order system for open loop system

(b) Determine the time constant of type-1 system for closed loop system.

Experiment 5: Determine the frequency response of given open loop linear system and time response of closed loop system.

Experiment 6: Obtain the frequency response of LAG and LEAD Compensator.

Experiment 7: To draw the frequency response of a given L,R,C network theoretically and to capture the time response for a given square wave input at 50Hz (power supply).

Experiment 8: Use Lag and Lead compensator with the given closed loop system and show that the lead compensator improves transient performance and lag compensator improves the steady state characteristics.

B. SIMULATION BASED LABORATORY PRACTICAL (Using MATLAB)

1. To study the performance of PID Controller for a given RLC series circuit.
2. Determine the G M (Gain Margin) and P M (Phase Margin) for given open loop transfer function and comment on stability.

i. $G(s)=\frac{20(0.5s+1)}{s^2(0.2s+1)}$

ii. $G(s)=\frac{50}{s^2+2s+1}$

3. Draw root locus for unity feedback system with following open loop transfer function

i. $G(s)=\frac{k(s+6)}{s(s+4)(s^2+4s+8)}$

Determine k for $\xi=0.5$. Obtain the step response of closed loop system and verify the value of ξ using measurement of peak overshoot.

4. For a given state space model

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -3 & -4\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 0\end{bmatrix}u$$

$$y=\begin{bmatrix}10 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\end{bmatrix}u$$

a. Find out time response for unit step input for initial condition of $x_1(0)=1, x_2(0)=2$.

b. Test for Controllability and Observability.

c. Test the stability from eigen value of A matrix.

COMMUNICATION SYSTEM AND NETWORKING (LAB) (##)

Experiment 1: To design and implement a Band Pass Filter for the range (400Hz-1KHz).

Experiment 2: To implement Amplitude Modulation (AM), demodulation and calculate the modulation index.

Experiment 3: To implement Frequency Modulation (FM) using IC 2206 and demodulation using IC 565.

Experiment 4: To implement Pulse Amplitude Modulation (PAM) and Demodulation.

Experiment 5: To implement Pulse Position Modulation (PPM).

Experiment 6: To implement Pulse Width Modulation (PWM).

Experiment 7: To implement Phase Locked Loop (PLL)and find out the lock range and capture range.

Experiment 8: To determine the performance of PCM.

Experiment 9: Study of LAN transmission media's , topologies , interconnection devices & LAN standards.

Experiment 10: Study of TCP/IP & Internet.

Experiment 11: To generate a random wireless scenario.

Experiment 12: To generate wireless MANETs scenario.

Experiment 13: To compare AODV and DSR routing protocols for wirelwss MANETs.

Experiment 14: To use Voice over IP application in wireless scenario.

Experiment 15: To compare reactive and Hybrid routing protocols for MANETs.

MICROPROCESSOR AND COMPUTER ORGANIZATION (LAB) (EE-16202)

Programs on 8085 Kit

Experiment 1: Write a program to Add two 8 bit Data result may be (i) 8 bits (ii) 16 bits.

Experiment 2: WAP to Subtraction of two 8 bit Data.

Experiment 3: WAP to Add series of 8 bit numbers. Result by be 8 bit or 16 bit.

Experiment 4: WAP to find the 2's complement of 16 bit Number.

Experiment 5: WAP for (ii) Multiplication and (ii) Division, data is of 8 bits and result bay be 8 or 16 bits.

Experiment 6: WAP for multi byte (ii) Addition and (ii) Subtraction.

Experiment 7: WAP for multi byte Addition of number of series.

Experiment 8: WAP to find the (i) largest and (ii) smallest number from a Data array.

Experiment 9: WAP to arrange a Data array in (i) Ascending (ii) Descending order.

Experiment 10: WAP to Display your name and moving display.

Study cards:

Experiment 11: 8155, 8255, 8253, 8251, 8259 8279, 8257

Interfacing modules:

Experiment 12: Traffic light control

DC motor control

Thumbwheel control

Stepper motor control

Elevator Simulator

D/A converter

A/D converter

Keyboard Simulator

Experiment 13: Basic programs of 8086 microprocessor

POWER SYSTEM – II (LAB) (EE-16203)

Experiment 1: Obtaining line parameters of a 345 kV transmission line and its modeling in MATLAB.

Experiment 2: Study of load flow analysis of a power system using (a) Gauss–Seidel and (b) Newton-Raphson methods.

Experiment 3: Study the effect of transformer in a power system while load flow analysis using MATLAB.

Experiment 4: To Study the effects of sudden short-circuit on a synchronous generator output using MATLAB.

Experiment 5: To obtain the current harmonics drawn by power electronics interface.

(a) To study the effect of real and reactive powers on bus voltages.

(b) Modeling of thyristor Controlled Reactors (TCR).

(c) Modeling of thyristor Controlled Series Capacitors (TCSC).

Experiment 6: To calculate transient stability limit of a 3-bus power system.

Experiment 7: To study the effect of symmetrical and unsymmetrical short-circuit faults of transmission lines.

Experiment 8: To study over voltages resulting from switching of transmission lines and limiting them by sing ZnO arresters.

ELECTRIC MACHINE- II (LAB) (EE-16204)

Experiment 1: Determination of voltage regulation of an alternator by synchronous impedance method and Potier triangle method

Experiment 2: Determination of losses and efficiency of an alternator.

Experiment 3: Determination of V-curves of a Synchronous motor

Experiment 4: Determination of direct axis and quadrature axis reactance of a salient pole alternator

Experiment 5 Determination of sub-transient reactance of salient pole synchronous machine

Experiment 6. Determination of sequence impedances of salient pole

Experiment 7 Run the induction machine as an induction generator and measure the real and reactive powers.

Experiment 8. Six step switch-on mode for a trapezoidal PMSM motor rated 1 kW, 3000 rpm and its speed regulation.

Experiment 9 Speed control of PMSM drive using MATLAB/SIMULINK

Experiment 10 Study of stepper motor drive using two H-bridge MOSFET Inverter

ELECTRIC DRIVES (EE-17101)

UNIT 1: Introduction of Drives-Concept of Electrical Drive, Classification of Drives, Block Diagram of an Electrical Drive, power modulators, Sources, Control Unit , Choice of Electrical Drive, Status of DC and AC Drive, Load Characteristics, Load With Rotational Motion and Transnational Motion, Classification of Load Torques, Load Torques function of Speed, Time, Path or Position Taken by the Load during Motion and Quadrant Operation

UNIT 2: Dynamics of Electrical Drive-Electric motor speed torque characteristics, Joint Speed-Torque Characteristic of an Electric Motor and Driven Unit, Stability of Drive System, Determination of Moment Of Inertia, Load Equalization, Concept of Transient Stability, Selection of motor under Continuous Duty, for Continuous variable Duty, for Short Duty Load, and intermittent Duty Load, Effect of Load Inertia, Environmental Factors

UNIT 3: Starting and Braking of DC Drives-Effect of staring on power supply, motor and load, Types of starters, Different methods of starting of a motor, Starting Circuit as a Function of Motor Speed, Function of Current and Function of Time, Thyristors and the resistance starter, Thyristor starting without resistance, Braking of DC Drives, Type of Braking, Friction Braking and Electrical)

UNIT 4: Speed Control of DC Drives-Performance parameters for Power Controller Fed DC Drives, Classify various power electronics controller fed DC drives, Types of controlled rectifier fed DC drives, Performance of Controlled Rectifier Fed DC Shunt Motor and Series Motor, Performance of Chopper fed DC drives

UNIT 5: Starting and Braking of AC Drives-Need of using starters for AC Drives, Two (Star-Delta and Auto-transformer) types of starters used for Squirrel cage Induction motor, Starter using additional resistance in rotor circuit, for Wound rotor (Slip-ring), Starting of Synchronous Motor, Principle of electric braking for AC drives, Types of braking of AC drives

UNIT 6: Speed Control of AC Drives-Different methods of speed control of induction motor, Advantage of low frequency starting of induction motor, Sources of Variable frequency generation, Variation of supply voltage, Injection of voltage in rotor circuit, static ScherbiusDrive, Static Kramer Drives, Rotor resistance control Speed Control of Synchronous Motor Drives, Traction Motor drive

Text/ Reference Books:

1. G.K.Dubey, "Fundamental of electric drives," Narosa Publishing House, 2nd Edition, 2015.
2. Vineeta Agarwal, "Fundamental of electric drives," Agarwal Publications, IEdition, 2013.
3. S. K. Pillai, "A First Course on Electrical Drives," New Age International Publishers, 3rd Edition, 2015.
4. P.C.Sen, "Thyristor DC drives,"John Wiley & Sons Inc., 1981.
5. B.K. Bose, "Modern Power Electronics and AC Drives,"Prentice Hall, 1st Edition, 2001.
6. V. Subramanayam, "Thyristor control of electric drives," Tata McGraw Hill Publication, 1st Edition, 1988.

RENEWABLE ENERGY SOURCES AND DISTRIBUTED GENERATION (EE-17102)

UNIT 1–DISTRIBUTED GENERATION RESOURCES:

Installed capacities of electrical power system, Renewable energy sources (RES) types solar, wind, small-hydro, diesel generator , marine, fuel cells, current break up of installed capacities and growth of RES, distributed generation technologies, standalone, hybrid and grid connected.

UNIT 2– POWER ELECTRONICS IN DG:

AC/DC, DC/DC and DC/AC converters in DG, Fully rated and partially rated converters, Battery charging, maximum power point tracking (MPPT) methods, Inverter topologies for solar and wind, reactive power, voltage, current and frequency control.

UNIT 3– SOLAR PV SYSTEM:

Solar photovoltaic (PV) cell technologies, Modules and Arrays, Solar radiation: irradiance, capturing and orientation, I-V and P-V characteristics, Series and parallel connection and characteristics, bypass diodes, Solar PV components: Batteries, Power conditioning units charge controllers, DC cables, protection and safety devices, etc., Utility, Commercial and Residential PVs, PV system design.

UNIT 4– WIND ELECTRICAL SYSTEM:

Wind Turbines, Wind sites, Fixed speed and Variable speed wind turbines, Synchronous generator, PMSG, Induction generator , doubly fed synchronous generator, Generation schemes, Land vs. offshore wind turbines, wind turbine characteristics, Hybrid energy systems.

UNIT 5– OTHER DG TECHNOLOGIES:

Energy Storage, Batteries, Capacitors, Ultra-Capacitors, flywheel, Thermal Storage , Fuel Cells and its characteristics.

UNIT 6– GRID INTEGRATION:

Standards for grid connection, Power Quality, Eigen Analysis, optimal location of DG, Islanding issues, Solar and Wind power park, Smart grid.

Text/Reference Books:

1. A. Ghosh and G. Ledwich, "Power Quality Enhancement using Custom Power Devices,"Springer, 2009.
2. Mukund R. Patel, "Wind and Solar Power Systems", CRC Press, 2nd Edition, 2005.
3. G.M.Masters, Renewable and Efficient Electric Power Systems," Wiley, 2013.
4. M.H. Rashid, "Power Electronics Handbook," Academic Press, HRD Edition,2001.
5. R. A. Messenger and J. Ventre, "Photovoltaic Systems Engineering," CRC Press, 3rd Edition, 2010.

6. C. S. Solanki, “Solar Photovoltaic Technology and Systems,” PHI 2013.

PROFESSIONAL ELECTIVE – I

NEURAL NETWORK AND FUZZY SYSTEM (EE-17301)

UNIT 1: Introduction of Artificial Intelligence techniques-Role of artificial intelligence techniques in engineering; Characteristics of ANN and Fuzzy Systems

UNIT 2: Neural Networks Systems-Biological neurons, NN terminology, Activation functions, Fundamental models of NN; McCulloch Pitt’s, Hebb, Single layer perceptron, Adaline network, solving logic gate function using these models, Types of NN based on learning methods, Supervised learning (Hebb learning rule, Bolzmann learning, Delta learning rule, Gradient descent techniques, Adaptation, Generalized delta rule), Unsupervised learning, Reinforcement learning, Self-organizing mapping, Adaptive resonance theory 12(L)

UNIT 3: Multilayer NNs-Types according to architecture- Feedforward NN, Recurrent NN, Dynamic learning of NN, Applications of NNs- Identification (Nonlinear model structures-NNFIR, NNARX, NNFIR, NNARMAX, NNOE), Control (Direct inverse, internal model, feedforward)

UNIT 4: Fuzzy systems-Introduction, Definition and terminology, Fuzzy set operations, their properties, Fuzzy relations, Its operations and properties, Fuzzy composition, Fuzzy linguistic variables, Rule structure- consequent and antecedent part, rule framing, Fuzzification, De-fuzzification (Max membership principle, Centroid, Weighted average, Mean max membership, Centre of sums, Centre of largest area), Inference system.

UNIT 5: Fuzzy system applications- Fuzzy controllers, approximate reasoning and approximation

UNIT 6: Introduction to Neural Network and Fuzzy Toolbox in MATLAB

Text/Reference Books:

1. Simon Haykin, “Neural networks - A comprehensive foundation,”Prentice Hall, 2003.
2. M. T. Hagan ,“Neural network design ,Cengage Learning,” 2nd edition, 2008
3. D. T. Pham and X Liu, “Neural network for identification, prediction and control,” Springer , 1995
4. Klir George J., Yuan Bo, “Fuzzy Sets and Fuzzy Logic: Theory and Applications,”

Prentice-Hall (1996)
5. B. Kosko, "Neural Networks and Fuzzy Systems," Prentice-Hall, 1994
6. T. J. Ross , "Fuzzy Logic with Engineering Applications Wiley-Blackwell;" 3rd edition 2010.

HIGH VOLTAGE ENGINEERING (EE-17302)

UNIT 1−GENERATION OF HIGH DC/AC VOLTAGES:

Half wave and full wave circuits, Ripple voltages in HW and FW rectifiers, voltage doubler circuits, simple voltage doubler and cascade voltage doubler. Voltage multiplier circuits, Cockcroft-Walton voltage multiplier circuits, Ripple and regulation, Electrostatics machines, principles, Van de Graaff generator, Cascade transformers, resonant transformers- parallel and series resonant test systems.

UNIT 2& 3−GENERATION OF HIGH FREQUENCY VOLTAGES:

Tesla coil.

Generation of impulse voltage/current: Standard impulse wave shape - Basic circuits for producing impulse waves -Analysis of commercial impulse generator circuits -Wave shape control. Multistage impulse generators –Marx circuit - modified Marx impulse generator circuit - Components of multi-stage impulse generator. Generation of switching surges, Definition of impulse current waveform, Circuit for producing impulse current waves.

UNIT 4−NON-DESTRUCTIVE TESTING OF DIELECTRIC MATERIALS:

Measurement of resistance, dielectric constant and loss factor.Partial discharge phenomena, discharge detection using straight detectors.

UNIT 5−HV TESTING OF ELECTRICAL APPARATUS:

Definitions - Terms and conditions, Test on insulators, cables, transformers, surge arresters. HV and EHV bushing design, selection, quality control, maintenance and diagnostic testing. Biological and environmental aspects in EHV and UHV line design. Live line maintenance, Principles - common live line maintenance - Tools for live line maintenance.

References

1. M.S.Naidu and V.Kamaraju, "High Voltage Engineering," Tata McGraw Hill, New Delhi, 4th Edition, 2008.
2. I. J.Nagarath, and D P. Kothari, "Modern Power System Analysis", McGraw Hill Education, 4th Edition,2011.

3. Dieter Kind. "An Introduction to High Voltage Experimental Techniques", John Wiley & Sons, 1978.
4. W. Hauschild and E. Lemke, "High-Voltage Test and Measuring Techniques," Springer,2014.
5. C.L. Wadhwa, "High Voltage Engineering,"New Age International Publishers, 3rd Edition, 2010.

UTILIZATION OF ELECTRICAL ENERGY & ELECTRIC TRACTION (EE-17303)

UNIT 1: Electrical Circuits used in Refrigeration and Air Conditioning and Water Coolers: Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants, Description of Electrical circuit used in a) refrigerator, b) air-conditioner, and c) water cooler

UNIT 2: Illumination, Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light, Laws of illumination, Different type of lamps, Illumination schemes, Illumination levels, Main requirements of proper lighting methods of generating high frequency power illumination: Laws of illumination, polar curves, design of indoor and outdoor systems, street lighting. Electrolytic Process: Principle of electro deposition, laws of electrolysis, applications of electrolysis.

UNIT 3−ELECTRIC TRACTION:

Advantages of electric traction, Different systems of electric traction, Types of services – urban, sub-urban, and main lines and their speed-time curves, Different accessories for track electrification, Factors affecting scheduled speed

UNIT 4: Electrical block diagram of an electric locomotive, Types of motors used for electric traction, Starting and braking of traction motors, Introduction to EMU and metro railways

Text/ Reference Books:

1. J.B. Gupta, "Utilization of Electrical Energy,"S K Kataria& Sons-New Delhi, 2014.
2. E. O. Taylor,"Utilization of Electric Energy," Orient Blackswan, 1st Edition.
3. C.L. Wadhwa, "Generation, Distribution and Utilization of Electrical Power,"New Age International Publishers, 3rd Edition, 2010.
4. M. BalasubbaReddy,"Generation and Utilization of Electrical Energy by India," Pearson India, 2010.

ADVANCED SEMI-CONDUCTOR DEVICES (EE-17304)

UNIT 1: Status of development of power semiconductor Devices, Diodes Types - P-N junction, schottky, contact, Gunn diodes, IMPATT (Impact ionization Avalanche Transit-Time) diodes; Step recovery diodes; Electrical rating - Switching and steady state characteristics - switching aid circuits - Series and parallel operation , Resonant tunnelling structures, RTD oscillators

UNIT 2 – SPECIAL TYPES OF THYRISTORS:

Field controlled thyristors and MCTs: Electrical rating - Switching and steady state characteristics - protection - Gate circuit requirements-Turn ON and Turn OFF methods

UNIT 3: Transistors Types – BJT, Hetro junction BJTs; (HBT), ratings - static and switching characteristics - driver circuit - switching aid circuit -Power Darlington. Static Induction Transistor SIT.

UNIT 4: Field Effect Transistors Types (JEFT, MOSFET, Metal Semiconductor Field Effect Transistor, MOSFET, HEMT, High Electron Mobility Transistor). Transport in low dimensional structures: HEMTs: Design of high frequency amplifiers and oscillators.

UNIT 5: IGBTs, Principle of working – switching characteristics - Gate drive requirements, Emerging Devices: - Power Integrated circuit - Characteristics –- New semiconductor materials for devices, (SiC, GaAs, PwrSoc),

UNIT 6: Intelligent power modules, Wide band gap devices, nano-electronics and ballistic devices, Terahertz and Millimeter Wave Devices

Text/ Reference Books:

1. Ned Mohan, “Power Electronics,”Prentice Hall of India, New Delhi, 3rd Edition, 2003
2. M. H. Rashid, “Power Electronics,”Prentice Hall of India, New Delhi, 2006.
3. B. W. Williams,“Power Electronic Devices, Applications and Passive Components,” ELBS Oxford University Press, 1992.
4. Mohan, M.et.al “Power Electronics converters, Applications and Design", John Wiley and Sons, New York, 2nd Edition, 1995.
5. M. H.Rashid, “Power Electronic Circuits, Devices and Applications,” Prentice Hall of India, New Delhi, 2nd Edition, 1994.

NETWORK SYNTHESIS (EE-17305)

UNIT 1− ELEMENTS OF NETWORK SYNTHESIS:

Ssynthesis of L-C Driving–point Immitances, synthesis of R-C Impedances or R-L Admittances , Synthesis of certain R-L -C Functions.

UNIT 2−ELEMENTS OF TRANSFER FUNCTION SYNTHESIS:

Properties of Transfer function, Synthesis of Y21 Z 21 with 1-Ω termination, Synthesis of Constant Resistance Networks.

UNIT 3 −FILTER DESIGN:

Filter design problem, Low Pass Filter Approximations, Synthesis of Low Pass Filter, Magnitude and Frequency Normalization, Frequency Transformations.

UNIT 4 − BIQUAD CIRCUITS:

Biquad Circuits, Four Op-Amp Biquad Circuit, Frequency and Phase Response of Biquad Circuit .Butterworth Low Pass filter,Chebychev,Bessel Thomson Filter.

UNIT 5 − LEAPFROG SIMULATION OF LADDERS

Ladder Simulation,Band pass Leapfrog Filters,Active Resonators,Band pass Leapfrog Design,Girling-Good Form of Leapfrog.

UNIT 6 − SWITCHED CAPACITOR FILTERS

Switched Capacitor,AnalogOperations ,Range of Circuit elements Sizes,Bandpass Switched – Capacitor Filters. OP Amp Oscillators: Loop gain, Conditions for Third –Order Circuit Oscillations Amplitude Stabilization

Text/ Reference Books:

1. Franklin F. Kuo, "Network Analysis and Synthesis", Wiley India Pvt Ltd, 2nd Edition, 2010.
2. M. E.Valkenberg, "Analog Filter Design, "Oxford University Press, 2008.
3. A. S.Sedra and P O Brackett, "Filter Theory and design: Active and Passive", Matrix Publishers, 1977.

VIRTUAL INSTRUMENTATION (EE-17306)

UNIT 1: Introduction, Virtual Instrumentation (VI) advantages

UNIT 2: Graphical programming techniques, data flow programming, VI's and sub VI's

UNIT 3: Structures, Arrays and Clusters

UNIT 4: Data acquisition methods, File I/O, DAQ hardware, PC hardware; operating systems, Instrumentation buses, ISA, PCI, USB, PXI

UNIT 5: Instrument control, Data communication standards, RS-232C, GPIB

UNIT 6: Real time operating systems, Reconfigurable I/O, FPGA

LAB

Exprtiment 1: Familiarization with LabVIEW Programming: Creating simple VI, navigation and editing, developing VI, converting VI into Sub-VI, boolean switch action.

Exprtiment 2: LabVIEW Functions & Debugging: Use of WHILE-loop, FOR-loop, IF-THEN, CASE structure, shift registers, local variables and debugging.

Exprtiment 3: Advance LabVIEW Functions: Mathematical functions, arrays, clusters, waveforms and charts, formula node, global variables.

Exprtiment 4: Data Acquisition: Analog I/O, digital I/O, application of measurement & automation explorer (MAX).

Exprtiment 5: VI Applications: Temprature measurement, signal analysis (RMS, FFT, DFT, etc.), PLL, PWM output etc.

Text/ Reference Books:

1. Jovita Jerome, "Virtual Instrumentation Using LabVIEW," PHI India New Delhi, 1st Edition, 2010.
2. S. Gupta & J. John, "Virtual Instrumentation Using LabVIEW," Tata McGraw-Hill, New Delhi, 1st Edition, 2005.
3. Robert Bishop, "Labview 7 Express Student Edition," , PHI.
4. LabVIEW User Manual, National Instruments, Texas Instruments, USA, www.ni.com.
5. LabVIEW FPGA Module User Manual, National Instruments, Texas Instruments, USA, 2004, www.ni.com.
6. Leonard Sokoloff, "Application LabView," PHI, OSBN – 0-13-833949-X.
7. Garry Johnsons, "LabVIEW Graphical Programming," McGraw Hill India, 4th Edition, 2011. LabVIEW FPGA Module User Manual, National Instruments, Texas Instruments, USA, 2004, available at www.ni.com
8. Application LabView, Leonard Sokoloff, PHI, OSBN – 0-13-833949-X
9. LabVIEW For Electrical Circuits, Machine Drives and Labs, NesimiErtugrul, PHI, ISBN – 0-13-0618860-1
10. Advanced LabVIEW Labs, John Essick, PHI, ISBN – 0-13-833949-X
11. LabVIEW Graphical Programming. Garry Johnsons, McGraw Hill.

CONTROL SYSTEM AND INSTRUMENTATION (LAB) (EE-17201)

List of experiments

Part A: Simulation based Experiments

Experiment 1: To obtain the time response (step, impulse and ramp response) and study the time domain performance indices (rise time, settling time, delay time, maximum peak overshoot etc.) for the transfer function of the continuous and discrete time systems using MATLAB.

Experiment 2: To study the controllability, Observability and stability of continuous and discrete time systems using root locus, Nyquist and Bode plot in MATLAB.

Experiment 3: To study the inverted pendulum system performance with pole placement, LQR and observer based control for using MATLAB.

Part B: Real time Experiments

Experiment 4: To study the real time linear inverted pendulum system with LQR.

Experiment 5: To study the real time PID controller for rotary pendulum system.

Experiment 6: To study the real time PD controller for magnetic ball suspension system using MATLAB.

Experiment 7: To study the real time PID controller for magnetic ball suspension system using LABVIEW.

Part C: Instrumentation Experiments

Experiment 8: Study and experimentation on displacement measurement using LVDT.

Experiment 9: Study and experimentation on speed Measurement.

Experiment 10: Study and experimentation on (i) pressure measurement; (ii) Piezoelectric transducers for force/ Load measurement; (iii) Strain Gauge measurement

Experiment 11: Study and experimentation on temperature sensing transducers such as thermocouple, thermistor, and RTD.

Experiment 12: Design and testing of high pass and low pass filters.

Experiment 13: Design with timer-555

Experiment 14: Design and testing of Instrumentation Amplifiers.

PROJECT (EE-17601)

POWER SYSTEM PROTECTION & SWITCHGEAR (EE-18101)

UNIT 1: Revolution from Electromagnetic to Static and Digital Relays. Fundamental principles of fuse and over current protection and application to feeder and motor protection.Arc interruption theories, Types of Circuit Breaker, RRRV, Resistance switching, current chopping, Testing and health monitoring of Switchgear.

UNIT 2: Fundamental principles of distance relaying and application to transmission system protection. Relay co-ordination in transmission and distribution system.

UNIT 3: Fundamental principles of differential protection and application to transformer, bus bar and generator armature winding protection

UNIT 4: Role of Current and Voltage transformers in power system protection.

UNIT 5: Introduction to Numerical relaying, DSP fundamentals like aliasing, sampling theorem, Discrete Fourier Transform and application to current and voltage phasor estimation

UNIT 6: Numerical relaying algorithms for over current, distance and differential protection with application to transmission system, transformer and bus bar protection.

UNIT 7: Issues in Micro-grid Protection

Text Books:

1. Power System Protection and Switchgear, B Ram, D N Vishwakarma, 2nd Edition, 2011, Tata McGraw-Hill
2. Electric Power Systems, C L Wadhwa, 6th Edition, , New Age International (P) Limited, Publishers (2008)
3. Switchgear Protection and Switchgear, S. S. Rao, 2008, Khanna Publishers
4. Distribution Automation Handbook, ABB Ltd
5. Network Protection and Automation Guide, Areva Ltd.

PROFESSIONAL ELECTIVE – II

EHV AC & DC TRANSMISSION (EE-18301)

UNIT 1 −GENERAL ASPECTS AND CONVERTER CIRCUITS:

HVAC and HVDC links - comparison, reliability, choice of best circuit for HVDC converters-transformer connection

UNIT 2 − BRIDGE CONVERTERS:

Analysis and control – power reversal- desired features of control - actual control characteristics

UNIT 3 −MIS-OPERATION OF CONVERTERS AND PROTECTION:

Converter disturbance - bypass action in bridges - commutation failure - basics of protection - DC reactors - voltage and current oscillations - circuit breakers – over voltage protection.

UNIT 4−HARMONICS, FILTERS AND CONVERTER CHARTS:

Characteristics and uncharacteristic harmonics - troubles due to harmonics - harmonic filters - converter charts of direct current and voltage - active and reactive power

UNIT 5 −DESIGN OF EHV LINES:

based on steady state limits and transient over voltages - design of extra HV cable transmission.

UNIT 6 −XLPE CABLES:

Gas insulated cables – corona.

Text/ Reference Books:

1. R. D. Begamudre, “Extra High Voltage AC Transmission Engineering,” New Age International, 3rdEdition, 2006.
2. K. R. Padiyar, “HVDC Power Transmission System,” New Age International Pulishers, 2ndEdition, 2010.
3. E. W. Kimbark, “EHV-AC and HVDC Transmission Engineering & Practice,” Khanna Publishers, 3rdEdition, 2001.
4. J.Arrilaga, “High voltage direct current transmission,” Peter Peregninver Ltd., London, U.K.,1983.

ELECTRIC VEHICLE TECHNOLOGY (EE-18302)

UNIT 1 −INTRODUCTION TO ALTERNATIVE VEHICLES:

Electric Vehicles, Hybrid Electric Vehicles, Electric and Hybrid Vehicle Components, Vehicle Mass and Performance, Electric Motor and Engine Ratings, Electric and Hybrid Vehicle History Well-to-Wheel Analysis, EV/ICEV Comparison, Electric Vehicle Market, Vehicle Mechanics, Roadway Fundamentals Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Velocity and Acceleration, Tire–Road Force Mechanics, Propulsion System Design

UNIT 2 −ALTERNATIVE VEHICLE ARCHITECTURES:

Electric Vehicles, Hybrid Electric Vehicles, Plug-In Hybrid Electric Vehicle Powertrain Component Sizing, Mass Analysis and Packaging, Vehicle Simulation, Battery Energy Storage, Batteries in Electric and Hybrid Vehicles, Battery Basics, Battery Parameters, Electrochemical Cell Fundamentals, Battery Modelling Traction Batteries, Battery Pack Management

UNIT 3 −ALTERNATIVE ENERGY STORAGE:

Fuel Cells, Ultracapacitors, Compressed Air Storage, Flywheels, Electric Machines Simple Electric Machines, DC Machines, Three-Phase AC Machines, Induction Machines, Permanent Magnet Machines Switched Reluctance Machines

UNIT 4 −POWER ELECTRONIC CONVERTERS:

Power Electronic Switches, DC/DC Converters, Cell Balancing Converters

UNIT 5 −ELECTRIC MOTOR DRIVES:

Electric Drive Components, DC Drives, Operating Point Analysis, AC Drives, SRM Drives

UNIT 6 −CONTROL OF AC MACHINES:

Vector Control of AC Motors, dqModeling, Induction Machine Vector Control, PM Machine Vector Control

UNIT 7 −INTERNAL COMBUSTION ENGINES:

Internal Combustion Engines, BMEP and BSFC, Vehicle Fuel Economy, Emission Control System

UNIT 8 −POWERTRAIN COMPONENTS AND BRAKES:

Powertrain Components, Gears, Clutches, Differential, Transmission, Vehicle Brakes

UNIT 9 −COOLING SYSTEMS:

Climate Control System, Powertrain Component Cooling System, Hybrid Vehicle Control Strategy Vehicle Supervisory Controller, Mode Selection Strategy, Modal Control Strategies, Vehicle Communications, OSI Seven-Layer Model, In-Vehicle Communications, Controller Area Network

Text/ Reference Books:

1. S.Dhameja,"Electric Vehicle Battery Systems," Elsevier Science, 2001.
2. J. Fenton & R.Hodkinson, "Lightweight Electric/Hybrid Vehicle Design," A Butterworth-heinemann Title,2001.
3. S.Leitman, B. Brant, "Build Your Own Electric Vehicle," McGraw Hill, 3rdEdition, 2013.
4. I. Husain,"Electric and Hybrid Vehicles: Design Fundamentals," CRC Press,2ndEdition, 2010.
5. M. Ehsani, Y.Gao; A.Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design,"CRC Press,2ndEdition, 2009.

BIOMEDICAL-INSTRUMENTATION (EE-18303)

UNIT 1 −THEORY, ANALYSIS AND DESIGN OF BIOMEDICAL TRANSDUCERS:

Electrical, mechanical, electromechanical, thermoelectric, photo-electric, electrochemical, and optical transducers, Applications to biomedical systems, Transducers for non-electrical quantities. Flow and pressure measuring instruments in biomedical engineering

UNIT 2 −ELECTRODES:

Theory of electrodes, Lead configurations of ECG electrodes, various types of electrodes, Electrodes used for ECG, EEG and EMG measurement

UNIT 3: Cardiovascular system, Sensor characteristics and design for measurement of medical parameters like ECG, arterial blood pressure, heart sounds, Nervous system, measurement of EEG.

UNIT 4: Medical laboratory Instrumentation, Development of non-invasive diagnostic instruments for tissue abnormalities, Medical Ultrasonography, Latest biomedical Instruments, Electro surgical unit, Pulse Ox meter, Foetal ECG.

UNIT 5: Patient monitoring equipment; pace makers, Defibrillators etc., organization in hospital, Patient safety-physiological effects of electrical currents. Grounding systems in hospital, safety codes for electro-medical equipment

UNIT 6: Biotelemetry- Radio Telemetry principles, FM, AM, PCM. Transmission of biological data through radio telemetry

Text/ Reference Books:

1. R.S. Khandpur, "Hand book of Biomedical instrumentation," TMH, 2003.
2. L. Cormwell et al., "Bio medical Instrumentation &Measurements,"Phi Learning, 10th Edition, 2009.
3. B. Carr, "Introduction to Biomedical Equipment," Prentice Hall-Gale 3rd Edition, 1997.
4. J.G.Webester, "Medical Instrumentation," John Wiley, 3rd Edition,1997.
5. R. L. Drake et. Al., "Anatomy for students," Elsevier, 2nd Edition,2009.
6. R. M. Rangayyan, "Biomedical Signal Analysis," John Wiley & Sons, 1st Edition, 2001.

OPERATION RESEARCH (EE-18304)

UNIT 1: Basics of O.R: Definition, OR Models, OR Techniques, Applications of OR, Linear programming, Simplex Algorithm, Duality, two-phase simplex algorithm, Sensitivity Analysis

UNIT 2: Transportation and Assignment problems: The transportation algorithm: Determination of Initial solutions, Stepwise Improvement to obtain optimal solution, The assignment model: Formulation as TP, The Hungarian method of solution.

UNIT 3: Game and Strategies, Queuing Theory, Inventory Control, Network Models, Critical Path Analysis CAP.

UNIT 4: Project Management: Basic steps in PERT, PERT & CPM Computations, Resource Scheduling.

UNIT 5: Optimization in OR, Simulated annealing, Tabu Search, Genetic Algorithm, Particle Swarm Optimization, Ant Colony Optimization,

UNIT 6: Multi Objective Optimization, Pareto Solutions, Introduction to Dynamic Programming

Text/ Reference Books:

1. Rao, S. S., Optimization Theory and Applications, New York Wiley
2. Gupta, P. K. and Hira D. S. Operations Research
3. Deb Kalyanmoy, Multi-objective Optimization using Evolutionary Algorithm, New York Wiley
4. Rardin R. L. Optimization in Operation Research, Prentice Hall
5. F. S. Hiller and G. J.Lieberman, "Introduction to Operations Research," McGraw-Hill Companies,7thEdition, 2008.
6. H. A. Taha, "Operations Research An introduction," Prentice-Hall, 2010.
7. L.C. Jhamb,"Quantitative Techniques," Everest Publishing house, 2009.
8. K.V.Mittal,"Optimization Methods in Operations Research and System Analysis," New Age International, 1stEdition, 1996.
9. J.K. Sharma, "Operation Research,"Laxmi Publications New Delhi, 5thedition, 2013.

CONVENTIONAL AND COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES (EE-18305)

UNIT 1 –BASIC CONSIDERATIONS:

Basic concept of design, limitation in design, standardization, modern trends in design and manufacturing techniques, Classification of insulating materials. Modes of heat dissipation & temperature rise time curves. Methods of cooling ventilation (induced & forced, radial & axial), direct cooling & quantity of cooling medium.Calculation of total MMF and magnetizing current. Specific permeance and leakage reactance

UNIT 2 –TRANSFORMER DESIGN:

Output equation design of core, yoke and windings, overall dimensions, Computation of no load current to voltage regulation, efficiency and cooling system designs.

UNIT 3 –DESIGN OF ROTATING MACHINES – I:

Output equations of rotating machines, specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size, Core and armature design of dc and 3-phase ac machines

UNIT 4 –DESIGN OF ROTATING MACHINES – II:

Rotor design of three phase induction motors. Design of field system of DC machine and synchronous machines, Estimation of performance from design data

UNIT 5 −COMPUTER AIDED DESIGN:

Philosophy of computer aided design, advantages and limitations. Computer aided design approaches analysis, synthesis and hybrid methods. Concept of optimization and its general procedure. Flow charts and 'c' based computer programs for the design of transformer, dc machine; three phase induction and synchronous machines.

UNIR 6: Various commercial Software packages for electrical machine design

Text/ Reference Books:

1. A. K. Sawhney, "A Course in Electrical Machine Design," DhanpatRai&Sons., 6th Edition, 2014.
2. K.G. Upadhyay, "Conventional and Computer Aided Design of Electrical Machines", GalgotiaPublications Pvt. Ltd., 1st Edition, 2004.
3. M.G. Say, "The Performance and Design of AC Machines," Pitman & Sons, 1985.
4. S.K. Sen, "Principle of Electrical Machine Design with Computer Programming," Oxford and IBM Publications.

MICROCONTROLLER & ITS APPLICATIONS (EE-18306)

UNIT 1 −MICROCONTROLLER BASICS:

8-Bit and 16-bit Microcontroller Internal Block Diagram, CPU, ALU, address bus, data bus, control signals, Working Registers, SFRs, Clock and Reset circuits, Stack and use of Stack Pointer, Program Counter. I/O Ports, Memory structure, Data Memory, Program Memory, and Execution of Program. Power saving modes and its operation, Timing diagram for execution cycle. Different Addressing Modes, Interrupts priority, interrupt handling, housekeeping during power on and power off situations, self-check and recoveries.

UNIT 2 −MICROPROCESSOR BASICS:

8085 basic concepts & 8086 basic concepts

UNIT 3−ON CHIP PERIPHERAL INTERFACES:

Interfacing concept and design rule , Interfacing of digital input and output pin PWM, ADC, I/O Pins, Timers, counters, Interrupts, UART, I2C, SPI, ICSP, DATA E2RAM, FLASH RAM

UNIT 4 −EXTERNAL INTERFACES:

A to D, D to A, LCD, LED & keyboard interfacing, I/O expansion techniques, Memory expansion techniques, RS232, RS485 transceivers. Stepper motor interfacing, DC Motor

interfacing, sensor interfacing, CAN Protocol and its interfacing, USB protocol and its interfacing, Blue-tooth, Zig-bee protocol and its interfacing

UNIT 5 − INTEGRATED DEVELOPMENT ENVIRONMENT (IDE) FOR MICROCONTROLLERS:

(Specific examples of ATMEL 89C51 with Kiel IDE or PIC micro controllers with MPLAB IDE) Study of datasheets, programming using assembly language and "C" Cross compiler, programming tools such as simulator, **Assembler**,"C" cross compiler, emulator and debugger. Illustrative applications and programming techniques, Tutorial programs should include programming using: Arithmetic instructions, Jump, Loop and Call instructions, I/O programming, Logic instructions, Single bit instructions, Timer/Counter Programming, UART programming, Interrupt Programming.

UNIT 6− ANALYSIS OF ANY REFERENCE DESIGN:

Application examples: Any reference circuit schematic with specification application and firmware analysis can be taken.

Text/ Reference Books:

1. Kenneth J. Ayala,"The 8051 microcontroller,"Penram International, 3rd edition, 2014.
2. M. A. Mazidi, "8051 Microcontroller and embedded systems," Pearson Higher Education,2nd Edition, 2011.
3. M.Predko,"Programming and customizing the 8051 microcontroller,"Tata McGraw Hill 1st Edition, 2011.
4. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Application with the 8085 –Microprocessor & Interfacing,"PrenticeHall, 4th Edition, 1998.

POWER SYSTEM OPERATION AND CONTROL (EE-18307)

UNIT 1−STRUCTURE OF POWER SYSTEM:

Physical structure; Conventional and Deregulated, Operation and control function, Hierarchy, Design and operating criteria

UNIT 2−LOAD DISPATCH CENTRE FUNCTIONS:

Preventive, Emergency and restorative control, Power system security, Factors affecting security, Contingency analysis; linear sensitivity analysis, AC power flow methods, Contingency selections, Concentric relaxation

UNIT 3−EQUIPMENT AND STABILITY CONSTRAINTS:

Capabilities and constraint operation of generators, exciters, turbines, network elements (lines, transformers, etc), Constraints on energy supply, load characteristics, Introduction to angle, frequency and voltage instability, Stability constraints.

UNIT 4−FREQUENCY CONTROL:

Primary loop control, Governors model, Secondary loop control, Automatic generation control in 2area system.

UNIT 5−VOLTAGE CONTROL:

Types/models of exciters and their characteristics, Automatic voltage regulator, Reactive power compensation devices and their characteristics

UNIT 6−POWER FLOW CONTROL:

Optimal load flow, Unit commitment, Use of optimization techniques, Use of HVDC and FACTS devices

UNIT 7−ADDITIONAL TOPICS:

Use of PMUs in control and protection, State estimation

References

1. P.M.Anderson,andA A.Fouad.,"Power System Control and Stability," John Wiley & Sons, Inc, 2003.

2. P. S. Kundur, “Power System Stability and Control,” Tata McGraw Hill Inc.,1st edition, 2006.
3. E.W. Kimbark, “Power System Satbility,” Wiley-IEEE, 1995.
4. K.R. Padiyar, “Power System Dynamics: Stability and Control,” John Wiley, 2nd edition, 2002.
5. P.S.R. Murthy, “Operation and Control in Power Systems,” BS Publications, 2nd edition, 2011.

DIGITAL PROTECTION OF POWER SYSTEM (EE-18308)

UNIT 1−NUMERICAL PROTECTION:

Introduction, block diagram of numerical relay, sampling theorem, correlation with a reference wave, least error squared (LES) technique, digital filtering, numerical over currentprotection.

UNIT 2−DIGITAL PROTECTION OF TRANSMISSION LINE:

Introduction, Protection scheme of transmission line, distance relays, traveling wave relays, digital protection scheme based upon fundamental signal, hardware design, software design, digital protection of EHV/UHV transmission line based upon traveling wave phenomenon, new relaying scheme using amplitude comparison.

UNIT 3−DIGITAL PROTECTION OF SYNCHRONOUS GENERATOR:

Introduction, faults in synchronous generator, protection schemes for synchronous generator, digital protection of synchronous generator.

UNIT 4−DIGITAL PROTECTION OF POWER TRANSFORMER:

Introduction, faults in a transformer, schemes used for transformer protection, digital protection of transformer.

UNIT 5−DISTANCE AND OVERCURRENT RELAY SETTING AND CO-ORDINATION:

Directional instantaneous IDMT overcurrent relay, directional multizone distance realy, distance relay setting, co-ordination of distance relays,co-ordination of overcurrent relays,computer graphics display, man-machine interface subsystem, integrated operation of national power system, application of computer graphics.

UNIT 6−PC APPLICATIONS IN SHORT CIRCUIT STUDIES FOR DESIGNING RELAYING SCHEME:

Types of faults, assumptions, development of algorithm for S.C. studies, PC based integrated software for S.C. studies, transformation to component quantities, S.C. studies of multiphase systems.Ultra high speed protective relays for high voltage long transmission line.

Text/Reference Books:

1. L. P. Singh, “Digital Protection,”New Age International (P) Limited Publishers, New Delhi, 2nd Edition, 1997.

2.Y. G.Paithankar,Marcel&Dekker,“Transmission Network Protection: theory and

practice,"New York,1998.
3.Y.G.Paithankar& S. R. Bhide,"Fundamentals of Power System Protection," Prentice Hall of India Pvt Ltd., New Delhi, 2006.
4.S. H. Horowitz,"Protective Relaying for Power System II,"IEEE press , New York,1st edition, 1981.
5.T.S.M. Rao,"Digital Relay / Numerical relays," Tata McGraw Hill, New Delhi.

PROFESSIONAL ELECTIVE – III

POWER QUALITY (EE 18318)

INTRODUCTION TO POWER QUALITY:

Introduction, Classification, Causes and Effects of Power Quality Problems, General Classes of Power Quality Problems, Power Quality disturbances (PQDs), Waveform Distortion, Long-/ Short -Duration Voltage Variations, Power Frequency Variations, Power Quality Standards, International Standards, CBEMA and ITI Curves., Useful Tools for Power Quality Analysis: Fourier Series, Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, STFT, Wavelet Transform.

HARMONICS:

Introduction, Fundamental Wave, Harmonics, Sources of Harmonics, Effects of Harmonics, Devices for controlling harmonic distortion, General Harmonic Indices, Harmonic Standards,

VOLTAGE UNBALANCE:

Introduction , Unbalance in Three Phase Power System, Sources of Unbalance, Condition of Voltage Unbalance, Effect of Unbalance, Voltage Unbalance Factor, Phase Voltage Unbalance Ratio, Line Voltage Unbalance Ratio

VOLTAGE UNBALANCE ASSESSMENT USING SEQUENCE COMPONENTS:

Sequence Component, Positive Sequence Current and Voltage Components, Negative Sequence Current and Voltage Components, Zero Sequence Current and Voltage Components, Balanced System , Unbalanced System, 'α' Operator and Angle Representation in Complex Plane, Currents and Voltages in Terms of Sequence Components with'α' Operator, Assessment of performance parameters of three-phase induction motor operating under supply voltage unbalance.

VOLTAGE SAG:

Voltage Sags, Voltage Sag Magnitude and Duration, Cause and Effects, RMS Voltage, Peak Voltage, and Fundamental Voltage component Method of Quantification Voltage sags, Phase Angle Jump, Missing Voltage, Point-on-Wave Characteristics,

FAULT BASED VOLTAGE SAGS:

Symmetrical and Unsymmetrical Voltage Sags, Multi-stage Voltage Sags, Voltage sags associated with (i) three-phase short circuit, (ii) Single line to ground fault, (iii) line to line fault, and (iv) line to line to ground faults.

CHARACTERIZATION AND CLASSIFICATION METHODS:

Minimum Magnitude and Total Duration Approach, ABC Classification and Characterization Methods, Six Phase Algorithm, Symmetrical Component method of Characterization of Voltage Sags, Merits and limitations of Methods of Characterization.

TRANSIENTS:

Origins and classifications, capacitor switching transients, lightening, load switching, impact on users, protection, and mitigation.

EQUIPMENT BEHAVIOUR UNDER PQDS:

Power Quality Monitoring: Monitoring considerations: Power line disturbance analyzer, power quality measurement equipment, harmonic /spectrum analyzer, flicker meters, disturbance analyser.

Power Quality Conditioners: Shunt and series compensators, DSTATCOM, DVR, UPQC etc.; Case-studies,

References:

1. B. Singh, A. Chandra, and K. Al-Haddad. "Power Quality: Problems and Mitigation Techniques," John Wiley & Sons, 2014.
2. R. C. Duganet. et al., "Electrical Power System Quality," Tata McGraw-Hill Education, 2012.
3. M. H.Bollen,"Understanding Power Quality Problems-Voltage sag & Interruptions," IEEE Press, 2000.
4. M. H. Bollen, A.Gu, "Signal Processing of Power Quality Disturbances," Wiley-IEEE Press, 2006.
5. J. C. Das, "Power System Harmonics and Passive Filter Designs," John Wiley & Sons, 2015.
6. E. Fuchs, and M. A. S.Masoum,"Power Quality in Power Systems and Electrical Machines," Elsevier, 2008.

MODELLING AND SIMULATION OF ELECTRICAL MACHINES (EE-18319)

UNIT 1: Review of electrical machines characteristics. Basic-drive schemes and drive applications. Fundamentals of energy conversion. Space vector, two-axis machine and reference frame theories. Torque production in cylindrical machines.Torque production in reluctance machines and elementary rotating machines

UNIT 2: Induction machine modelling. Space vector based modelling and matrix based approach. Transient and steady state performance of three phase induction motors. Induction motor control, (steady state approach). Induction machine drives, (slip ring induction motor drive, v/f drive and vector controlled drives) design and analysis. Starting and braking. Converter systems for drives.

UNIT 3: Cylindrical and salient pole synchronous machine modeling and design. Transient and steady state performance of a synchronous machine connected to grid. Analysis of conventional and permanent magnet synchronous machine drives, including v/f and vector controlled drives.

UNIT 4: DC machine modelling. Steady state and transient behaviour of various DC machines. Starting and braking methods of DC machines fed by a constant voltage supply. Thyristor controlled and transistor controlled DC machine drives analysis.

UNIT 5: Simulation of Electrical Machines and Systems – I, Rotating Field Simulation in AC Machines. Dynamic Simulation of Three-Phase Induction (Asynchronous) Motor.

UNIT 6: Simulation of Electrical Machines and Systems – II, Dynamic Simulation of Brushless Permanent Magnet AC Motor Drives. Dynamic Simulation of Direct Current Motors. Simulation of Stepper Motors

Text/ Reference Books:

1. Fitzgerald and Kingsley, "Electric Machinery McGraw-Hill Higher Education,"7th edition, 2013.
2. D. Kellyand S. Simmons, "Introduction to Generalized Machine Theory,"McGraw-Hill Inc., US 1968.
3. N.N. Hancock, "Matrix Analysis of Electric Machinery,"Pergamon Press, 2nd Revisededition, 1975.
4. N.Ertugrul,LabVIEW® "Electric Circuits, Machines," "Drives, and Laboratories,"Prentice Hall,2002.

ADVANCED INSTRUMENTATION (EE-18320)

UNIT 1 –INTRODUCTION:

Introduction to embedded systems and architecture, system design using specification and modeling tools

UNIT 2 −COMPUTING PLATFORMS:

Overview of embedded computing platforms; microprocessors, microcontrollers, DSPs and SoCs, hardware – software design and partitioning

UNIT 3 − DESIGNS AND TRADE-OFFS:

Design issues, consideration and trade-offs: performance memory, power, timing, cost, and development time. Memory hierarchy, system interfaces and communication with peripheral units, timers-counters, introduction to real-time system and real-time scheduling.

UNIT 4 − RTOS:

Real-time software development: high level languages and programming issues, systems performance: networked embedded systems.

Text/ Reference Books:

1. J.W. S. Liu, "Real-time systems," Pearson, 1st edition,2000

ELECTRICAL SYSTEM DESIGN (EE-18321)

UNIT 1: Overview of industry and their requirement of electrical systems, Scope of Electrical Engineers in Modern Industry, Basic Electrical Terms- Definitions, Glossary, Units, Knowing Client requirements & collection of specific data for projects, Understanding various phases of projects, Project management- Project Estimation, Testing & Commissioning, Planning, Procurement Process, Tendering, etc.

UNIT 2: Use of International Standards, Electrical Codes & Standards - BS, NEC, IEE, IEEE, NFPA, IEC Design Basis, std. practices/procedure and specifications, Understanding, Basic Electrical Formulae, Basic Design requirement based on the type of various plants, Intra-discipline co-ordination with civil, process, mechanical, piping, telecom HVAC etc.

UNIT 3: Wiring Accessories & Cable Management Systems, Cable Selection and Sizing and cable laying methods, Selection and sizing of electrical equipment used in various projects, Preparation of equipment specifications, High Voltage system requirements including substation design.

UNIT 4: Lighting systems, Lighting Fixtures (Types & Applications), Lighting Design- Illumination Lux Levels, Emergency & Exit Lighting System, Specialized Engineering like Heat Tracing systems and cathodic protection design, Design of Earthlings system, Lightning system and lightning protection system, Low current systems- Fire alarm & detection system, CCTV system etc.

UNIT 5: Generation, Transmission & Distribution of Electricity, Design of power distribution, Earthing and lighting protection systems system, Equipment vendor drawing review and approval.

UNIT 6: Electrical System Drafting (CAD)- Preparation of lighting layouts, Preparation of Power Layouts, Preparation of Single Line Diagrams (SLD) or Riser Diagrams, Preparation of Electrical General Installation Details & Sections, Preparation of LV or Electrical Room Details, Procurement Requirements and installation standards., Inspection of Equipment/system.

Text/ Reference Books:

1. S. Marran, "Electrical System Design and Specification Handbook for Industrial Facilities,"Prentice Hall PTR, 1 Edition, 1998.
2. T. R. Bosela, "Electrical System Design,"Prentice Hall, 1st Edition, 2002.
3. A. Thumannt and H. Franz, "Efficient Electrical Systems Design Handbook,"Fairmont Press, 1st Edition, 2009.
4. K.B. Raina,"Electrical Design Estimating and Costing,"New Age International, 2007.

FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS) (EE-18322)

UNIT 1 −FACTS CONTROLLERS:

Introduction to Flexible AC Transmission Systems (FACTS), challenges and needs, Power Flow in AC transmission line, Power flow control, Description and definition of FACTS controllers

UNIT 2 −POWER ELECTRONIC CONTROLLERS:

Power Electronics Devices, ratings and control characteristics, Diodes, Thyristors, GTOs and IGBTs in FACTS controllers, Static power converter structures, Thyristor circuits, Voltage-sourced and current-sourced converters, Converter output and harmonic control, power converter control issues, six-pulse and multi-pulse converters, Sinusoidal pulse width modulation, Multilevel converters

UNIT 3 −SHUNT COMPENSATION:

Ideal mid-point compensation, Static Var Compensator (SVC), Thyristor Control Reactor (TCR), Static synchronous shunt compensator (STATCOM), reactive power compensation, Operation and control, Configurations and applications

UNIT 4 −SERIES COMPENSATION:

Ideal series compensation, Sub-synchronous resonance (SSR), GTO Capacitor series compensation (GCSC), Thyristor switched series capacitor (TSSC), Thyristor controlled series capacitor (TCSC), mitigation of sub-synchronous resonance, Static synchronous series compensator (SSSC), Power flow control, Operation and control, Configurations and applications.

UNIT 5 −COMBINATION OF SHUNT SERIES COMPENSATION:

Unified power flow controller (UPFC), Power flow studies, operational constraints, circle diagrams, Interline power flow controller (IPFC), Thyristor controlled phase angle regulator (TCPAR), principle of operation and Configurations

UNIT 6 −SHUNT AND SERIES COMPENSATION IN DISTRIBUTION SYSTEM:

Distribution Static synchronous shunt compensator (DSTATCOM), reactive and harmonic power, compensation, Dynamic voltage restorer (DVR), Sag and swell compensation.

Text/Reference Books:

1. N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems," IEEE Press, 2000.

2. K.R. Padiyar, “FACT’s Controllers in Transmission & Distribution,” New Age Publisher, Delhi, 2007.
3. V. K. Sood, “HVDC and FACTS Controllers: Applications of Static Converters in Power Systems,” Springer, 2004.
4. E. Acha et al, “FACTS: Modelling and Simulation in Power Networks,” John Wiley and Sons, 2004.
5. A. Ghosh and G. Ledwich, “Power Quality Enhancement using Custom Power Devices,” Kluwer Academic Publisher, Boston, 2002.

ANALYTICAL INSTRUMENTATION (EE-18323)

UNIT 1−INTRODUCTION:

Basics of analytical instrumentation, use of computers in analytical instrumentation, statistical techniques

UNIT 2−EMISSION AND ABSORPTION SPECTROSCOPY:

Introduction, em radiation, laws of absorption radiation, uv and visible radiation spectroscopy, calorimeters, double beam spectro-photometer; Infrared spectroscopy - Basic components, types, sample handling techniques. Atomic absorption spectro-photometers – principle, sources of interference, meter scale

UNIT 3 −FLAME PHOTOMETERS:

Principle and construction, clinical types, expression for concentration, interferences, procedures for determination.

UNIT 4 −MASS SPECTROMETERS:

Types and principle of operation, inductively coupled mass-plasma spectrometer, trapped ion analyzers, ion cyclotron mass spectrometer (ICR), Quadruple ion trap mass spectrometer, uses of mass spectrometry; Separation techniques – Gas, ion and liquid chromatography and head space analysis.

UNIT 5 −MICROSCOPY:

Concept of scanning electron microscopy, transmission electron microscopy, tunneling microscopy, and atomic force microscopy; Applications in material characterization

UNIT 6 −NUCLEAR MAGNETIC RESONANCE:

NMR spectroscopy, principle of NMR, types of NMR spectrometers, constructional details, variation T-60A NMR spectrometer, sensitivity enhancement for analytical NMR spectroscopy, Fourier transform NMR spectroscopy. 10(L)

UNIT 7: Application case studies

Text/ Reference Books:

1. R.S. Khandpur,"Handbook of analytical instruments,"Tata McGraw-Hill Education, 2nd Edition, 2007.
2. H. Willard, L. Merritt, and J. Dean, "Instrumental methods of analysis," Van Nostrand Co., New York, 1981.

MECHATRONICS (EE-18324)

UNIT 1: Introduction & Principles of Robotics

UNIT 2: Motor Load modeling, Mechanical elements, Mechanisms, Machines, Types of motion, Kinematic Chains, The four-bar chain, The slider-crank mechanism, Cams: Classification of cam mechanisms, Modes of input/output motion, Follower configuration, Follower arrangement, Cam shape, Motion events, Constant velocity motion, Constant acceleration motion, Harmonic motion, etc

UNIT 3: Power transmission and sizing, Gearboxes: Planetary gearbox, Harmonic gearbox, Cycloid gearbox, Lead and ball screws, Belt drives, Bearings: Conventional bearings, Air bearings, Magnetic bearings, Couplings, Shafts: Static behavior of shafts, Transient behavior of shafts

UNIT 4: Velocity and position transducers, Rotating velocity transducers, Brushed d.c.tacho-generators, Brushless d.c.tacho-generators , Incremental systems , Electromechanical pulse encoders , Position transducers , Brushed potentiometers , Linear variable differential transformers - LVDT , Resolvers , Rotary and linear Inductosyn , Optical position sensors , Application of position and velocity transducers

UNIT 5: Induction motor characteristics, Scalar control, Vector control : Vector Control using sensors and Sensor less Vector Control

UNIT 6: Motors and actuators such as Voice Coils, Limited-angle torque motors, Piezoelectric motors , Switched Reluctance motors , Shape-memory alloy

UNIT 7: Controllers for automation, Servo control, Digital controllers, Advanced control systems , Digital signal processors , Motion controllers , Programmable logic controllers

UNIT 8: Networks, Network architecture, Industrial networking

UNIT 9: Hardware-in-the-loop simulation and rapid prototyping of real-time closed-loop computer control of electromechanical systems

Text/ Reference Books:

1. Richard Crowder, "Electric Drives and Electromechanical Systems Applications and Control"Newnes (an imprint of Butterworth-Heinemann Ltd), 2006
2. Robert H. Bishop. "The Mechatronics Handbook", CRC Press, with ISA– The Instrumentation, Systems, Automation Society (50 Chapters), 2002. ISBN: 0-8493-0066-5.
3. Onwubolu, "Mechatronics: Principles and Applications," Elsevier; 1 edition2006.

PROCESS CONTROL (EE-18325)

UNIT 1− INTRODUCTION TO PROCESS CONTROL

UNIT 2 −MATHEMATICAL MODELING:

Development of mathematical models, Modeling considerations forcontrol purposes.

UNIT 3 −DYNAMIC BEHAVIOR OF CHEMICAL PROCESSES:

Computer simulation and the linearization ofnonlinear systems, Brief of Laplace transforms, Transfer functions and the input-output models,Dynamics and analysis of first, second and higher order systems.

UNIT 4 −FEEDBACK CONTROL SCHEMES:

Concept of feedback control, Dynamics and analysis of feedbackcontrolledprocesses, Stability analysis, Controller design, Frequency response analysis and itsapplications

UNIT 5 −ADVANCED CONTROL SCHEMES:

Feedback control of systems with dead time or inverse response,Control systems with multiple loops, Feedforward and ratio control, Instrumentation: Final controlelements, Measuring devices for flow, temperature, pressure and level.

Text/ Reference Books:

1 P. Harriot,"Process control,"Tata McGraw-Hill Publishing Co., New Delhi, 1991.

2. S. K. Singh, "Computer Aided process control,"PHI Learning Pvt. Ltd.,2004.

3.D. E. Seborg, T. F. Edgar, D. A.Mellichamp, Francis J. Doyle Process Dynamics and Control, International Student Version, 3rdEdition, 2011.

4. T. E.Marlin, "Process control : Designing processes & control systems," McGraw-Hill Higher Education, 2ndEdition, 2000.

5. S. Bennett, "Real-Time Computer Control," Prentice Hall, 2ndEdition, 1994

DISTRIBUTION AUTOMATION (EE-18326)

UNIT 1: Distribution system planning-Tools for distribution system planning and design

UNIT 2: Substation Automation-Data acquisition from field devices and supervisory control of field devices, Fault location, Fault isolation, service restoration, substation reactive power control

UNIT 3: Feeder level Automation-Data acquisition from Field devices at feeder level, supervisory control of field devices, Fault location, Fault isolation, service restoration, Feeder reconfiguration, feeder reactive power control.

UNIT 4: Customer level Automation-automatic meter reading, Remote programming of time-of-use (TOU) meters, Remote service connect / disconnect, Automated customer claims analysis

UNIT 5: Control hierarchy and control centre architecture-RTU's , IEDs, PLCs, Use of GPS and GIS systems for Asset/Facilities management.

UNIT 6: Cost benefit analysis of Distribution Automation schemes-Review of distribution automation roadmaps of prominent utilities in Europe and US, Review of distribution automation in Indian utilities.

Text/ Reference Books:

1. M. S. Nardone, "Direct Digital Control Systems: Application Commissioning," Kluwer,Springer US, 1 Edition, 1999.
2. K. Peter Brand and others Substation Automation Handbook
3. M.K.Khedkar, G.M. Dhole, "Electric Power Distribution Automation," University Science Press,2010.
4. A.S.Pabla, "Electric Power Distribution,"TMH,5th Edition, 2004

ELECTRIC DRIVE AND RENEWABLE ENERGY (LAB) (EE-18201)

Experiment 1 To test the performance of Micro-controller based reversible regenerative DC drive using 4-quadrant MOSFET based chopper.

Experiment 2 To test the performance of Microprocessor controlled reversible DC drive using 1 phase SCR dual converter.

Experiment 3 To study the VSI fed Induction motor drive operated in V/F control mode by operating with manual operation or by PC based or by digital keypad on the Drive module and verify its functioning and comment on the performance.

Experiment 4 To perform slip power recovery using thyristorised Rectifier Bridge converter for wound rotor induction motor.

Experiment 5 To control the speed of a given brushless DC (BLDC) motor using pulse width modulation (PWM) method.

Experiment 6 To perform the 4-quadrant operation of a 0.5-hp dc motor using IGBT based chopper.

Experiment 7 To control the 3-phase induction motor using IGBT based 3-phase inverter.

Experiment 8 To control the given DC motor using Chopper module and SCR Converter module with PC interface.

Experiment 9 To control the pulse width modulation (PWM) voltage source inverter (VSI) fed 3-phase AC drive with DSP controller.

Experiment 10 To control the speed of a given three-phase induction motor by V/F (voltage/frequency) control.

PROJECT (EE-18601)

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS (##)

UNIT 1: Principles of Measurement and error analysis-Methods of measurement, Characteristics of instruments & measurement systems, Errors in measurement & its analysis. 5(L)

UNIT 2: Analog Instruments-Classification, Principle of operation of Permanent Magnet Moving Coil (PMMC) and Moving Iron Instruments, Voltmeters & ammeters, Errors in Voltmeter and Ammeters, Range extension, Advantages and disadvantages , Electrodynamometer Instruments, Power & Energy measurement. 8(L)

UNIT 3: Electronic Instruments-Digital Instruments for measurement of current, voltage, resistance etc., Measurement of frequency & phase, Cathode Ray Oscilloscopes (CRO) – analog and special CRO. 4(L)

UNIT 4: Potentiometers & Bridges-D.C. & A.C. Potentiometers, D.C. & A.C. Bridges, Measurement of inductance and capacitance & quality factor, Measurement of low, medium, high resistances and earth Resistances.
4(L)

UNIT 5: Instrument Transformers- Principle of operation and applications, Current transformer and its error analysis, Potential transformer and its error analysis, Misc. Measurement**,** Frequency & power factor.
4(L)

UNIT 6: Introduction to DAC & ADC System-Analog to Digital Conversion: Ramp, Voltage to Frequency Converter (Integrating type), Dual slope integration Techniques, Digital to Analog Conversion: Weighted Resistor type, R-2R Ladder type, Specification of D/A Converter -Resolution, Accuracy.
5(L)

UNIT 7: Transducers – Measurement of displacement, strain, velocity, acceleration, force etc.
6(L)

Text/ Reference
Books:

- E.W.Golding & F.C.Widdis, "Electrical measurement & measuring instruments"
  A.H.Wheeler &Co.Pvt Ltd. India.
- A.D.Helfrick & W.D.Cooper, "Electronic Instruments & Measurement Technique"
  Prentice Hall of India.
- David A. Bell, "Electronic Instrumentation & Measurement" Prentice Hall of India.
- M.B.Stout, "Basic Electrical measurement" Prentice Hall of India.
- H.S. Kalsi, " Electronic Instrumentation"