AMRITSAR COLLEGE OF ENGINEERING AND TECHNOLOGY, AMRITSAR

(Autonomous status conferred by UGC under UGC act-1956, (2f), NAAC-A Grade)

DEPARTMENT OF ELECTRICAL ENGINEERING

Programme Outcomes (POs)

	POs	Graduate Attributes
PO 1	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems	Engineering knowledge
PO 2.	Identify, formulate and analyze complex engineering problems in the field of Electrical Engineering.	Problem analysis
PO 3.	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the cultural, societal and environmental considerations.	Design/development of solutions
PO 4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in the field of Electrical Engineering.	Conduct investigations of complex problems
PO 5	Create, select and apply appropriate techniques, resources, and modern engineering for modeling of complex engineering activities in the field of Electrical Engineering.	Modern tool usage
PO 6	Apply reasoning by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	The engineer and society
PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	Environment and sustainability
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	Ethics
PO 9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	Individual and team work
PO 10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations.	Communication
PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	Project management and finance
PO 12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	Life-long learning

Programme Specific Outcomes (PSOs)

PSO 1	Able to understand, design and implement the various electrical Networks, Transmission and distribution networks for various industrial and research purposes.
PSO 2	Able to excel in various electrical software/project competitions and technological challenges in the modern era.
PSO 3	Able to gain practical competency with emerging technologies, electrical devices and Instrumentations.

AMRITSAR COLLEGE OF ENGINEERING AND TECHNOLOGY AMRITSAR

Syllabus Scheme Structure for 2016 Batch onwards

Department of Electrical Engineering

	Course: B.Tech. Semester: **3rd**							
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
ACFE-16311	Functional English- I	1	1	-	50	-	50	2
ACAP-16312	Aptitude- I	1	1	-	50	-	50	2
ACAM-16301	Engineering Mathematics-III	3	1	-	40	60	100	4
ACEE-16301	Circuit Theory	3	1	-	40	60	100	4
ACEE-16302	Transformers & Direct Current Machines	3	1	-	40	60	100	4
ACEE-16303	Electrical Measurements & Instrumentation	3	1	-	40	60	100	4
ACEE-16304	Electronic Devices and Circuits	3	1	-	40	60	100	4
ACEE-16305	Laboratory-I (Semiconductor Devices and Circuit Theory)	-	-	2	30	20	50	1
ACEE-16306	Laboratory-II (Electrical Machines -I)	-	-	2	30	20	50	1
ACEE-16307	Laboratory-III (Electrical Measurements and Instrumentation)	-	-	2	30	20	50	1
ACEE-16308	Institutional Training (Undertaken after 2nd semester)	-	-	-	60	40	100	2
		17	7	6	390	460	850	29
		Contact Hours= 30 hrs						

Department of Electrical Engineering

	Course: B.Tech. Semester: **4TH**							
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
ACFE-16411	Functional English- II	1	1	-	50	-	50	2
ACAP-16412	Aptitude- II	1	1	-	50	-	50	2
ACEE-16401	Asynchronous Machines	3	1	-	40	60	100	4
ACEE-16402	Linear Control Systems	3	1	-	40	60	100	4
ACEE-16403	Electromagnetic Fields	3	1	-	40	60	100	4
ACEE-16404	Power System-I (Transmission & Distribution)	3	1	-	40	60	100	4
ACEE-16405	Power Plant Engineering	3	-	-	40	60	100	3
ACEE-16406	Laboratory-I (Electrical Practice and Maintenance)	-	-	2	30	20	50	1
ACEE-16407	Laboratory-II (Control System)	-	-	2	30	20	50	1
ACEE-16408	Laboratory-III (Electrical: Estimation & Costing)	-	-	2	30	20	50	1
GF-400	General Fitness	-	-	-	100	-	100	1
		17	6	6	490	360	850	27
		Contact Hours= 29 hrs						

AMRITSAR COLLEGE OF ENGINEERING AND TECHNOLOGY AMRITSAR

Syllabus Scheme Structure for 2016 Batch onwards

Department of Electrical Engineering

	Course: B.Tech. Semester: **5TH**							
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
ACFE-16511	Functional English- III	1	1	-	50	-	50	2
ACAP-16512	Aptitude- III	1	1	-	50	-	50	2
ACEE-16501	Synchronous Machines	3	1	-	40	60	100	4
ACEE-16502	Electric Generation & Economics	3	1	-	40	60	100	4
ACEE-16503	Digital Electronics and Microprocessors	3	1	-	40	60	100	4
ACEE-16504	Power Electronics	3	1	-	40	60	100	4
ACEE-16505X	Elective –I	3	-	-	40	60	100	3
ACEE-16506	Laboratory-I (Electrical Machines-II)	-	-	2	30	20	50	1
ACEE-16507	Laboratory-II (Digital Circuits and Microprocessors)	-	-	2	30	20	50	1
ACEE-16508	Laboratory-III (Power Electronics)	-	-	2	30	20	50	1
ACEE-16509	Industrial Training (Undertaken after 4TH semester)	-	-	-	60	40	100	2
		17	6	6	450	400	850	28
	Contact Hours= 29 hrs							

Elective -I	
ACEE-16505A	Energy Auditing and Management
ACEE-16505B	Instrumentation in Power System
ACEE-16505C	Biomedical instrumentation
ACEE-16505D	Energy Efficient Machines

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Syllabus Scheme Structure for 2016 Batch onwards

Department of Electrical Engineering

	Course: B.Tech. Semester: **6th**							
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
ACFE-16611	Functional English- IV	1	1	-	50	-	50	2
ACAP-16612	Aptitude- IV	1	1	-	50	-	50	2
ACEE-16601	Electric Power Utilization	3	1	-	40	60	100	4
ACEE-16602	Power System-II (Switch Gear & Protection)	3	1	-	40	60	100	4
ACEE-16603	Non-Linear & Digital Control Systems	3	1	-	40	60	100	4
ACEE-16604X	Elective –II	3	1	-	40	60	100	4
ACEE-16605	Signal and Systems	3	-	-	40	60	100	3
ACEE-16606	Laboratory-I (Signal and Systems)	-	-	2	30	20	50	1
ACEE-16607	Laboratory-II (Power System-II)	-	-	2	30	20	50	1
ACEE-16608X	Elective-III	-	-	2	30	20	50	1
GF-600	General Fitness	-	-	-	100	-	100	1
		17	6	6	490	360	850	27
	Contact Hours= 29 hrs							

Elective -II		Elective -III	
ACEE-16604A	Microcontroller, PLC & SCADA	ACEE-16608A	Laboratory-III (Micro controller, PLC & SCADA)
ACEE-16604B	Networks and Data Communication	ACEE-16608B	Laboratory-III (Networks and Data communication)
ACEE-16604C	Embedded Systems	ACEE-16608C	Laboratory-III (Embedded Systems)
ACEE-16604D	Robotics and Automation	ACEE-16608D	Laboratory-III (Robotics and Automation)

Department of Electrical Engineering

	Course: B.Tech. Semester: **7th**							
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
ACEE-16701	Power System Analysis	3	1	-	40	60	100	4
ACEE-16702	High Voltage Engineering	3	1	-	40	60	100	4
	Open Elective	3	-	-	40	60	100	3
ACEE-16704X	Elective -IV	3	-	-	40	60	100	3
ACEE-16705	Lab-I (Power System Analysis)	-	-	2	30	20	50	1
ACEE-16706	Seminar	-	-	2	100	0	100	1
ACTP-16701	Pre Placement Activity	2			50	0	50	1
ACEE-16707	Major Project	-	-	2	100	100	200	2
GF-700	General Fitness	-	-	-	100	-	100	1
		12	2	8	540	360	900	20
		Contact Hours= 22 hrs						

Elective -IV	
ACEE-16704A	HVDC Transmission
ACEE-16704B	Power System Operation and Control
ACEE-16704C	Flexible AC Transmission Systems
ACEE-16704D	Power System Restructuring and deregulation
ACEE-16704E	Power quality Monitoring and conditioning
ACEE-16704F	Computer Aided Electrical machine design
ACEE-16704G	Power System Reliability

Open Elective

Sr.No	Subject Code	Subject Name
1.	ACCE-16814	Disaster Management
2.	ACCE-16818	Infrastructure Development & Management
3.	ACEE-16703	Non Conventional Energy Sources
4.	ACCS-16712	HAINA (Rooting & Switching Technology)
5.	ACCS-16613	Human Resource Management
6.	ACME-16704	Operation Research

Department of Electrical Engineering

	Course: B.Tech. Semester: **8th**							
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
ACEE-16801	Industrial Training-II	-			300	200	500	10
ACEE-16802	Software Training				150	100	250	5
	Total	-	-	-	450	300	750	15

Summary				
1	**Total Credits**	**146**		
2	**Marks** **Ist year(750+700)** **2nd/3rdyear** **7th sem** **8th Sem** **Total Marks**	 **1450** **3400** **900** **750** **6500**		

Third Semester

ENGINEERING MATHEMATICS-III (ECE/EE)

Subject Code : ACAM-16301

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:
The learning objective of the core mathematics courses can be put into three categories:
Content Objective: Student should learn fundamental mathematical concept and how to apply them.
Skill Objectives: Students should learn critical thinking, modeling problem solving and effective uses of technology
Communication Objectives: Students should learn how to read mathematic and use it to communicate knowledge.

Section A

Fourier Series: Periodic functions, Euler's formula. Even and odd functions, half range expansions.

Laplace Transforms: Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, applications to solution of ordinary linear differential equations with constant coefficients.

Section B

Partial Differential Equations: Formation of partial differential equations, homogeneous partial differential equations with constant coefficients.

Applications of PDEs: Wave equation and Heat conduction equation in one dimension.

Section C

Functions of Complex Variable: Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

Section D

Non Linear Equations: Bisection Method, Newton Raphson Method, False Position Method.

Linear System: Gauss Elimination Method, Gauss Jordan Method.

Differential Equations: Runge Kutta Methods upto 4^{th} Order, Euler Method

References :

1. Kreyszing, E., Advanced Engineering Mathematics, Eighth edition, John Wiley, New Delhi.

2. Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3. Higher Engineering Mathematics, N.P. Bali.
4. Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957. 4.Peter. V. O'Nil, Advanced Engineering Mathematics, Wadsworth Publishing Company.
5. Numerical Methods in Engineering, B.S. Grewal
6. Conte S.D. and Carl D Boor, Elementary Numerical Analysis: An Algorithem Approach, Tata Mc Graw Hill, New York

CIRCUIT THEORY
ACEE-16301

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: To differentiate between network & circuit and to learn the properties of circuit elements. Application of network theorems to solve complex circuit problems as demonstrated by their field placements. To study the difference between transient & steady state response. Difference between time and frequency domain and apply these approaches to problem solving and apply them in practical situations.

Section I CIRCUITS CONCEPTS: Independent and dependent sources, Signals and wave forms: Periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity.

Section II TIME AND FREQUENCY DOMAIN ANALYSIS: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, Time domain behaviors from poles and zeros, Convolution Theorem.

Section III NETWORK SYNTHESIS: Network functions, Impedance and admittance function, Transfer functions, Relationship between transfer and impulse response, poles & zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles & zeros, Real liability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Section IV FILTERS SYNTHESIS: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, Pass bands and stop bands, Design of constant-K, m-derived filters, Composite filters.

References :

1. Bird John, *Electrical Circuit Theory and Technology*, 2nd Ed., Newnes
2. Chakraborty, Abhijit, *Circuit Theory*, 2nd Edition, Dhanpat Rai, 2001
3. Chaudhury D. Roy, *Networks & Synthesis*, New Age International.
4. Edminister J.A., *Electric Circuits*, 4th Edition, Tata McGraw Hill, 2002
5. Iyer T.S.K.V., *Circuit Theory*, Tata McGraw Hill, 2006
6. Mohan, Sudhakar Sham, *Circuits & Networks Analysis and Synthesis*, 2nd Edition, Tata Mc Graw Hill, 2005
7. Van Valkenberg, M.E., *Network Analysis & Synthesis*, PHI learning, 2009 8. Van Valkenberg, M.E., *Network Analysis & Synthesis*, 3rd Edition, Pearson Education, 2006
8. http://nptel.ac.in/courses/108102042/
9. https://pdfree.org/pdf/downloads/circuit-theory-analysis-and-synthesis-chakrabarti.pdf

TRANSFORMERS AND DIRECT CURRENT MACHINES
ACEE-16302

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: To understand the construction of transformer and how does it work. Perform testing on transformer and to evaluate efficiency and voltage regulation. Develop equivalent circuit, phasor diagram and circuit parameters. Comprehend the construction, working and characteristics of dc machines. Exploit knowledge in context of applications of dc generators and motors in industry.

Section I

TRANSFORMERS: Working principle, construction of single phase transformer, EMF equation, phasor diagrams on no-load and on loaded conditions, open circuit and short circuit tests, equivalent circuit parameters estimation, voltage regulation and efficiency, back to back test. Effect of saturation on exciting current and in-rush current phenomenon. Parallel operation of single phase transformers.

Section II

AUTO TRANSFORMERS: Principle of operation, equivalent circuit and phasor diagrams, comparison with two winding transformer.

THREE-PHASE TRANSFORMERS: Different types of winding connections, Voltage and current ratios, Parallel operation of three phase transformers. Three winding transformer's equivalent circuit, off-load and on-load tap changing transformer, Scott connections. Testing of transformers.

Section III

D.C. GENERATOR: Working principle , construction of DC Machines, Armature windings, single and double layer winding diagrams, E.M.F. and torque equations, armature reaction, effect of brush shift, compensating winding, commutation, causes of bad commutation, methods of improving commutation, methods of excitation of d.c. generators and their characteristics.

Section IV

D.C. MOTOR: Working principle characteristics, starting of shunt and series motor, starters, speed control methods: field and armature control. Braking: plugging, dynamic and regenerative braking, Testing: Swinburn's test, Hopkinson test, Field test. Estimation of losses and efficiency.

References :

1. Bimbhra P.S., *Electrical Machinery, Khanna Publishers*
2. Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery,* 6th Edition, McGraw Hill

3. Langsdorff E.H., *Principles of D.C. machines*, McGraw Hill
4. Nagrath I.J. and Kothari D.P., *Electrical Machines*, 4th Edition, Tata McGraw Hill,
5. Say M G, *Alternating Current Machines*, 5th edition, Sir Isaac Pitman & Sons Ltd.
6. http://nptel.ac.in/courses/108105017/
7. https://sites.google.com/site/eeenotes2u/courses/electrical-machines-1-2

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION
ACEE-16303

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: An ability to gain knowledge of different types of analog measuring instruments and their applications. To understand various types of bridges and related lab experiments. To understand various magnetic measurements and transducers in real life. An ability to use techniques, skills related to potentiometers in different field applications.

Section I

BRIDGES: Sources and Detectors, General equation for bridge balance, Wheatstone bridge and its sensitivity analysis, Kelvin double bridge, AC bridges: applications and conditions for balance, Maxwell's bridge, Hay's bridge, Schering bridge, Wien bridge, DeSauty's bridge, Wagner Earthling Device

Section II

GENERAL THEORY OF ANALOG MEASURING INSTRUMENTS: Operating torque, damping & controlling torque, T/W ratio, Pointers & Scales. Principles of operation of various types of electro mechanical indicating / registering instruments viz. PMMC, dynamometer, induction, thermal, etc. for dc & ac measurement of voltage, current, power, frequency, phase & power factor etc., energy meter.

Section III

POTENTIOMETERS: Basic D.C. / A.C. potentiometer circuit, Modern form of D.C. potentiometer, Resistance and calibration of voltmeter & ammeter using D.C. potentiometer, volt ratio box.

Section IV

MAGNETIC MEASUREMENTS: Flux meter, B-H Curve, Hysteresis loop, iron loss measurement by Wattmeter and Bridge methods. TRANSDUCERS: Introduction, Classification, Electrical transducer, Types of transducers for measuring displacement, strain, vibration, pressure, flow, temperature, force, liquid level, humidity, PH value, Basic principles of resistive transducers, Inductive transducers, Capacitive transducers, Thermoelectric, Piezo electric transducers

References :

1. Bell David A., *Electronics Instrumentation and Measurements,* Prentice Hall, India
2. Golding Edward William and Widdis Frederick Charles, *Electrical Measurements and Measuring instruments,* Wheelers India
3. Helfrick A.D. and Cooper W.D., Modern *Electronic Instrumentation. & Measurement Techniques*, Prentice Hall
4. Murthy D. V. S., Transducers and Instrumentation, Prentice-Hall, India
5. Sawhney A. K., *A Course in Electrical & Electronics Measurement & Inst*rumentation., Dhanpat Rai & Sons.
6. nptel.iitg.ernet.in
7. https://www.electrical4u.com/electrical-measuring-instruments-types-accuracy-precisi..
8. https://books.google.co.in/books/.../Electrical_Measurements_and_Measuring_In.html?i

ACEE-16304
ELECTRONIC DEVICES AND CIRCUITS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: Explaination of basics concepts related to p-n junction diodes. Understanding of BJT, JFET, MOSFET and Amplifiers. Derive their characteristics and solve numericals related to various topics. To understand the concept and working of IC's, oscillators and regulated power supply.

Section I BASIC SEMICONDUCTOR AND DIODES: Intrinsic and extrinsic semiconductors, diffusion and drift currents, terminal characteristics of junction diode, Load-line analysis of diode circuits, half wave rectifier and full wave rectifiers, Clippers and Clampers, capacitive filters, RC and LC filter, voltage multipliers. Principles, construction, characteristics and applications of Zener diodes, Light Emitting Diodes, Schottky Diode, Varactors

Section II BIPOLAR AND UNIPOLAR TRANSISTORS: Bipolar junction transistor (BJT)- physical structure and modes of operation, Transistor characteristic and parameters, Common Base, Common Emitter and Common Collector Configurations, Transistor biasing, Transistor as a switch, Basics characteristics of an amplifier, Simple transistor model (re model), Common Emitter, Common Collector and Common base amplifiers, hybrid equivalent circuit, H-parameters, circuit analysis using h-parameters. Junction field effect transistor (JFET): Characteristics, parameters and biasing. Metal oxide field effect transistor (MOSFET): Characteristics, parameters and biasing. Class a power amplifier, Class B, Class AB Push-pull and Class C, amplifiers.

Section III INTEGRATED CIRCUIT AND OPERATIONAL-AMPLIFIERS AND OSCILLATORS: Introduction to IC's, Op-Amps, OpAmp Characteristics, Feedback, Different feedback configurations, Current– to–voltage converter and voltage-to- current converters, voltage and current amplifiers, mathematical operations using Op-Amp, summing, differential, integrating amplifiers, Comparators and Schmitt trigger. Oscillations, Feedback oscillator Principles,, RC phase shift oscillator, Wein bridge oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillators, frequency stability, negative resistance in oscillators. Active Filters (1st order) with low pass, high pass, band pass, band stop and all pass. Pin configuration of 555 timer, 555 timer as Oscillator: monostable, bistable and astable multivibrator.

Section IV REGULATED POWER SUPPLIES: Unregulated power supplies, line and load regulations, Zener diode voltage regulators, transistor series and shunt regulators, current limiting, Op-Amp voltage regulators, integrated circuit (LM-3XX) voltage regulators. Introduction to switching regulators. Working of Switched Mode Power Supply (SMPS).

References :

1. Boylestad, Robert.L. *Electronic Devices and Circuit Theory*, Pearson Education
2. Cathey Jimmie J., *Theory and Problems of Electronic Devices and Circuit*s, McGraw-Hill
3. Floyd Thomas L., *Electronic Devices*, Pearson Education
4. Gayakwad, Ramakant A. *OP-AMPS and Linear Integrated Circuits*, Prentice Hall of India
5. Malvino Albert Paul and Bates David, *Electronic Principles*, edition 7th, Tata McGraw Hill
6. Millman Jacob, *Integrated Electronic Devices and Circuits*, Tata McGraw Hill
7. http://www.vidyarthiplus.in/2011/11/electronic-device-and-circuits-edc.html
8. https://www.smartzworld.com/notes/electronic-devices-and-circuits-edc/
9. http://nptel.ac.in/courses/122106025/

Laboratory-I (Semi-conductor Devices and Circuit Theory)
ACEE-16305

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

Section-A

1. To design and implement a half wave and full wave rectifier with help of discrete components
2. To implement and design a voltage regulator circuit with help of zener diode .
3. To calculate the efficiency of Class A, Class B and Class AB amplifier
4. To calculate the oscillating frequency of various oscillators.
5. To verify Superposition theorem, Norton's theorem, Thevenin's theorem and maximum power transfer theorem.

Section-B (Project oriented)

1. To construct a D.C. supply circuit (regulated and unregulated).
2. Project based on 3*3*3 LED Cube using 555 Timer and CD4020 IC.
3. Project based on temperature controlled automatic switch.
4. Project based on broken wire detector circuit using IC CD 4069.
5. To design the various filter circuits and check their response on half wave and full wave rectifier.

Laboratory-II (Electrical Machines-I)
ACEE-16306

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

Section-A

1. To perform Open circuit and short circuit tests on a single phase transformer and hence find equivalent circuit, voltage regulation and efficiency. Also do it under different loading conditions.
2. To perform parallel operation of two single phase transformers.
3. To perform Scott connections on three phase transformer to get two phase supply.
4. To obtain load characteristics of direct current (d.c.) shunt/series /compound generator. Also draw its speed – torque characteristics.
5. To perform Swinburne's test (no load test) to determine losses of direct current (d.c.) shunt motor.

Section-B (Project oriented)

1. To design the core and winding of a single phase transformer.
2. To design the core and winding of a D.C. machine.

ACEE-16307
Laboratory-III (Electrical Measurements and Instrumentation)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

Section-A

1. To Study the characteristics of (i) Light measurement using LDR and photo cell sensor (ii) Resistance Temperature Detector (RTD), (iii) Thermistor, (iv) Thermocouple and (v) Electromagnetic Flowmeter.
2. To measure Insulation and Earth Resistance by Megger.
3. Water level measurement using capacitive transducer of a Liquid in a Tank.
4. Determination of frequency and phase angle using CRO.
5. To find 'Q' of an inductance coil and verify its value using Q- meter.

Section-B (Project oriented)

1. To construct various bridges like wheatstone bridge, Kelvin's Bridge, Schering Bridge, Anderson's Bridge, etc
2. To prepare a small project related to Light detecting Resistor (LDR).

Fourth Semester

ACEE-16401
ASYNCHRONOUS MACHINES

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: To understand the basics of induction machines mostly used in industry. To learn and analyze different types of fractional horse power motors. Identify their equivalent circuit and parameters after testing. Understand the functioning and applications of special purpose and single phase motors.

Section I POLYPHASE INDUCTION MACHINES: Analogy between induction motor and transformer, production of rotating field in space distributed three-phase winding, constructional features, concept of slip and operation, rotor frequency, current and power, equivalent circuit, phasor diagram, torque-slip characteristics, effect of rotor circuit resistance, starting torque, crawling and cogging, cage motors(double cage and deep bar motor).

Section II STARTING METHODS AND SPEED CONTROL: Starting methods, speed control: (i) control of speed of rotating field, (ii) control of slip speed. Effect of voltage injection in rotor circuit of slip ring induction motor. Motor tests for estimation of equivalent circuit parameters, Scherbius method of speed control.

Section III INDUCTION GENERATOR: Isolated and Grid mode operation, method of excitation, performance characteristics of three-phase self-excited induction generator.

SPECIAL PURPOSE MOTORS: Stepper Motors: construction, principle of operation and applications. Linear Induction Machines: construction, principle of operation and applications. Universal Motor: construction, principle of operation and applications.

Section IV SINGLE –PHASE MOTORS: Double revolving field theory, types of single phase motors, characteristics and equivalent circuit. Shaded pole motor: working principle and characteristics.

References :

1. Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery*, 6th Edition, McGraw Hill
2. Langsdorff E.H., *Principles of A.C. Machines*, McGraw Hill
3. Nagrath I.J. and Kothari D.P., *Electrical Machines*, 4th Edition, Tata McGraw Hill,
4. Bimbhra P.S., *Electrical Machinery, Khanna Publishers* 5. Say M G, *Alternating Current Machines*, 5th edition, Sir Isaac pitman & Sons Ltd.
5. http://nptel.ac.in/courses/108106072/
6. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Roorkee/Electrical%20Machines%202%20(Video).htm

ACEE-16402
LINEAR CONTROL SYSTEMS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: To understand the concept of control system and its importance. Differentiates linear and non-linear control with their applications. To model physical system from an electrical equivalent. Understand the concept of stability and apply its various techniques to find out stability.

Section I Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems.

Section II Modeling: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Section III Time Domain Analysis: Typical test - input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion.

Section IV Root Locus Technique: The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot.

Section V Frequency Domain Analysis: Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems, Log. Magnitude versus Phase angle plot, Nyquist criterion for stability, Compensation, Necessity of compensation, series and parallel compensation, compensating networks.

References :

1. Dorf Richard C. and Bishop Robert H., *Modern Control System*, Addison –Wesley, Pearson New Delhi
2. Ogata K., *Modern Control Engineering*", Prentice Hall,
3. Kuo B. C., *Automatic Control System*", Prentice Hall
4. Nagrath I.J. and Gopal M., *Control System Engineering*, Wiley Eastern Ltd.
5. Automatic Control Systems by Hasan Saeed.
6. nptel.ac.in/courses/108101037/
7. https://www.electrical4u.com/types-of-systems-linear-and-non-linear-system/link.springer.com/book/10.1007% F978-1-4615-0553-2

ACEE-16403
ELECTROMAGNETIC FIELDS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: To apply knowledge of vector relations with help of solving numerical problems. Formulates the relations between divergence, curl & gradient and their interpolation in different integral theorems. To analyze Electromagnetic Wave theory using wave propagation theory and develop them with help of Maxwell's equations for time varying fields

Part I

REVIEW OF VECTOR ANALYSIS: Vector analysis, Physical interpretation of gradient, divergence and curl; integral theorems: Divergence theorem, Stoke's theorem, Green's theorem and Helmholtz theorem.

ELECTROSTATICS: Introduction to fundamental relations of electrostatic field; potential function; Field due to continuous distribution of charges; Equipotential surfaces;

Part II

Gauss's law and its applications; Poisson's equation and Laplace's equation, capacitance, electrostatic energy, Conditions at Boundary between dielectrics, Uniqueness theorem.

STEADY MAGNETIC FIELD: Magnetic induction and Faraday's laws; magnetic Flux Density; magnetic field strength and magnetomotive force; Ampere's work Law in the differential vector form; permeability; energy stored in a magnetic field ; magnetic vector potential, Analogies between electric and magnetic fields.

Part III

MAXWELL'S EQUATIONS AND POYNTING VECTOR: Equation of continuity for time varying fields, Inconsistency of ampere's law, Maxwell's equations in integral and differential form for static and time varying fields, conditions at a Boundary surface, Concept of Poynting vector, Poynting Theorem, Interpretation of E X H.

Part IV

ELECTROMAGNETIC WAVES: Solutions for free-space conditions; Uniform plane Wave Propagation; Wave equations for a conducting medium; Sinusoidal time variations; Polarization; Conductors and Dielectrics; Direction Cosines; Reflection by Perfect Conductor -normal and oblique incidence, Perfect Dielectric-normal incidence, Brewster angle, Surface impedance.

References :

1. Edward C. Jordan and Keith G Balmain, *Electromagnetic Waves and Radiating Systems*, Prentice- Hall Inc.
2. Kraus John D. *Electromagnetics, McGraw-Hill Publishers*
3. Edminister Joseph A., *Schaum's Theory and Problems of Electromagnetics, McGraw-Hill*
4. Rao N. Narayana, *Elements of Engineering Electromagnetics, Pearson Education*
5. http://nptel.ac.in/courses/108106073/
6. http://www.rle.mit.edu/cehv/documents/ElectromagneticFieldTheory-ZahnSolutionsManual.pdf

ACEE-16404
POWER SYSTEMS – I (Transmission and Distribution)

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: To know the types of conductors and their relative merits and demerits used in transmission and distribution systems. To gain the knowledge of transmission line parameters and thereby the knowledge of design parameters for substation. To understand the concept of underground cables.

Section I

Chapter I : SUPPLY SYSTEM: Introduction to Transmission and Distribution systems, Comparison between DC and AC systems for Transmission and Distribution, comparison of cost of conductors, choice of working voltage for transmission and distribution, economic size of conductors - Kelvin's law, Radial and mesh distribution networks, Voltage regulation.

Chapter II: CONDUCTORS AND TRANSMISSION LINE CONSTRUCTION: Conductor materials; solid, stranded, ACSR, hollow and bundle conductors. Different types of supporting structures for overhead lines. Elementary ideas about transmission line construction and erection. Stringing of conductors, spacing, sag and clearance from ground, overhead line insulators, concept of string efficiency.

Section II

Chapter III: TRANSMISSION LINE PARAMETERS AND PERFORMANCE: Introduction to line parameters, Resistance of transmission line, inductance of single phase two wire line, concept of G.M.D., Inductance of three phase line, Use of bundled conductor, transposition of power lines, capacitance of 1-phase and 3-phase lines, effect of earth on capacitance of conductors. Representation of short transmission line, medium length line (nominal T & II circuits). long length line by hyperbolic equations and equivalent T & II circuits. Power flow through transmission lines, ABCD constants, Voltage regulation.

Section III

Chapter IV: CIRCLE DIAGRAM AND LINE COMPENSATION: Receiving end circle diagram for long transmission lines based on ABCD constants, power loci, surge impedance loading, reactive power requirement of system series and shunt compensation, Synchronous phase modifiers , rating of phase modifiers.

Section IV

Chapter V: UNDERGROUND CABLES: Classification of cables based upon voltage and dielectric material, insulation resistance and capacitance of single core cable, dielectric stress, Capacitance of 3 core cables, methods of laying, heating effect, Maximum current carrying capacity, cause of failure, comparison with overhead transmission lines.

References :

1. Elgerd O.L., *Electrical Energy System Theory - An introduction*, Tata McGraw-Hill Publication
2. Gupta B.R., Power System Analysis & Design, Wheeler Publishing.
3. Nagrath I.J. and Kothari D.P., Power System Analysis Tata McGraw-Hill Publication
4. Stevenson Jr. W.D., *Elements of Power System Analysis*, Tata McGraw-Hill Publication
5. Wadhwa C.L., *Course in Electrical Power*, New Age International (P) Ltd.
6. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/ui/TOC.htm
7. https://www.vidyarthiplus.com/vp/thread-23407.html#.WRQ7H2mGPIU

ACEE-16405
POWER PLANT ENGINEERING

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objectives: To Understand several systems available for power generation along with their advances and disadvantages. Knowledge of non-conventional power plants. To understand the working of various types of generators, condensers and turbines used. Knowledge of combined operation of power plants and pollution control in them.

Part I

STEAM GENERATORS, CONDENSERS AND TURBINES: Classification of steam generators, selection, operation of locomotive, Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbine efficiencies, compounding, governing and control.

Part II

STEAM AND NUCLEAR POWER PLANT: Classification, Operation, Description of Rankin cycle, Regenerative cycle, Reheat-Regenerative Cycle, Binary Vapour Cycle, Selection of plant site and its layout, coal handling system, combustion system, Fluidised bed combustion, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.
Nuclear power plant, Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Site selections, safety measures, plant layout, Fusion reaction, Future of nuclear power.

Part III

HYDRO-ELECTRIC AND DIESEL POWER PLANTS: Hydrological Cycle, Hydrograph, Flow duration curve, Selection of site, Essential features, Classification of hydro plants, Selection of water turbines for hydro power plant, Automatic and remote control of hydro-station, layout of hydro power plant. Diesel power plants, Classifications of IC Engines and their performance, Four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Celane number, knocking, super charging, operation and layout of diesel power plant.

Part IV

GAS TURBINE: Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Thermal refinement to gas turbines cycle, Plant layout, applications, gas turbines Cycle calculations.

COMBINED OPERATION OF POWER PLANTS AND POLLUTION CONTROL:
Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants, Pollution from thermal & nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

References :

1. Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., *A Textbook on Power System Engineering,* Dhanpat Rai & Co.
2. EI-Wakit M.M., *Power Plant Engineering*, McGraw Hill, USA.
3. Rajput R.K., *Power Plant Engineering*, Luxmi Publications.
4. Sharma P.C., *Power Plant Engineering*, Kataria & Sons.
5. Skrotzki B.G.A. and Vapot W.A., *Power Station Engineering and Economy*, Tata McGraw-Hill.

ACEE-16406
Laboratory-IV (Electrical Practice and Maintenance)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

1. Demonstration of various kind of wiring schemes for houses, offices and other applications
   i) House wiring ii) Staircase wiring iii)Distribution Board wiring iv) From Energy meter wiring
2. Fault finding and repair of domestic small electrical goods & appliances –
   i) Tube light ii) Fan iii) Electric press iv) Electric kettle v) Mixer – Grinder
3. Fault finding and repair of various household electrical goods and appliances –
   i) Geyser ii) Refrigerator iii) Washing machine
4. Demonstration and study of the following electrical machines
   i) Water pump ii) Domestic generator iii) Domestic inverter

ACEE-16407
Laboratory-V (Control System)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

Section-A

1 To study the synchros Transmitter-Receiver set and to use it as an error detector.

2. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.

3. A program to determine the transfer function using MATLAB

4 A program to find Time and Frequency response of control systems using MATLAB

5. To plot pole-zero plot, Bode plot, Nyquist and Root Loci diagrams using MATLAB.

Section-B (Project oriented)

1. Design of Control Systems using MATLAB and SIMULINK.

ACEE-16408
Laboratory-VI (Electrical: Estimation and Costing)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

1. To study Indian electricity rules
2. To carryout wiring diagram of residential building, Educational institute and Industry. Giving selection of appropriate wiring, list materials and accessories for given project.
3. To study the design consideration of Panel Boards.
4. To study the design consideration of various electrical systems: a. 3 phase four wire distribution systems
   b. Earthing
5. To estimate the cost of a domestic installation (Residential building, laboratory room or Drawing hall etc) with concept of illumination design. TERI (The Energy Research Institute) recommendations on lighting schemes
6. To estimate the cost of industrial installation (Work shop, agriculture, flour mill etc).
7. To estimate the cost of overhead service connection (Single phase and three phase).
8. To estimate the cost of underground service connection (single phase and three phase).
9. To estimate the cost of overhead, 440 V, 3-phase, 4 wire or 3 wire distribution line.
10. To estimate the cost of underground, distribution line.
11. To estimate the cost of any one electrical appliance.
12. To estimate the cost of repairs and maintenance of any one domestic appliance.
13. To study various types of light sources and lighting schemes.
14. To make wiring diagrams of motor control circuits for starting of a. 3 phase induction motor b. Wound Motor c. Synchronous motor

References:

1. Raina K.B. and Bhattacharya S.K., *Electrical Design, Estimating and Costing*, Tata McGraw Hill, New Delhi
2. Gupta J.B., *A course in Electrical Installation, Estimating and Costing*, SK Kataria and Sons, N.Delhi
3. Sharma B.R. and Rai H.M., *Electrical Estimating and Costing*
4. Uppal S.L., *Electrical Wiring, Estimating and Costing*
5. Singh Surjeet, *Estimating and Costing*, Dhanpat Rai and Co., New Delhi

Fifth Semester

ACEE-16501
SYNCHRONOUS MACHINES

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:
1. To understand the synchronous machines mostly used in industry.
2. To learn and analyze different types of motors.
3. Identify their equivalent circuit and parameters after testing.
4. Understand the functioning and applications of transients and single phase motors.

Part-I

GENERAL ASPECTS: Construction and working principle of synchronous machines, Excitation systems, production of sinusoidal electromotive force (EMF), flux and magnetomotive force (MMF) phasors in syn. machines; cylindrical and salient pole rotors.

WINDINGS: Classification of windings, pitch factor, distribution factor. Electromagnetic Force equation.

Part-II

ALTERNATORS: Construction, Phasor diagram of cylindrical rotor alternator, ratings, nature of armature reaction, determination of synchronous reactance; open-circuit characteristics, short- circuit characteristics, short-circuit ratio, short-circuit loss. Effect of variation of power factor on voltage. Determination of voltage regulation: EMF method, MMF. method. Zero power factor (Z.P.F).method. Alternator on infinite bus bar, operation at constant load and variable excitation, power flow through inductive impedance. Power-angle characteristics of synchronous machines:- cylindrical and salient pole. Two reaction theory of salient pole machines, power factor control.

Part-III

SYNCHRONOUS MOTORS: Operating characteristics, power-angle characteristics, conditions for maximum power developed. V-curves and inverted V-curves, methods of starting, synchronous motors applications, synchronous condensers. Hunting and damper windings.

PARALLEL OPERATION OF ALTERNATORS: Conditions for proper synchronizing for single phase and three phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing.

Part-IV

TRANSIENTS: Transient reactances and time constants from equivalent circuits, synchronous machine reactances and their determination, Short circuit. Oscillogram, Synchronization with the grid system, Qualitative introduction to the transient stability of the synchronous machines.

SINGLE PHASE SYNCHRONOUS MOTORS: Reluctance and Hysteresis motors.

BOOKS RECOMMENDED:
1. Bimbhra P.S., *Electrical Machinery, Khanna Publishers*
2. Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery,* 6th Edition, McGraw Hill
3. Langsdorff E.H., *Principles of D.C. machines*, McGraw Hill
4. Nagrath I.J. and Kothari D.P., *Electrical Machines*, 4th Edition, Tata McGraw Hill,
5. Say M G, *Alternating Current Machines*, 5th edition, Sir Isaac Pitman and Sons Ltd.

ACEE-16502
ELECTRIC GENERATION AND ECONOMICS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:
1. Focus on the resources that are available for electric power generation.
2. Estimate load requirements using various factors and load curves.
3. Explore their knowledge about existing tariff plans.
4. Apply the knowledge gained in analysis of economic scheduling.

Part-I

Introduction: Electrical energy sources, organization of power sector in India, single line diagram of thermal, hydro and nuclear power stations. Classification of power plants in base load and peak load plants

Loads and Load curves: Types of load (fixed voltage loads, resistive loads, Inductive motor loads, Mechanical load), effect of load on supply voltage, Maximum demand, Group diversity factor, Peak diversity factor, Types of load, chronological load curves, load-duration Curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.

Part-II

Power Plant Economics: Capital cost of plants, annual fixed cost, operating costs and effect of load factor on cost of energy, depreciation.

Tariffs and power factor improvement: Objectives of tariff making, different types of tariff (domestic, commercial, agricultural and industrial loads). Need for power factor (p.f.) improvement, power factor improvement using capacitors, determination of economic power factor.

Part-III

Selection of plant: Plant location, plant size, number and size of units in plants, economic comparison of alternatives based on annual cost, rate of return, present worth and capitalized cost methods.

Economic operation of steam plants: Methods of loading turbo-generators, input- output curve, heat rate, incremental cost, method of Lagrangian multiplier, effect of transmission losses, co- ordination equations, and iterative procedure to solve co-ordination equations.

Part-IV

Hydro-thermal co-ordination: Advantages of combined working of Run-off River plant and steam plant, reservoir hydro plants and thermal plants, long-term operational aspects, scheduling methods.

Pollution and environmental problems: Energy and environment, Air pollution, Aquatic impacts, nuclear plant and hydro plant impacts.

Cogeneration: Definition and scope, Topping and Bottoming Cycles, Benefits, cogeneration technologies.

BOOKS RECOMMENDED:
1. Deshpande M.V., *Power Plant Engineering*, Tata McGraw Hill (2004).

2. EI-Wakit M.M., *Power Plant Engineering,* McGraw Hill, USA
3. Rajput R.K., *Power Plant Engineering,* Luxmi Publications
4. Sharma P.C., *Power Plant Engineering*, Kataria and Sons
5. Skrotzki B.G.A. and Vapot W.A., *Power Station Engineering and Economy*, Tata McGraw-Hill
6. Arora S.C. and Dom Kundwar S., A course in *Power Plant Engineering,* Dhanpat Rai.
7. Nag, P.K., *Power Plant Engineering,* Tata McGraw Hill
8. Gupta B.R., *Generation of Electrical Energy,* S. Chand (1998).
9. Nagrath I.J. and Kothari D.P., Power System Analysis Tata McGraw-Hill Publication
10. Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., *A Textbook on Power System Engineering,* Dhanpat Rai and Co.

ACEE-16503
DIGITAL ELECTRONICS AND MICROPROCESSORS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:

1. To be able to design and implement combinational and sequential circuits
2. To be well versed with various types of digital to analog converters and analog to digital converters
3. To be familiar with basic architecture of 8-bit and 16-bit microprocessors
4. To understand the interfacing of 8 bit microprocessor with memory and peripheral chips involving system design.

Part-I

COMBINATIONAL and SEQUENTIAL CIRCUITS: Introduction to Boolean variables, Boolean theorems and DeMorgan Theorem, Sum of product and Product of sum form of Logic expressions, Duality, Hamming Code, Cyclic Redundancy Check (CRC) code, Logical functions using Karnaugh map methods, multiplexers, demultiplexers, encoders, decoders, adders, subtractors, parity generators, parity checkers, code converters, Flip-flops, JK flip-flops, D flip-flops, T flip- flops, SR flip- flops, Registers and Counters: Series and Parallel registers; Synchronous & Asynchronous counters, Up and Down counters, Ring counters & Mod- Counters, State .

Part-II

DIGITAL TO ANALOG (D/A) AND ANALOG TO DIGITAL (A/D) CONVERTERS: Introduction, weighted register D/A converter, binary ladder, D/A converter, specifications for D/A converters, parallel A/D converter, successive approximation A/D converter single & dual slope A/D converter, A/D converter using voltage to frequency conversion, A/D converter using voltage to time conversion, countertype A/D converters.

Part-III

Introduction to Microprocessors:
Types of computers, Microprocessor evolution and types, Central Processing Unit (CPU) operation and terminology, idea of 8- bit, 16-bit, 32-bit and 64- bit Microprocessors from Intel, Motorola and Zilog and their comparisons.
Introduction to 8-bit Microprocessor: 8085 Microprocessor architecture, classification of instructions, Instruction format, and overview of the 8085 instruction set.

Part-IV

Interfacing of 8085 Microprocessor and Introduction to 8086 Microprocessor:
Programmable parallel ports and handshake, Interfacing a Microprocessor to Keyboards and alphanumeric displays, Digital to Analog (D/A) converter operation, interfacing and applications, Analog-to Digital (A/D) converter specifications and Interfacing
Introduction to 16-bit Microprocessor: 8086 Internal Architecture and pin configuration.

BOOKS RECOMMENDED:

1. R.P. Jain, “Modern digital electronics” , 3rd edition , 12th reprint Tata McGraw Hill Publication, 2007.
2. Anand Kumar, “Fundamentals of digital circuits” 1st edition, Prentice Hall of India, 2001
3. Gaonkar, Ramesh S. Microprocessor Architecture, Programming and Applications with the 8085, Penram International
4. Ram B, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai and Sons,
5. Hall, Douglas V. Microprocessors and interfacing: Programming and Hardware, Tata McGraw Hill

ACEE-16504
POWER ELECTRONICS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:
1. Understand the importance of power electronics and its application.
2. Identify/mitigate the problems and find ways to solve them using power electronics.
3. Understand the operation, function and interaction between various components and subsystems used in power electronics converter.
4. Apply the knowledge gained for their project work.
5. Understand, analyze, design, model and synthesize power converter based systems used for conversion of electric energy.

Part-I

Thyristors and their characteristics: Introduction to Thyristor family, V-I characteristics of silicon- controlled rectifier (SCR), gate turn-off thyristor (GTO), Bidirectional diode for alternating current (DIAC) and Bidirectional, Triode for Alternating Current (TRIAC). Principle of operation of silicon-controlled rectifier (SCR). Two transistor analogy. Turn on methods of a thyristor Switching characteristics of thyristors during tum-on and turn-off. Gate characteristics. Firing of thyristors. Gate triggering circuits. Series and parallel operation of silicon-controlled rectifiers (SCR) and their triggering circuits. Thyristor specifications; such as latching current and holding current, critical rate of rise of off-state voltage (dv/dt) and critical rate of rise of on-state current (di/dt) etc. Protection of SCR from over voltage and over current. Snubber circuits. Power dissipation.

Part-II

Thyristor commutation techniques: Self commutation by resonating the load (Class A), Self commutation by LC circuit (class B), Complementary commutation (class C), Auxiliary commutation (class D), External pulse commutation (class E), AC Line commutation (class F).

Phase controlled techniques: Introduction to phase angle control. Single phase half wave controlled rectifiers. Single phase half controlled and full controlled bridge rectifiers. Three phase full controlled bridge rectifiers. Effect of resistive, inductive and resistive cum inductive loads. Basic circuit and principle of operation of Dual Converter, circulating current mode and non-circulating current mode of operation. Applications of rectifiers and dual converters to speed control of DC motor drives.

Part-III

Choppers: Introduction of chopper, Basic chopper classification, Basic chopper operations. Control strategies, Chopper configuration, voltage commutated chopper, Current commutated chopper, Load commutated chopper. **Cycloconverters:** Basic principle of operation, Single phase to. single phase cycloconverter. Three phase half wave cycloconverter. Advantages disadvantages of cycloconverters.

Part-IV

Inverters: Introduction & Classification of inverter. Operating principle, Single phase half bridge voltage source inverters, Single phase full bridge inverter. Modified McMurray half-bridge and full-bridge inverter. Three-phase bridge inverter. Voltage control (Pulse-width modulation (PWM) control etc.) and reduction of harmonics in the inverter output voltage. Series inverter.

Symbols and V-I characteristics of Silicon Unilateral Switch (SUS), Silicon Controlled Switch (SCS), Silicon Bilateral Switch (SBS), Unijunction Transistor (UJT), Programmable Unijunction Transistor (PUT), Light-activated silicon-controlled rectifier (LASCR), Reverse conducting Thyristors (RCT), Static Induction Thyristor (SITH), N-Metal Oxide Semiconductor Controlled Thyristor (N-MCT), Field Controlled Thyristors (FCT).

BOOKS RECOMMENDED:
1. Bimbhra, P.S., *Power Electronics*, Khanna Publishers.
2. Singh M.D. and Khanchandani K.B., *Power Electronics*, Tata Mc Graw Hill Publishing company limited.
3. Rashid M.H., *Power Electronics*, Circuits Devices and Applications, Prentice Hall (India)
4. Sen, P.C., *Power Electronics*, Tata McGraw Hill Publishing Company limited.
5. Bhattacharya S.K. and Chatterji, S. *Industrial Electronics and Control*, by New Age international Publications(P) Ltd, New Delhi.

ACEE-16505A
ENERGY AUDITING AND MANAGEMENT

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objectives:

1. The purpose of energy audit is to analyze the energy flows in a building and to understand its energy dynamics.
2. During the energy audit, we looks for opportunities to reduce the amount of energy input into the building without negatively affecting the outputs
3. It is connected closely to environmental management, production management, logistics and other established

PART-I

Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act- 2001 and its features.

Energy Management and Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

PART-II

Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

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

PART-III

Electrical system: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues

Compressed air system: Types of air compressors, Compressor efficiency, efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency.

PART-IV

High Voltage Alternating Current and Refrigeration System: Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting refrigeration and air conditioning system performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities.

BOOKS RECOMMENDED: 1. Abbi, Y.P. and Jain, S., *Handbook on Energy Audit and Environment Management*, Teri Bookstore
2. Diwan, P., *Energy Conservation*, Pentagon Press (2008).
3. Younger, W., *Handbook of Energy Audits*, CRC Press (2008)
4. Sawhney and Maheshwari, *Solar Energy and Energy Conservation*, Prentice Hall (India)
5. Rao S. and B. B. Parulkar, *Energy Technology,* Khanna Publishers
6. David S., *Hand Book of Industrial Energy Conservation,* Van Nostrand Reinhold Publishing Company.

ACEE-16505B
INSTRUMENTATION IN POWER SYSTEM

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objectives:

1. To acquire knowledge about Power System and to identify Energy storage methods.
2. To work on Transmission lines and Instrumentation scheme used for HVDC.
3. To understand the working of Automatic Generation and Voltage Control.
4. To acquire knowledge about Instrumentation schemes for monitoring and control.
5. To acquire knowledge about Signal Transmission Techniques.

Part-I

Introduction: Measurement of electrical quantities, Active and reactive power in power plants, Energy meters, Instrument transformers and their transient response.
Instrumentation Techniques: Telemetry, Remote Control, remote signaling and supervisory control and data acquisition (SCADA), signal formation, conversion and transmission.

Part-II

Signal Transmission Techniques: Analog pulse and digital modulation, Amplitude modulation(AM) and Frequency modulation (FM), AM and FM Transmitter and Receiver, Phase Modulation, Pulse modulation, Digital transmission techniques, error detection and correction.

Part-III

Telemetry: Telemetry errors, DC, pulse and digital telemetry methods and systems.
Supervisory Control and Data Acquisition: Function of SCADA system, remote terminal unit (RTU) details, Control center details, Communication between control centers, control center and remote terminal unit.

Part-IV

Power Plant Instrumentation: Hydroelectric power plant instrumentation, Thermal power plant instrumentation, Nuclear Power plant Instrumentation. Applications of SCADA system to Indian Power Systems.

RECOMMENDED BOOKS:

1. Cegrell,T., *Power System Control Technology,* Prentice-Hall of India Private Limited(2001).`
2. Lindsley, D.M. , *Power Plant Control and Instrumentation,* IEEE Press (2000).
3. Jarvis, E.W., *Modern Power Station Practice: Control and Instrumentation (Vol. F),* British Electricity International (1980).

ACEE-16505C
BIOMEDICAL INSTRUMENTATION

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objectives:

1. To acquire knowledge about various measurement and recording biomedical instruments
2. To understand the working of bio-electrical and non-electrical signals.
3. To acquire knowledge about biomedical Instrumentation on human body.

PART-I

Transducers: Strain gauge for respiratory flow transducer, piezo resistive transducer for intracardiac catheter, thermistor as temperature sensing elements - its characteristics and compensation for non-linearity.
Piezoelectric transducer: its equivalent circuits and impedance frequency characteristics. Its applications as intra cardiac microphone, heart assist device and ultrasonic instruments. Variable inductance transducer, different configuration and application for measurement of muscular tremor. linear variable differential transformer (LVDT) and its signal processing circuitry. Magnetostrictive and variable capacitance transducers, stretched diaphragm transducer and its characteristics.

PART-II

Measurement and recording of bioelectric signals: electrocardiogram (ECG), electromyogram (EMG), electroencephalogram (EEG) and instruments for picking up and reproducing bioelectric signals, specific design characteristics, sources of noise and its removal.

PART-III

Measurement and recording of non-electric signal: Measurement and recording of pressure, temperature, respiration rate, pulse rate and blood flow. Electromagnetic blood flow meter, thermography, pH measurements, gas analysis, ESR (erythrocyte sedimentation rate) measurement, plethysmograph, X-Ray, tonometer and dialysis. Ultrasonics and echoencephalography radiography imaging isotopes and nuclear medicine.
Equipment for effecting the human body: Stimulator, defibrillator, pacemaker, diathermy.

PART-IV

Prosthetics: Upper and lower extremity prostheses, harness control, EMG-controlled externally powered prosthesis, basic concept of monofunctional and multifunctional devices.
Biotelemetry: Radio-telemetry of biological signal, signal source, antenna and frequency design considerations, example of single channel FM units.

RECOMMENDED BOOKS:

1. Walter Welkowitz and Sid Deutch, *Biomedical Instruments, theory and design*, Academic press 1976.
2. Guha S.K., *An Introduction to Medical Electronics*, Bharti Publishers, Patna.
3. Harry E. Thomas, *Handbook of Biomedical Instrumentation and Measurement*, Reston Publishing Company, 1974.
4. Marvin D. Weisis, *Biomedical Instrumentation*, Chilton Book Company, 1973.
5. Geddes L.A., Barker L.E., *Principles of Applied Medical Instrumentation*, John Willey and Sons, 1968.

ACEE-16505D
ENERGY EFFICIENT MACHINES

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objectives:

1. Reduce total energy consumption while maintaining a high quality of life and vibrant local economy.
2. Encourage energy conservation in residential, commercial, industrial, public institutional natural resource and transportation sector.
3. Organize controlling system on energy saving.

PART-I

INTRODUCTION: Need for energy efficient machines, energy cost and two part tariff, energy conservation in industries and farms -a necessity, introduction to energy management and energy audit system. Review of induction motor characteristics.

PART-II

ENERGY EFFICIENT MOTORS: Standard motor efficiency, why more efficient motors? An energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labeling, energy efficient motor standards. Motor life cycle

PART-III

POWER FACTOR: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor

PART-IV

INDUCTION MOTORS AND ADJUSTABLE DRIVE SYSTEMS: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.

BOOKS RECOMMENDED:

1. Andreas John C., *Energy efficient electric motors*, Marcel Dekker Inc. 1992.
2. Thuman Albert, *Introduction to Efficient Electric System Design*, The Fairmount Press Prentice Hall.
3. Tripathi S.C. , *Electric Energy Utilization and Conservation*, Tata McGraw-Hill 1991.
4. Belove Charles, *Handbook of Modem Electronics and Electrical Engineering*, John Wiley & Sons.

ACEE-16506
Laboratory-VII (Electrical Machines-II)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

Section-A

1. To perform load-test on three-phase Induction motor and to plot torque versus speed characteristics.

2. To perform no-load and blocked–rotor tests on three-phase Induction motor to obtain equivalent circuit parameters and to draw circle diagram.

3. To study the speed control of three-phase Induction motor by Kramer's Concept.

4. To study the speed control of three-phase Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.

5. To study star- delta starters physically and a) to draw electrical connection diagram b) to start the three-phase Induction motor using it. c) to reverse the direction of three-phase Induction motor

6. To start a three-phase slip –ring induction motor by inserting different levels of resistance in the rotor circuit. And to plot torque –speed characteristics.

7. To perform no-load and blocked–rotor test on single-phase Induction motor and to determine the parameters of equivalent ckt. Drawn on the basis of double revolving field theory.

8. To perform load –test on single-phase. Induction motor and plot torque –speed characteristics.

9. To perform no load and short circuit. Test on three-phase alternator and draw open and short circuit characteristics.

10. To find voltage regulation of an alternator by zero power factor (ZPF.) method.

11. To study effect of variation of field current upon the stator current and power factor with synchronous motor running at no load and draw Voltage and inverted Voltage curves of motor.

12. To measure negative sequence and zero sequence reactance of Synchronous Machines.

13. Parallel operation of three phase alternators using • Dark lamp method • Two-Bright and one dark lamp method

Section-B

1. To design star- delta starters and draw electrical connection diagram
2. To design core and winding of synchronous motor

ACEE-16507
Laboratory-VIII (Digital Circuits and Microprocessors)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

Objectives:

1. To be able to implement combinational logic circuits such as half/full adder and subtractor.
2. To be able to verify the truth table of the Multiplexer and De-Multiplexer
3. To verify practically the truth table and working schema of various sequential circuits Like S-R, J-K, D and T Flip flops.
4. To get familiarize with implementation of Counters and Registers
5. To understand the basic architecture of 8- bit microprocessor
6. To learn the programming of 8085 microprocessor

List of experiments:

1. Design and verification of the truth tables of half adder/subtractor and full adder/subtractor circuits using gates 7483.
2. Verification of the truth table of the Multiplexer 74150 and De-Multiplexer 74154
3. (a) Design and test of an S-R flip-flop using NOR/NAND gates.
   (b) Verify the truth table of a J-K flip-flop
4. (a) Design and test of a D flip-flop using NOR/NAND gates
   (b) Verify the truth table of a T flip-flop
5. Operate the counters 7490, 7493 and 74192. Verify the frequency division at each stage. With a low frequency clock (say 1 Hz) display the count on LEDs.
6. Design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
7. Verify the truth table of decoder driver 7447 / 7448. Hence operate a 7 segment LED display through a counter using a low frequency clock.
8. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip
9. Study of 8085 Microprocessor Kit.
10. Write a program to add two 8-bit number using 8085.
11. Write a program to add and subtract two 16-bit number using 8085.
12. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
13. Write a program to sort series using bubble sort algorithm using 8085.

ACEE-16508
Laboratory-IX (Power Electronics and Drives)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

Section A

1. To study principle of operation of SCR, plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
4. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
5. Study of the microprocessor based firing control of a bridge converter.
6. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
7. Study of Jones chopper or any chopper circuit to check the performance.
8. Thyristorised speed control of a D.C. Motor.
9. Speed Control of induction motor using thyristors.
10. Study of series inverter circuit and to check its performance.
11. Study of a single-phase cycloconverter.
12. To check the performance of a McMurray half-bridge inverter.

Section B

1. To design the circuit of Jones chopper.
2. To design the circuit of McMurray half-bridge inverter.

ACEE-16509
INDUSTRIAL TRAINING (UNDERTAKEN AFTER 4TH SEMESTER)

Internal Marks: 60 **L T P**
External Marks: 40 **0 0 0**
Total Marks: 100

Objectives:

1. Students become familiar with the industry scenario.

2. Students learn the practical aspects of what they have studied.

3. To expose the students to actual working environment and enhance their knowledge and skill from what they have learned in the college.

4. To instill the good qualities of integrity, responsibility and self confidence.

5. To cultivate student's leadership ability and responsibility to perform or execute the given task.

6. To provide learners hands on practice within a real job situation.

Sixth Semester

ACEE-16601
ELECTRIC POWER UTILIZATION

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:
1. An ability to understand various types of industrial drives and PLC based drives.
2. An ability to identify the various traction systems.
3. An ability to use various welding and heating techniques in real life.
4. An ability to explore the knowledge gained for project work related to design of lighting schemes.
5. An ability to use techniques, skills related to refrigeration system for engineering practice.

PART-I

Electric Drives: Electrical drives & Mechanical drives, Concept of electrical drives, Basic features of industrial drives, review of operating and starting characteristics of different types of electric motors for various drives (AC and DC motors). Estimation of rating and heating of motors, Load equalization (Fly wheel effect), Drives for particular services.

PART-II

Electric Traction: Introduction to Indian railways system , Electric Locomotive Classes, Various types of Traction system, single phase feeding arrangement prevalent in India. Substation. arrangements, Different Types of Catenary construction and line insulation, Span and dropper design Calculations.
Electric Heating and Welding: Methods of electric heating, types of electric heating, constructional details and performance of resistance heating furnace. Dielectric heating.

PART-III

Alternating current (AC).and Direct current (DC) Welding, Resistance and Arc Welding. Electric Beam Welding, Laser Welding. Typical construction of electrical welding AC and DC set.
Illumination: Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles, Design of lighting schemes and equipment used for indoor, industrial and flood lighting.

PART-IV

Refrigeration and Air conditioning: Refrigeration system, Domestic refrigeration, Air conditioner, Comfort Air conditioning, Effective temperature.
Electrolysis: Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis.

BOOKS RECOMMENDED:
1. Partab H., *Modern Electric Traction,* Dhanpat Rai
2. De N.K. and Sen P.K., *Electric Drives*, PHI publication
3. Berde M.S., *Electric Motor Drives*, Khanna Publishers
4 Gupta J.B., *Utilization of Electric Power and Electric Traction*, S.K. Kataria and Sons
5. Tripathy S. C., *Electric Energy Utilization and Conservation*, Tata McGraw Hill
6. Taylor E.O., *Utilization of Electric Energy,* Orient Blackswan
7. Hughes Austin, *Electric Motors and Drives: Fundamentals, Types and Applications*, Newnes, (2005)

ACEE-16602
POWER SYSTEM-II (Switchgear and Protection)

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**1**	**0**
Total Marks : 100			

Objectives- 1. To know the types of substations and their relative merits and demerits used in power systems.
2. To gain the knowledge of circuit breakers, relays, isolators etc and thereby the knowledge of protection in power system.

PART-I

Sub-Station: Types, Main equipment in Substation, substation layout, Busbar-arrangements.
Isolators and Fuses: Isolating switches functions, Types, Rating and operation. Fuse-types, Rating, Selection, theory and characteristics, applications.

PART-II

Circuit Breakers: Need for Circuit Breakers, Arc phenomenon, Theory of Arc Interruption, Recovery Voltage and Restriking Voltage, Various Types of Circuit Breakers. Principles and Constructional Details of Air Blast, Minimum Oil, SF6, Vacuum Circuit Breakers etc.
Protective Relays: Introduction, classification, constructional features; and Characteristics of Electromagnetic, Induction, Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay, Negative sequence relay, introduction to static and up-based relays.

PART-III

Protection of Feeders: Time graded protection, Differential and Distance protection of feeders, choice between Impedance, Reactance and Mho relays, Elementary idea about carrier current protection of lines.
Protection of Generators and Transformers: Types of faults on alternator, Stator and rotor protection, Negative sequence protection, Loss of excitation and overload protection. Types of fault on transformers, percentage differential protection, Gas relays.

PART-IV

Protection against over voltage and earthing: Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/Surge Absorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.

BOOKS RECOMMENDED

1. Rao S., *Switchgear and Protection,* Khanna Publishers
2. Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., *A Textbook on Power System Engineering,* Dhanpat Rai and Co.
3. Wadhawa C.L. , *A Course in Electrical Power,* New Age international Pvt. Ltd
4. Badri Ram and Vishwakarma D.N., *Power system Protection and Switchgear*, Tata McGraw Hill
5. Deshpande M.V., *Switchgears and Protection*, Tata McGraw Hill

ACEE-16603
NON-LINEAR AND DIGITAL CONTROL SYSTEMS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives :-1. To understand effect basic non linearity in Electrical control system.
2. To utilize state variables techniques for analysis of various MIMO systems
3. To use Z transformation for analysis of discrete system in control Engineering.

PART-I

STATE VARIABLE TECHNIQUES: State variable representation of systems by various methods, solution of state variable model. Controllability and observability.

PHASE PLANE ANALYSIS: Singular points, Method of isoclines, delta method, phase portrait of second order nonlinear systems, limit cycle.

PART-II

DESCRIBING FUNCTION ANALYSIS: Definition, limitations, use of describing function for stability analysis, describing function of ideal relay, relay with hystersis, dead zone, saturation, coulomb friction and backlash.

PART-III

LYAPUNOV'S STABILITY METHOD: Lyapunov's direct method, generation of Lyapunov's function by Krasovskii's and Variable Gradient methods.

PART-IV

SAMPLED DATA SYSTEMS: Sampling process, mathematical analysis of sampling process, application of Laplace transform. Reconstruction of sampled signal, zero order, first order hold. Z- transform definition, evaluation of Z-transform, inverse Z-transform, pulse transfer function, limitations of Z-transform, State variable formulation of discrete time systems, solution of discrete time state equations. Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems.

BOOKS RECOMMENDED:

1. Ogata K., *Modern control engineering*. Prentice Hall (India)
2. Nagrath I.J., Gopal M., *Control system engineering*, New Age Publications
3. Hsu J.C. and Meyer A.U., *Modern control principles and application*
4. Gopal M., *Digital Control and State Variable Methods*, Tata McGraw Hill
5. Kuo B.C. and Golnaraghi F., *Automatic Control System, Wiley* Publications 6. Dorf R.V. and Bishop R.H., *Modern Control Systems*, Adison Wesley

ACEE-16604A
MICROCONTROLLER, PLC AND SCADA

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:
1. Understand the need and importance of microcontrollers and how they differ from microprocessor.
2. Develop logic so that they are able to develop their programming skills and make assembly language programs.
3. Interface external devices with 8051 microcontroller and able to analyze how they interact with each other.
4. Apply the knowledge gained to develop microcontroller based practical projects.
5. Understand PLC's and develop simple applications using ladder logic

PART-I

Introduction: Microprocessor, Micro-controllers and their comparison. The 8051 Architecture: Introduction, 8051 micro-controller hardware, input/ output, pins, ports and circuits, external memory, counters and timers, serial data input/ output, interrupts.

PART-II

8051 Assembly Language Programming: The mechanics of programming, assembly language programming process, programming tools and techniques, instruction set (data moving, logical operations, arithmetic operations, jump and call instructions),Input /output Programming, Stack (push and pop)instructions.

PART-III

Microcontroller Applications: Interfacing keyboards, displays, Digital-to-Analog (D/A) and Analog-to-Digital (A/D), introduction to the use of assemblers and simulators, Introduction of ARDUINO board, Pin description and specifications.

PART-IV

Programmable Logic Controllers (PLC): Introduction, operation of PLC, difference between PLC and Hardwired system, difference between PLC and Computer, relay logic and ladder logic, Basic symbols, ladder rungs, Process control relay ladder diagram for motor control manually and with pressure and temperature control switch.

Supervisory Control and Data Acquisition: Function of SCADA system, remote terminal unit (RTU) details, Control center details, Communication between control centers, control center and remote terminal unit. Applications of SCADA system to Indian Power Systems.

RECOMMENDED BOOKS:

1. Kenneth J Ayola, *The 8051 Micro Controller- Architecture, Programming and Application*, Penram International Publication
2. John B Peatman, *Design with Micro Controller,* Tata McGraw Hill
3. Ray A. K. and Bhurchandi K. M., *Advanced Microprocessors and Peripherals; Architecture, Programming and Interfacing*, Tata McGraw Hill
4. Mazidi M. A. and Mazidi J. G., *The 8051 Micro-controller and Embedded System*, Pearson Education.
5. Udayashankara V. and Mallikarjunaswamy M.S., *8051 Microcontroller Hardware, Software and Applications*, TataMcGraw Hill Education Pvt. Ltd., (2010)
6. Surekha Bhanot, *Process Control*, Oxford Higher Education.

7. Otter, Job Dan, *Programmable Logic Controlle*r, P.H. International, Inc, USA
8. Dunning Gary, *Introduction to PLCs*, Tata McGraw Hill
9. Kumar Rajesh, *Module on PLCs and their Applications*, NITTTR Chandigarh

ACEE-16604B
NETWORKS AND DATA COMMUNICATION

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:

1. To make the students to understand the basic concepts of data communication and evolution of computer networks.
2. To be well versed with guided/unguided media and Analog to Analog A/D, D/A and Digital to Digital conversions.
3. To be familiar with Digital data communication, Multiplexing and Switching Techniques and basic concepts of spread spectrum.
4. To understand the error detection and correction techniques.
5. To be able to know about the Protocol Architectures.

PART-I

Introduction: Basic Concepts of analog and digital signals, data transmission concepts, Analog and digital transmission, transmission impairments
Transmission Media: Guided and Un-guided media, Performance, Shannon Capacity, Media Computerization.

PART-II

Encoding and Modulating: Digital–to-Digital conversion, Analog and digital conversion, Digital to Analog conversion, Analog to Analog conversion.
Digital Data Communication: Digital data transmission, Data terminal equipment (DTE) - data circuit-terminating equipment (DCE) Interface, Electronic Industries Alliance, Modems, Cable Modems.

PART-III

Multiplexing And Switching: Frequency-division multiplexing **(**FDM), wavelength-division multiplexing (WDM), Time-division Multiplexing (TDM) application- telephone systems, Digital subscriber line (DSL), Par Circuit switching , Packet Switching and Message switching virtual circuits.
Spread Spectrum: Concept, Frequency hoping spread spectrum, direct sequence spread spectrum, code division Multiple Access.

PART-IV

Error Detection and Correction: Types of Errors, Detection, Vertical Redundancy Check (VRC), longitudinal redundancy check (LRC), cyclic redundancy check (CRC), Checksum, Error Correction.
Protocol Architecture: Protocols, Standards, OSI (Open Systems Interconnection) model, TCP (Transmission Control Protocol)/ IP (Internet Protocol) Protocol Architecture, IP addressing, IP classes.

BOOKS RECOMMENDED:
1. Ulylers D Balck, *Data Communication and Distributed Networks*, Prentice Hall (India)
2. Andrew S. Teanebaum, *Computer Networks*, Prentice Hall (India)
3. William Stallings, *Data and Computer Communication*, Pearson Education
4. Behrouz A Ferouzan *Data Communications and Networking*, Tata McGraw Hill.

ACEE-16604C
EMBEDDED SYSTEMS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives:

1. To make understand the students about the major components that constitute an embedded system
2. To get familiarize with PIC microcontroller and its interfacing
3. To develop familiarity with tools used to develop in an embedded environment
4. To understand the real time operating system

PART-I

Introduction: Review of Embedded Hardware: Terminology, Gates, Timing Diagram, Memory, Microprocessor Buses, Direct Memory Access, Interrupts, and Built instructions on the Microprocessor. Conventions used on Schematic, Interrupts, Microprocessor Architecture, Interrupt Basic, Shared Data Problem, Interrupt Latency.

PART-II

PIC Micro controller and Interfacing: Introduction, CPU Architecture, Registers, Instruction Sets, Addressing Modes, Programs, Interfacing Methods, Parallel I/O Interface, Parallel Port Interface, Memory Interfacing, High Speed I/O Interfacing, Interrupt, Interrupt Service Routine, features of Interrupts, Interrupt vector and Priority, Timing Generation and Measurements, Input Capture, Output Compare, Frequency Measurement, Serial I/O Device RS232, RS845, Analog Interfacing, Applications.

PART-III

Software Development and Tools: Embedded System Evolution Trends, Round – Robin, Robin with Interrupts, Function Scheduling architecture, Algorithms, Introduction to assembler, Compiler and Cross compilers and Integrated Development Environment (IDE), Object Oriented Interfacing, Recursion, Debugging Strategies, Simulators.

PART-IV

Real Time Operating Systems (RTOS): Task And Task States, Tasks and Data, Semaphores and shared data, operating system services, Message queues, Timer Function, Events, Memory Management, Interrupt Routines in an RTOS Environment, Basic Design Using RTOS.

BOOKS RECOMMENDED:

1. Gajski D.D., Vahid F., Gong J., Narayan S., *Specification and Design of Embedded Systems*, Prentice Hall.
2. Steve Heath, Newnes *Embedded systems Design*, Prentice Hall.
3. Balarin F., Chiodo, *Hardware Software Co-design of Embedded Systems*, Academic Publishers.

ACEE-16604D
ROBOTICS AND AUTOMATION

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Objectives: 1. Understand the need and scope of automation.
2. To understand various electrical and electronics controls.
3. Understand the functioning of robotics and sensors.
4 To have the knowledge of robotics in industries.

PART-I

Introduction Concept and scope of automation, Socio economic consideration, Low cost automation.
Pneumatic Logic Circuits Hydraulic and pneumatic cylinders - construction, design and mounting, Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations.

PART-II

Fluidics Boolean algebra, Truth tables, Conda effect, Fluidic elements - their construction working and performance characteristics: Elementary fluidic circuits.
Transfer Devices and Feeders Their Classification: Construction details and application of transfer devices and feeders (Vibratory bowl feeder, reciprocating tube feeder and centrifugal hopper feeder).

PART-III

Electrical and Electronic Controls Introduction to electrical and electronic controls such as electromagnetic controllers - transducers and sensors, microprocessors, programmable logic controllers (PLC), Integration of mechanical systems with electrical, electronic and computer systems.

PART-IV

Robotics Introduction, classification based on geometry, devices, control and path movement, End effectors - types and applications, Sensors - types and applications, Concept of Robotic/Machine vision, Teach pendent.
Industrial Applications of Robots for material transfer, machine loading / unloading, welding, assembly and spray painting operations.

BOOKS RECOMMENDED:
1. Anthony Esposito, Fluid Power with applications, Pearson.
2. S.R. Majumdar, Pneumatic Control, Tata Mc Graw Hill.
3. S.R. Deb, Robotics and Flexible Automation, Tata mc Graw Hill
4. A.K Gupta, S.K. Arora, Industrial Automation and Robotics, Laxmi Pubilaction (P) Ltd.

ACEE-16605
SIGNAL AND SYSTEMS

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objectives: 1. To make the students capable of understanding various signals and systems.
2. To analyze various signals in Continuous and discrete form.
3. To make the students learn how signal behaves in Frequency domain

PART-I

Classification of Signals and Systems: Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic & aperiodic, random &deterministic signals, Even& Odd Signals, Energy & Power Signals, Description of continuous time and discrete time systems.

PART- II

Analysis of Continuous Time Signals and analysis of Discrete Time Signals: Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and its properties in Signal Analysis, Power Spectral Density and Energy spectral density, Sampling of CT signals and aliasing, DTFT and its properties.

PART- III

Linear Time Invariant -Continuous Time Systems: Linear Time invariant Systems and their properties. Differential equation & Block diagram representation, Impulse response, Convolution integral, Frequency response (Transfer Function), Fourier transforms analysis.

PART- IV

Linear Time Invariant -Discrete Time System: Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT.

BOOKS RECOMMENDED:

1. Communication Signals & System by Simon Haykins, John Wiley & Sons.
2. Signal, System & Transforms, Phillips, Pearson Education.
3. Fundamentals of Signals and Systems by Edward W Kamen & Bonnie's Heck, Pearson Education.

ACEE-16606
LABORATORY-X (SIGNAL AND SYSTEMS)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments:

1. Generation of continuous and Discrete Unit step signal.
2. Generation of exponential and Ramp Signal in Continuous and Discrete Domain.
3. Continuous and Discrete time Convolution.
4. Adding and subtracting two Given Signals (Continues as well as Discrete Signals)
5. To generate a random binary wave.
6. To Generate a Random Sequences with arbitrary distribution, means and Variances for following: Rayleigh Distribution Uniform distribution Gaussian distribution.
7. To Plot Probability density functions. Find Mean and Variance for the above distribution .
8. To study Power Spectrum Density.
9. To study Difference Equation to develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
10. To develop program modules based on operation on sequences like signal shifting, signal folding, signal addition and signal multiplication.
11. To develop program for discrete convolution and correlation.
12. To develop program for finding response of the LTI system described by the difference equation.
13. To develop program for computing inverse Z-transform.

ACEE-16607
LABORATORY-XI (POWER SYSTEM-II)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

Note: Atleast TEN experiments are to be performed in a semester. list of experiments is given below:

List of Experiments:

Section-A

1. To study the performance of a transmission line. Also compute its ABCD parameters.
2. Study of Characteristics of over current and earth fault protection.
3. To study the operating characteristics of fuse. (HRC or open type)
4. To find the earth resistance using three spikes
5. To study over current static relay.
6. To study the different types of faults on transmission line demonstration panel/model.
7. To study the radial feeder performance when a. Fed at one end b. Fed at both ends
8. To study the performance of under voltage and over voltage relay.
9. To study the characteristics of bimetal mini circuit breakers.
10. To study the characteristics of Distance Relay.
11. To find the breakdown strength of transformer oil.

Section-B

1. To design relay (overcurrent and undervoltage)
2. To demonstrate protection of power system.

ACEE-16608A
LABORATORY-III (MICRO CONTROLLER, PLC AND SCADA)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

Note: Atleast five experiments are to be performed in a semester in Section A while Section B and C is compulsory for all.

List of Experiments:

Section A:
1. Study of 8051/8031 Micro-controller kits.
2. Write a program to add two numbers lying at two memory locations and display the result.
3. Write a program for multiplication of two numbers lying at memory location and display the result.
4. Write a program to Subtract two numbers lying at two memory locations and display the result.
5. Write a program to divide two numbers lying at two memory locations and display the result.
6. Write a program to Display any name on LCD
7. Study of interrupt structure of 8051/8031 micro-controllers
8. Write a program to control a stepper motor in direction, speed and number of steps.
9. Write a program to control the speed of DC motor.

Section B:
1. Implementation of different gates using PLC.
2. Implement basic logic operations, motor start and stop operation using PLC
3. Implement Traffic light control using Arduino board.
4. Design Temperature sensor using Arduino board.

Section C:
1. PLC interfaced with SCADA and status read/ command transfer operation.
2. Parameter reading of PLC in SCADA.
3. Alarm annunciation using SCADA.
4. Reporting and Trending in SCADA System.
5. Temperature sensing using SCADA.

ACEE-16608B
LABORATORY-III (NETWORKS AND DATA COMMUNICATION)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments

1. Write specifications of latest desktops and laptops.
2. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
3. Preparing straight and cross cables.
4. Study of various LAN topologies and their creation using network devices, cables and computers.
5. Configuration of TCP/IP Protocols in Windows and Linux.
6. Designing and implementing Class A, B, C Networks
7. To configure the IP address for a computer connected to LAN and to configure network parameters of a web browser for the same computer.
8. To plan Personal Area Network.
9. To configure WLAN.
10. To configure Adhoc networks.

ACEE-16608C
LABORATORY-III (EMBEDDED SYSTEMS)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments

1. Study of ARM7 & ARM9 Bit Processor Architecture and Pin Diagram.
2. Study of Interrupt structure in ARM Processors
3. Write ARM Processor program to Flash LED
4. Interfacing of an LCD Display
5. Write a program to interface an ADC
6. Write a program to generate a Ramp waveform using DAC interface
7. Write a program to control a Stepper Motor
8. Write a program to control the speed of DC motor
9. Interface relays and write a program to control them
10. Interface ZIGBEE with ARM to control more external devices
11. Interfacing of Biometric information recorder
12. Interfacing RFID module with ARM Microcontroller.

ACEE-16608D
LABORATORY-III (ROBOTICS AND AUTOMATION)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

List of Experiments

1. Design and assembly of hydraulic / pneumatic circuit.
2. Study of power steering mechanism using cut piece model.
3. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves.
4. Use of direction control valve and pressure control valves clamping devices for jig and fixture.
5. Study of robotic arm and its configuration.
6. Study the robotic end effectors.
7. Study of different types of hydraulic and pneumatic valves.

ACEE-16701 POWER SYSTEM ANALYSIS

Internal Marks:40 **L T P**

External Marks:60 **3 1 0**

Total Marks:100

Objective: The purpose of subject is to understand the power system specially load flow analysis, fault analysis, stability and modeling. It helps students for further achievements in the field of Electrical engineering.

Part - I

SYSTEM MODELLING: System modelling of synchronous machines, transformers, loads etc, per unit system, single line diagram of electrical networks, single phase impedance diagrams. Formulation of impedance and admittance matrices for the electrical networks.

Part- II

LOAD FLOW STUDIES: Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutions by the Gauss-Seidal method and Newton Raphson Method.

Part-III

FAULT ANALYSIS: Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers, Algorithm for short circuit studies, Symmetrical Component transformation, construction of sequence networks of power systems. Symmetrical Analysis of Unsymmetrical Line-to-ground (LG), Line-to line (LL), double line to ground (LLG) faults using symmetrical components.

Part - IV

POWER SYSTEM STABILITY: Steady state stability, Dynamics of a synchronous machine , Power angle equations , Transient stability, equal area criterion, Numerical solution of swing equation , factors effecting transient stability.

BOOKS RECOMMENDED:

1. Elgerd O.I., Electric Energy Systems Theory, Tata McGraw Hill
2. Nagrath I.J., Kolthari D.P., Modern Power System Analysis, Tata McGraw Hill
3. Stevenson W.D., Elements of Power System Analysis, McGraw Hill
4. Nagrath I.J. and Kothari D.P., Power System Engineering, Tata McGraw Hill
5. Arrillaga J. and Arnold C.P., Computer Analysis of Power Systems, John Wiley & Sons
6. Stagg Glenn W. and Ei-Abiad Ahmed H., Computer Methods in Power System Analysis, Tata McGraw Hill
7. Kusic G.L., Computer Aided Power System analysis, Prentice Hall, India

ACEE-16702 HIGH VOLTAGE ENGINEERING

Internal Marks:40 **L T P**

External Marks:60 **3 1 0**

Total Marks:100

Objective: The purpose of subject is to aware students about high voltage AC and DC transmission and generation, Breakdown of dielectrics etc . Further, it helps students for further achievements in the field of Electrical engineering.

Part-I

Extra High Voltage (EHV) Transmission and Corona Loss: Need for EHV Transmission. Use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, Corona loss. Factors affecting the corona loss. Radio interference due to corona. Shunt and series compensation in EHV lines. Tuned power lines. Insulation Co-ordination.

Part-II

High Voltage Direct Current (HVDC) Transmission: Advantages, disadvantages and economics of HVDC Transmission system. Types of Direct Current (DC) links, converter station equipment, their characteristics.

Insulating materials for High Voltage: Applications of insulating materials used in power transformers rotating machines, circuit breakers, cables, power capacitors.

Part-III

Conduction and breakdown in Gases, Liquids and Solid Dielectrics: Solids - Intrinsic, electromechanical and thermal breakdown composite dielectrics, solid dielectrics used in practice. Liquids:- Conduction and breakdown in pure and commercial liquids, suspended particle theory, cavitation and bubble theory, stressed oil volume theory, Liquids used in practice. Gases:- Ionization process, Townsend's current growth equations, Ist and 2nd ionization coefficients. Townsend's criterion for breakdown. Streamer theory of breakdown, Pashen's law of Gases. Gases used in practice.

Part-IV

Generation of High Voltages: High Voltage Direct Current (HVDC), High Voltage Alternating Current (HVAC), Power frequency and High frequency: Impulse voltage and impulse current Generation, Tripping and contact of Impulse Generator. Measurement of voltage and current: High voltage direct current, Alternating current and Impulse voltage and currents.

BOOKS RECOMMENDED:

1.Bagamudre, Rakesh Das Extra High Voltage A.C. Transmission Engineering, New Age International Publishers.
2. Kimbark E.W., High Voltage Direct Current Transmission, Wiley-Interscience
3. Kamaraju V. and Naidu M.S., High Voltage Engineering, Tata McGraw-Hill Education
4. Jha R.S., High Voltage Engineering, Dhanpat Rai

ACEE-16703 NON-CONVENTIONAL ENERGY SOURCES

Internal Marks: 40
External Marks: 60 **L T P**
Total Marks: 100 **3 0 0**

Objective: The purpose of subject is to understand the power system specially different types of Non Conventional Energy sources. It helps students for further achievements in the field of Electrical engineering.

Part - I

INTRODUCTION: Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.

MHD GENERATORS: Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of Magneto-Hydro-Dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.

Part - II

THERMO-ELECTRIC GENERATORS: Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect.

Part - III

PHOTOVOLTAIC EFFECT AND SOLAR ENERGY: Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.

Part - IV

FUEL CELLS: Principle of action, Gibb's free energy, general description of fuel cells,types, construction, operational characteristics and application.

MISCELLANEOUS SOURCES: Geothermal system, hydro-electric plants, wind power, tidal energy, Bio-mass energy

BOOKS RECOMMENDED:

1. Gupta B. R., Generation of Electrical Energy, S. Chand.
2. Rai, G.D., Non Conventional Energy Sources, Khanna Publishers (2005).
3. Rao, S. and Parulekar, B.B., Energy Technology: Non Conventional, Renewable and Conventional, Khanna Publishers (2005).

4. Wadhwa, C.L., Generation, Distribution and Utilization of Electric Energy, New Age International (P) Limited, Publishers (2007).
5. Simon , Christopher A., Alternate Source of Energy, Rowman and LittleField Publishers Inc.(2007).
6. Venikov, V.A. and Putyain, E.V., Introduction to Energy Technology, Mir Publishers (1990).
7. Chakrabarti A., Soni M. L., Gupta P. V. and Bhatnagar U. S., Power System Engineering, Dhanpat Rai and Co.
8. Kothari D.P., Singal K.C. and Ranjan R., Renewable Energy Sources and Emerging Technologies, Prentice Hall (India)

ACEE-16704E POWER QUALITY MONITORING AND CONDITIONING

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objective: The purpose of subject is to understand the power system specially Power quality Monitoring and onditioning. It helps students for further achievements in the field of Electrical engineering.

Part - I

Overview and definition of power quality (PQ): Sources of pollution, and regulations, Power quality problems rapid voltage fluctuations voltage unbalance, Voltage dips and voltage swells, Short duration outages,

Definitions Voltage sag analysis and mitigation: Sag caused by motor starting, Sag caused by utility fault clearing, Sag mitigation, Sag magnitude and duration calculations in single-phase systems, Equipment performance in presence of sag, Computers, Alternating current (AC) and direct current (DC) drives.

Part - II

Harmonics: Effects-within the power system, Interference with communication Harmonic measurements. Harmonic elimination.

Part - III

Harmonic distortion: Power system harmonics: harmonic analysis, Harmonic sources-the static converters, Transformer magnetization and non-linearities, Rotating machines, arc furnaces, Fluorescent lighting. Introduction to power converters, Fourier analysis, Total harmonic distortion, rms and average value calculations, Arcing and saturable devices, Effects of harmonic distortion, System response characteristics.

Part - IV

Principles for controlling harmonics: Locating sources of harmonics, Passive and active filters, Harmonic filter design.
Monitoring power quality: Monitoring essentials, Power quality measuring equipment, Current industry trends.
Power Conditioning: Electric power conditioning, Active and passive filters, IEEE, IEC, ANSI standards, Power Acceptability Curves, Various standards

BOOKS RECOMMENDED:

1. Beaty, H. and Santoso,S., Electrical Power System Quality
2. Kennedy, B., Power Quality Primer, McGraw Hill (2000).
3. Bollen, M.H.J., Power Quality Problems: Voltage Sag and Interruptions, IEEE Press (2007).

4. Mohan, N., Power Electronics, New Age International (P) Limited, Publishers (2007)

ACEE-16704F COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Internal Marks: 40	L	T	P
External Marks: 60			
Total Marks: 100	3	0	0

Objective: The purpose of subject is to understand the power system specially designing of various electrical machines by using computer aided tools. It helps students for further achievements in the field of Electrical engineering.

Part-I

Review of Magnetic and insulating materials.

Principles of design of Machines: Factors and limitations in design, specific magnetic and electric loadings, output, real and apparent flux densities, separation of main dimensions for D.C., induction and synchronous machines.

Part-II

Heating, Cooling and Ventilation: Temperature rise calculation, continuous, short time and intermittent ratings, types of ventilation, hydrogen cooling and its advantages.

Part-III

Design of Transformers: General considerations, output equation, main dimensions, leakage reactance, winding design, tank and cooling tubes, calculation of magnetizing current, losses, efficiency and regulation.

Part-IV

Design Three-phase induction motors: General considerations, output equation, choice of specific electric and magnetic loadings, No. of slots in stator and rotor, elimination of harmonic torques, design of stator and rotor windings, leakage reactance, equivalent resistance of squirrel cage rotor, magnetizing current, temperature rise and efficiency. Introduction to computer aided electrical machine design.

BOOKS RECOMMENDED:

1. Sawhney A.K., A Course in Electrical Machine Design, Dhanpat Rai.
2. Aggarwal R.K., Principles of Electrical Machine Design, S. K. Kataria and Sons.
3. Deshpande M.V., Design And Testing of Electrical Machines- PHI Learning Pvt. Ltd.
4. Upadhyay K.G., Design of Electrical Machine, New Age International.
5. Hamdi Essam S., Design of small electrical machines,Wiley publications

ACEE-16704G POWER SYSTEM RELIABILITY

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objective: The purpose of subject is to understand the power system specially different components of power system reliability It helps students for further achievements in the field of Electrical engineering.

Part-I

PROBABILITY AND RELIABILITY: Review of probability concepts, probability distributions, applications of binomial distribution to engineering problems, probability distribution in reliability evaluation, reliability indices, network modeling and evaluation of simple and complex networks, system reliability evaluation using probability distributions, frequency and load duration techniques, key indices of power system reliability and their calculations.

Part-II

GENERATION SYSTEM RELIABILITY EVALUATION: Concept of loss of load probability (LOLP), Energy demand, EDNS (Energy Demand Not Served), Evaluation of these indices for isolated systems, generation system, reliability analysis using the frequency and duration techniques.

Part-III

TRANSMISSION SYSTEM RELIABILITY EVALUATION: Evaluation of LOLP and EDNS, indices for an isolated transmission system, interconnected system reliability, bulk power system reliability.

Part-IV

SYSTEM RELIABILITY EVALUATION: Reliability analysis of radial systems with switching.

BOOKS RECOMMENDED:

1. Billinton R., Power System Reliability Calculation, MIT Press, USA.
2. Endreyni, Reliability Modeling in Electric Power System, John Wiley, New York

ACEE-16704A HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

Internal Marks: 40	**L T P**
External Marks: 60	
Total Marks: 100	**3 0 0**

Objective: The purpose of subject is to understand the power system specially analysis of HVDC line and faults related to HVDC Transmission. It helps students for further achievements in the field of Electrical engineering.

Part - I

Direct Current (DC) power transmission technology: Introduction, comparison of Alternating Current (AC) and Direct Current (DC) transmission, application of DC transmission, application of DC transmission, description of DC transmission system, Configurations, planning for High Voltage Direct Current (HVDC) transmission, modern trends in DC transmission. Introduction to Device: Thyristor valve, valve tests, recent trends.

Part - II

Analysis of High Voltage Direct Current (HVDC) converters: Pulse number, choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, characteristics of a twelve-pulse converter, detailed analysis of converters with and without overlap.

Part - III

Converter and HVDC system control: General, principles of DC link control, converter control characteristics, system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link, power control, higher level controllers, telecommunication requirements.

Part - IV

Converter faults and protection: Introduction, converter faults, protection against over-currents, over-voltages in a converter station, surge arresters, protection against over-voltages.

Smoothing reactor and DC line: Introduction ,smoothing reactors, DC line, transient over voltages in DC line, protection of DC line, DC breakers, Monopolar operation, effects of proximity of AC and DC transmission lines.

Component models for the analysis of AC/DC systems: General, converter model, converter control, modelling of DC network, modelling of AC networks.

BOOKS RECOMMENDED:

1. Bagamudre, Rakesh Das Extra High Voltage A.C. Transmission Engineering, New Age International Publishers.
2. Kimbark E.W., High Voltage DC Transmission, Wiley-Interscience
3. Kamaraju V. and Naidu M.S., High Voltage Engineering, Tata McGraw-Hill Education
4. Jha R.S., High Voltage Engineering, Dhanpat Rai
5. Kuffel, E. and Abdullah, M. High Voltage Engineering, Pergamon Press
6. Wadhwa C. L., High Voltage Engineering, New Age Publications.
7. Padiyar, K.R. HVDC Power Transmission Systems: Technology and System Interactions, New Age International

ACEE-16704B POWER SYSTEM OPERATION AND CONTROL

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objective: The purpose of subject is to understand the power system specially different components of power system operation and control It helps students for further achievements in the field of Electrical engineering.

Part-I

Introduction to Power Generation Units: Characteristics and its variations,

Economic Operation of Power Systems: Fuel consumption, Characteristics of thermal unit, Incremental fuel rate and their approximation, minimum and maximum power generation limits.

Part-II

Economic Dispatch: Economic dispatch problem with and without transmission line losses, Unit Commitment and solution methods. Hydrothermal scheduling: fixed-head and variable head, Short- term and Long-term,

Part-III

Power System Control: Power system control factors, interconnected operation, tie-line operations, Reactive power requirements, during peak and off peak hours, Elementary ideas of load frequency and voltage, reactive power control; block diagrams of P-f and Q-V controllers, ALFC control, Static and Dynamic performance characteristics of automatic load frequency control (ALFC) and automatic voltage regulator (AVR) controllers, Excitation systems.

Part-IV

Power System Security: Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and linear programming.

Power flow analysis in AC/DC systems: General, modelling of DC links, solution of DC load flow, discussion, per unit system for DC quantities, solution techniques of AC-DC power flow equations.

BOOKS RECOMMENDED:

1. Kothari D.P. and Dhillon J.S., Power System Optimization, Prentice-Hall of India Pvt. Ltd. New Delhi
2. G L.K .Kirchmayer, Economic Operation of Power Systems, John Willey & Sons,N.Y.
3. Wood A.J, Wollenberg B.F , Power generation operation and control.

4. Kothari D.P. and Nagrath I.J., Modern Power System Analysis ,Tata Mc Graw-Hill Publishing Company Ltd., New Delhi

ACEE-16704D POWER SYSTEM RESTRUCTURING AND DEREGULATION

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

Objective: The purpose of subject is to understand the power system specially different components of power system restructuring and deregulation of electrical energy. It helps students for further achievements in the field of Electrical engineering.

Part-I

INTRODUCTION: Basic concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system, advantages of competitive system.
POWER SYSTEM RESTRUCTURING: An overview of the restructured power system, Difference between integrated power system and restructured power system. Explanation with suitable practical examples.
Part-II

DEREGULATION OF POWER SECTOR: Separation of ownership and operation, Deregulated models, pool model, pool and bilateral trades model, multilateral trade model. Competitive electricity market: Independent System Operator activities in pool market, Wholesale electricity market characteristics, central auction, single auction power pool, double auction power pool, market clearing and pricing, Market Power and its Mitigation Techniques, Bilateral trading, Ancillary services, Transmission Pricing.
Part-III

OPEN ACCESS SAME TIME INFORMATION SYSTEM (OASIS): Introduction, structure, functionality, implementation, posting of information, uses.
CONGESTION MANAGEMENT: Congestion management in normal operation, explanation with suitable example, total transfer capability (TTC), Available transfer capability (ATC), Transmission Reliability Margin (TRM), Capacity Benefit Margin (CBM), Existing Transmission Commitments (ETC).
Part-IV

DISTRIBUTED GENERATION ON POWER QUALITY: Resurgence of distributed generation (DG), DG technology, Interface to utility System, Operating conflicts, DG on low voltage distribution networks, Siting DG, Interconnection standards

BOOKS RECOMMENDED:

1. Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd.
2. Lorrin Philipson and H. Lee Willis, Marcel Dekker, Understanding Electric Utilities and
3. Deregulation, New York, CRC Press, 2005.
4. Marija llic, Francisco Galiana and Lestor Fink , Power System Restructuring Engineering & Economics , Kulwer Academic Publisher, USA-2000.
5. Santoso Surya, Beaty H. Wayne, Dugan Roger C., McGranaghan Mark F., Electrical Power System Quality, McGraw Hills, 2002.

ACEE-16704C FLEXIBLE AC TRANSMISSION SYSTEMS

Internal Marks: 40	L T P
External Marks: 60	3 0 0
Total Marks: 100	

Objective: The purpose of subject is to understand the power system specially various flexible AC transmission system components and their utilization in the field of electrical engineering. It helps students for further achievements in the field of Electrical engineering.

Part-I

Power Transmission control: Fundamental of alternating current (AC) power transmission, transmission problems and needs, the emergence of Flexible Alternating Current Transmission Systems (FACTS), FACTS controller and consideration. Uncompensated transmission lines and compensated transmission lines.

Part-II

Shunt Compensation: Principle, configuration, control and applications of Shunt Static Var Compensator (SVC) and Static Synchronous compensator (STATCOM).

Series Compensation: Fundamental of series compensation, principle of operation, Application of Thyristor Controlled Series Capacitor (TCSC) for different problems of power system, TCSC layout, Static Synchronous Series Compensator (SSSC): principle of operation.

Part-III

Phase Shifter: Principle of operation, steady state model of static phase shifter (SPS), operating characteristics of SPS, power current configuration of SPS application.

Unified Power Flow Controllers (UPFC): Basic operating principles and characteristics, control UPFC installation applications, UPFC model for power flow studies.

Part-IV

Reactive Power Control: Introduction, reactive power requirements in steady state, sources of reactive power, static var systems, reactive power control during transients. Harmonics and filters: Introduction, generation of harmonics, design of AC filters, DC filters, carrier frequency and RI noise.

Transmission line steady State Operation: Lossless Transmission lines, Maximum Power Flow, Line loadability, reactive compensation techniques. Congestion management on transmission lines using FACT devices.

RECOMMENDED BOOKS:

1. Ghosh,A. and Ledwich,G., Power Quality Enhancement Using Custom Power Devices, Kluwer Academic Publishers (2005).
2. Hingorani, N.G. and Gyragyi,L., Understanding FACTS :Concepts and Technology of Flexible AC Transmission System, Standard Publishers and Distributors (2005).
3. Sang, Y.H. and John, A.T., Flexible AC Transmission Systems, IEEE Press (2006).
5. K.R. Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publisher, 2007.
6. Miller T.J.E., Reactive Power Control in Electric Systems, John Wiley.

ACEE-16705 Laboratory-XII (Power System Analysis)

Internal Marks:30 **L T P**

External Marks:20 **0 0 2**

Total Marks:50

Objective: The purpose of laboratory is trained students about the tool etap. Through etap students are further able to design any configuration of power sytem and also analysis its working/output.

Part-A

Note: Atleast Eight experiments are performed in a semester.

List of experiments is given below: List of Experiments:

1. Design of transmission systems for given power and distance.

2. Short circuit calculations and calculations of circuit breaker ratings for a power system network.

3. Design of substations

4. Design of distribution systems

5. Y-bus formation

6. Z-bus formulation

7. Load flow analysis by Gauss Seidal method

8. Load flow analysis by Newton Raphson method

9. Fault analysis for line-to-line (L-L), Line-to-Ground (L-G) etc

10. Design of underground cabling system for substation.

Part – B

1. To obtain power system stability on High Voltage Alternating current (HVAC) system with the help of Flexible Alternating Current Transmission Systems (FACTS) devices.

2. Optimal Capacitor placement on a system having variable reactive power and low voltage profile.

3. To obtain relay co-ordination on a power system.

4. To obtain optimal generator pricing on hydro-thermal and renewable energy systems.

5. To find synchronous reactances (Transient, sub-transient) during fault analysis.

ACEE-16706 Seminar

Internal Marks:100	**L T P**
External Marks:0	**0 0 2**
Total Marks:100	

Students are required to give PPT on topics related to advancement of Electrical Engineering topics after presenting PPT, student is also required to deposit related report to concerned teacher.

ACEE-16707 Major Project

Internal Marks:100 **L T P**

External Marks:100 **0 0 2**

Total Marks:200

Design, Fabrication, Simulation, Evaluation, Testing etc. related to Electrical Engineering is to be carried out under the supervision of guide(s).

DEPARTMENT OF APPLIED SCIENCES

Pre Placement Activities

ACTP-16701

Purpose : The Purpose of Pre Placement Activity classes is to check the communication as well as technical skills of the students in final year to give them an idea of how does Placement take place and what it actually takes to get through selection process of any suitable placement activity .

Following are some of the activities that come under Pre-Placement Activity Classes:-

Activity 1. INTRODUCTION : It takes Self Introduction and Resume Building Skills . In this students work upon their spoken skills, non- verbal/ behavioral aspects and consequently tell about their brief family background, Education, Technical- Non Technical Skills, Accolades and Achievements and Hobbies and Interests. All above said ingredients are put in order on a page in typed form to make a resume/ CV with a declaration statement.

Activity2. Mock Interview: Mock Interviews are conducted to prepare the students for handling frequently asked Interview based Questions.

Activity3. Extempore: Students also participate in extempore activity. It helps the students to strengthen their presence of mind and creative thinking past.

Activity3. PPT Presentation: In this activity, Students make Power Point Presentations on Social, Political, Socio-Political, Economical topics of National & International importance.

Important Note: Of all above activities, after Initial Evaluation, Second Evaluation is done, if required and list of students is handed over to T&P cell.

Prepared by

Ms. Rajni Arora

Head

(Applied Sciences)