JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
(An Autonomous Institute of Govt. of M.P.)

Affiliated to Rajiv Gandhi Technological University, Bhopal (MP)

Scheme of Study and Examination (w.e.f. July 2010)

B.E. Third Year **Branch : ELECTRICAL ENGINEERING** **Sem : Fifth**

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
					SESSIONAL EXAM			ESE	SUB TOTAL	
		L	T	P	TA	CT	TOTAL			
EE- 18	Electrical & Electronics Instrumentation	3	1	-	10	20	30	70	100	4
EE-20	Electrical Machines - II	3	1	-	10	20	30	70	100	4
EE-22	Electromagnetic Theory	3	1	-	10	20	30	70	100	4
EE-25	Electrical Power Generation	3	1	-	10	20	30	70	100	4
EE-30	Power Electronics : Devices & Circuits	3	1	-	10	20	30	70	100	4
(PRACTICAL/DRAWING/DESIGN)										
EE-19L	Electrical & Electronics Instrumentation Lab	-	-	2	20	-	20	30	50	2
EE-21L	Electrical Machines Lab - II	-	-	2	20	-	20	30	50	2
EE-31L	Power Electronics : Devices & Circuits Lab	-	-	2	20	-	20	30	50	2
EE-51L	Electrical Engineering Simulation Lab	-	-	2	20	-	20	30	50	2
EE-26L	Industrial Training – I	-	-	2	50	-	50	-	50	2
EE-61L	Seminar/Group Discussion	-	-	2	50	-	50	-	50	2
	Total	**15**	**5**	**12**	**230**	**100**	**330**	**470**	**800**	**32**

T.A. Teachers Assessment, CT- Class Test, ESE - End Semester Examination, Total Marks 800 Total Periods : 32, Total Credits : 32

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	ELECTRICAL & ELECTRONICS INSTRUMENTATION	EE-18	Min "D"	Min "D"	5.0

ELECTRICAL & ELECTRONICS INSTRUMENTATION

Unit-I : Cathode Ray Oscilloscope (CRO)
Different parts of CRO, Block diagram, Electrostatic focusing, Electrostatic deflection, post deflection acceleration, Screen for CRTs, Graticule, Vertical & Horizontal deflection system, Time base circuit, Oscilloscope probes, Application of CROs, Special purpose CROs- Multi input, Dual trace, Dual beam, Sampling, Storage (Analog & Digital) Oscilloscopes.

Unit-II : A.C. Bridges :
Maxwells bridge, (Maxwells inductance & inductance capacitance) Hays bridge, Schering Bridge, High Voltage & relative permittivity) Weins bridge, Wagner's Earth detector, Impedance measurement by Q meter .

Unit-III :Non Electrical Quantities (Transducers):
Classification of Transducers, strain gauge, Displacement Transducer (LVDT) & (RVDT) ,(RTD) Thermistor, Thermocouple, Piezo- -Electric transducers, Optical Transducer, photo emissive, Photoconductive, photo voltaic, Photo diode, Photo Transistor, Nuclear Radiation Detector, Capacitive Transducer.

Unit –IV: Wave analyzer
(Frequency selective and Heterodyne) Harmonic Distortion Analyzer, Spectrum Analyzer Network analyzer, Single and Function Generators , sweep frequency generator, pulse and square wave Generator, Beat Frequency Oscillator
Digital display system and indicators, instruments used in computer controlled instrumentation RS 232 & IEEE 488, GPIB electric interface.

Unit-V : Digital Measurement and Instruments :
Advantages of Digital instruments over analog instruments, Digital to analog conversion (DAC) Variable resistive type R-2R Ladder Type, Binary ladder, Weighted converter using op amp and transistor, Practical DAC. Analog to digital conversion (ADC) ramp Technique, Dual slope Integrating Type, Integrating Type (voltage to frequency) Successive Approximations, digital voltmeters and multi-meters, Resolution and sensitivity of digital meter, PLC structure, Principal of operation, response time and application Digital panel meter, Data acquisition system.

References:

1. H.S. Kalsi : Electronics Instrumentation TMH
2. K.Sawhney : Instrumentation and Measurements, Dhanpat Rai and Co.
3. Helfric and Cooper : Modern Electronic Instrumentation and Measurement Techniques Pearson.

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	**ELECTRICAL MACHINE - II**	**EE-20**	Min "D"	Min "D"	5.0

ELECTRICAL MACHINE – II

Unit – I : Basic Principles of Three Phase Induction Motor :

Constructional details, types – squirrel cage, slip ring, principle of operation, production of rotating magnetic field, speed / slip, rotor current and voltage, torque developed, condition for max. torque, torque/slip and torque/speed characteristics, induced emf in stator and rotor winding.

Unit – II : Performance Analysis of Three Phase Induction Motor :

Rotor circuit model, stator circuit motor, complete equivalent circuit, referred to stator, approximate equivalent circuit, power flow diagram, circle diagram, no load & block rotor test, starters used with three phase induction motor- DOL, auto-transformer , star delta starter, effect of space harmonics on performance of three phase induction motor, cogging and crawling, different methods of speed control, pole changing, stator voltage control, variable frequency control.

Unit – III : Polyphase Synchronous Machine (Alternator)

Constructional details, advantages of rotating field, excitation system, EMF equation, armature winding coil span/pitch factor, distribution or breadth factor, armature leakage reactance, armature reaction in synchronous machine.

Synchronous impedance, equivalent circuit and phasor & equivalent Ckt. diagram of synchronous generator, voltage regulation, emf method, mmf method, ZPFC/potier delta method, two reaction theory, torque angle characteristic of salient pole synchronous machine determination of Xd & Xq, parallel operations of alternator, process of synchronization, significance of synchronizing power coefficient, transient condition of alternator, SCR cooling of synchronous machine.

Unit – IV : Polyphase Synchronous Machine (Motor)

Construction, principle of operation, main features of synchronous motor, torque developed, power flow equation for synchronous motor, phasor diagram, effect of varying field current, V & inverted V curves, starting of Synchronous motor, Hunting or phase swinging, application of synchronous motor.

Unit – V : Special Electric Motors :

Switch reluctance motor, linear induction motor, stepper motor, PMBLDC motor, AC series motor hysteresis motor their industrial application.

Books Recommended :

1. Electrical Machines by Nagrath & Kothari, TMH Publication
2. Electrical Machinery by P.S. Bhimbra, Khanna Pub.
3. AC Machine by Langsdorf, TMH Pub.
4. Electrical Technology by H.Cotton, CBS Pub.
5. Electrical Machines by Ashfaq Hussain, Dhanpat Rai Pub.

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	**ELECTROMAGNETIC THEORY**	**EE-22**	Min "D"	Min "D"	5.0

ELECTROMAGNETIC THEORY

Unit – I

Cartesian, cylindrical & spherical co-ordinate systems, scalar & vector fields, gradient, divergence & curl of a vector field, Divergence theorem & Stokes's theorem, concept of vectors.

Electrostatic Fields – Coulomb's law, electric field intensity due to different charge distribution viz. line charge, sheet charge, field due to continuous volume – electric potential, properties of potential function, potential gradient equipotential surfaces, line of force, Gauss law, applications of Gauss law, Gauss law in point form, method of images.

Unit – II

Laplace's poisson's equations, solution of Laplace's equation. Electric dipole, dipole moment, potential, electric field intensity due to dipole. Behavior of conductors in an electric field. Conductor & insulator, electric field inside a dielectric, polarization. Boundary value conditions for electric field. Capacitance & capacitances of various types of capacitors. Energy stored and energy density in static electric field. Current density, conduction & convection current density ohms law in point form, equation of continuity.

Unit – III

Static Magnetic Field, Biot-Savart's law, Magnetic Field intensity due to straight current carrying filament, circular, square and solenoidal current carrying wire. Relationship between magnetic flux, flux density & magnetic field intensity.

Ampere's circuital law and its applications, magnetic field intensity due to infinite sheet and various other configurations, Ampere's circuital law in point form. Magnetic force, moving charge in a magnetic field, Lorentz force on straight and long current carrying conductors in magnetic field, force between two long & parallel current carrying conductors. Magnetic dipole & dipole moment, a differential current loop as dipole, torque on a current carrying loop in magnetic field, Magnetic Boundary conditions.

Unit – IV

Scalar magnetic potential and its limitations, vector magnetic potential and its properties, vector magnetic potential due to different simple configurations; Self and Mutual inductances, determination of self & mutual inductances, self inductance of solenoid, toroid coils, mutual inductance between a straight long wire & a square loop. Energy stored in magnetic field & energy density.

Faraday's law, transformer & motional EMFs. Dislacement current, maxwell's equations as Generalization of circuit equations, Maxwell's equation in free space, Maxwell's equation for harmonically varying Field static and steady fields. Maxwell's equations in differential & integral form.

Unit – V

Electro Magnetic Waves : Uniform plane wave in time domain in free space, sinusoidally time varying uniform plane wave in free space, wave equation and solution for material medium, Uniform plane wave in dielectrics and conductors. Poynting vector theorem , instantaneous, average and complex pointing vector, power loss in a plane conductor, energy storage. Polarisation of waves. Reflection by conductors and dielectric – normal & Oblique incidence. Reflection at surface of a conducting medium surface impedance, transmission line analogy.

Note : Field plotting of electomegnetic systems on a PC using standard softwares. Application for low and high frequency devices, Suggested Softwares, GEMINI (Infolytica), ANSYS, ANSOFT, NISA.

Books Recommended :

1. Elements of Electromagnetic – Mathew N.O. Sadiku (Oxford)
2. Electromagnetic fields – P.V. Gupta (Dhanpat Rai)
3. Elements of Engineering Electromagnetic – N.N.Rao (PHI)
4. Engineering Electromagnetic – William H.Hayt (TMH)
5. Electromagnetic – John D. Kraus (Mc Graw Hill)
6. Electromagnetic wave & Radiating System – Jordan Balmian (PHI)
7. Fields and Wave Electromagnetic – David K. Cheng (Addison Wesley)
8. Electromagnetic Field – S.P. Seth (Dhanpat Rai & Sons)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	ELECTRICAL POWER GENERATION	EE-25	Min "D"	Min "D"	5.0

ELECTRICAL POWER GENERATION

UNIT-1

General consideration on various sources of energy, energy conversion employing steam, energy conversion using water gas turbine

a) MHD generation

b) Solar generation

c) Wind power station

d) Geothermal power generation.

UNIT-II

Thermal, nuclear and gas power station:

Block diagram of thermal power station, selection of site .Different types of auxiliaries used in thermal power station .Nuclear Power Station: Different types of reactors and fuels, safety methods, waste disposal.

Gas Power Station:

Block diagram, gas cycles, combined cycle power plants. Comparison between these power stations

UNIT-III

Hydro Power Station:

Choice of site, block diagram including surge tank and penstock, Hydrographs, flow duration curve .Types of turbines, base load and peak load power station.

UNIT-IV

Economic aspects of power plant operations:

Definitions, load factor, demand factor and Diversity factor. Calculation of cost of generation, fixed charges, interest and depreciations. Methods of Depreciation. Tariffs: different types of tariffs, power factor improvement**.**

UNIT-V

Economic Scheduling of Power Stations:

Economic operation of power system, criteria of loading of power plants with and without transmission loss, load dispatching in power system, co-generation and coordination of power plants.

References:

1 Nagpal," Power Plant Engineering", Khanna publisher

2 Deshpandey," Modern Design of Power Station".

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	POWER ELECTRONICS DEVICES & CIRCUITS	EE-30	Min "D"	Min "D"	5.0

POWER ELECTRONICS DEVICES & CIRCUITS

UNIT I

POWER SEMICONDUCTOR DEVICES

Power Diodes, transistors, power mosfet, IGBT, thyristors, characteristics, two- transistor equivalent model, turn on & off, techniques thyristor performance parameters, protection circuits & thermal design of thyristors, commutation techniques-forced and natural.

UNIT II

CONTROLLED RECTIFIERS

Principle of phase controlled converter operation, single-phase half wave, Full wave and semi converters. Three phase half wave, Full wave and semi converters Dual converters, power factor improvement, Symmetrical angle control, pulse width modulation control, effects of load and source inductance, Design of converter circuits, regulated DC power supplies.

Cyclo converter:

Principles of operation of single and three phase cyclo converters.

UNIT III

AC VOLATGE CONTROLLERS

Principle of phase control, single phase AC Voltage controllers with resistive and inductive loads. Three phase AC voltage controllers with resistive & inductive loads, Industrial applications of AC controllers. Unity power factor controller, design of AC controller.

UNIT IV

DC CHOPPER

Principles of step down & step up choppers, operation with R-L load, four quadrants choppers, thyristor chopper circuit, impulse commutation, effects of source inductance, chopper circuit design, switched mode power suppliers, and regulators.

UNIT V

INVERTER CIRCUITS

Principle of operation of inverter, single phase & three phase voltage source, inverter magnitude of voltage & harmonics control. forced commutation techniques, , current source inverters, inverter circuit design.

References:

1. M.H.Rashid," Power Electronics Circuit, Devices & Applications", Person publication,1993.
2. M.Ramsmoorthy, "An Introduction to transistor their Applications", affiliated East-West Press.
3. P.C.Sen "Power Electronics", TMH publication.
4. M.D.Singh, K.B.Khanchandani," Power Electronics", TMH, Delhi 2001.
5. Chakravarti A.," Fundamental of Power Electronics and Drives", Dhanpat Rai & Co.
6. Dr P.S. Bhimra," Power Electronics", Khanna Publication.
7. Vedam Subramanyam," Power Electronics" New Age International Revised II ed.2006.
8. Randal Shaffer, "Fundamental of Power Electronics with MATLAB learning" 2008.

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	**ELECTRICAL & ELECTRONICS INSTRUMENTATION LAB**	**EE-19L**	Min "D"	Min "D"	5.0

ELECTRICAL & ELECTRONICS INSTRUMENTATION LAB
(Suggested Exercise)

List of Experiments:-

1. Measurement of inductance of a coil using Anderson Bridge.
2. Measurement of capacitance of a capacitor using schering bridge.
3. LVDT and capacitance transducers characteristics and calibration.
4. Resistance strain gauge- Strain Measurement and calibration.
5. Measurement of R,L,C & Q using LCR-Q meter.
6. Study & measurement of frequency using Lissajous patterns.
7. Measurement of pressure using pressure sensor.
8. Study of Piezo-electric Transducer and Measurement of impact using Piezo-electric Transducer
9. Measurement of Displacement using LVDT.
10. Measurement of speed of a Motor using photoelectric transducer.
11. Study & Measurement using ph meter.
12. Temperature measurement & Control using thermo couple & using thermistor.

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	**ELECTRICAL MACHINE – II LAB**	**EE- 21L**	Min "D"	Min "D"	5.0

ELECTRICAL MACHINE – II LAB

(Suggested Exercise)

List of Experiments :

1. To perform load test on 3-phase induction motor & determine torque, output power, input power, efficiency, p.f. & slip.
2. To perform No-Load & Block rotor test on 3-phase induction motor
3. To determine regulation of Alternator using synchronous impedance method
4. To determine regulation of Alternator using Potier method.
5. To synchronize an incoming alternator to Busbar using bright & dark lamp method.
6. To determine V & inverted V curves of synchronous motor
7. Study of stepper motor.
8. Study of PMBLDC motor
9. Study of Switch Reluctance motor.

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E/PTDC	**POWER ELECTRONICS DEVICES & CIRCUITS LAB**	EE- 31L	Min "D"	Min "D"	5.0

POWER ELECTRONICS DEVICES & CIRCUITS LAB

(Suggested Exercise)

List of Experiments :

1. SCR characteristics
2. TRIAC characteristics.
3. MOSFET characteristics
4. IGBT characteristics

5. To study the different triggering circuits for thyristor.
   i. Resistor triggering circuit.
   ii. R-C triggering circuit
   iii. UJT triggering circuit.
6. AC voltage control by using TRIAC & DIAC

7. Study of 1-pulse & 2-pulse converter with R and L load.
8. Study of three phase semi converter & full converter with R and R-L load.
9. Study of single phase dual converter.
10. Study of single phase cycloconverter.
11. Study of Impulse commutated chopper.
12. Series & parallel inverter
13. Speed control of single phase induction motor.

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E.	**ELECTRICAL ENGINEERING SIMULATION LAB**	EE-51L	Min "D"	Min "D"	5.0

ELECTRICAL ENGINEERING SIMULATION LAB

(Suggested Exercise)

List of Experiments :

1. Computation of parameters and Modelling of Transmission lines.
2. Formation of bus admittance and impedance matrices
3. Solution of power flow using gauss-seidel method.
4. Short circuit analysis.
5. Solution of power flow using Newton-raphson method.
6. Load – frequency dynamics of single area power systems.
7. Load – frequency dynamics of two area power systems.
8. Transient and small signal stability analysis – single machineinfinite bus system.
9. Transient stability analysis – multi machine infinite bus system.
10. Economic dispatch in power systems.

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
B.E	**INDUSTRIAL TRAINING - I**	EE-26L	Min "D"	Min "D"	5.0

INDUSTRIAL TRAINING - I

The student shall go to an Industry at the end of Fourth Semester during summer and shall prepare a report on the Practical Training undergone there. He has to present the report in Fifth semester and assessment will be done by committee of two members (Headed by H.O.D. of the Department).

COURSE CONTENT & GRADE (w.e.f. July 2010)

Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE	**SEMINAR/GROUP DISCUSSION**	EE-61L	Min "D"	Min "D"	5.0

Objectives of Group Discussion & Seminar is to improve the Mass Communication and Convincing/ understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves.

Evaluation will be done by assigned faculty based on group discussion and power point presentation.