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. Fourth Year **Branch: Electrical Engineering** **SEM: Seventh**

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
		L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
					TA	CT	TOTAL			
EE-36	Power System Analysis	3	1	-	10	20	30	70	100	4
EE-38	High Voltage Engineering	3	1	-	10	20	30	70	100	4
EE-40	Electrical Drive	3	1	-	10	20	30	70	100	4
EE-42	Power System Planning & Reliability	3	1	-	10	20	30	70	100	4
Refer Table	Elective – I	3	1	-	10	20	30	70	100	4
(PRACTICAL/DRAWING/DESIGN)										
EE- 37L	Power System Analysis Lab	-	-	2	20	-	20	30	50	2
EE-39L	High Voltage Engineering Lab	-	-	2	20	-	20	30	50	2
EE-41L	Electrical Drive Lab	-	-	2	20	-	20	30	50	2
EE-44L	Major Project Planning	-	-	4	40	-	40	60	100	4
EE-45L	Industrial Training-II*	-	-	2	50	-	50	-	50	2
	Total	15	5	12	200	100	300	500	800	32

*Students will go for Industrial Training after VI semester in the summer vacations and will be assessed in VII semester.

T.A. = Teachers Assessment, CT= Class Test, ESE= End Semester Examination

Total Marks= 800, Total Periods= 32, Total Credits= 32

Elective-I					
EE-043A	1. Digital Control System	EE-043B	2. Generalized Theory Of Electrical Machine	EE-043C	3.Soft Computing Techniques

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	**POWER SYSTEM ANALYSIS**	EE-36	Min "D"	-	5.0

POWER SYSTEM ANALYSIS

Unit – I : General Problems associated with modern interconnected power Systems deregulation. Power system restructuring distributed generation congestion available transfer capacities pricing of energy and transmission service.

Unit – II : Power flow studies – Formulation of statics power flow equations and solutions using Gauss-seidel Newton Raphson and FDLF methods, comparison of these methods Economic operation of power system – Economic dispatch Emission dispatch line loss. ITI. Economic dispatch using lagrangian multiplier method.

Unit – III : MW Frequency control Coherency, control area, modeling of speed control mechanism load demping block diagrammatic representation of single and two area interconnected system. Static and dynamic response optimum parameter adjustment.

Unit – IV : MVAR Voltage control problem : Difference in control strategy over MW - f control characteristics of an excitation system DC AC and static excitation system. General block diagram representation of voltage regulators.

Unit –V : Power System stability – steady state dynamic and transients stability swing equation, equal are criterion solution of swing equation using step by step method modified Eulers method and Range Kuta method methods of improving transient stability.

Reference Books :

1. Modern Power System Analysis by I.J. Nagrath & D.P. Kothari Tata Mc Graw Hill Pub. Co. Ltd. 2nd edition.
2. Electrical Power Systems by C.L. wadhwa New Age International (p) LTd 2nd exition 1998
3. Reactive power control in Electric Systems by T.JE Millar John wiley &Son
4. T.K. Nagarkar, MS. Sokhija Power System Analysis, Oxford University press.
5. Elgerd O.I. Electric Energy Systems Theory. TMH New Delhi Second Edition 1983
6. Prabha Kundur Power system stability and control Mc Graw hill inc New York 1983
7. Taylor C.W. Power System Voltage Stability MC Graw Hill inc New Yark 1993
8. Nagrath I.J Kothari D.P. Power System Engineering Tata Mc graw hills New Delhi 1994
9. Weedy B.M. Electric Power System John Wiley and Sons 3rd edition.
10. P.S. R. Murthy Power System Operation and Control B.S. publication.

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	**HIGH VOLTAGE ENGINEERING**	EE-38	Min "D"	Min "D"	5.0

HIGH VOLTAGE ENGINEERING

Unit –I : Breakdown mechanism in gases : ionization, ionization processes, Townsend's mechanism, time lag for breakdown, Streamer theory, Paschen's law, effect of temprerature on B.D. Voltage, Desirable properties of a gaseous insulation, SF6 as an insulator, vacuum as a dielectric.

Unit – II : Breakdown of gases in uniform and non uniform fields : factors affecting time lag for BD, BD in a uniform AC field, BD under impulse voltage, volt time characteristics, B.D. in non uniform field, degree of non uniformity, effect of polarity of electrodes on B.E. voltage, Carona, carona loss on conductor at DC voltage, carona loss on conductor at AC voltage.

Unit – III : Breakdown in liquid and solids : Break down in liquids, classification of liquids, B.D. in pure liquids, B.D. in commercial liquids, different theories of B.D. in liquids, fifferent theories of B.E. in solids, intrinsic B.E. electromechanical B.D. thermal B.D. mechanism of B.D. occurring after prolonged operation, B.D. of composite dialectics.

Unit – IV : Generation of High Voltage : Impulse voltage, impulse voltage generation, single stage IG circuits- their analysis, multistage IG, constructional details of IG. Power transformer impulse testing, measurement of impulse voltage by sphere gap.

Unit – V : Generation of High AC voltage : Cascaded transformer, series resonant transformer, tesla coil, generation of high DC voltage- half and full wave rectifier, voltage double circuit, measurement of AC, DC high voltage, sphere gap, voltage dividers.

References :

1. M.S. naidu and V.Kamaraju, High Voltage Engineering, Tata Mc Graw Hill
2. D.V. Razevig "High Voltage Engineering" translated by Dr. M.P. Chourasia Khanna Pub.
3. Kuffel & Zingal High Voltage Engineering.
4. Kuffel & Abdulah, High Voltage Engg.
5. C.L. Wadhana " High Voltage Engineering"

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	**ELECTRICAL DRIVES**	EE-40	Min "D"	Min "D"	5.0

ELECTRICAL DRIVES

Unit I : Basic Concepts of Electric Drives : Elements of drive systems, Requirement of electric drives, Rating & Selection of drives, groups and individual drives, Constant power and Constant torque drives.
Motor Mechanism dynamics : Review of Characteristics of AC & DC motors, load characteristic, load-drive speed torque characteristics, quadrant speed torque characteristics. Mechanical Systems Stability of Electric drives, referred moment of inertia and torque of motor load combination, load equalization.

Unit II : DC Drives : Starting & Braking of conventional, Phase controlled and chopper controlled drives, Transient & Steady state analysis, Energy recovery systems.

Unit III : Induction Motor Drives : Conventional method of Starting braking and speed control, PWM, (VSI) Voltage source Inverter and Current Sources (CSI) fed IM drives, cyclo converter fed drive, Vector control drives.
Slip Controlled IM Drives : Review of Conventional methods & converter controlled-Crammers & Scherbius drives; rotor impedance control.

Unit IV : Synchronous Motors Drives : VSI and CSI fed; self-controlled-Brush less &. commutatorless dc & ac motor drives.

Unit V : Special Drives : Fundamentals of Switched reluctance motors, Stepper Motors, Permanent Magnet Motor Introduction to vector control; Digital control of drives.
Case Studies Electric traction, steel & cements plants, textile & paper mills, machine tool drive and CNC, electric cars.

References:

- Pillai S. K. "A first course on Electrical Drives", Second edition, Wiley Eastern.
- Dubey G. K., "Power Semiconductor Controlled Drives", Prentice-Hall, Englewood Cliffs! .
- Dubey G. K. , "Fundamentals of Electrical Drives". Narosa Publishing House.
- Bose B. K., "Power Electronics and AC Drives", Prentice-Hall.
- Murphy M. D., and Tumbuli F., "Power Electronic Control of AC Motors", Pergamon Press, Oxford University Press.
- P.V. Rao, "Power semiconductor Drives", BS Publications

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	**POWER SYSTEM PLANNING & RELIABILITY**	EE-42	Min "D"	-	5.0

POWER SYSTEM PLANNING & RELIABILITY

Unit-I : Review of Probability Theory : Element of probability theory Probability Distribution, Random variable, Density and distribution functions. Mathematical expectation. Binominal distribution, Poisson distributions, Normal distribution, Exponential distribution, Weibull distribution.

Unit-II : Reliability of Engineering Systems : Component reliability, Hazard models, Reliability of systems wit non-repairable components, series, Parallel, Series-Parallel, Parallel-series configurations. Non-series-parallel configurations, minimal tie-set, minimal cut-set and decomposition methods. Repairable systems, MARKOV process, Long term reliability, Power System reliability.

Unit-III : Reliability of Engineering Systems : Reliability model of a generating unit, State space methods, Combing states, sequential addition method, Load
modeling, Cumulative load model, merging of generation and load models, Loss of load probability, Percentage energy loss, Probability and frequency of failure, Operating reserve calculations.

Unit-IV : Power Network Reliability : Weather effect on transmission lines, Common mode failures, Switching after fauls, three, state components, Normally open paths, Distribution system reliability.

Unit-V : Composite System Reliability : Bulk Power supply systems, Effect of varying load, Inter connected systems, correlated and uncorrelated load models, Cost and worth of reliability.

Reliability Improvement & Testing : Proper Design simplicity, Component improvement Testing Plans, time censored & sequential reliability tests, accelerated life test, Environ mental test, Reliability estimations

References:

- J. Endreny, Reliability Modeling in Electric Power Systems, John Wiley & Sons.
- Roy Billinton & Ronald, N allan, Reliability Evaluation of Power Systems, Plenum Press, New York.

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	**DIGITAL CONTROL SYSTEM**	EE-043A	Min "D"	-	5.0

DIGITAL CONTROL SYSTEM

Unit - I : SAMPLING AND RECONSTRUCTION, Z-TRANSFORMS, Z-PLANE ANALYSIS OF DISCRETE TIME CONTROL SYSTEM.

Introduction Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.

Introduction, Linear difference equations, pulse response, Z- transforms, Theorems of Z transforms the inverse Z transforms, Modified Z Transforms.

Z Transform method for solving difference equations , pulse transforms function block diagram analysis of sampled data systems, mapping between s-plane and z-plane.

Unit – II : STATE SPACE ANALYSIS, CONTROLLABILITY AND OBSERVABILITY :

State space representation of discrete time systems pulse transfer function matrix solving discrete time state space equations state transition matrix and its properties, methods for computation of state transition matrix, Discretization of continuous time state space equations.

Concepts of Controllability and observability, controllability and observability conditions for pulse transfer function.

Unit – III : STABILITY ANALYSIS :

Mapping between the S-plane and the Z plane- primary strips and complementary strips- constant frequency loci, constant dampling ratio loci, stability analysis of close loop system in the Z plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

Unit –IV : DESIGN OF DISCRETE TIME CONTROL SYSTEM BY CONVENTIONAL METHODS.

Transient and steady – State response Analysis – Design based on the frequency response method Bilinear Transformation and Design procedure in the w-plane, lead lag and lead lag compensators and digital PID controllers.

Unit V : STATE FEEDBACK CONTROLLERS AND OBSERVERS :

Design of state feedback controller through pole placement Necessary and sufficient conditions. Ackerman's formula

State Observers – full order and Reduced order observer.

Reference Books :

1. Digital control Systems Kuo Oxford University Press 2nd Edition 2003
2. Digital Control and State Variable Methods by M. Gopal TMH

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	**GENERALISED THEORY OF ELECTRICAL MACHINES**	EE-043B	Min "D"	-	5.0

GENERALISED THEORY OF ELECTRICAL MACHINES

Unit - I : Generalised Theory : Conversions – Basic two pole machines – Transformer with movable secondary – Transformer voltage and speed voltage Kron's primitive machine Analysis of electrical machines.

Unit – II : Linear Transformation : Invariance of Power – Transformations from displaced brush axis, three phases to two phase, Rotating axes to stationary axes Transrormed impedance matrix Troque calculations.

Unit – III : DC Machines : Generalized Representation – Generator and motor operation – Operation with displaced brushes – Steady state and transient analysis – sudden short circuit – Sudden application on inertia load – Electric braking of DC motors.

Unit – IV : AC Machines : Synchronous Machines : Generalized Representation – Steady state analysis Transient analysis – Electromechanical transients. Induction Machines : Generalized representation performance equation – steady state analysis – Transient analysis Double case machine – Harmonics – Electric braking.

Unit- V : Special Machines : Generalized Representation and steady state analysis of Reluctance motor Brushless DC Motor – Variable Reluctance Motor Single phase series motor.

Reference Books :

1. Gupta J.B. Theory & Performance of Electrical Machines, S.K.Kataria & Sons, New Delhi 2010
2. Bimbhra P.S. Generalized Circuit Theory of Electrical Machines, Khanna Pub Ltd. 5th

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	**SOFT COMPUTING TECHNIQUES**	EE-043C	Min "D"	-	5.0

SOFT COMPUTING TECHNIQUES

UNIT-I : Review of probability theory: Random variable, distribution functions , function of random variable. generation of random digit, and random variants from various distribution function, Monte Carlo simulation, sampling distributions station evolution using MCS, confidence interval, coefficient of variation.

UNIT- II : propagation rule of training, RBF and FLN network.

UNIT-III : Draw back of classical optimization techniques, genetic algorithm; binary and real parameter GA, constraints handling in GA.

UNIT-IV
Evolution strategies(ES), two members non-recombinative ES, multi member ES, recombinative ES. Optimization based on swarm intelligence particle, swarm optimization and its variants .

UNIT-V : Application of soft computing techniques to problem of electrical engg. e.g. economic dispatch, reliableoptimization, ANN training using evolutionary algorithms.

References:

1. R.Y. Rubinstein Simulation and the Monte Carlo method, John Wiley & sons 1st Edition.
2 Paul. L. Mayer-Introducing probability and statical application, Addition Weslay.
3 Rajasekaran and pai- Neural Network, Fuzzy logic & Genetic Algorithms. PHI Learing
4 LiMin. Fu, Neural Networks in Computer Intelligence, 9th Reprint TMH
5 Multi objective optimization using evolutionary algorithm- Kalyanmoy Deb John Wiley & Sons Ltd.
6 Probability and Random processes for Electrical Engineering , Alberto Leon Garcia IInd Pearson .
7 Principles of soft computing- S N Shivanandan, S N Deepa Wiley India (P) Ltd, I edition 2007.
8 Hand book of genetic algorithm- Rajaserkharans, vijaya laxmi pai.
9 PSO Tutorial- Kennedy Ebuehart.
10 Sivanandam & Deepa- An Introduction to Neural Networks using Matlab 6.0 1st ed., TMH
11 M.Amirthavalli, Fuzzy logic and neural networks, Scitech publications.

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	**POWER SYSTEM ANALYSIS LAB**	EE-37L	-	Min "D"	5.0

POWER SYSTEM ANALYSIS LAB

Suggested Exercise :

List of Experiments:

1. To develop a program in Matlab for information of Y-bus matrix for N bus system.
2. Load flow solution for 3-bus system using Gauss-Seidel, Newton Raphson and FDLF methods up to 3 iteration.
3. Load flow solution for IEEE6-bus and 30-bus system in Matlab using Newton Raphson method.
4. Assessment of transient stability of a single machine system.
5. Effect of compensation on voltage profile of IEEE 6-bus system.
6. Study of any software tools (PSAT, EDSA, MY POWER, ETAP etc).

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	**HIGH VOLTAGE LAB**	EE-39L	Min "D"	Min "D"	5.0

HIGH VOLTAGE LAB

List of experiments :

1. Find out standard impulse wage 1.2/50 micro sec using impulse generator.
2. Impulse testing of power transformer.
3. Impulse testing of cable
4. To determine the breakdown voltage of sphere sphere gap
5. Rod rod gap
6. Needle needle gap
7. Needle plane gap
8. To determine the breakdown voltage of transformer oil
9. To find out string efficiency of insulators.

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	**ELECTRICAL DRIVE LAB**	EE-41L	Min "D"	Min "D"	5.0

ELECTRICAL DRIVE LAB

List of Experiments:

1. Study the starting and running characteristics of converter fed DC traction motor.
2. To study the energy recovery systems and braking of a DC drive.
3. To study the braking Methods of a three-phase induction motor.
4. To study the performance of VSI fed three-phase induction motor using PWM technique.
5. To control the speed of a three phase slip ring Induction motor using rotor impedance control.
6. To study the performance of Vector Controlled three phase Induction motor drive.
7. To Study frequency Controlled Synchronous motor drive.
8. To study the control & performance Characteristics of switched Reluctance motor.
9. To study the performance & control of a Stepper motor.
10. To Study the Performance of a permanent magnet Brushless dc motor drive.

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	**Major Project Planning**	EE-44L	-	Min "D"	5.0

Major Project Planning

COURSE GUIDELINES

The Major Project Work provides students an opportunity to do something on their own and under the supervision of a guide. Each student shall work on an approved project, which may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work involves sufficient work so that students get acquainted with different aspects of manufacture, design or analysis. The students also have to keep in mind that in final semester they would be required to implement whatever has been planned in the Major Project in this semester. It is possible that a work, which involves greater efforts and time may be taken up at this stage and finally completed in final semester, but partial completion report should be submitted in this semester and also evaluated by an external examiner. At the end of semester, all students are required to submit a synopsis.

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	**INDUSTRIAL TRAINING –II***	EE-45L	-	Min "D"	5.0

INDUSTRIAL TRAINING (4 weeks)

Student shall go to an Industry at the end of Sixth Semester during summer and shall prepare a report on the Practical Training undergone there. Student has to present the report in seventh semester and assessment will be done by committee (headed by HOD with faculty members of the department). Student has to submit a report of 30-40 pages (max) including certificate and cover pages.

1 OBJECTIVE OF INDUSTRIAL TRAINING

The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World of Work and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem and possibly an industry guide for their Major Project in final semester.

Industrial training of the students is essential to bridge the wide gap between the classroom and industrial environment. This will enrich their practical learning and they will be better equipped to integrate the practical experiences with the classroom learning process.

2 LEARNING THROUGH INDUSTRIAL TRAINING

During industrial training students must observe following to enrich their learning: - Industrial environment and work culture. - Organizational structure and inter personal communication. - Machines/ equipment/ instruments - their working and specifications. - Product development procedures and phases. Project planning, monitoring and control. - Quality control and assurance. - Maintenance system. - Costing system. - Stores and purchase systems. - Layout of Computer/ EDP/MIS centers. - Roles and responsibilities of different categories of personnel. - Customer services. - Problems related to various areas of Work etc. Faculty and TPO are supposed to plan industrial training in such a manner that students get exposure on most of the above arena in the field (world of work). Students are supposed to acquire the knowledge on above by -

1. Observation,
2. Interaction with officials at the workplace
3. Study of Literature at the workplace (e.g. User Manual, standards, maintenance schedules, etc.)
4. "Hand's on" experience
5. Undertaking / assisting project work.
6. Solving problems at the work place.
7. Presenting a seminar.
8. Participating in-group meeting/ discussion.
9. Gathering primary and secondary data/ information through various sources, Storage, retrieval and analysis of the gathered data.
10. Assisting officials and managers in their working.
11. Undertaking a short action research work.
12. Consulting current technical journals and periodicals in the library.
13. Discussions with peers.