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)

BE (PTDC) **Branch : Electrical Engineering** **Sem: Seventh**

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
		L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
					TA	CT	TOTAL			
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
EE-46	EHV AC & DC Transmission	3	1	-	10	20	30	70	100	4
Refer Table	Elective -I	3	1	-	10	20	30	70	100	4
(PRACTICAL/DRAWING/DESIGN)										
EE-41L	Electrical Drive Lab	-	-	2	20	-	20	30	50	2
EE-67L	Advance Electrical Drive Lab	-	-	2	20	-	20	30	50	2
EE-44AL	Major Project Planning	-	-	2	20	-	20	30	50	2
EE-51L	Electrical Engineering Simulation Lab	-	-	2	50	-	50	-	50	2
	Total	**12**	**4**	**8**	**150**	**80**	**230**	**370**	**600**	**24**

T.A. Teachers Assessment, CT- Class Test, ESE - End Semester Examination, Total Marks 600 Total Periods : 24, Total Credits : 24

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

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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(PTDC)	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

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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(PTDC)	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.

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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(PTDC)	EHV AC & DC TRANSMISSION	EE-46	Min "D"	-	5.0

EHV AC & DC TRANSMISSION

Unit-I

Constitution of EHV a.c. and d.c. links, Kind of d.c. links, Limitations and Advantages of a.c. and d.c. transmission, Principal application of a.c. and d.c. transmission, Trends in EHV a.c. and d.c. transmission, Power handling capacity. Converter analysis garetz circuit, Firing angle control, Overlapping.

Unit-II

FACTS devices, basic types of controller, series controller, static synchronous series compensator(SSSC), thyristor-controlled series capacitor(TCSC), thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), series-series controller, combined series-shunt controller, unified power flow controller(UPFC), thyristor controlled phase shifting transformer(TCPST).

Unit-III

Components of EHV d.c. system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonics generation, Adverse effects, Classification, Remedial measures to suppress, filters, Ground return. Converter faults & protection harmonics misoperation, Commutation failure, Multiterminal D.C. lines.

Unit-IV

Control of EHV d.c. system desired features of control, control characteristics, Constant current control, Constant extinction angle control. Ignition Angle control. Parallel operation of HVAC & DC system. Problems & advantages.

Unit-V

Travelling waves on transmission systems, Their shape, Attenuation and distortion, effect of junction and termination on propagation of traveling waves. Over voltages in transmission system. Lightning, switching and temporary over voltages: Control of lighting and switching over voltages

Reference:

1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,-" HVDC Transmission" john willy & sons pub.
3. Arrillaga,- "HVDC Transmission"2nd Edition ,IEE londan pub.
4. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
6. Narain.G. Hingorani, l. Gyugyi-"Undustanding of FACTS concept and technology", John Wiley & sons pub.
7. P.Kundur- "H.V.D.C. Transmission" McGraw Hill Pub.

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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(PTDC)	DIGITAL CONTROL SYSTEMS	EE-043A	Min "D"	-	5.0

DIGITAL CONTROL SYSTEMS

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

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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(PTDC)	GENERALISED THEORY OF ELECTRICAL MACHINES	EE-043B	Min "D"	-	5.0

GENERALISED THEORY OF ELECTRICAL MACHINES

Unit-I

Review : Primitive machine, voltage and torque equation. Concept of transformation change of variables & m/c variables and transform variables. Application to D.C. machine for steady state and transient analysis, and equation of cross field commutator machine.

Unit-II

Induction Machine : Voltage, torque equation for steady state operation, Equivalent circuit, Dynamic performance during sudden changes in load torque and three phase fault at the machine terminals. Voltage & torque equation for steady state operation of 1- ö induction motor & scharge motor.

Unit-III

Synchronous Machine : Transformation equations for rotating three phase windings, Voltage and power equation for salient and non salient alternator, their phasor diagrams, Simplified equations of a synchronous machine with two damper coils.

Unit-IV

Operational Impedances and Time Constants of Synchronous Machines: Park's equations in operational form, operational impedances and G(P) for a synchronous machine with four Rotor Windings, Standard synchronous machine Reactances, time constants, Derived synchronous machine time constants, parameters from short circuit characteristics.

Unit-V

Approximate Methods for Generator & System Analysis : The problem of power system analysis, Equivalent circuit & vector diagrams for approximate calculations, Analysis of line to line short circuit, Application of approximate method to power system analysis.

References:

- P.C.Krause, Analysis of Electric Machinery.
- B.Adkins, The General theory of Electrical Machines.
- B.Adkins & R.G.Harley, The General theory of AC Machines.
- P.S.Bhimbra, Generalised theory of Electrical m/c
- White & Woodson, Electro Mechanical Energy Conversion.

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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(PTDC)	SOFT COMPUTING TECHNIQUES & APPLICATIONS	EE-043C	Min "D"	-	5.0

SOFT COMPUTING TECHNIQUES & APPLICATIONS

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 :
Evolution of ANN artificial neurons. Activation function general network structure δ- rule, and back 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, reliable optimization, 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 L
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.

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Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE(PTDC)	**ADVANCE ELECTRICAL DRIVES LAB**	EE-67L	Min "D"	Min "D"	5.0

ADVANCE ELECTRICAL DRIVES 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.

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Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE(PTDC)	**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.

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Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE(PTDC)	**MAJOR PROJECT PLANNING**	EE-44AL	-	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.

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Course	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE(PTDC)	ELECTRICAL ENGINEERING SIMULATION LAB	EE-51L	-	Min "D"	5.0

ELECTRICAL ENGINEERING SIMULATION LAB

1. Introduction to lab view software and Elves hardware board
2. Displacement measurement using LVDT with lab view
3. Displacement measurement using straingnage with lab view.
4. Liquid level measurement using lab view.
5. Measurement of flow rate by Anemometer through lab view.
6. Measurement of temperature by RTD through lab view.

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