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 : Sixth

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
		L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
					TA	CT	TOTAL			
EE-32	Control System	3	1	-	10	20	30	70	100	4
EE-27	Signal & Systems	3	1	-	10	20	30	70	100	4
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
(PRACTICAL/DRAWING/DESIGN)										
EE-33L	Control System Lab	-	-	2	20	-	20	30	50	2
EE-39L	High Voltage Lab	-	-	2	20	-	20	30	50	2
EE-37L	Power System Analysis	-	-	2	20	-	20	30	50	2
EE-35AL	Minor Project	-	-	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

COURSE CONTENTS (w.e.f.)

Category of Course	Course Title	Course Code	Credits-4			Theory Papers
			L	T	P	
BE/PTDC	**CONTROL SYSTEM**	EE-32	3	1	-	Max. Marks-70 Min.Marks-22 Duration – 3 hrs.

CONTROL SYSTEM

UNIT-I

Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchros & Potentiometer), Servomotors (AC & DC), techogenerators, power amplifier, stepper motors.

UNIT-II

Time-domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants, Feedback control actions: Proportional, derivative and integral control.

UNIT-III

Concept of stability, Necessary condition for stability Hurwitz, Stability criterion, Relative stability analysis, Root locus technique.

UNIT-IV

Frequency response analysis and stability in frequency domain: Correlation between time and frequency response analysis, Polar plots, Bode plots, Effect of adding pole and zeros, Nyquist stability criterion, gain margin and phase margin, Relative stability from Nyquist plot, Frequency domain compensation, lead, lag, lag-lead compensation.

UNIT-V

State space analysis: Concept of state, state space representation of systems, Block diagram for state equation, Transfer function decomposition, Solution of state equation, Concept of controllability and observability.

REFERENCES:

- I.J. Nagrath and M. Gopal, "Control system Engineering", New Age International.
- K. Ogata, Modern Control Engineering, PHI.
- B.C. Kuo, Automatic Control systems, PHI
- Gopal M., Control System : Principles & Design, TMH.
- N.K. Sinha, Control Systems, New Age International
- Stefani, Shahian, Savant, Hostetter – "Design of feed back control System's", Oxford

COURSE CONTENTS (w.e.f.)

Category of Course	Course Title	Course Code	Credits-4			Theory Papers
			L	T	P	
BE/PTDC	**SIGNAL & SYSTEMS**	EE-27	3	1	-	Max. Marks-70 Min.Marks-22 Duration – 3 hrs.

SIGNAL AND SYSTEMS

Unit-I

Dynamic Representation of Systems: systems Attributes, Causality linearity, time-invariance. Special Signals, Complex exponentials, Singularity functions (impulse and step functions)..Linear Time-Invariant Systems: Differential equation representation convolution integral. Discrete form of special functions. Discrete Convolution and its properties. Realization of LTI system (differential and difference equations).

Unit-II

Fourier Analysis of Continuous Time Signals and Systems: Fourier Series, Fourier Transform and properties, Parseval's theorem, Frequency response of LTI systems. Sampling Theorem.

Unit-III

Fourier Analysis of Discrete Time Signals & Systems: Discrete-Time Fourier Series, Discrete-Time Fourier Transform (including DFT) and properties, Frequency response of discrete time LTI systems.

Unit-IV

Laplace Transform: Laplace Transform and its inverse: Definition, existence conditions, Region of Convergence and properties, Application of Laplace transform for the analysis of continuous time LTI system (stability etc.) Significance of poles & zeros.

Z-Transform: Z-Transform and its inverse: Definition, existence, Region of convergence and properties, Application of Z-Transform for the analysis of discrete time LTI systems, Significance of poles and zeros.

Unit-V

Sampling: The sampling theorem, reconstniction of Signal from its samples, sampling in the frequency domain, sampling of discrete-time signals.

References

1. Alan V. Oppenheim, Alan S. Will sky and H. Nawab, Signals and systems, Prentice Hall, 1997
2. Simon Haykin, Communication Systems, 3rd Edition, John Wiley, 1995

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

Category of Course	Course Title	Course Code	Credits-4			Theory Papers
			L	T	P	
BE/PTDC	**POWER SYSTEM ANALYSIS**	EE-36	3	1	-	Max. Marks-70 Min.Marks-22 Duration – 3 hrs.

POWER SYSTEM ANALYSIS

UNIT-I :*General*- Problems associated with modern interconnected power systems, deregulation, power systems restructuring, distributed generation, congestion, available transfer capacities, pricing of energy and transmission services.

UNIT-II : *Power flow studies*- Formulation of static 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, ITL economic dispatch using lagrangian multiplier method.

UNIT-III : *MW Frequency control*- Coherency, control area, modeling of speed control mechanism, load damping, 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 area criterion, solution of swing equation using step by step method modified Eulers method and Rnge-kutta method, methods of improving transient stability.

Reference Books:

1. Modern Power System Analysis-I.J. Nagrath & D.P Kothari Tata Mc Graw-Hill Publication Company Ltd 2nd edition.
2. Electrical Power Systems-by C.L. Wadhwa New Age International (P) Limited Publishers, 2nd edition 1998.
3. Reactive power Control in Electric Systems-by T.J.E. Miller, John Wiley & Sons.
4. T.K. Nagsarkar, M.S. Sukhiza, -"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 Theory" TMH, New Delhi, Second Edition 1983.
7. Taylor C.W., "Power System Voltage Stability", Mc-Graw Hill Inc, New York, 1993.
8. Magrath IJ, Kothari D.P., "Power System Engineering" Tata Mc-Graw Hill Inc, 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.
11. Power Generation, Operation and Control by A.J.wood & B.F. Wollenberg John Wiley &Sons Inc. 1984.
12. Power Systems Analysis-by Bergen Prentice Hali Inc.
13. Economic Operation of Power Systems-by L.K.Kirchmayer Wiley Eastern Lid.

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

Category of Course	Course Title	Course Code	Credits-4			Theory Papers
			L	T	P	
BE/PTDC	**HIGH VOLTAGE ENGINEERING**	EE-38	3	1	-	Max. Marks-70 Min.Marks-22 Duration – 3 hrs.

HIGH VOLTAGE ENGINEERING

UNIT-I :*Breakdown in gases*:

Mechanisms of breakdon in gases, various related ionization processes. Townsends and streamer theories. Paschen's Law, Breakdown in Non-uniform fields. Effect of wave shape of impressed voltage on the breakdown strength. Breakdown of sphere gap arid rod gap.

UNIT-II : *Breakdown in liquid and solids*:

Mechanisms of breakdown in liquids, suspended particle, suspended water, cavitation and tubble and electronic breakdown theories. Mechanisms of breakdown in solids; intrinsic electro-mechanical, erosion, surface, thermal and streamer, Relation between electric strength of solids and time, intrinsic breakdown strength.

UNIT-III : *Impulse Generator*:

Specifications of an impulse voltage Wave, standard impulse, reasons for adopting the particular shape, Analysis and control of simple circuit of impulse generator. Multistage impulse generator (Marks circuit) circuit working, ear thing arid tripping. Techniques to observe wave front on C.R.O.

Generation of High Voltage

Methods of generation of power frequency high voltage cascade transformers and resonance methods, Generation of high voltage d.c., voltage stabilization. Tesla coil.

UNIT-IV : *Measurement of High Voltage*:

Potential dividers-resistive, capacitive and mixed dividers for high voltage. Sphere gap; construction, mounting, effect of nearby earthed objects, humidity and atmospheric conditions, effect of irradiation and polarity, Electrostatic voltmeter; principle and classification, constructional details of and absolute electrostatic voltmeter. Oscilloscopes and their applications in applications in high voltage measurement.

UNIT-V : *High Voltage Testing*:

Measurement of insulation resistance of cables. Wet and dry flashover test of insulators. Testing of insulators in simulated polluted conditions. Testing off transformers and rotating machines. Measurement of breakdown strength of oil. Basic techniques of non-destructive testing of insulators; measurement of loss angle, High Voltage Schering bridge, and partial discharge measurement techniques.

Over Voltage and Insulation coordination

Lighting, Switching and temporary over voltages, BIL, SIL, methods of insulation coordination.

References:

- L.V. Bewley, "Traveling Waves on Transmission Systems" Wiley New York.
- M.S. Naidu and V. Kamaraju "High Voltage Engineering" Tata McGraw Hill.
- D.V. Razevig: "High Voltage Engineering", translated by Dr. M.P. Chourasia, khanna Publisher.
- Kuffel & Zingal, High Voltage Engg.
- Kuffel & Abdullanh, High Voltage Engg.

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	**CONTROL SYSTEM LAB**	EE- 33L	Min "D"	Min "D"	5.0

CONTROL SYSTEM LAB
Suggested Exercise :

List of Experiments :

- Time response of second order system.
- Characteristics of synchros.
- Effect of feedback on servomotors.
- Determination of transfer function of A-C servomotor.
- Determination of transfer function of D-C motor.
- Formulation of PI & PD controller and study of closed loop responses of I^{st} and II^{nd} order dynamic 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	
PTDC	**HIGH VOLTAGE LAB**	EE-39L	Min "D"	Min "D"	5.0

HIGH VOLTAGE LAB

Suggested Exercise :

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

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE/PTDC	**MINOR PROJECT**	EE-35AL	Min "D"	Min "D"	5.0

Study regarding field data/Laboratory investigating Analysis /Design of the subject related to civil Engineering.