Jabalpur Engineering College, Jabalpur

Semester VII Credit Based Grading System (CBGS) w.e.f. July 2018

Scheme of Examination

Bachelor of Engineering B.E. (Electrical Engineering)

Subject Wise Distribution of Marks and Corresponding Credits

Scheme of Examination w.e.f. July 2018 Acadamic Session 2018-19

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits	Total Marks
			Theory			Practical							
			End. Sem.	Mid Sem. MST	Quiz, Assignment	End Sem.	Lab Work		L	T	P		
1	EE7001	High Voltage Engineering	70	20	10	30	20	150	3	1	2	6	
2	EE7002	Electrical Drive	70	20	10	30	20	150	3	1	2	6	
3	EE7003	Power System Control	70	20	10	30	20	150	3	1	2	6	
4	EE7004	Elective-III	70	20	10	-	-	100	3	1	-	4	
5	EE7005	Elective-IV	70	20	10	-	-	100	3	1	-	4	
6	EE7006	Project-I	-	-	-	60	40	100	-	-	4	4	
7	EE7007	Industrial Training (Two Weeks)	-	-	-	30	20	50	-	-	2	2	
		Total	**350**	**100**	**50**	**180**	**120**	**800**	**15**	**5**	**12**	**32**	**800**

MST: Minimum of two mid semester tests to be conducted. **L: Lecture** **T: Tutorial** **P: Practical**

Department Elective-III (Three Subjects)			Department Elective-IV (Three Subjects)	
S.No.	Subject Code	Subject Name	Subject Code	Subject Name
1	EE7004A	Power System Planning & Reliability	EE7005A	Generalized Theory of Electrical Machines
2	EE7004B	Soft Computing Techniques	EE7005B	Digital Control System
3	EE7004C	Advance Digital Communication	EE7005C	Advanced Industrial Electronics

Controller (Exam.)
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

Registrar (Academic)
for Principal
Jabalpur Engineering College
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DEAN
Academic
JEC, Jabalpur (M.P.)

Principal
Jabalpur Engineering College
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Jabalpur Engineering College, Jabalpur
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Bachelor of Engineering (CBGS) Semester: VII (Electrical Engineering)

(w.e.f. July 2018)

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		Theory			Practical							
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work	Assignments Quiz, Term/Paper					
EE7001	High Voltage Engineering	70	20	10	30	10	10	150	3	1	2	5

Course Objectives:
The course is an advanced course in high voltage technology and electrical insulating materials. It deals with basic gaseous, liquid and solid dielectric breakdown theories. It also contains important experimental methods of high voltage generation and measurement. The course makes the students familiar with various applications where high voltage field is used.

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 temperature 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, Corona, corona loss on conductor at DC voltage, corona 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, different 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 & Abdullah, High Voltage Engg.
5. C.L. Wadhana, "High Voltage Engineering".

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 Outcomes:

Students should be able to:

1. Development of fundamentals of breakdown theories for gaseous dielectrics.
2. Analyze the breakdown theories for liquid dielectrics.
3. Describe the fundamentals of breakdown theories for solid dielectrics.
4. Compare the generating methods for high DC, AC, and impulse voltage.
5. Measure the high voltages for DC, AC and impulse waveforms.

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EE7002	ELECTRICAL DRIVES	70	20	10	30	10	10	150	3	1	2	5

Course Objective: This course will give the students a basic understanding of various methods of controlling electric machines for use in variable speed and positioning applications.

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

List of Experiments:

1. To perform speed-torque characteristics of separately excited DC motor using four-quadrant chopper by open loop and close loop control.
2. To perform four-quadrant speed-torque characteristics of a separately excited DC motor fed from single fully controlled converter in the armature, field.
3. To perform the speed control of single phase induction motor using V/F method, by open loop and closed loop control.
4. To perform the speed control of three phase induction motor using V/F method, by open loop and closed loop control.
5. To perform the speed control of three phase induction motor using vector control.
6. To perform the speed control of three phase induction motor using sensor-less vector control.
7. To perform speed-torque characteristics of permanent magnet synchronous motor using intelligent power module.
8. To perform speed-torque characteristics of permanent magnet brushless DC motor by open loop and closed loop control.
9. To perform speed-torque characteristics of Switched Reluctance Motor (SRM) using power module.

Course Outcome: After completion of this course students will be able to-

1. Describe element of electric drive system and dynamics of motor mechanism.
2. Elaborate the operation of dc motor drives to satisfy four-quadrant operation to meet mechanical load requirements.
3. Illustrate different types of induction motor drives and slip controlled IM drives.
4. Apply speed control techniques of synchronous motor drive on various industrial applications.
5. Explain different types of special motors and their speed control.

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EE7003	POWER SYSTEM CONTROL	70	20	10	30	10	10	150	3	1	2	5

Course Objectives:

- To learn the constitution of power systems, their operation in an economic mode and their control.
- To learn the concept of power system control through various power electronic controllers including state of art FACTS and SCADA controllers, their operational aspects and their capabilities and their integration in power flow analysis
- To impart learning about the power system controls namely MW-frequency control for modeling of speed control mechanism, static and dynamic response and optimum parameter adjustment in power system control.

POWER SYSTEM CONTROL

Unit – I: General -1 Problem associated with modern interconnected power systems, deregulation of electric utilities, Competitive market for generation, power system restructuring, congestion available transfer capacities, pricing of energy,

Unit – II: General – 2 Distribution in deregulated market, the development in competition, demand side management, Maintaining distribution planning, transmission expansion in new environment Transmission in open access, Unbundling Generation, Transmission and distribution, BOT, ISO power exchange (PX).

Unit – III: PS control- Introduction to SCADA, Introduction to Flexible AC Transmission System (FACTS), Voltage quality in power systems, Distributed generation.

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

Reference Books:

1. P.S. Kundur, Prabha Kundur, "Power System Stability and Control" ,McGraw Hill Education, 2005
2. D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Tata Mc-Graw Hill Publishing Company, Third Edition, 2008.
3. C.L. Wadhwa, "Electrical Power Systems", New-Age International Publishers", Sixth edition, 2009.
4. PSR Murthy," Power System Operation and Control", McGraw Hill Publishing.

Course Outcomes:

1. Optimize the cost of generation for interconnected power system
2. Manage the demand side load in distributed deregulated market.
3. Apply the power system control through various power electronic controllers including state of art FACTS and SCADA controllers.
4. Model the system for speed control mechanism in MW frequency control.
5. Utilize different control strategies for MVAR voltage control.

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EE7004 (A)	POWER SYSTEM PLANNING & RELIABILITY	70	20	10	-	-	-	100	3	1	-	4

Course Objective:

1. Be acquainted with the main concept of short term and long term planning.
2. Understand the load forecasting methodology, power costs and reactive power planning.
3. Acquainted with the categories of electric energy consumers.

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 modelling, 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 faults, three, state components, Normally open paths, Distribution system reliability.

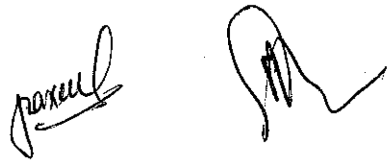
Unit-V: Composite System Reliability: Bulk Power supply systems, Effect of varying load, Inter connected systems, correlated and uncorrelated load models, Cost and worth of reliability.
Reliability Improvement & Testing: Proper Design simplicity, Component improvement Testing Plans, time censored & sequential reliability tests, accelerated life test, Environ mental test, Reliability estimations

References:

1. J. Endreny, Reliability Modelling in Electric Power Systems, John Wiley & Sons.
2. Roy Billinton & Ronald, Nallan, Reliability Evaluation of Power Systems, Plenum Press, New York.

Course Outcomes:

1. Understand the concept of probability theory, distribution, network modelling and reliability analysis.
2. Describe the reliability functions with their relationships and Markov modeling.
3. Evaluate reliability models using frequency and duration techniques and generate various reliability models.
4. Explicate the reliability of composite systems and distribution systems.



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		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work	Assignments Quiz, Term/Paper					
EE7005(B)	DIGITAL CONTROL SYSTEM	70	20	10	-	-	-	100	3	1	-	4

Course Objectives

The core course in electrical engineering introduces the fundamental concepts, principles and application of digital control system analysis and design to the students. The course cover classical control design methods as well as the modern control design techniques.

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 damping 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 Outcomes

Having successfully completed this module, students will be able to demonstrate knowledge and understanding of:

1. Z-Transform analysis of sampled data feedback loops
2. Stability theorems and root locus techniques
3. A suite of techniques for digital controller design
4. Optimal control design method
5. Design of state feed controllers and observers