SCHEME OF STUDIES AND EXAMINATIONS
FOR
MASTER OF TECHNOLOGY
IN
Electrical And Electronics Engineering
(POWER SYSTEMS)

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATIONS FOR MASTER OF TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING
(Specialization: Power Systems)
SEMESTER-I

S.No.	Course Code	Course Title	Teaching schedule			Class Work	Examination		Total
							Theory	Practical	
1	MTEPS1001	Microprocessors & Microcontroller	3	1	0	50	100	-	150
2	MTEPS1002	HVDC Transmission	3	1	0	50	100	-	150
3	MTEPS1003	Power System Operation and Control	3	1	0	50	100	-	150
4	MTEPS1004	Reactive Power Compensation & Management	3	1	0	50	100	-	150
5	MTEPS1005	Elective – I	3	1	0	50	100	-	150
6	MTEPS1006	Power Systems Laboratory	0	0	2	50	-	50	100
		Grand Total	15	5	2	300	500	50	850

NOTE:

1. **The paper setter shall set each theory paper of 100 marks covering entire syllabus. However the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of A^+ , A,B,C,D & E. The examination of practical courses shall also be evaluated on the basis of these grades.**
2. **The sessionals of theory and practical courses shall also be evaluated in the basis of these grades.**
3. **The choice of student for any elective shall not be binding on the department to offer it.**
4. **The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATIONS FOR MASTER OF TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING

(Specialization: Power Systems) SEMESTER-II

S.No.	Course Code	Course Title	Teaching schedule			Class Work	Examination		Total
							Theory	Practical	
1	MTEPS2001	Power System Dynamics and Stability	3	1	0	50	100	-	150
2	MTEPS2002	FACTS Controllers	3	1	0	50	100	-	150
3	MTEPS2003	Real Time Control of Power Systems	3	1	0	50	100	-	150
4	MTEPS2004	Advanced Power System Protection	3	1	0	50	100	-	150
5	MTEPS2005	Elective – II	3	1	0	50	100	-	150
6	MTEPS2006	Simulation Laboratory	0	0	2	50	-	50	100
		Grand Total	15	5	2	300	500	50	850

NOTE:

1. **The paper setter shall set each theory paper of 100 marks covering entire syllabus. However the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of A^+ , A,B,C,D & E. The examination of practical courses shall also be evaluated on the basis of these grades.**
2. **The sessionals of theory and practical courses shall also be evaluated in the basis of these grades.**
3. **The choice of student for any elective shall not be binding on the department to offer it.**
4. **The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATIONS FOR MASTER OF TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING
(Specialization: Power Systems) SEMESTER-III

S.No.	Course Code	Course Title	Teaching Schedule			Class Work	Examination		Total
			L	T	P		Theory	Practical	
1	MTEPS3001	Elective – III	3	1	0	50	100	-	150
2	MTEPS3002	Elective – IV	3	1	0	50	100	-	150
3	MTEPS3003	Seminar			2	50	-	50	100
4	MTEPS3004	Dissertation - Phase I	0	0	4	150	-	-	150
		Grand Total	6	2	6	300	200	50	550

NOTE:

1. **The paper setter shall set each theory paper of 100 marks covering entire syllabus. However the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of A^+ , A,B,C,D & E. The examination of practical courses shall also be evaluated on the basis of these grades.**
2. **The sessionals of theory , practical and Seminar courses shall also be evaluated in the basis of these grades.**
3. **The choice of student for any elective shall not be binding on the department to offer it.**
4. **The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATIONS FOR MASTER OF TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING
(Specialization: Power Systems)
SEMESTER-IV

S.No.	Course Code	Course Title	Teaching Schedule			Class Work	Examination		Total
			L	T	P		Theory	E.VIVA	
1	MTEPS4001	Dissertation Final Phase	0	0	20	200	-	400	600
		Total			20	200	-	400	600

NOTE:

1. **The sessionals of Dissertation shall be evaluated on the basis of grades i.e A^+, A,B,C,D & E.**
2. **The Dissertation shall be evaluated by an examination committee consisting of the head of the department, Dissertation Supervisor and one External examiner. The evaluation should be based on above grades.**
3. **The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATIONS FOR MASTER OF TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING
(Specialization: Power Systems)

LIST OF ELECTIVES

S.No.	Course Code	Course Title	Teaching Schedule			Class Work	Examination		Total
			L	T	P		Theory	Practical	
ELECTIVE-I									
1	MTEPS1005(i)	Electrical distribution System	3	1	0	50	100	-	150
2	MTEPS1005(ii)	EHVAC Transmission	3	1	0	50	100	-	150
3	MTEPS1005(iii)	Power Quality	3	1	0	50	100	-	150
ELECTIVE-II									
1	MTEPS2005(i)	AI Techniques	3	1	0	50	100		150
2	MTEPS2005(ii)	Insulation Technology	3	1	0	50	100		150
3	MTEPS2005(iii)	Advanced DSP	3	1	0	50	100		150
ELECTIVE-III									
1	MTEPS3001(i)	Digital Control Systems	3	1	0	50	100		150
2	MTEPS3001(ii)	Power System Reliability	3	1	0	50	100		150
3	MTEPS3001(iii)	PLC Controllers and their Applications	3	1	0	50	100		150
ELECTIVE-IV									
1	MTEPS3002(i)	Voltage Stability	3	1	0	50	100		150
2	MTEPS3002(ii)	Power System Deregulation	3	1	0	50	100		150
3	MTEPS3002(iii)	Demand-side Energy Management	3	1	0	50	100		150

***Student has to take one subject out of subjects offered by department from this list.**

NOTE:

1. **The paper setter shall set each theory paper of 100 marks covering entire syllabus. However the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of A^+ , A,B,C,D & E. The examination of practical courses shall also be evaluated on the basis of these grades.**
2. **The sessionals of theory , practical , Seminar and Dissertation courses shall also be evaluated in the basis of these grades.**
3. **The choice of student for any elective shall not be binding on the department to offer it.**
4. **The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).**

M.D UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATIONS FOR

MASTER OF TECHNOLOGY IN
Electrical And Electronics Engineering (Specialization: Power Systems)

The Performance of the student of M.Tech Power system Course shall be graded on the basis of percentage of marks and corresponding grades as mentioned below:

A)

Marks		**Grades**		
Marks				
85	≤	A^+	≤	100
75	≤	A	<	85
60	≤	B	<	75
50	≤	C	<	60
40	≤	D	<	50
00	≤	E	<	40

Letter Grades	**Performance**	**Division**
A^+	Excellent	First
A	Very Good	First
B	Good	First
C	Fair	Second
D	Pass	Third
E	Repeat	Fail

Note: The candidate who have passed all the semesters examination in the first attempt obtaining at least 75% marks in aggregate shall be declared to have passed in the first division with Distinction in the degree.

B)

Actual percentage of Marks Obtained and Corresponding grades should be mention on detailed marks certificate of student. To obtain "D" grade a student must have secure at least 40% marks in each subject of the semester Examinations.

C)

Students who earned an "E" grade or less than 40% marks in any subject shall Have re appear in that subject.

SEMESTER-I

MTEPS1001 MICROPROCESSORS & MICRO CONTROLLERS

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit-I: Register Organization of 8086, Architecture, Signal description of 8086, Physical memory Organization, addressing modes of 8086.

Unit-II : 8086/8088 instruction set and assembler directives, machine language instruction formats.

Unit-III: General Bus Operation, minimum mode 8086 system and timings, maximum mode 8086 system mode and timings

Unit–IV : Fundamental I/O considerations, Programmed I/O, Interrupt I/O, Block transfers and DMA.

Unit-V : Introduction to stack, stack structure of 8086/8088, Interrupts and Interrupt service routine, interrupt cycle of 8086/8088.

Unit-VI: Interfacing ROM, RAM and I/O ports to Micro Computer System, PPI (Programmable Peripheral Interface), 8255 modes of operation, Interfacing A to D converters, Interfacing D to A converters, Interfacing Pirnciples and stepper motor interfacing.

Unit-VII : Programmable Interval timer 8254, Programmable Interrupt Controller 8259A, Key Board or Display Controller 8279, Programmable Communication Interface 8251 USART.

Unit-VIII: Introduction to 8051/31 Micro Controller, PIN diagram, architecture, Different modes of Operation of timer/counters, addressing modes of 8051 and instruction set.

REFERENCE BOOKS

1. Microprocessors and Interfacing : Programming and Hardware by Douglas V. Hall, 2nd edition, TMH, New Delhi, 1999.
2. Micro Computer Systems : The 8086/8088 family by YU-CHENG LIU, GLENN A. GIBSON, 2nd edition, PHI India, 2000.
3. The 8051Microcontrollers : Architecture, Programming & Applications by Kenneth J Ayala, Second Edition, Penram International Publishing (India).
4. Advanced Microprocessors and Peripherals, Architecture Programmingand Interfacing by A.K. Ray & K.M. Bhurchandi, Forth reprint 2004, TMH.
5. The 8051 Microcontroller and Embedded Systems – Mohammad Ali Mazdi, Janice GillispieMazidi, Pearson Education (Singapore) Pvt. Ltd., 2003.

MTEPS1002 H.V.D.C. TRANSMISSION

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 :H.V.D.C. Transmission : General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration.

Unit 2 : Static Power Converters : 3-pulse, 6-pulse and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers.

Unit 3 : Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

Unit 4 : Control of HVDC Converters and systems : constant current, constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control.

Unit 5 : Interaction between HV AC and DC systems – Voltage interaction, Harmonic instability problems and DC power modulation.

Unit 6 : Multi-terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

Unit 7 : Transient over voltages in HV DC systems : Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults

Unit 8: Converter faults and protection in HVDC Systems: Converter faults, over current protection - valve group, and DC line protection, circuit breakers. Over voltage protection of converters, surge arresters.

REFERENCE BOOKS

1. K.R.Padiyar : High Voltage Direct current Transmission, Wiley Eastern Ltd., New Delhi – 1992.
2. E.W. Kimbark : Direct current Transmission, Wiley Inter Science – New York.
3. J.Arillaga : H.V.D.C.Transmission Peter Peregrinus ltd., London UK 1983
4. E.Uhlman : Power Transmission by Direct Current, Springer Verlag, Berlin Helberg – 1985.

MTEPS1003 POWER SYSTEM OPERATION AND CONTROL

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 : Unit commitment problem : Introductions to UCP, thermal &Hydral constraints in Unit commitment : Priority list scheme method, unit commitment problem solution by priority list scheme method,

Unit 2 : Unit commitment problem solutions by Dynamic programming Approach. Introduction, advantages of DP method over priority list scheme, Back word DP approach, forward DP approach algorithm and their flow charts solution UCP using Dynamic program method.

Unit 3 : Load Frequency Control-I : Necessity of keeping frequency constant. Definition of control area, single area control, Block diagram representation of an isolated Power System, Steady State analysis, Dynamic response-Uncontrolled case.

Unit 4 : Proportional plus Integral control of single area and its block diagram representation, steady state response, load frequency control and Economic dispatch control.

Unit 5 : Load Frequency Control-II : Load frequency control of 2-area system : uncontrolled case and controlled case, tie-time bias control.

Unit 6 : Optimal LF control-steady state representation, performance Index and optimal parameter adjustment.

Unit 7 : Generation with limited Energy supply : Take-or-pay fuel supply contract, composite generation production cost function. Solution by gradient search techniques, Hard limits and slack variables, Fuel scheduling by linear programming.

Unit 8 : Interchange Evaluation and Power Pools Economy Interchange, Economy interchange Evaluation, Interchange Evaluation with unit commitment, Multiple Interchange contracts. After-the-fact production costing, Transmission Losses in transaction Evaluation, other types of Interchange, power pools.

REFERENCE BOOKS

1. Electrical Energy Systems Theory - by O.I.Elgerd, Tata McGraw-Hill Publishing Company Ltd, 2nd edition.
2. Power System Analysis by HadiSaadat – Tata McGraw Hill Publications
3. Power Generation, Operation and Control - by A.J.Wood and B.F.Wollenberg,Johnwiley& sons Inc. 1984.
4. Modern Power System Analysis - by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company ltd, 2nd edition.

MTEPS1004 REACTIVE POWER COMPENSATION AND MANAGEMENT

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

UNIT I:Load Compensation

Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.

UNIT II: Steady – state reactive power compensation in transmission system:

Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples

UNIT III:Transient state reactive power compensation in transmission systems:

Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples

UNIT-IV:Reactive power coordination:

Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency – Harmonics, radio frequency and electromagnetic interferences

UNIT-V:Demand side management:

Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels

UNIT-VI:Distribution side Reactive power Management:

System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks

UNIT-VII:User side reactive power management:

KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations

UNIT-VIII: Reactive power management in electric traction systems and are furnaces: Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace

REFERENCE BOOKS

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982 (Units I to IV)
2. Reactive power Management by D.M.Tagare, Tata McGraw Hill, 2004.(Units V toVIII)

MTEPS1005(i) ELECTRICAL DISTRIBUTION SYSTEMS (ELECTIVE-I)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 : General : Introduction to Distribution systems, an overview of the role of computers in distribution system planning-Load modeling and characteristics: definition of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor-Relationship between the load factor and loss factor - Classification of loads (Residential, Commercial, Agricultural and Industrial) and their characteristics.

Unit 2 : Distribution Feeders and Substations : Design consideration of Distribution feeders: Radial and loop types of primary feeders, voltage levels, feeder-loading.

Unit 3 : Design practice of the secondary distribution system.

Location of Substations : Rating of a Distribution Substation, service area with primary feeders. Benefits derived through optimal location of substations.

Unit 4 : System analysis : Voltage drop and power loss calculations : Derivation for volt-drop and power loss in lines, manual methods of solution for radial networks, three-phase balanced primary lines, non-three-phase primary lines.

Unit 5 : Protective devices and coordination : Objectives of distribution system protection, types of common faults and procedure for fault calculation.

Unit 6 : Protective Devices: Principle of operation of fuses, circuit reclosers, line sectionalizer and circuit breakers. Coordination of protective devices : General coordination procedure.

Unit 7 : Capacitive compensation for power factor control: Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched) power factor correction, capacitor location. Economic justification.Procedure to determine the best capacitor location.

Unit 8 : Voltage control : Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

REFERENCE BOOKS

1. Electric Power Distribution System Engineering by Turan Gonen, Mc.Graw-Hill Book Company,1986.
2. Electric Power Distribution-by A.S. Pabla, Tata McGraw-Hill Publishing Company, 4th edition, 1997.

MTEPS1005(ii) **EHVAC TRANSMISSION (ELECTIVE-I)**

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 :E.H.V. A.C. Transmission , line trends and preliminary aspects ,standard transmission voltages – power handling capacities and line losses – mechanical aspects.

Unit 2 :Calculation of line resistance and inductance : resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductor lines and multi conductor lines, Maxwell's coefficient matrix.

Unit 3 : Line capacitance calculation : capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficients for bundled conductor lines, sequence inductances and capacitances and diagonalization.

Unit 4 : Calculation of electro static field of AC lines - Effect of high electrostatic field on biological organisms and human beings.

Unit 5 : Surface voltage Gradient on conductors, surface gradient on two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than 3 sub conductors, Mangolt formula.

Unit 6 : Corona : Corona in EHV lines – corona loss formulae – attenuation of traveling waves due to corona – Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.

Unit 7 : Power Frequency voltage control : Problems at power frequency, generalized constants, No load voltage conditions and charging currents, voltage control using synchronous condenser, cascade connection of components : Shunt and series compensation, sub synchronous resonance in series – capacitor compensated lines

Unit 8 : Static reactive compensating systems : Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

REFERENCE BOOKS

1. Extra High Voltage AC Transmission Engineering – Rakosh Das Begamudre, Wiley Eastem ltd., New Delhi – 1987.
2. EHV Transmission line reference book – Edision Electric Institute (GEC) 1986.

MTEPS1005(iii) **POWER QUALITY (ELECTIVE-I)**

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 : Power and Voltage Quality : General, classes of Power Quality Problems, Power quality terms, Power frequency variations, the power quality evaluation procedure.

Unit 2 : Voltage quality : Transients, long and short duration Voltage variations, Voltage imbalance, waveform distortion, Voltage Flicker.

Unit 3:Voltage sags and Interruptions :Sources of sags and Interruptions. Estimating Voltage sag performance.

Unit 4 : Fundamental Principles of Protection. Solutions at the end-user level. Evaluating Ride-through Alternatives. Motor-Starting Sags.

Unit 5 : Fundamentals of Harmonics : Harmonic distortion. Voltage versus Current distortion.Harmonic indexes.Harmonic sources from commercial loads.Harmonic sources from industrial loads.Locating Harmonic sources.System response characteristics.Effects of Harmonic Distortion.

Unit 6 : Distributed Generation and Power Quality : Resurgence of DG. DG Technologies. Interface to the Utility System. Power Quality Issues.Operating Conflicts. DG on distribution Networks . Siting DG distributed Generation, Interconnection standards.

Unit 7 :**Wiring and Grounding :** Resourses, Definitions, Reasons for Grounding, Typical wiring and grounding problems, Solution to wiring and grounding problems.

Unit 8 : Power Quality Monitoring : Monitoring Consideration. Historical Perspective of power quality measurement equipment. Assessment of Power Quality.

REFERENCE BOOKS

1. Electrical Power Systems Quality : By ROGER C. DUGAN, Electrotek Concepts Inc. (second edition)

MTEPS1006 POWER SYSTEM LABORATORY

L-T-P **Team Work Marks: 50**

3-1-0 **Practical Marks: 50**

Total Marks:100

Exam. Duration: 3 Hrs.

1. Determination of Sub-Transient Reactance of a Salient Pole Machine.
2. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine.
3. Fault Analysis of
   i) LG Fault
   ii) LL Fault
   iii) LLG Fault
   iv) LLLG Fault
4. Power Angle Characteristics of a Salient Pole Synchronous Machine.
5. Equivalent Circuit of a Three Winding Transformer.
6. Characteristics of IDMT Over Current Relay (Electro Magnetic Type).
7. Characteristics of Static Negative Sequence Relay.
8. Characteristics of Over Voltage Relay.
   i) Electromagnetic Type
   ii) Microprocessor Type
9. Characteristics of Percentage Biased Differential Relay.
   i) Electromagnetic Type
   ii) Static Type
10. Simulation of 220KV Transmission line model.
    i) Ferranti Effect
    ii) Transmission line parameter
    iii) Surge Impedance loadings
    iv) Voltage control methods
11. Transformer Oil Testing.

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & setup by the concerned institution as per the scope of the syllabus.

MTEPS2001 POWER SYSTEM DYNAMICS & STABILITY

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 : System Dynamics : Synchronous machine model in state space form , computer representation for excitation and governor systems –modelling of loads and induction machines.

Unit 2 : Stability – steady state stability limit – Dynamic Stability limit – Dynamic stability analysis.

Unit 3 : State space representation of synchronous machine connected to infinite bus, Time response – Stability by eigen value approach.

Unit 4 : Digital Simulation of Transient Stability : Swing equation, Machine equations

Unit 5 : Concept of Multimachine Stability, Multimachine Transient Stability Under Different Faulted Conditions.

Unit 6 : Effect of governor action and exciter on power system stability. Effect of saturation, saliency & automatic voltage regulators on stability.

Unit 7 : Excitation Systems : Rotating Self-excited Exciter with direct acting Rheostatic type, voltage regulator – Rotating main and Pilot Exciters with Indirect Acting Rheostatic Type Voltage Regulator.

Unit 8 : Rotating Main Exciter, Rotating Amplifier and Static Voltage Regulator – Static excitation scheme – Brushless excitation system.

REFERENCE BOOKS

1. Power System Stability by Kimbark Vol. I&II, III – 1968, Dover Publication Inc, New York 1968.
2. Power System control and stability by Anderson and Fund, Vol – I, P.M.Arolerson&A.A.fouad, Galgotia Publications 3B/12, UttarimargRajunder Nagar, New Delhi – 110060, 1981, 1 st edition.
3. Power System Dynamics Stability and Control by K.R.Padiyar, Second edition B.S.Publications 2002.
4. Computer Applications to Power Systems–Glenn.W.Stagg&Ahmed. H.El.Abiad
5. Power Systems Analysis & Stability – S.S.VadheraKhanna Publishers.
6. Power System Analysis by "HadiSaadat" – Tata McGraw Hill Publications
7. Power System Analysis by John J.Graniger William D.Stevenson. JR. – Tata McGraw Hill Publications.

MTEPS2002 FACTS CONTROLLERS

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 : Transmission interconnections, power flow in an AC System, loading capability limits, Power flow and Dynamic stability considerations, importance of controllable parameters.

Unit 2 : Opportunities for FACTS, basic types of FACTS controllers, benefits from FACTS controllers, Requirements and Characteristics of High Power devices – Voltage and Current rating, losses and speed of switching, parameter trade-off of devices.

Unit 3 : Basic concept of Voltage source converter, Single phase full wave bridge converter, Single phase-leg (pole) operation, Square-wave voltage harmonics for a single phase Bridge, 3 Phase full wave bridge converter.

Unit 4 : Transformer connections for 12 pulse, 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source converters, comparison of current source converters with voltage source converters.

Unit 5 : Objectives of shunt compensation, mid point voltage regulation for line segmentation, End of line voltage support to prevent voltage instability, improvement of transient stability, Power oscillation damping.

Unit 6 : Methods of controllable var generation: variable impedance type static var generators – TCR and TSR, TSC, FC-TCR, TSC-TCR, switching converter type var generators, hybrid var generators.

Unit 7 : SVC and STATCOM : The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping, operating point control and summary of compensation control.

Unit 8 : Static series compensators : Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.

REFERENCE BOOKS

1. Understanding FACTS,N.G.Hingorani and L.Guygi, IEEE Press, Standard Publications, 2001.
2. Flexible a c transmission system (FACTS), Edited by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London.

MTEPS2003 REAL TIME CONTROL OF POWER SYSTEM

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 : State Estimation : Different types of State Estimations, Theory of WLS state estimation, sequential and non-sequential methods to process measurements.

Unit 2 : Bad data Observability, Bad data detection, identification and elimination.

Unit 3 : Security and Contingency Evaluation : Security concept, Security Analysis and monitoring, Contingency Analysis for Generator and line outages by iterative linear power flow method, Fast Decoupled model, and network sensitivity methods.

Unit 4 : Computer Control of Power Systems : Need for real time and computer control of power systems, operating states of a power system,

Unit 5 : SCADA - Supervisory control and Data Acquisition systems implementation considerations, energy control centres, software requirements for implementing the above functions.

Unit 6 : Voltage Stability : What is voltage stability, voltage collaMTEPSe, and voltage security, relation of voltage stability to rotor angle stability.

Unit 7 : Voltage stability analysis Introduction to voltage stability analysis `P-V' curves and `Q-V' curves, voltage stability in mature power systems, long-term voltage stability, power flow analysis for voltage stability, voltage stability static indices and Research Areas

Unit 8 : Application of AI and ANN in Power System : Basic concepts and definitions, algorithms for load flow, short term load forecasting, fault diagnosis and state estimation.

REFERENCE BOOKS

1. John J.Grainger and William D.Stevenson, Jr. : Power System Analysis, McGraw-Hill, 1994, International Edition.
2. Allen J.Wood and Bruce F.Wollenberg : Power Generation operation and control, John Wiley & Sons, 1984.
3. R.N.Dhar : Computer Aided Power Systems Operation and Analysis, Tata McGraw Hill, 1982
4. L.P.Singh : Advanced Power System Analysis and Dynamics, Wiley Eastern Ltd. 1986.
5. PrabhaKundur : Power System Stability and Control -, McGraw Hill, 1994.
6. P.D.Wasserman : `Neural Computing : Theory and Practice' Van Nostrand-Feinhold, New York.

MTEPS2004 ADVANCE POWER SYSTEM PROTECTION

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 :CLASSIFICATION OF STATIC RELAYS : Basic construction of static relays, Classification of protective schemes, Comparison of Static relays with electromagnetic relays, Amplitude comparator,Phase comparator, Principle of Duality.

UNIT 2: AMPLITUDE AND PHASE COMPARATORS(2-INPUT):

Rectifier bridge circulating and opposed Voltage type- Averaging -phase splitting type - Sampling type of amplitude Comparison. Block spike type-Phase splitting type- Transistor integrating type-Rectifier bridge type- Vector product type Phase comparison.

Unit 3 STATIC OVER CURRENT RELAYS : Instantaneous- Definite time – Inverse time-Directional- IDMT- Very inverse Time-Extremely inverse time over current relays. Time current characteristics of Over current relays-applications

Unit 4 : DISTANCE PROTECTION: Impedance Relay: operating principle- relay Characteristic-Protective Schemes-Static Impedance Relay- Static reactance relay- static MHO relay-effect of arc resistance,effect of power surges,effect of line length and source impedance on performance of distance relays-Quadrilateral relay – Elliptical relay.-selection of distance relays

UNIT 5: PILOT RELAYING SCHEMES: Wire pilot protection:circulating current scheme-balanced voltage scheme-translay scheme-half wave comparison scheme- Carrier current protection: phase comparison type-carrier aided distance protection-operational comparison of transfer trip and bloking schemes-optical fibre channels

UNIT6: AC MACHINES AND BUS ZONE PROTECTION: Protection of Alternators: stator protection-rotor protection-over voltage protection-over speed protection-Transformer protection: earth faults in transformers-percentage differential protection-protection against magnetic inrush current-generator and transformer unit protection-Bus zone protection: differential current protection-high impedance relay scheme-frame leakage protection

Unit 7 : MICROPROCESSOR BASED PROTECTIVE RELAYS:

Introduction-over current relays-Impedance relay-Directional relay-Reactance relay.

Unit 8: PROTECTION AGAINST OVER VOLTAGES: Protection of transmission lines, stations, and substations against direct lightning strokes-protection against travelling waves-Insulation coordination.

REFERENCE BOOKS

1. Power system protection ---by TSM Rao.
2. Power system protection and switch gear--by Badri Ram& DN Vishwakarma.
3. Switch gear and protection---by MV Deshpande.
4. Protective relaying vol-2 ---by Warrington.
5. Power system protection and switch gear---by Ravindranath&Chandan.

MTEPS2005(i) AI TECHNIQUES (ELECTIVE-II)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit – I: Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models.introduction-neural network models-architectures-knowledge representation-learning process-learning tasks.

Unit- II:Feed Forward Neural Networks

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Unit–III: ANN paradigm-back propagation-RBF algorithms-Hope field networkS

Unit IV : Genetic algorithms-introduction-encoding-fitness function-reproduction operators

Unit V: Genetic modelling-genetic operators-cross over and mutation-generational cycle-convergence of genetic algorithm-

Unit – VI: Classical AND Fuzzy Sets

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT VII:Fuzzy Logic System Components

Fuzzification, Membership value assignment, development of rule base and decision making ystem, Defuzzification to crisp sets, Defuzzification methods.

UNIT VIII: Applications of Ai Techniques-load forecasting-load flow studies-economic load dispatch-load frequencycontrol-reactive power control-speed control of dc and ac motors

REFERENCE BOOKS

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

MTEPS2005(ii) INSULATION TECHNOLOGY (ELECTIVE-II)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

UNIT I GENERAL PROPERTIES OF INSULATING MATERIALS

Requirements for insulating materials - electrical properties - molecular properties of dielectrics - dependence of permittivity on temperature, pressure, humidity and voltage - permittivity of mixtures - practical importance of permittivity-behavior of dielectrics under alternating fields - complex dielectric constants-bipolar relaxation and dielectric loss - dielectric strength.

UNIT IIBREAKDOWN MECHANISMS IN GASEOUS DIELECTRICS

Behavior of gaseous dielectrics in electric fields-gaseous discharges-different ionization processes-effect of electrodes on gaseous discharge - Townsend's theory - streamer theory - electronegative gases and their influence on gaseous discharge - Townsend's criterion for spark break down-gaseous discharges in non-uniform fields - breakdown in vacuum insulation.

UNIT IIIBREAKDOWN MECHANISMS IN SOLID DIELECTRICS

Intrinsic breakdown of solid dielectrics - electromechanical breakdown - streamer breakdown and thermal breakdown of solid dielectrics - erosion-electrochemical breakdown - tracking in dielectrics and treeing.

UNIT IVBREAKDOWN MECHANISMS IN LIQUID DIELECTRICS

Electronic breakdown of - cavitation breakdown of liquid dielectrics - suspended particle theory of breakdown of liquid dielectrics.

UNIT VINSULATION MATERIALS

Natural inorganic insulating materials - synthetic inorganic insulating materials - natural organic insulating materials - synthetic organic insulating materials.

REFERENCE BOOKS

1. Adrianus, J.Dekker, "Electrical Engineering materials", Prentice Hall of India Pvt. Ltd., New Delhi, 1979
2. Van Vlack, "Elements of materials science", Addison Wesley, 1964
3. Kuffel, E., Zaengl, W.S. and Kuffel J., "High Voltage Engineering Fundamentals", Newness, Second Edition, Butterworth-Heinemann Publishers, New Delhi, 2000
4. Dissado. L.A., Fothergill. J.C, "Electrical Degradation and Breakdown in Polymers", Peter Peregrinus, 1992

MTEPS2005(iii) ADVANCED DSP (ELECTIVE)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

UNIT-I: Digital Filter Structure

Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-Digital Sine-cosine generator-Computational complexity of digital filter structures.

UNIT-II: Digital filter design

Preliminary considerations-Bilinear transformation method of IIR filter design-design of Low pass highpass-Bandpass, and Band stop- IIR digital filters-Spectral transformations of IIR filters- FIR filter design-based on Windowed Fourier series- design of FIR digital filters with least –mean- Square-error-constrained Least-square design of FIR digital filters

UNIT-III: DSP algorithm implementation

Computation of the discrete Fourier transform- Number representation-Arithmetic operations-handling of overflow-Tunable digital filters-function approximation.

UNIT-IV Analysis of finite Word length effects

The Quantization process and errors- Quantization of fixed -point and floating -point Numbers-Analysis of coefficient Quantization effects - Analysis of Arithmetic Round-off errors-Dynamic range scaling-signal- to- noise ratio in Low -order IIR filters-Low-Sensitivity Digital filters-Reduction of Product round-off errors using error feedback-Limit cycles in IIR digital filters- Round-off errors in FFT Algorithms.

UNIT V: Power Spectrum Estimation

Estimation of spectra from Finite Duration Observations signals – Non-parametric methods for power spectrum Estimation – parametric method for power spectrum Estimation-Estimation of spectral form-Finite duration observation of signals-Non-parametric methods for power spectrum estimation-Walsh methods-Blackman & torchy method.

REFERENCE BOOKS

1. Digital signal processing-sanjit K. Mitra-TMH second edition
2. Discrete Time Signal Processing – Alan V.Oppenheim, Ronald W.Shafer - PHI-1996 1st edition-9th reprint
3. Digital Signal Processing principles, algorithms and Applications – JohnG.Proakis -PHI – 3rd edition-2002
4. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C. Gnanapriya – TMH - 2nd reprint-2001
5. Theory and Applications of Digital Signal Proceesing-LourensR. Rebinar&Bernold
6. Digital Filter Analysis and Design-Auntonian-TMH

MTEPS2006 SIMULATION LABORATORY

L-T-P **Team Work Marks: 50**

3-1-0 **Practical Marks: 100**

Total Marks:100

Exam. Duration: 3 Hrs.

1. Y - Bus Formation.
2. Gauss – Seidel Load Flow Analysis.
3. Decoupled Load Flow Analysis.
4. Fast Decoupled Load Flow Analysis.
5. Load Flow Analysis for Distribution Systems.
6. Formation of Z-Bus.
7. Symmetrical and Unsymmetrical fault analysis using Z-Bus.
8. Economic load dispatch without and with transmission loss.
9. Unit Commitment Problem.
10. Hydro-Thermal scheduling problem.
11. Transient stability analysis using point by point method.
12. Step Response of Two Area System with Integral Control and Estimation of Tie Line Power Deviation using SIMULINK

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & setup by the concerned institution as per the scope of the syllabus.

MTEPS3001(i) DIGITAL CONTROL SYSTEMS (ELECTIVE-III)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1: Discrete data and digital Control Systems – basic elements, advantages and disadvantages, examples, - Impulse sampling and data hold – transfer functions of Zero order hold and First order hold.

Reconstructing original signals from sampled signals – sampling theorem, ideal low pass filter, frequency response characteristics of the Zero order hold.

Unit 2 : The Z-transform, Z transforms of some elementary functions, Important properties and theorems of the Z-transform, The inverse Z-transform, S-transform method for solving difference equations, the pulse transfer function, realization of digital controllers.

Unit 3: Mapping between the s-plane and the z-plane, the Jury stability test, stability analysis by use of the bilinear transformation and Routh stability criterion. Liapunov stability analysis of discrete time systems.

Unit 4: Transient response specifications, steady state error analysis. Design based on frequency response method, Analytical design method.

Unit 5: Concept of the state space method, State space representations of discrete time systems, solving discrete time state space equations. Discretisation of continuous time state space equations.

Unit 6: Controllability, Observability, Principle of Duality, Design via pole placement necessary and sufficient condition. Ackerman's formula, Dead Beat response.

Unit 7: State observers – necessary and sufficient condition for state observation, full order state observer, minimum order state observer.

Unit 8: Microprocessor and DSP control : Microprocessor control of control systems, single-board controllers with custom-designed chiMTEPS, DMC – 1005 board, digital signal processors – TMS 320 DSMTEPS, development system and support tools. Effects of finite word length and quantization on controllability and closed loop pole placement. Effect of quantization – least upper bound on quantization error.

REFERENCE BOOKS

1. Discrete-time Control Systems, 2nd edition K.OGATA, Pearson Education Asia.
2. Digital Control Systems : 2nd edition, B.C.KUO, Oxford University Press

MTEPS3001(ii) POWER SYSTEM RELIBILITY (ELECTIVE-III)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

UNIT – I **Basics of Probability theory & Distribution :** Basic probability theory – rules for combining probabilities of events – Bernoulli's trials – probabilities density and distribution functions – binomial distribution – expected value and standard deviation of binomial distribution.

UNIT – II **Network Modelling and Reliability Analysis :**Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method.

UNIT – III **Reliability functions :**Reliability functions f(t), F(t), R(t), h(t) and their relationships – exponential distribution – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF, MTTR, MTBF.

UNIT – IV **Markov Modelling :**Markov chains – concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities. – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models.

UNIT – V **Frequency & Duration Techniques :** Frequency and duration concept – Evaluation of frequency of encountering state, mean cycletime, for one , two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states.

UNIT – VI **Generation System Reliability Analysis** : Reliability model of a generation system– recursive relation for unit addition and removal – load modeling - Merging of generation load model – evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE.

UNIT – VII **Composite Systems Reliability Analysis :**Decompositions method – Reliability Indices – Weather Effects on Transmission Lines.

UNIT – VIII **Distribution System and Reliability Analysis :**Basic Concepts – Evaluation of Basic and performance reliability indices of radial networks.

REFERENCE BOOKS

1. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York.
2. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, New York.
3. An Introduction to Reliability and Maintainability Engineering. Charles E. Ebeling, TATA McGraw- Hill – Edition.

MTEPS3001(iii) **PLC CONTROLLER AND THEIR APPLICATIONS (ELECTIVE-III)**

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1:

PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

Unit 2:

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation.

Unit 3:

Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

Unit 4:

PLC Registers: Characteristics of Registers, module addressing, holding registers, input registers, output registers.

Unit 5:

PLC Functions: Timer functions and Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions.

Unit 6:

Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications.

Unit 7:

Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions.

Unit 8:

Analog PLC operation: Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning, PID functions.

REFERENCE BOOKS

1. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A.Reiss, Fifth Edition, PHI
2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.

MTEPS3002(i) VOLTAGE STABILITY (ELECTIVE-IV)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit 1 : Reactive Power flow and voltage stability in power systems**:** Physical relationship indicating dependency of voltage on reactive power flow - reactive power transient stability; Q-V curve; definition of voltage stability, voltage collapse and voltage security. Voltage collapse phenomenon, Factors of voltage collapse, effects of voltage collapse, voltage collapse analysis.

Reasons for aggravation of the problem.

Unit 2 : Power system loads : Load characteristics that influence voltage stability such as – Discharge lighting, Induction motor, Air conditioning and heat pumps, Electronic power supplies, Over Headlines and cables.

Unit 3 : Reactive Power compensation : Generation and absorption of reactive power – Reactive power compensators & voltage controllers : - shunt capacitors, synchronous phase modifier – static VAR system – on load tap changing transformer, booster transformers.

Unit 4 : Voltage stability static indices : Development of voltage collapse index – power flow studies – singular value decomposition – minimum singular value of voltage collapse – condition number as voltage collapse index.

Unit 5 :voltage stability margins & Improvement of voltage stability: Stability margins, voltage stability margin of un compensated and compensated power system . Dynamic voltage stability – voltage security , Methods of improving voltage stability and its practical aspects.

REFERENCE BOOKS

1. Performance operation and control of EHV power transmission SystemsAchakrabarti, D.P.Kothari, A.K. Mukhopadhyay, A.H. Wheeler publishing, 1995.
2. Power system Voltage stability - C.W. Taylor , Mc. Graw Hill, 1994

MTEPS3002(ii) POWER SYSTEM DEREGULATION (ELECTIVE-IV)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

UNIT I

Need and conditions for deregulation. Introduction of Market structure, Market Architecture, Spot market, forward markets and settlements. Review of Conceptsmarginal cost of generation, least-cost operation, incremental cost of generation.

Power System Operation: Old vs. New

UNIT II

Electricity sector structures and Ownership /management, the forms of Ownership and management. Different structure model like Monopoly model, Purchasing agency model, wholesale competition model, Retail competition model.

UNIT III

Framework and methods for the analysis of Bilateral and pool markets, LMP based markets, auction models and price formation, price based unit commitment, country practices.

UNIT IV

Transmission network and market power. Power wheeling transactions and marginal costing, transmission costing. Congestion management methods- market splitting, counter-trading; Effect of congestion on LMMTEPS- country practices

UNIT V

Ancillary Services and System Security in Deregulation. Classifications and definitions, AS management in various markets- country practices. Technical, economic, & regulatory issues involved in the deregulation of the power industry.

REFERENCE BOOKS

1. Power System Economics: Designing markets for electricity - S. Stoft
2. Power generation, operation and control, -J. Wood and B. F. Wollenberg
3. Operation of restructured power systems - K. Bhattacharya, M.H.J. Bollen andJ.E. Daalder
4. Market operations in electric power systems - M. Shahidehpour, H. Yaminand Z. Li
5. Fundamentals of power system economics - S. Kirschen and G. Strbac.
6. Optimization principles: Practical Applications to the Operation and Marketsof the Electric Power Industry - N. S. Rau
7. Competition and Choice in Electricity - Sally Hunt and Graham Shuttleworth

MTEPS3002(iii) DEMAND SIDE ENERGY MANAGEMENT (ELECTIVE-IV)

L-T-P **Team Work Marks: 50**

3-1-0 **Theory paper Marks: 100**

Total Marks:150

Exam. Duration: 3 Hrs.

NOTE: Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

Unit-1 : Energy Audit : Definitions-Need-concepts-Types of energy audit; Energy index – cost index – pieharts – Sankey diagrams.

Unit-2 : Energy Economics: Introduction-Cost benefit risk analysis-Payback period-Straight line depreciation-Sinking fund depreciation—Reducing balance depreciation-Net present value method-Internal rate of return method-Profitability index for benefit cost ratio.

Unit-3 : Energy Conservation in Electric utilities and Industry: Electrical load management: Energy and load management devices-Conservation strategies; conservation in electric utilities and industry: Introduction-Energy conservation in utilities by improving load factor-Utility voltage regulation-Energy conservation in Industries-Power factor improvement.

Unit-4 : Energy–efficient electric motors (EEMs) : Energy efficient motors-construction and technical features-case studies of EEMs with respect to cost effectiveness-performance characteristics; Economics of EEMs and system life cycle-direct savings and payback analysis-efficiency factor or efficiency evaluation factor

Unit-5 : Electric Lighting: Introduction-Need for an energy management program-Building analysis-Modification of existing systems-Replacement of existing systems-priorities: Illumination requirement : Task lighting requirements-lighting levels-system modifications-non illumination modifications-lighting for non-task areas-reflectances-space geometry; System elements.

Unit-6 : Light sources - characteristics of families of lamps-lamp substitution in existing systems-selection of Higher efficiency lamps for a new system-Luminaries-ballasts-energy conservation in lighting. White light LED and conducting Polymers.

Unit-7 : Space Heating ,Ventilation, Air-Conditioning(HVAC) and Water Heating: Introduction-Heating of buildings-Transfer of Heat-Space heating methods-Ventilation and air-conditioning-Insulation-Cooling load-Electric water heating systems-Energy conservation methods.

Unit-8 : Co-generation and storage: Combined cycle cogeneration-energy storage: pumped hydro schemes-compressed air energy storage(CAES)-storage batteries-superconducting magnetic energy storage (SMES)

REFERENCE BOOKS

1. Energy management Hand book by Wayne C.Turner, John Wiley and sons publications
2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publiching Company Ltd. New Delhi
3. Energy efficient electric motors selection and application by John C.Andreas
4. Hand book on Energy Audit and Management by Amitkumar Tyagi, published by TERI (Tata Energy Research Institute)
5. Energy management by Paul W.O' Callaghan McGraw Hill Book Company.
6. Energy conversion systems by Rakesh Das Begamudre, New Age International Publishers
7. Energy Management – by W.R.Murphy & G.Mckey Butterworths.

MTEPS3003(i) **SEMINAR**

L-T-P **Team Work Marks: 50**

0-0-2 **P/VV Marks: 50**

Total Marks:100

Exam. Duration: 3 Hrs.

Seminar shall be based on tentative topic on dissertation such as review paper on some specific well defined area/specialized stream of Electrical And Electronics Engineering. Each student has to prepare a write up of about 25 pages of "A4" size sheets and submit it in duplicate as the term work.

The student has to deliver a seminar talk in-front of faculty members of the department and his classmates. The faculty members, based on the quality of the work and preparation and understanding of the candidate, shall do an assessment of the seminar internally-jointly. Some marks should be reserved for the attendance of the student in the seminars of the others students.

MTEPS3004 **DISSERTATION-PHASE I**

L-T-P **Team Work Marks: 50**

0-0-20 **P/ viva Marks: 100**

Total Marks: 150

Exam Duration: 3 Hrs

The term work under this, submitted by the student shall include-

1. Work diary maintained by the student and counter signed by his guide.
2. The contents of work diary shall reflect the efforts taken by candidate for

(a) Searching the suitable project work
(b) Visit to different factories or organizations
(c) Brief report of journals and various papers referred
(d) Brief report of web sites seen for project work
(e) The brief of feasibility studies carried to come to final conclusion
(f) Rough sketches
(g) Design calculation etc. carried by the student

The student has to make a presentation in front of experts in addition to guide as decided by department head.

MTEPS4001 **DISSERTATION- FINAL PHASE**

L-T-P **Team Work Marks: 200**

0-0-20 **P/ viva Marks: 400**

Total Marks: 600

The dissertation submitted by the student on topic already approved by university authorities on the basis of initial synopsis submitted by the candidate shall be according to following guidelines Format of dissertation report-

The dissertation work report shall be typed with double space on A4 bond paper. The total number of pages not more than 150 and not less than 60. Figures, graphs, annexure etc. be added as per requirement. The report should be written in the following format:

1. Title sheet
2. Certificate
3. Acknowledgement
4. List of figures/ photographs/ graphs/ tables
5. Abbreviations
6. Abstract/ final synopsis
7. Contents
8. Text with usual scheme of chapters
9. Discussion of the results and conclusion
10. Bibliography (The source of illustrative matter should be acknowledge clearly at appropriate place)