M.D UNIVERSITY,ROHTAK
SCHEME OF STUDIES AND EXAMINATION
B.Tech. III YEAR (ELECTRICAL & ELECTRONICS ENGINEERING)
SEMESTER - VI
Modified 'F' Scheme effective from 2011-12

Course No.	Course Title	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
EE-312-F	Power Systems –II (EE, EEE)	3	1	-	4	50	100	-	150	3
EE-314-F	Computer Added Electric Machines Design (EE, EEE)	3	1	-	4	50	10 0	-	150	3
EE-306-F	VLSI Design	3	1	-	4	50	100	-	150	3
EE-304-F	Control systems engg. (EE, EEE,ECE)	3	1	-	4	50	100	-	150	3
EE-318-F	Electric Power Generation (EE, EEE)	3	1	-	4	50	100	-	150	3
EE-344-F	Transmission Lines And Networks	3	1	-	4	50	100	-	150	3
EE-324-F	Control system engg. Lab (EE, EEE,ECE)	-	-	2	2	25	-	25	50	3
EE-330-F	VLSI Design Lab	-	-	2	2	25	-	25	50	3
EE-326-F	Computer Added Electric Machines Design Lab (EE, EEE)	-	-	2	2	25	-	25	50	3
EE-328-F	Power Systems Lab (EE, EEE)	-	-	2	2	25	-	25	50	3
GPEE-302-F	General Proficiency	-	-	-	-	50	-	-	50	3
	TOTAL	**18**	**6**	**8**	**32**	**450**	**600**	**100**	**1150**	

1. **Each student has to undergo practical training of 6 weeks during summer vacation and its evaluation shall be carried out in the VII semester.**
2. **Students will be allowed to use non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.**

EE-312-F **POWER SYTEMS - II**

L	T	P
3	1	-

Theory : 100 Marks
Class work : 50 Marks
Total : 150 Marks
Duration of Exam : 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

SYMMETRICAL FAULT ANALYSIS: Transients on a transmission line, short circuit of synchronous machine at no load and on full load.

SYMMETRICAL COMPONENTS: Symmetrical component transformation, phase shift in star-delta transformation, sequence impedances.

UNSYMMETRICAL FAULT ANALYSIS: Single line to ground fault, line to line fault, double line to ground fault, open conductor fault.

Section-B

CIRCUIT BREAKERS: Theory of arc interruption, circuit breaker, circuit breaker ratings, restriking voltage transients, current chopping, duties of switch gear, automatic switch, air circuit breaker, bulk oil, minimum oil, air blast, SF6 CB, vacuum and DC circuit breakers.

APPARATUS PROTECTION: Transformer, generator, motor and bus zone protection.

Section-C

PROTECTIVE RELAYS: Nature and causes of faults, consequences, zone of protection, essential qualities, primary and backup protections, relay classification, principal types of electromagnetic relays, i.e. attracted armature, induction disc, induction cup types.

RELAY APPLICATION AND CHARACTERISTICS: Over -current, instantaneous over current, IDMT, directional and differential relays, distance relays, plain impedance, mho, reactance, offset mho type, transmission line & feeder protection, introduction, over current, distance, pilot wire and carrier current protection, neutral grounding.

Section-D

STATIC & DIGITAL RELAYS: Classification of static relays, amplitude and phase comparators, block-spike and block-average comparators , rectifier type relays. Introduction to digital relay: basic principles. Application of microprocessors and computers - recent Trends. Travelling wave relay, relaying schemes based on microwave and optical fiber link.

TEXT BOOKS:

1. Power System protection and switchgear –B.Ram, D.N.Vishvakarma : TMH.
2. Switchgear and protection - S.S.Rao : Khanna Pub.

REF. BOOKS:

1. Protective Relays -Their Theory and Practice Vol.I & II: W.Van Warrington.
2. Advanced power system analysis and dynamics: L.P.Singh, Wiley Eastern N.Delhi.
3. Digital Protection : Protective relay from Electro Mechanical to Microprocessor-L.P.Singh,Wiley Eastern.
4. Power System Protection and Switchgear -B.Ravinder Nath and M.Chander, Wiley Eastern,N.Delhi.
5. A course in Electrical Power - Soni, Gupta and Bhatnagar - Dhanpat Rai & Sons.
6. Power System Engg: I.J. Nagrath and D.P. Kothari(TMH).
7. Power System Engineering: V. K. Mehta.

EE-314-F COMPUTER ADDED ELECTRIC MACHINES DESIGN

L	T	P		
3	1	-	Theory	: 100 Marks
			Class work	: 50 Marks
			Total	: 150 Marks
			Duration of Exam	: 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

GENERAL: General features and limitations of electrical machine design. Types of enclosures, heat dissipation, temperature rise heating and cooling cycles and ratings of machine machines. Cooling media used.

BASIC DESIGN PRINCIPLES: Output equation and output coefficient, Specific electric and magnetic loading. Effect of size and ventilation.

Section-B

MAGNETIC CIRCUITS: MMF calculation for airgun and iron parts of electrical machines, gap contraction coefficient. Real and apparent flux densities. Estimation of magnet current of transformers and rotating machines, no load current of transformers and induction motors. Leakage flux and reactance calculations for transformers and rotating machines, Design of field magnet.

Section-C

DETAILED DESIGN: Design of transformer, D.C. machines induction motor and synchronous machine and their performance calculations.

Section-D

COMPUTER AIDED DESIGN: Computerization of design Procedures. Development of Computer program and performance prediction. Optimization techniques and their applications to design Problems.

TEXT BOOKS:

1. A course in Electrical Machine Design by A.K. Sawhney, Khanna Pub.

REFERENCE BOOKS:

1. Theory, performance and Design of alternating current machines by MG Say, ELBS, 15th Ed. 1986.
2. Theory, Performance and Design of Direct Current machines by A.E. Clayton, 3rd Ed. 1967.
Optimization Techniques, S.S. Rao

EE-306-F **VLSI DESIGN**

L	T	P
3	1	-

Theory : 100 Marks
Class work : 50 Marks
Total : 150 Marks
Duration of Exam : 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

BASIC MOS TRANSISTOR : Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – Second order effects – MOS Transistor Model.

Section-B

NMOS & CMOS INVERTER AND GATES : NMOS & CMOS inverter – Determination of pull up / pull down ratios – Stick diagram – Lamda based rules – Super buffers – BiCMOS & steering logic.

Section-C

SUB SYSTEM DESIGN & LAYOUT: Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

Section-D

DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAY LOGIC : NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA**.**

VHDL PROGRAMMING: RTL Design – Combinational logic – Types – Operators – Packages – Sequential circuit – Sub-programs – Test benches. (Examples: address, counters, flipflops, FSM, Multiplexers / De-multiplexers).

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New Delhi, 2003.
2. Introduction to Digital Integrated Circuits : Rabaey,Chandrakasan & Nikolic.
3. Principles of CMOS VLSI Design : Neil H.E. Weste and Kamran Eshraghian; Pearson.

REFERENCE BOOKS

1. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Education, India, 2002
2. VLSI Technology: S.M. Sze; McGraw-Hill.

EE-304-F **CONTROL SYSTEM ENGINEERING**

L	T	P		
3	1	-	Theory	: 100 Marks
			Class work	: 50 Marks
			Total	: 150 Marks
			Duration of Exam	: 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

INTRODUCTORY CONCEPTS :System/Plant model, types of models, illustrative examples of plants and their inputs and outputs, controller servomechanism, regulating system, linear time-invariant (LTI) system, time-varying system, causal system, open loop control system, closed loop control system, illustrative examples of open-loop and feedback control systems, continuous time and sampled data control systems. Effects of feedback on sensitivity (to parameter variations),stability, external disturbance (noise), overall gain etc. Introductory remarks about non-linear control systems.

Section-B

MATHEMATICAL MODELLING : Con**c**ept of transfer function, relationship between transfer function and impulse response, order of a system, blockdiagram algebra, signal flow graphs : Mason's gain formula & its application, characteristic equation, derivation of transfer functions of electrical and electromechanical systems. Transfer functions of cascaded and non-loading cascaded elements. Introduction to state variable analysis and design.

Section-C

TIME DOMAIN ANALYSIS : Typical test signals, time response of first order systems to various standard inputs, time response of 2nd order system to step input, relationship between location of roots of characteristics equation, w and wn, time domain specifications of a general and an under-damped 2nd order system, steady state error and error constants, dominant closed loop poles, concept of stability, pole zero configuration and stability, necessary and sufficient conditions for stability Hurwitz stability criterion Routh stability criterion and relative stability. Root locus concept, development of root loci for various systems, stability considerations..

Section-D

FREQUENCY DOMAIN ANALYSIS , COMPENSATION & CONTROL COMPONENT :Relationship between frequency response and time-response for 2nd order system, polar, Nyquist, Bode plots, stability, Gain-margin and Phase Margin, relative stability, frequency response specifications.

Necessity of compensation, compensation networks, application of lag and lead compensation, basic modes of

feedback control, proportional, integral and derivative controllers, illustrative examples.

Synchros, AC and DC techo-generators, servomotors, stepper motors, & their applications, magnetic amplifier.

TEXT BOOK :

1. . Control Systems :Anuj Jain & Naveen mehra vayu education
2.Control Systems - Principles & Design : Madan Gopal; Tata Mc Graw Hill.
3. Control System Engineering : I.J.Nagrath & M.Gopal; New Age

REFERENCE BOOKS :

1. Automatic Control Systems : B.C.Kuo, PHI.
2. Modern Control Engg : K.Ogata; PHI.

EE-318-F ELECTRICAL POWER GENERATION

L	T	P
3	1	-

Theory : 100 Marks
Class work : 50 Marks
Total : 150 Marks
Duration of Exam : 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

INTRODUCTION: Energy sources, their availability, Recent trends in Power Generation, Interconnected Generation of Power Plants.

Section-B

POWER GENERATION PLANNING: Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of power generation, Depreciation, tariff.

Section-C

CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, classification, Schematic diagram and working of Thermal Power Stations, Hydro Electric Plant, Nuclear Power Plant and Diesel Power Stations.
NON-CONVENTIONAL ENERGY SOURCES: Wind, Solar, Tidal, Ocean, and Geothermal sources of Energy, fuel cell, Magneto Hydro Dynamic (MHD) system.

Section-D

ELECTRIC ENERGY CONSERVATION & MANAGEMENT: Energy management, Energy Audit, Energy Efficient Motors, Co-generation.

TEXT BOOKS:
1. Electric Power Generation, B.R.Gupta
2. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons,1984.

REF. BOOKS:
1. A Course in Electric Power System, Soni, Gupta, Bhatnagar, Dhanpat Rai & Sons
2. Power System Engineering, Nagrath & Kothari, Tata Mc-Graw Hill, New Delhi
3. Power Plant Engg: G.D. Rai
4. Electric Power: S.L. Uppal (Khanna Publishing)

EE-344-F **TRANSMISSION LINES AND NETWORKS**

L	T	P
3	1	-

Theory : 100 Marks
Class work : 50 Marks
Total : 150 Marks
Duration of Exam : 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section A

INTRODUCTION

Fundamental quantities; Primary Constants of Transmission line; loop Inductance; Shunt Capacitance; loop Resistance; Skin effect; Transmission line equations; characteristic Impedance; Propagation Constant; Computation of Primary and Secondary Constants.

OPEN, SHORT AND TERMINATED LINES

Reflected and incident waves; standing waves in open and short-circuited lines; Input Impedance of open and short-circuited lines; Transmission lines as circuit Elements; Input Impedance of terminated lines; Reflection Co-efficient; Standing wave Ratio; Reflection loss due to mismatching; Efficiency.

Section B

POWER LINES

Transmission of Electrical Energy; Overhead transmission lines; Characteristics of low frequency transmission lines, Effect of length; calculation of Inductance, Capacitance; circle diagram, Receiving-end power diagrams, sending-end power diagram;

Section C

TRANSMISSION LINES MEASUREMENTS

The Measurement of standing wave Ratio, Wavelength, Impedance, Power and Reflection Co-efficient; Special Impedance Measuring methods; Measurement of standing waves in wave guides; Measurement of Insertion loss.

Section D

EQUALIZERS AND FILTERS

Classification of Equalizers; Inverse Impedance and inverse Network; full series Equalizer, full shunt Equalizer and Bridge – T Equalizer; Lattice Equalizer; Characteristics of Equalizers; Equalizer for Transmission for Digital Data; Active Filters, First order and second order Butterworth filter; universal active filters.

ATTENUATORS:

Symmetrical Attenuators, Symmetrical T-Attenuator, Π-Attenuator, Bridged T-Attenuator, Lattice Attenuators; A Symmetrical T-Attenuator, L-Attenuator, Π-Attenuator; Minimum loss Attenuator, Attenuator for variable load; Balanced and unbalanced Attenuators; Ladder Attenuators.

TEXT BOOKS:

Transmission Lines and Networks by UMESH SINHA, Satya Prakashan.

EE-324-F **CONTROL SYSTEM LAB**

L T P			
0 0 2	CLASS WORK	:	25
	EXAM	:	25
	TOTAL	:	50
	DURATION OF EXAM	:	3 HRS

LIST OF EXPERIMENTS:

1. To study speed Torque characteristics of
   a) A.C. servo motor
   b) DC servo motor .
2. (a) To demonstrate simple motor driven closed loop DC position control system.
   (b) To study and demonstrate simple closed loop speed control system.
3. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots .
4. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing
   number of steps, direction of rotation & speed.
5. To implement a PID controller for temperature control of a pilot plant.
6. To study behavior of 1 order,2 order type 0,type 1 system.
7. To study control action of light control device.
8. To study water level control using a industrial PLC.
9. To study motion control of a conveyor belt using a industrial PLC

MATLAB BASED (ANY FOUR EXPT.)

10. Introduction to MATLAB (Control System Toolbox), Implement at least any
    - Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox.
    - Determine transpose, inverse values of given matrix.
    - Plot the pole-zero configuration in s-plane for the given transfer function.
    - Plot unit step response of given transfer function and find peak overshoot, peak time.
    - Plot unit step response and to find rise time and delay time.
    - Plot locus of given transfer function, locate closed loop poles for different values of k.
    - Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.
    - Plot bode plot of given transfer function and find gain and phase margins
    - Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

EE-330-F **VLSI DESIGN LAB**

L T P			
0 0 2	CLASS WORK	:	25
	EXAM	:	25
	TOTAL	:	50
	DURATION OF EXAM	:	3 HRS

Combinational & Sequential Design Exercises using FPGA (Spartan 3) & CPLD

1) Design of Half-Adder, Full Adder, Half Subtractor, Full Subtractor
2) Design a parity generator
3) Design a 4 Bit comparator
4) Design a RS & JK Flip flop
5) Design a 4: 1 Multiplexer
6) Design a 4 Bit Up / Down Counter with Loadable Count
7) Design a 3: 8 decoder
8) Design a 8 bit shift register
9) Design a arithmetic unit
10) Implement ADC & DAC interface with FPGA
11) Implement a serial communication interface with FPGA
12) Implement a Telephone keypad interface with FPGA
13) Implement a VGA interface with FPGA
14) Implement a PS2 keypad interface with FPGA
15) Implement a 4 digit seven segment display

EE-326-F CONVENTIONAL AND CAD OF ELECTRIC MACHINES -LAB

L T P
0 0 2

Class Work	: 25 marks
Exam	: 25 marks
Total	: 50 marks
Duration of exam.	: 3 hours

This will pertain the syllabus of theory Paper CONVENTIONAL AND CAD OF ELECTRIC MACHINES.

EE-328-F POWER SYSTEMS LAB

L	T	P
-	-	2

Practical	: 25 marks
Class work	: 25 marks
Total	: 50 marks
Duration of exam.	: 3 hours

1. To draw the operating characteristics of IDMT relay.
2. To study the performance of Earth fault relay.
3. To study the performance of a over voltage relay.
4. To study the performance of under voltage relay.
5. Testing of breakdown strength of a transformer oil.
6. To study flash point test of transformer oil.
7. To find ABCD ,Hybrid & Image parameters of a model of transmission line.
8. To study performance of a transmission line under no load condition & under load at different power factors.
9. To observe the Ferranti effect in a model of transmission line.
10. To study performance characteristics of typical DC distribution system in radial & ring main configuration..
11. To study characteristics of MCB & HRC Fuse.
12. To study radial feeder performance when a) fed at one end b) fed at both ends.