M.D. UNIVERSITY, ROHTAK
Scheme of studies & Examination
Bachelor of Engineering (Electrical Engg.)

SEMESTER VI

Modified 'E ' Scheme Effective from 2007 –2008

Course No.	Course Title	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
EE-312-E	POWER SYSTEMS –II (EE, EEE)	3	1	-	4	50	100	-	150	3
EE-314-E	Conventional & CAD of Electric Machines (EE, EEE)	3	1	-	4	50	10 0	-	150	3
EE-316-E	ADVANCED MICROPROCESSOR AND MICRO-CONTROLLER	3	1	-	4	50	100	-	150	3
EE-304-E	CONTROL SYSTEMS ENGG. (EL,EE, EEE)	3	1	-	4	50	100	-	150	3
EE-318-E	ELECTRIC POWER GENERATION (EE, EEE)	3	1	-	4	50	100	-	150	3
EE-310-E	DIGITAL SYSTEM DESIGN (EL,EI, IC,EE,CSE, AEI)	3	1	-	4	50	100	-	150	3
EE-324-E	CONTROL SYSTEM ENGG. LAB (EL,EE, EEE, AEI)	-	-	2	2	25	-	25	50	3
EE-320-E	ADVANCED MICROPROCESSOR AND MICRO-CONTROLLER LAB	-	-	2	2	25	-	25	50	3
EE-326-E	Conventional & CAD of Electric Machines Lab (EE, EEE)	-	-	2	2	25	-	25	50	3
EE-328-E	POWER SYSTEMS LAB (EE, EEE)	-	-	2	2	25	-	25	50	3
GPEE-302-E	GENERAL PROFICIENCY	-	-	-	-	50	-	-	50	3
	TOTAL	**18**	**6**	**8**	**32**	**450**	**600**	**100**	**1150**	

Note:

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-E POWER SYTEMS - II

L	T	P
3	1	-

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

1. SYMMETRICAL FAULT ANALYSIS: Transients on a transmission line, short circuit of synchronous machine at no load and on full load.
2. SYMMETRICAL COMPONENTS: Symmetrical component transformation, phase shift in star-delta transformation, sequence impedances.
3. UNSYMMETRICAL FAULT ANALYSIS: Single line to ground fault, line to line fault, double line to ground fault, open conductor fault.
4. 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.
5. 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.
6. 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.
7. APPARATUS PROTECTION: Transformer, generator, motor and bus zone protection.
8. 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.

Note: 8 questions are to be set –one from each unit. Students have to attempt five questions in all.

EE-314-E CONVENTIONAL AND CAD OF ELECTRIC MACHINES

L	T	P
4	-	-

Theory	: 100 marks
Class Work	: 50 marks
Total	: 150 marks
Duration of exam.	: 3 hours

1. 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.

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

3. 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.

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

5. 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.
3. Optimization Techniques, S.S. Rao

NOTE: 8 questions are to be set –at least one from each unit. Students have to attempt any 5 Questions.

EE-316-E **ADVANCED MICROPROCESSOR & MICROCONTROLLER**

L T P		
3 1 0	CLASS WORK	:50
	EXAM	:100
	TOTAL	:150
	DURATION OF EXAM	:3 HRS

1. THE 8086 ARCHITECTURE: Pin diagram of 8086 and description of various signals. Architecture block diagram of 8086 & description of sub-blocks such as EU & BIU & of various registers ; Description of address computations & memory segmentation; Program relocation; Addressing models; Instruction formats.
2. INSTRUCTION SET OF 8086: Instruction execution timing, Assembler instruction format; Data transfer instructions, Arithmetic instructions, Branch instructions, Looping instructions, NOP & HLT instructions, Flag manipulation instructions, Logical instructions, Shift & Rotate instructions, Directives & operators, simple example such as copying a block of data, finding maximum from an array of numbers, using look up table technique etc.

3. MICROCONTROLLERS: comparison between Microcontrollers & Microprocessors. Block diagram of 8051, Pin diagram & details, I/O structure, Memory organization. Special function registers. External memory, 8032/8052 Enhancements, Reset operation.
   Instruction Set: Addressing modes, arithmetic, Logical. Data transfer. Boolean variable, program branching instructions.
   Timer Operation: Timer Mode register, Timer Control register. Timer modes & Overflow flag., clocking sources, Start, Stopping & controlling the timers. Programs for generating various frequecy. Square waves.
   Serial Port Operation: Serial port control register, Modes & operation. Serial port band rate. Multoprocessor communication. Initialization & programming of serial port.
   Interrupt: Organization, processing interrupts, program design using interrupts. Serial port interrupts, External interrupts.

TEXT BOOKS:

1. The 8051 Microcontroller; 1. Scott Mackenizie, Prentice Hall, Eagle wood Cliff
2. Yu-Chang Liu & Glenn A Gibson Microcomputer systems: the 8086/8088 Family: architecture,Programming & Design.

REFERENCE BOOKS:

1. Brey, "Intel Microprocessors, 8086,8088,80186,80286/Pentium
2. Triekel & Singh,"The 8088 & 8086 Microprocessors -Programming, interfacing,
3. Bhupinder singh Chabra, "The Intel 8086/8088 Microprocessors architecture programming, design & interfacing," Dhanpat Rai & Sons.
4. Kenneth J. Ayala, "8051 Microcontroller Architecture, programming & Applications", 2nd edition 1996, Penram International Publishers, India.
5. Website: W W W at mel. Com.

EE-304-E CONTROL SYSTEM ENGINEERING

L T P			
3 1 0	CLASS WORK	:	50
	EXAM	:	100
	TOTAL	:	150
	DURATION OF EXAM	:	3 HRS

UNIT1. INTRODUCTORY CONCEPTS :
System/Plant model, types of models, illustrative examples of plants and their inputs and outputs, controller, servo-mechanism, 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.

UNIT2. MATHEMATICAL MODELLING :
Concept of transfer function, relationship between transfer function and impulse response, order of a system, block diagram 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.

UNIT3. 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.

UNIT4. ROOT LOCUS TECHNIQUE :
Root locus concept, development of root loci for various systems, stability considerations.

UNIT5. FREQUENCY DOMAIN ANALYSIS :
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.

UNIT6. COMPENSATION :
Necessity of compensation, compensation networks, application of lag and lead compensation, basic modes of feedback control, proportional, integral and derivative controllers, illustrative examples.

UNIT7. CONTROL COMPONENTS : Synchros, AC and DC techo-generators, servomotors, stepper motors, & their applications, magnetic amplifier.

TEXT BOOK :
1. 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.
3. Control Systems - Principles & Design : Madan Gopal; Tata Mc Graw Hill.
4. Modern Control Engineering.R.C.Dorl & Bishop; Addison-Wesley

NOTE: Eight questions are to be set - at least one from each unit. Students have to attempt five questions.

EE-318-E ELECTRICAL POWER GENERATION

L	T	P
3	1	-

Theory	: 100
Class work	: 50
Total	: 150
Duration of Exam.	: 3 Hrs.

1. INTRODUCTION: Energy sources, their availability, Recent trends in Power Generation, Interconnected Generation of Power Plants.
2. 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.
3. 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.
4. NON-CONVENTIONAL ENERGY SOURCES: Wind, Solar, Tidal, Ocean, and Geothermal sources of Energy, fuel cell, Magneto Hydro Dynamic (MHD) system.
5. 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)

NOTE: 8 questions are to be set at least one from each unit. Students have to attempt any five questions.

EE-310-E DIGITAL SYSTEM DESIGN

L T P			
3 1 0	CLASS WORK	:	50
	EXAM	:	100
	TOTAL	:	150
	DURATION OF EXAM	:	3 HRS

UNIT 1. INTRODUCTION :
Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL, data objects, classes and data types, Operators, Overloading, logical operators.Types of delays Entity and Architecture declaration. Introduction to behavioural, dataflow and structural models.

UNIT 2. VHDL STATEMENTS :
Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements.
Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

UNIT 3. COMBINATIONAL CIRCUIT DESIGN:
VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc.

UNIT 4. SEQUENTIAL CIRCUITS DESIGN :
VHDL Models and Simulation of Sequential Circuits
Shift Registers, Counters etc.

UNIT 5. DESIGN OF MICROCOMPUTER :
Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL

UNIT 6. DESIGN WITH CPLDs AND FPGAs :
Progr ammable logic devices : ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

REFERENCE BOOKS:
1. IEEE Standard VHDL Language Reference Manual (1993).
2. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
3. "A VHDL Primmer" : Bhasker; Prentice Hall 1995.
4. "Digital System Design using VHDL" : Charles. H.Roth ; PWS (1998).
5. "VHDL-Analysis & Modelling of Digital Systems" : Navabi Z; McGraw Hill.
6. VHDL-IV Edition :Perry; TMH (2002)
7. "Introduction to Digital Systems" : Ercegovac. Lang & Moreno; John Wiley (1999).
8. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000)
9. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).

NOTE : Eight questions are to be set - at least one question from each unit. Students will be required to attempt five questions in all.

EE-324-E **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 A.C. servo motor and to plot its torque speed characteristics.

2. To study D.C. servo motor and to plot its torque speed characteristics.

3. To study the magnetic amplifier and to plot its load current v/s control current characteristics for :
   (a) series connected mode
   (b) parallel connected mode.

4. To plot the load current v/s control current characteristics for self exited mode of the magnetic amplifier.

5. To study the synchro & to:
   (a) Use the synchro pair (synchro transmitter & control transformer) as an error detector.

   (b)Plot stator voltage v/s rotor angle for synchro transmitter i.e. to use the synchro transmitter as position transducer.

6. To use the synchro pair (synchro transmitter & synchro motor) as a torque trans mitter.

7. (a) To demonstrate simple motor driven closed loop position control system.
   (b) To study and demonstrate simple closed loop speed control system.

8. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots .

9. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.

10. To implement a PID controller for level control of a pilot plant.

11. To implement a PID controller for temperature control of a pilot plant.

12. To study the MATLAB package for simulation of control system design.

NOTE : At least ten experiments have to be performed in the semester, at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus of EE-304-C.

EE-320-E ADVANCED MICROPROCESSOR & MICROCONTROLLER LAB

L	T	P
-	-	2

Practical : 25 Marks
Class work : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hours

LIST OF EXPERIMENTS:

1. Study of 8086 microprocessor kit, its operation & commands.
2. Write a well-documented program for copying 12 bytes from source to destination, on 8086 microprocessor kit.
3. Write a program for 8086 for division of a defined double word (stored in a data segment) by another double word and verify.
4. Write a well-documented program for finding the square root of a given number, on 8086, microprocessor kit.
5. Write a program using 8086 for finding the square of a given number and verify.
6. Write a program using 8086 and verify for:
   a. Finding the largest number from an array.
   b. Finding the smallest number from an array.
7. Write a program using 8086 for arranging an array of numbers in descending order and verify.
8. Write a program using 8086 for arranging an array of numbers in ascending order and verify.
9. Write a program for 8086 for finding square of a number using look-up table and verify. .
10. Write a program to interface a two digit number using seven-segment LEDs. Use 8086 microprocessor and 8255 PPI.
11. Write a program to control the operation of stepper motor using 8086 microprocessor and 8255 PPI.

NOTE: At least 10 experiments are to be performed with atleast 7 from above list, remaining 3 may either be performed from the above list or designed & set by concerned institution as per the scope of syllabus.

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

L	T	P
		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-E **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 characteristcs of IDMT relay.
2. To draw the operating characteristcs of differential relay.
3. To study Bucholtz relay.
4. Testing of transformer oil.
5. To find ABCD parameters of a model of transmission line.
6. To observe the Ferranti effect in a model of transmission line.
7. To study the plain impedance relay and plot its tripping characteristics.
8. To study the MHO relay and plot its tripping characteristics
9. To study the power control by phase shifting transformer.
10. To plot annual/monthly/daily load demand of nearby area.
11. To draw single line diagram of distribution system of HVPNL of near by area of the college concerned.
12. To design 11 KV substation.

NOTE : At least 10 experiments have to be performed, with at least 7 from above list, remaining 3 may either be performed from above list or designed & set by the concerned institution as per latest developments/ advancements in Electrical Engg.