Swami Ramanand Teerth Marathwada University, Nanded

Teaching and Evaluation Scheme for

Third Year Common to Electrical Engineering & Electrical, Electronics and Power (Revised Syllabus, 2014 Course)

(w.e.f. Academic Year 2016-17)

Semester V

Course Code	Course Name	Teaching Scheme			Credit Structure		Evaluation Scheme			
		L	T	P	L+T	P	MSE	ESE	CE	ESE (POE)
EE301	Power System Engineering	4			4		20	80		
EE302	Electrical Machines Design	4			3		20	80		
EE303	Control System -I	3	1		4		20	80		
EE304	Microcontrollers and Microprocessors	3	1		4		20	80		
EE305	Signals and Systems	3	1		3		20	80		
EE306	Electrical Machines Design Lab			2		1			30	70
EE307	Control System -I Lab			2		1			30	70
EE308	Microcontrollers and Microprocessors Lab			2		1			30	70
EE309	Basic Simulation Laboratory			2		1			30	70
Total		**17**	**3**	**8**	**18**	**4**	**100**	**400**	**120**	**280**

Total Credits: 22 **Total contact Hours/Week: 28**

***MSE-**Mid Semester Exam

***ESE-**End Semester Exam

***CE-**Continuous Evaluation

***Minimum for passing in Theory, Audit and Practical/workshop/ Seminar: 40% Each**

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Semester VI

Course Code	Course Name	Teaching Scheme			Credit Structure		Evaluation Scheme			
		L	T	P	L+T	P	MSE	ESE	CE	ESE (POE)
EE310	Electromagnetic and Fields	3	1		4		20	80		
EE311	Power System Analysis	4			4		20	80		
EE312	Control System-II	3	1		3		20	80		
EE313	Power Electronics	4			4		20	80		
EE314	Electrical Estimation & Electrical Utilization	3	1		3		20	80		
EE315	Power System Analysis Lab			2		1			30	70
EE316	Control System-II Lab			2		1			30	70
EE317	Power Electronics Lab			2		1			30	70
EE318	Seminar			2		1			100	
Total		**17**	**3**	**8**	**18**	**4**	**100**	**400**	**190**	**210**

Total Credits: 22 **Total contact Hours/Week: 28**

***MSE-**Mid Semester Exam

***ESE-**End Semester Exam

***CE-**Continuous Evaluation

***Minimum for passing in Theory, Audit and Practical/workshop/ Seminar: 40% Each**

In-plant Training: Every student has to undergo training arranged by T & P department, in some company for one month to get the exposure and practical experience. He/ She has to submit the detailed report of the training, on the basis of which the term-work marks shall be awarded in B.E (Final Year).

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Third Year Common to Electrical Engineering & Electrical, Electronics and Power (Revised Syllabus, 2014 Course)

Effective from 2016-17

EE301. POWER SYSTEM ENGINEERING

Teaching Scheme	**L: 04**	**T: 00**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

1. To introduce students to the basic structure and requirements of any electric power supply system.
2. To develop knowledge about nature of power systems engineering and the profession.
3. To develop an understanding of components in a power system and to understand the basic principles involved in these components.
4. To explore analysis and design principles for the complete power system.

Course Contents:

Unit 1: Fundamentals of Power Systems **(6 Hours)**

Introduction to modern power system: Generation, Transmission and sub-transmission, Distribution, Loads. Growth of power system in India, present Indian power industry, GRID formation, concept of National GRID.

Basic Principles: Power in single phase AC circuits, complex power, power factor correction, the complex power balance, complex power flow.

Unit 2: Transmission line Parameters **(8 Hours)**

Resistance, Inductance: Definition, Inductance due to internal flux of two wire single phase line of composite conductor line, Concept of GMD, Inductance of three phase line with equal & unequal spacing, vertical spacing. Capacitance: Concept of electric field, Potential difference between two points in space, Effect of earth's surface on electric field, Computation of capacitance of single phase, three phase transmission lines with & without symmetrical spacing for solid & composite conductors. Concept of GMR and GMD, Skin effect, Proximity Effect, Ferranti effect.

Unit 3: Mechanical design of overhead transmission line **(8 Hours)**

Main components of overhead line, conductor materials, line supports, Insulators: Type of insulators, potential distribution over suspension insulator string, string efficiency, methods of improving string efficiency. Corona: Phenomenon of corona, factors affecting corona, advantages and disadvantages of corona, methods of reducing corona. Sag: Sag in overhead line, calculation of sag, Effects of wind & ice coating on transmission line.

Unit 4: Performance of Transmission Lines **(6 Hours)**

Classification lines such as short, medium, long lines Voltages and currents at sending end and receiving end of the lines. Determination of generalized ABCD constants in them, Circle Diagrams.

Unit 5: Distribution system **(10 Hours)**

Distribution system: Classification of distribution system, AC and DC distribution system, overhead versus underground system, connection scheme of distribution system. AC and DC distribution calculations.

Substations: Classification of substation, selection & location of site, main connection schemes, Equipments used in substation, Symbols used in substation, Connection diagram and its layout.

Unit 6: Underground cables **(6 Hours)**

General construction of cables, Requirements of cables, Cable conductors, insulating materials for cables, classification of cables, Insulation resistance of a single core cables, Capacitance of single core cables. Dielectric stress in a single core cable, most economical diameter conductor, Grading of cables, Capacitance of three core belted type cables, Measurement of insulation resistance of cables, heating of cables, Thermal resistance of cables, Selection of cables.

Course Outcomes:

After completing this course student will have-

1. Ability to model and represent power system components
2. Ability to use software development tools to simulate and analyze the system
3. Ability to implement corrective measure for immediate as well as long term solution to the system problems

Text/Reference Books:

1. C.L. Wadhwa, “Electrical Power Systems”, 6th Edition, New Age International, 2010.
2. D.P.Kothari, I.J.Nagrath, “Power System Engineering” 2nd Edition, McGraw Hill Education(India) Pvt. Ltd, 2008.
3. Stevenson W.D. “Power System Analysis”, TMH, 4th Edition 1989.
4. Hadi Saadat, Power System Analysis, TMH, 1st Edition, 2002

5. J.B. Gupta, “Electrical Power”, SK Kataria & Sons(2012).
6. S.L. Uppal, “Electrical Power”, Khanna Publication.

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Effective from 2016-17

EE302. ELECTRICAL MACHINE DESIGN

Teaching Scheme	**L: 04**	**T: 00**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

1. To make the student conversant with the design process of electrical machines and Computer aided design of the electrical machines.
2. To develop the capabilities in the student to apply basics of electrical engineering for design of electrical machines.

Course Contents:

Unit 1: Transformer Design (8 Hours)

Output equation with usual notations, choice of specific loadings, expression of volt per turn, core, yoke and windings of transformer, design for minimum cost, design for minimum loss or maximum efficiency, design of main dimensions design of core (rectangular core, square & stepped cores), variation of core diameter, selection of core areas & type of core, choice of flux density, design of winding, windows space factor, windows dimensions, overall dimensions, simplified steps for transformer design.

Unit 2: Performance parameter of Transformer (8Hours)

Estimation of no-load current, losses, efficiency and regulation of transformers, calculation of mechanical forces developed under short circuit conditions, estimation of resistance and leakage reactance of transformer. Design of tank, temperature rise of plain walled tank and design of cooling tubes (round and rectangular).

Unit 3: Design of DC Machines (8 Hours)

Design output equation, choice of specific electric and specific magnetic loadings, selection of no of poles, core length, armature diameter, length of air gap, no of armature coils, no of armature slots, cross section of armature conductors, slots dimensions, design of commutater and brush gear, design of main dimensions of dc machine. Design of DC windings, types of dc windings, pitches, choice and design of simplex lap and wave winding.

Unit 4: Design of 3-Phase Induction Motor –I **(8 Hours)**

Constructional features, output equation with usual notations, specific electrical and magnetic loadings, ranges of specific loadings, turns per phase, number of stator slots. Suitable combinations of stator and rotor slots, length of air gap, factors affecting length of air-gap, main dimension, stator winding,(turns per phase, stator conductors), shapes of stator slots, area of stator slots, length of mean turn, stator teeth, stator core, design of wound rotor motor.

Unit 5: Design of 3-Phase Induction Motor part-II **(8 Hours)**

Rotor design, no of rotor slots,(rules for selecting rotor slots, reduction of harmonic torques), design of rotor bars & slots, (rotor bar currents, area of rotor bar, shapes & size of rotor slots, rotor slot insulations), design of end rings for cage rotor, design of wound rotor. Design of AC windings. Single and double layer integral slot and fractional pitch three phase's windings.

Unit 6: Computer Aided Design of Electrical Machines **(6 Hours)**

Benefits of computer in machine design, methods of approach, optimization and computer aided design of induction motor and three phase transformer.

Course Outcomes :

1. Student will be able to understand significance of electrical machine design and components.
2. An ability to design a system, a component to meet desired needs, differentiate and will be able to compare different options based on results, and able to analyze and interpret results for different industrial application to meet desired needs within realistic constraints and confirms manufacture ability.
3. Students will build an ability to identify, formulate and solve industrial problems related to machine and equipment design problems.
4. With the basic knowledge of the machines, equipment's design and course, students will be able to develop computer programs for the utility and machine design techniques.
5. Students will understand broad education necessary to understand the impact of electrical machine design solutions in a global and economical context.

Text Books:

1. A Course in Electrical Machine Design, A.K.Sawhney, Dhanpat Rai & sons New Delhi.
2. Principles of Electrical Machine Design, R. K. Agarwal, S. K. Katariya and sons.
3. Theory and Performance and Design of A.C. Machines, M.G. Say, ELBS London, 3rd Edition.

Reference Books:

1. Design of Electrical Machines, K. G. Upadhyay, New age publication.
2. A Text Book of Electrical Engineering Drawings, K.L. Narang, Satya Prakashan, New Delhi.
3. Electrical Machine Design Data Book, A Shanmugasundaram, G. Gangadharan, R. Palani, 3rd Edition, Wiely Eastern Ltd. New Delhi.

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Effective from 2016-17

EE303. CONTROL SYSTEM I

Teaching Scheme	**L: 03**	**T: 01**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

1. To enhance the analytical ability of the students in facing the challenges posed by growing trends in control system
2. To enhance the describing ability of the students to represent the control system mathematically.
3. To enhance the describing ability of the students to analyze the system in time and frequency domain.

Course Contents:

Unit 1: Introduction to Control System (08 hours)

Introduction, examples of control systems, open loop and closed loop control systems, effect of feedback on overall gain, parameter variations, control over system dynamics, regenerative feedback, Transfer function and impulse response of systems, canonical form of feedback control system.

Control system components : DC and AC servomotors, servo amplifier, potentiometers, synchro transmitters, synchro receivers, synchro control transformer, PLC concept and architecture, SCADA- architecture and applications.

Unit 2:Mathematical Models of Physical System (06 hours)

Block diagram representation of control system, rules and reduction techniques, signal flow graphs, Mason's gain formula and its application to block diagram reduction.

Unit 3. Time Domain Analysis of Control System (06 hours)

Standard test signals, Impulse response function, First order system, second order system, time domain specifications of systems, Classification of control systems according to "Type" of systems, Steady – state errors, static error constants, Steady – state analysis of different types of systems using step, ramp and parabolic input signals

Unit 4. Stability Analysis of Control System (08 hours)

Introduction to concept of stability, Stability analysis using Routh's stability criterion, Absolute stability, Relative stability. Root-Locus Analysis**:** Introduction, Root–Locus plots, summary of general rules for constructing Root–Locus, Root–Locus analysis of control systems.

Unit 5. Frequency Response Analysis (08 hours)

Introduction, Frequency domain specifications, resonance peak and peak resonating frequency, relationship between time and frequency domain specification of systems. Frequency-Response Plots: Bode plots, Polar plots, gain margin, phase margin, Log–magnitude Vs phase plots, stability analysis of system using Bode plots. Nyquist stability criterion, stability and relative stability analysis.

Unit 6. Control System Performance Measure (04 hours)

Improvement of system performance through compensation lead ,lag and lead lag compensation, PI, PD ,PID controller.

Course Outcome:

Students will be able to analyze and represent the control system mathematically.
Students will be able to analyze the control system in time and frequency domain.

Text Books:

1. I.J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers, 4th Edition, 2006.
2. Katsuhiko Ogata, "Modern control system engineering", Prentice Hall, 2010.
3. B. C. Kuo, "Automatic Control System", Wiley India, 8th Edition, 2003.
4. Natarajan Ananda, Babu P. Ramesh "Control Systems Engineering" , Second Edition, Scitech Publication, 2010.

References:

1. Richard C Dorf and Robert H Bishop, "Modern control system", Pearson Education, 12th edition, 2011.
2. Nise N. S. "Control Systems Engineering", John Wiley & Sons, Incorporated, 2011
3. Jacqueline Wilkie, Michael Johnson, Reza Katebi, "Control Engineering: An Introductory Course", Palgrave Publication, 2002.
4. D. Roy Choudhary, "Modern Control Engineering", PHI Learning Pvt. Ltd., 2005.
5. Smarajiti Ghosh, "Control Systems : Theory and Applications" , Dorling Kindersley (RS), 2012.

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Effective from 2016-17

EE304. MICROCONTROLLER AND MICROPROCESSORS

Teaching Scheme	**L: 03**	**T: 01**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

1. To study the Architecture of uC 8051and uP 8086
2. To study the addressing modes & instruction set of 8051 and 8086.
3. To develop skill in simple applications development with programming 8051 &8086.
4. Developing of assembly language programs and providing the basics of the microcontroller and microprocessors.
5. To provide solid foundation on interfacing the external devices to the controller and processor.

Course Contents:

Unit 1: 8051 Microcontroller (07 Hours)

RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. 8051 Architecture, Hardware, Input / Output Pins, Ports and Circuits. Memory organization, Counter and Timers, Serial Data Input / Output, Interrupts.

Unit 2: Assembly Language of 8051 (08 Hours)

Addressing modes, Instruction set. Programming; Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic. Programming examples in C.

Unit 3: Interfacing with 8051 (05 Hours)

Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs, Interfacing with DACs.

Unit 4: 8086 Microprocessors **(08 Hours)**

Introduction, A Microprocessor survey, comparison of microprocessor and microcontroller, Architecture of 8086 Microprocessor, 8086 pin signals, timing diagram of 8086 Microprocessor, 8086 Addressing modes, instruction set, Interrupt vector table, 8086 Assembly language programming.

Unit 5: Interfacing Memory and I/O with 8086 **(08 Hours)**

Basic 8086 bus configuration, memory addressing, address decoding, memory system design examples, input/output port addressing and decoding, Programming and interfacing: 8255A, 8259, 8237.

Unit 6: Coprocessor 8087 And High end processors **(04 Hours)**

Architecture of 8087, interfacing with 8086. Data types, instructions and programming. Introduction to 80386 and 80486, Protected mode operation.

Course outcome:

Upon successful completion of this course, a student should be able :

1. To Understand the basic architecture of 8051 and 8086.
2. To understand the basic programming used in microcontroller and microprocessor based systems.
3. To implement any system using microcontrollers and processors.
4. To understand coprocessor 8087 and some high end processors.
5. To develop interfacing to real world devices.

Text Books:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems – using assembly and C "- PHI, 2006 / Pearson, 2006

2. Yu-cheng Liu, Glenn A.Gibson, "Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design", PHI 2003

Reference Books:

1. The 8051 microcontroller, Kenneth J. Ayala, Delmar Cengage Learning, 3rd edition, ISBN: 81-315-0200-7
2. Predko ; "Programming and Customizing the 8051 Microcontroller" –, TMH
3. C and the 8051, 2nd Ed,Tom Shultz, 1998, Prentice Hall.
4. Microprocessors and Interfacing, Douglas V. Hall, Tata McGraw Hill Education,2006
5. The 8088 and 8086 Microprocessors, walter A Triebel, Awtar Singh, Pearson Education, Fourth Edition

6. The Intel Microprocessors: 8086/8088, 80186, 80286, 80386 & 80486, Bary B.Brey, Prentice Hall, India 1996.
7. The Pentium Microprocessor-James L.Antonakos

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Effective from 2016-17

EE305. Signals and Systems

Teaching Scheme	**L: 03**	**T: 01**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

This course trains students for an intermediate level of fluency with signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing (including audio, image and video processing), communication theory, and system theory, control, and robotics.

Course Contents:

Unit 1: Signals and Systems **(10 Hours)**

Introduction, Continuous Time and Discrete Time Signals: Transformations of the Independent Variable; Elementary continuous Time and Discrete Time Signals(Unit Step,ramp,parabolic,Impulse,reactangular,triangular,signum,sinc,sinusoidal,exponential);Basic operations on signals; Classification of signals (periodic, aperiodic, even, odd, energy, power, causal, non-causal); Classification of Systems; Basic System Properties(distributive, associative, commutative, shifting, convolution);Causal LTI Systems described by Differential and Difference Equations, Impulse response ,step response ,stability, BIBO stability criterion.

Unit 2: Fourier series Representation **(6 Hours)**

Introduction, Fourier series representations of Continuous Time Periodic Signals, Evaluation of Fourier Coefficients, Symmetry Conditions ,cosine representation, Exponential Fourier Series, Existence of the Fourier series, Properties of Continuous Time Fourier Series, Fourier series representation of Discrete-Time Periodic Signals, Properties of Discrete-Time Fourier Series, Fourier series and LTI Systems.

Unit 3: Fourier Transform-Continuous Time Signals **(6 Hours)**

Representation of Aperiodic Signals; Continuous time Fourier Transform; Existence of Fourier Transform; Properties of Continuous Time Fourier Transform(linearity, shifting, reversal, scaling, differentiation, conjugation, convolution, multiplication); Fourier Transform of Periodic Signals; Systems Characterized by Linear Constant-Coefficient Differential Equations.

Unit 4: Fourier Transform-Discrete Time Signals (6 Hours)

Representation of Aperiodic Signals, Discrete Time Fourier Transform, Existence of Discrete Time Fourier Transform; Properties of the Discrete- Time Fourier Transform(linearity, shifting, reversal, scaling, differentiation, conjugation, convolution, multiplication, duality);Discrete Time Fourier Transform of Periodic Signals; Systems Characterized by Linear Constant-Coefficient Difference Equations

Unit 5: Laplace Transform (8 Hours)

Introduction, Region of Convergence for Laplace Transforms, S-plane, Unilateral Laplace Transform; Properties of Unilateral Laplace Transform (linearity, transform, scaling, time shift, frequency shift, differentiation, conjugation, convolution, initial and final value theorem) Inversion of Unilateral Laplace Transform(Distinct poles, Multiple poles, complex roots);Inversion of Bilateral Laplace Transform; Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform; Block Diagram Representations(direct form, cascade and parallel form).

Unit 6: Z-Transform (8 Hours)

Introduction, The z-Transform; Region of Convergence of Finite Duration Sequences(Right hand, left hand and two sided sequence), Properties of Region of Convergence, Properties of Z-Transform(linearity, transform, scaling, time shift, frequency shift, differentiation, conjugation, convolution, initial and final value theorem); Some Common Z-Transform Pairs, Inverse Z-Transform(long division method, partial fraction expansion, residue, convolution method) Analysis and Characterization of LTI Systems using Z- Transforms, Block Diagram Representations(direct form, cascade and parallel form).

Course outcome:

Upon successful completion of this course, a student should be able to:

1. Be able to classify systems based on their properties: in particular, to understand and exploit the implications of linearity, time-invariance, causality, memory, and bounded-input, bounded-out (BIBO) stability
2. Determine Fourier transforms for continuous-time and discrete-time signals (or impulse-response functions), and understand how to interpret and plot Fourier transform magnitude and phase functions.
3. Understand the need to define two new transforms—the Laplace and Z transforms—to treat a class of signals broader than what the Fourier transform can handle.
4. Understand the relationships among the various representations of LTI systems—linear constant-coefficient difference or differential equation, frequency response, transfer function, and impulse

response—and infer one representation from another (e.g., determine the impulse response from the difference equation, etc.).

5. Understand the properties, as well the analysis and design implications, of interconnections of LTI systems—parallel, series (cascade), and feedback—in the time and transform domains.

Text/Reference Books:

1. Signals and Systems by A. V. Oppenheim, A. S. Willsky, and Nawab, 2nd Edition, PHI.
2. Signals and Systems by Simon Haykin
3. Signals and Systems by P.Ramesh Babu, R. Anandanatarajan,Fourth edition,Scitech publication.
4. Siebert's "Circuits, Signals, and Systems", MIT Press (McGraw Hill)
5. Papoulis'"Circuits and Systems" from HRW

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Effective from 2016-17

EE306. ELECTRICAL MACHINE DESIGN LAB

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**30 Marks**	**70 Marks**	**40%**

Term Work:

Term work consists of minimum four drawing sheets (Minimum one sheets should be drawn using suitable software)

1. Details and assembly of 3- phase transformer with design report.
2. Details and layout of AC winding with design report.
3. Assembly of DC machine.
4. Detail and assembly of 3- phase induction motor with design report.
5. Report based on Industrial visit to a manufacturing unit. (Transformer or Induction motor).

Practical Examination:
The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

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EE307. CONTROL SYSTEM-I LAB

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**30 Marks**	**70 Marks**	**40%**

Term Work/List of Experiments:

A) Minimum five experiments should be conducted.

1. Experimental determination of DC servo motor parameters for mathematical modelling, transfer function and characteristics.
2. Experimental study of time response characteristics of R-L-C second order system: Validation using simulation.
3. Experimental frequency response determination of Lag and Lead compensator.
4. PID control of level/Pressure/Temperature control system.
5. Experimental determination of transfer functions of two tank system.
6. Experimental determination of transfer function of PWM servo amplifier.
7. Experimental analysis of D.C. Position Control System.

B) Minimum three experiments should be conducted.

1. Stability analysis using a) Bode plot b) Root locus c) Nyquist plot using software.
2. Time response of second order system effect of P,PI, PID on it.
3. Analysis of closed loop DC position control system using PID controller.
4. Effect of addition of pole-zero on root locus of second order system.

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

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EE308. MICROCONTROLLERS AND MICROPROCESSORS LAB

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**30 Marks**	**70 Marks**	**40%**

Termwork

Hardware Lab:

Term work consists of **Any Four** experiments from the List of following:

1. Testing the 8051 I/O ports.
2. Timer programming
3. The 8051 serial interface
4. Interrupt programming.
5. Interfacing M × N key board.
6. Interfacing DAC and ADC to the 8051.

Software Lab

Term work also consists of **Any Four** experiments from the List of following:

1. Any four programs 0f 8086 (DEBUG/MASM)
2. Assembler and Simulator
3. Examining Flags and Stacks
4. Simulating I/O ports
5. Data transfer: (Program to transfer data from ROM to RAM and RAM to RAM)
6. Arithmetic operation-I (Hex and BCD addition and subtraction)
7. Arithmetic operation-II (Division and Multiplication)

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

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Effective from 2016-17

EE309. BASIC SIMULATION LABORATORY

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**30 Marks**	**70 Marks**	**40%**

Course Objectives:

1. To study the Simulink toolboxes and special toolboxes.
2. To get introduce with PSPICE software and simulation based on it.

List of Experiments & Term Work:

Minimum ten experiments to be performed from

1. Three MATLAB experiments using Control System Toolbox.
2. Three MATLAB programming experiments using MATLAB m-file.
3. Four MATLAB experiments using Power System Toolbox.
4. Four experiment on circuit analysis using P-spice software.

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

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EE310. ELECTROMAGNETIC FIELDS

Teaching Scheme	**L: 03**	**T: 01**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields
2. To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
3. To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
4. To impart knowledge on the concepts of Faraday’s law, induced emf and Maxwell’s equations
5. To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

Course Contents:

Unit 1: Vector analysis: (10 Hours)

Scalars and vectors, Vector algebra, Vector components and unit vectors, Vector field, The Cartesian Coordinate System, Dot, cross products, circular, cylindrical and spherical coordinate systems. Coulomb's Law and electric field intensity, Electric field due to a continuous Volume Charge Distribution, field of a line charge, field of a Sheet of a charge

Unit 2: Electric Flux Density Gauss Law and divergence: (7 Hours)

Gauss's Law and its Applications: to some symmetrical charge distribution and differential volume element, divergence, Maxwell's first equation (electrostatics), the vector operator and the Divergence theorem, Energy and Potential Energy expended in moving a point charge in an electric field, line integral, potential difference and potential, potential gradient, potential field of a point charge and system of charges, dipole, energy density in electrostatic field.

Unit 3: Conductors dielectric and capacitance: (5 Hours)

Current and current density, continuity of current, conductor properties and boundary conditions nature of dielectric, boundary conditions for perfect dielectric, capacitance, and capacitance of two-wire line. Poisson's and Laplace Equations:

Unit 4: Steady Magnetic Field: (10 Hours)

Biot-Savart's law, Amperes circuital law, curls, strokes theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials.

Unit 5 : Magnetic forces and inductance: (7 Hours)

Force on moving charge, differential current element, force between differential current element and-ft torque on a closed circuit, nature of magnetic materials, magnetization permeability, magnetic boundary conditions, magnetic circuit, self and mutual inductance.

Unit 6: Time varying field sand Maxwell's equations : (5 Hours)

Faradays law, Maxwell's equations in point form, Maxwell's equations in integral form.

Course outcomes:

1. 1.Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

Text Books:

1. William H.Hayt. "Engineering Eletromagnetics"Tata Mc Graw-hill Fifth edition.
2. Edminister Schawn's "Outline Theory and Problems of Electromagnetics" Tata McGrawhill edition.

Reference Books:

1. Singh, "Electromagnetic Waves and Fields" Tata McGraw-hill edition

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EE311. POWER SYSTEM ANALYSIS

Teaching Scheme	**L: 04**	**T: 00**	**P: 00**
Evaluation Scheme	**ESE 80 Marks**	**MSE 20 Marks**	**Minimum Passing Marks 40%**

Course Objectives:

1. To analyse and prepare model of a Power System Network.
2. To study load flow using different techniques like Gauss Seidel method, NR – method & Fast decoupled method.
3. To understand different techniques of determination of fault current for various faults in power system.

Course Contents:

Unit 1

Representation of Power System Components And Network calculations (04 Hours)

Single line diagram and impedance or reactance diagram, per unit system, per unit methods of representation of system and its components such as transformers (1 phase/3 phase) Two winding / Three winding) Synchronous machines (motors and generators) load.

Unit 2

Load Flow Studies: (10 Hours)

Load flow problem Bus classification, Nodal admittance matrix, Network model formulation and development of load flow equations. Iterative methods of solution a) Gauss Sidel method b) Newton Raphson method c) Fast decoupled method.

Graph Theory- Definition, Tree and Co-Tree, Cut-Set, Basic Loops, Basic Cut-Sets, Loop Equations and Node Equations, Bus admittance and bus impedance matrix, network solution using matrix algebra.

Unit 3

Symmetrical Fault Analysis: (06 Hours)

Introduction, Transients on a transmission line, Short circuit of a synchronous machine on no load & loaded condition, Selection of circuit breakers, Algorithms of short circuit studies.

Unit 4

Symmetrical Components: **(06 Hours)**

Symmetrical Components of Unsymmetrical phasors, power in terms of symmetrical components sequence impedances and sequence network of unloaded alternators and other power systems components network.

Unit 5

Unsymmetrical Fault Analysis: **(08 Hours)**

Unsymmetrical faults on unloaded alternator and three phase power system with a) line to ground b) line to line c) double line to ground d) one conductor open fault e) Two conductor open fault, Simplified models of synchronous machines for transient analysis, Park's transformation and determination of transients constants with numerical problems.

Unit 6

Power System Stability: **(08 Hours)**

Power system stability problem, Rotor dynamics, m/c representation, Swing equation, power angle equation for two m/c system, Steady state stability and transient state stability, equal area criterion for stability and its application. Numerical solution of swing equation, factors affecting transient stability, methods for improving stability of Power system.

Course Outcomes:

After completing of this course, student will be able to:

1. Use the models of power system components and analyze them.
2. Compute various electrical parameters of power system under various fault conditions.
3. Carry out the stability studies for a single machine infinite bus system.

Text/Reference Books:

1. "Elements of Power System Analysis", William Stevenson, Tata Mc Graw Hill(2001), 4th Edition.
2. "Power System Analysis", I.J. Nagrath and D.P. Kothari, Tata Mc Graw Hill-Education (2007), 2nd Edition.
3. "Electrical Power System", Ashfaq Husain, Cbs Publication (2009), 5th Edition.
4. "Power System Analysis", Hadi Sadat, Tata Mc Graw Hill Edition, Copy 1999.
5. "Power System Analysis", P.S.R Murthy, BS Publications, Copy 2007

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EE3012. CONTROL SYSTEM-II

Teaching Scheme	**L: 03**	**T: 01**	**P: 00**
Evaluation Scheme	**ESE 80 Marks**	**MSE 20 Marks**	**Minimum Passing Marks 40%**

Course Objectives:

1. To enhance the analytical ability of the students in facing the challenges posed by growing trends in designing control system in time and frequency domain
2. To enhance the ability of students to analyze and design the control system in modern control approach.
3. To enhance the ability of students to understand the non linear control system.
4. To enhance the ability of the students to analyze the discrete time control system.

Course Contents:

Unit 1: Introduction to Non- Linear Control System (06 Hours)

Introduction to Non- Linear Control System ,Different types of non-linearities ,Phase plane method, singular.

Unit 2: Stability concept of non linear system (08 Hours)

BIBO Vs state stability, Definations of Lyapunov functions, Lyapunov analysis of LTI systems, The first and second methods of Lyapunov to analyze non linear systems.

Unit 3: Non linear controller (06 Hours)

Sliding mode control ,Fuzzy logic controller , Artificial Neural network , Optimal controller.

Unit 4:Mathematical Preliminaries (08 Hours)

Solution of Linear algebraic equation, Rank ,Null space matrix , homogenous and non homogenous equations Eigen vector, canonical form representation ,caley halmilton theorem .

Unit 5:State space analysis and design (06 Hours)

Concept of state, state variable and state model, state transition matrix controllabity and observability, kalman test and Gilbert’s test.

Unit 6: Discrete time control system **(06 Hours)**

Basic elements of discrete data control system and its advantages over the continuous time system, A/D and D/A conversion, sample and hold device ,digital controller.

Course Outcome:

1. Students will be able to design the controller in time and frequency domain.
2. Students will be able to analyze and design the control system in modern approach.
3. Students will be able to analyze the non linear control system
4. Students will be able to analyze the discrete time control system.

Text Book:

1. Control System Engineering by I J Nagrath & M Gopal, New Age International Publishers,5th edition
2. Digital Control Systems by B.C. Kuo, Printice Hall India, 4th Ed.

Reference Books:

1. Modern Control Engineering by K. Ogata, Pearson Education, 4th Edition
2. Control System Engineering by R Ananda natrajan, P Ramesh Babu, 2nd Edition, Scitech
3. Control System Engineering by SK Bhattacharya, 2nd Edition, Pearson Education
4. Control System Engineering by Norman S Nise, 4th Edition
5. Control Systems Principles & Design by M Gopal, 2nd Ed
6. Feedback Control of Dynamic Systems- G. Franklin, J.D. Powell, A Emami, Pearson Edition, 4th Ed

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EE313. POWER ELECTRONICS

Teaching Scheme	**L: 04**	**T: 00**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

To enable students to gain knowledge and understanding in the following aspects:

1. Fundamentals of power electronic devices and characteristics.
2. The concepts and operating principles of power electronics circuits.
3. Design procedures and techniques of power electronics systems.

Course Contents:

Unit 1: Silicon Controlled Rectifier (8 Hours)

Construction, Static and dynamic Characteristics, specifications/rating of SCR, Two-Transistor Analogy, Gate Characteristics, UJT Triggering Circuits, Protection (over voltage, over current, and Thermal), design of snubber circuit for dv/dt and di/dt protection, Gate Turn Off(GTO) Thyristor (Basic Structure, V-I characteristics, Switching performance, applications)

Unit 2: Modern Power Electronics Devices & DC-DC Converters (8 Hours)

Transistor based Devices: MOSFET, IGBT, Construction, working, transfer and VI characteristic, specifications, safe operating area, MCT construction and VI characteristics.

DC-DC converter: Principle of operation of chopper, classification on the basis of operating quadrants. Control techniques: CLC, TRC, PWM and FM Techniques. Steady state time-domain analysis of type A chopper and Numerical with RLE load. Areas of application.

Unit 3: Single Phase AC-DC Converters (8 Hours)

Half wave converter, Mid-point converter, Fully controlled converter (rectification and inversion mode), Half controlled converter (Semicoverter), Operation of all converters with R, RL and RLE load, derivation of Average and RMS output voltage, power factor, THD, TUF. Numerical based on output voltage and current calculations, Effect of source inductance on operation of converter, Concept of overlap angle and voltage drop calculation.

Unit 4: Three Phase Converters & AC Voltage Regulators (6 Hours)

Three phase converter: Half wave converter, Fully controlled converter, rectification and inversion mode, Half controlled converter (Semicoverter), Operation of all converters with R, RL and RLE load, derivation of Average and RMS output voltage, power factor, THD, TUF. Numerical based on output voltage and current calculations

AC voltage regulator: DIAC, TRIAC- four mode operation, triggering of TRIAC using DIAC; Single phase AC Voltage regulator principle with R and RL Load, derivation of Average and RMS output voltage, Concept of two stage AC voltage regulator

Unit 5: Single Phase DC-AC Inverters (8 Hours)

Half bridge voltage source inverter, full bridge VSI, derivation of output voltage and current, current source inverter, Numerical.

PWM techniques: Single pulse, multiple pulse and sinusoidal pulse modulation with Fourier analysis.

Unit 6: Three Phase DC-AC Inverters (6 Hours)

Three phase VSI using 120˚ and 180˚ mode and comparison, PWM based CSI and VSI, voltage control and harmonic analysis.

Course outcome:

Upon successful completion of this course, a student should be able to:

1. Understand the fundamental principles and applications of power electronics circuits
2. Solve problems and design switching regulators according to specifications.
3. Use Computer-aided techniques for the design of power converter circuits.
4. Appreciate the latest developments in power electronics.
5. Assimilate new technological and development in related field

Text/Reference Books:

1. M.H.Rashid - Power Electronics 2nd Edition, Pearson publication
2. Ned Mohan, T.M. Undeland, W.P. Robbins - Power Electronics, 3rd Edition, John Wiley and Sons
3. B.W. Williams: Power Electronics 2nd edition, John Wiley and sons
4. Ashfaq Ahmed- Power Electronics for Technology, LPE Pearson Edition.
5. Dr. P.S. Bimbhra, Power Electronics, Third Edition, Khanna Publication.
6. K. Hari Babu, Power Electronics , Scitech Publication.
7. M. D. Singh and K. B. Khandchandani, Power Electronics, Tata McGraw Hill.
8. Vedam Subramanyam - Power Electronics , New Age International , New Delhi
9. Dubey, Donalda, Joshi,Sinha, Thyristorised Power controllers, Wiely Eastern New Delhi
10. M.H.Rashid - Power Electronics Handbook, Butterworth-Heinemann publication, 3 edition

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EE314. ELECTRICAL ESTIMATION & ELECTRICAL UTILIZATION

Teaching Scheme	**L: 03**	**T: 01**	**P: 00**
Evaluation	**ESE**	**MSE**	**Minimum Passing Marks**
Scheme	**80 Marks**	**20 Marks**	**40%**

Course Objectives:

1. To ensure that the knowledge acquired can be applied in various fields such as electric heating, illumination and electric traction.
2. To make the students aware about the importance of maximizing the energy efficiency by optimum utilization of electrical energy.
3. To provide know about electrochemical processes and applications of these in practical world, modern welding techniques.

Course Contents:

Unit 1. Wiring Estimation: (12 Hours)
Study of different types of insulated wires, different types of switches, accessories, switch boards, wiring systems, wiring defects, use of megger-tests as per I.S.S..Estimation of materials for wiring installation for residential building, Workshops & agricultural pumps. Earthing, Plate & Pipe earthing, Electric shock & emergency treatment. Materials estimate for Pole mounted substation, Plinth Mounted substation.

Unit 2. Load Characteristics : (02 Hours)
Type of loads, Basic equation of motion for drive systems, Determination of load torque, Power requirements & moment of inertia of load, Speed-torque curve of load, acceleration time drive, Environments of motors, Load characteristics for a few typical drives, inertias of load connected to motors.

Unit 3. Electrical Heating and Welding: (06 Hours)
Advantages and methods of electric heating, Resistance heating, Induction heating & Dielectric heating, Electric arc Furnaces. Electric Welding, Resistance and Arc Welding, Electric welding

equipment, Comparison between A.C. & D.C. welding, Modern welding techniques like ultrasonic welding, laser welding.

Unit 4. Illumination : (08 Hours)

Introduction, terms used in illumination, Laws of illumination, Polar Curves, Photometry, Integrating Sphere, Source of light, Discharge lamps, MV & SV lamps, Comparison between Tungsten filament lamps & fluorescent tubes, Basic principles of light control, lighting, Street lighting & Flood lighting.

Unit 5. Electrical Traction: (10 Hours)

Traction Systems, Steam engine drive, I.C. engine drive, Electric drive, Diesel electric traction, Battery drives, Mechanics of train movements. Speed-Time curves for different services, Trapezoidal and Quadrilateral speed-time curves, average & schedule speed, Calculations of tractive effort, Specific energy consumption for given run, effects of varying acceleration & braking retardation, Adhesive weight. Coefficient of adhesion, Starting of traction motors, calculation methods to reduce energy loss during starting. Types of braking, advantages & limitations.

Unit 6 Selection of Motors for industrial applications (02 Hours)

Motor selection e.g. in textile industries, Machine tools, Cranes, Compressor, Rolling machines, Cement & Sugar mills.

Course Outcomes:

1. To develop ability amongst the students to design heating element for resistance furnaces and design-illumination schemes. To develop ability amongst the students to analyze the Performance of arc furnaces, electric traction, different sources of light, illumination schemes, electric traction.
2. Students will understand domestic installation service connection and calculation of number of different materials in the form of an estimate.
3. Students will develop self and lifelong learning skills, introduce professionalism for successful career.

Text/Reference Books:

01. Electric Motors Applications & Control by M.V. Deshpande
02. Utilization of electrical energy by O.E. Taylor
03. A Course in Electrical Power by J.B. Gupta
04. Electrical Power by S.L. Uppal
05. Art & Science of Utilization of Electrical Energy by H. Partab
06. Electrical Wiring, Estimating & Costing by S.L. Uppal
07. Electrical Installation Estimating & Costing by J.B. Gupta.

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EE315. POWER SYSTEM-II LAB

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**30 Marks**	**70 Marks**	**40%**

Term work:

It will consist of a record of the following experiments based on the prescribed syllabus.

1. Determination of sequence n/w of synchronous m/c.
2. Determination of sequence n/w of Induction motor.
3. Solution to load flow problem using GS, NR and FD method using software.
4. Fault analysis of various faults like LG, LLG and LL faults at least 3 sets of software experiments.
5. Four problems on stability using Equal area criteria.
6. Four problems on stability using swing curve plot.

Note:-The above set of computational work is to be carried preferably using softwares like MATLAB, Scilab, Maple, Simulink, PowerWorld and SimPower etc.

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

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EE316. CONTROL SYSTEM-II LAB

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**30 Marks**	**70 Marks**	**40%**

Term Work:

Minimum 8 programs should be performed in the laboratory based on the entire syllabus.

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

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EE317. POWER ELECTRONICS LAB

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**30 Marks**	**70 Marks**	**40%**

Term work:

It will consist of a record of at least eight of the following experiments based on the prescribed syllabus.

1. Static VI characteristic of SCR and TRIAC (Both)
2. Single phase fully controlled converter with R and RL load
3. Single phase A.C. voltage regulator
4. Static VI characteristic of GTO
5. VI Characteristic of MOSFET and IGBT (Both)
6. DC step up and step down chopper
7. 1- phase full bridge type PWM based VSI using transistor devices
8. 3-phase full bridge type PWM based VSI using transistor devices
9. Three phase AC-DC fully controlled bridge converter
10. Three phase voltage source inverter using 120° and 180°mode
11. Study of cascaded type multilevel inverter using simulation.
12. Harmonic analysis of three phase VSI inverter with different PWM techniques using simulation.
13. Single phase half controlled converter with R and RL load using simulation
14. Design of snubber circuit and verification using simulation

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

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EE318. SEMINAR

Teaching Scheme	**L: 00**	**T: 00**	**P: 02**
Evaluation	**CE**	**POE**	**Minimum Passing Marks**
Scheme	**100 Marks**	**00 Marks**	**40%**

Student needs to identify a topic in consultation with supervisor, related with cutting edge development in the field and carry out critical literature survey and present it as seminar. In no case a topic covered in UG syllabi will be selected.

Note:

Inplant Training: Every student has to undergo training arranged by T & P department, in some company for one month to get the exposure and practical experience. He/She has to submit the detailed report of the training, on the basis of which the term-work marks shall be awarded in B.E (Final Year).