B.TECH (ELECTRICAL ENGINEERING) - COURSE SYLLABI

Course Title	**Applied Chemistry**
Course Number	**AC-111**
Credits	**4**
Course Category	**DC**
Pre-requisites	**Nil**
Contact Hours (L-T-P): 3-1-0	**3-0-1**
Type of Course	Theory
Course Objectives	To impart the knowledge of applications of chemical sciences in the field of engineering and technology.
Course Outcomes	After completion of the course the students shall be able to understand: 1. The basic knowledge of methods of chemical analysis and the instrumentation involved 2. Water treatment procedures for municipal and industrial uses. 3. About solid, liquid and gaseous fuels 4. About lubricants, types and their applications 5. About corrosion and techniques to control corrosion 6. About polymers and their applications
Syllabus	**UNIT-I: METHODS OF CHEMICAL ANALYSIS (10 L)** Introduction to chemical analysis, Classification, Qualitative and gravimetric analysis, (quantitative analysis) Principle of gravimetry. The steps involved in gravimetric analysis, with special emphasis on precipitation, Digestion, Favorable conditions for precipitation, Von-Wiemarn ratio, Types of precipitates, Impurities in precipitates and their minimization.Volumetric Analysis, Titration, Titrant, Analyte Basic requirements of titrimetric method. Primary and Secondary standards, Basic requirements of primary standard. Types of titrations, Acid-Base Titration (strong acid versus strong base, pH Titration curve) Redox titration (Iodimetry, Iodometry), Precipitation titration (Silver nitrate versus sodium chloride), Chelometric titration (Ca2+/Mg2+ versus EDTA). Absorption Spectrophotometry, Beer and Lambert's law (definition and units of terms involved, deviation from Beer Lambert's law, numerical problems), block diagram of single beam UV – Visible Spectrophotometer. Definition of chromatography, Stationary and mobile phases, Classification of chromatography on the basis of physical mode and mechanism (adsorption, partition, size exclusion and ion exchange), RF Value. **UNIT-II: TREATMENT OF WATER FOR MUNICI PAL AND INDUSTRIAL USE (10 L)** Uses of water for municipal and industrial purposes, Sources of water, Impurities in water, Requirements of water for municipal use, Municipal water treatment methods, Plain sedimentation, Sedimentation with coagulation and filtration. Disinfection, Requirements of a good disinfectant, Types of disinfecting agents (Bleaching powder, Liquid chlorine, Ozone, UV radiations and Chloramine), Break point chlorination, Advantages of break point chlorination, super chlorination and dechlorination, Requirements of water for industrial use, Hardness of water, Units of hardness, Calculation on hardness, Theories of estimation of hardness by soap and EDTA methods.Boiler defects (Sludge and scale formation, Priming and foaming), Boiler corrosion and caustic embrittlement (Causes and prevention). Removal of hardness, Lime-soda process, Zeolite process, Ion-exchange process Advantages and limitations of the process, Calculations based on lime – soda process.

	UNIT-III: FUELS AND COMBUSTION (10 L) Definition of fuels, Classification of fuels, Calorific value and its determination by bomb calorimeter, Dulong's formula. Coal, Coal analysis (Boximate and ultimate analysis), Significance of constituents of coal Petroleum, Classification and important fractions of petroleum and their uses (Petrol, Diesel, Lubricating oils), Synthetic petrol (Synthesis by polymerization, by cracking by Fisher Tropsch process by Bergius process) Gaseous fuels (CNG, LPG), Advantages and disadvantages of gaseous fuels, Combustion calculations based on solid and liquid fuels. **UNIT-IV: LUBRICANTS AND LUBRICATION (10 L)** Definition and classification of lubricants, Functions of lubricants, Lubrication (Types of lubrication and their mechanisms). Liquid lubricants (Mineral oils, Fatty oils, Compounded oils and Silicone fluids) Greases types of greases and conditions of their use, Testing of greases, Solid lubricants and conditions of their use. Testing of liquid lubricants (Viscosity and viscosity index, Flash and fire points, cloud, pour and setting points, Saponification value, Aniline point), Selection of lubricants (Cutting tools, Internal combustion engine, Transformer, Refrigerators). **UNIT- V: CORROSION AND ITS PREVENTION (10 L)** Definition, Significance (Economic aspect), Classification of corrosion. Dry corrosion, Mechanism of dry corrosion, Types of oxide film, Pilling Bedworth rule. Electrochemical corrosion, mechanism of electrochemical corrosion, Factors influencing corrosion rate. Electrochemical series and Galvanic series Corrosion control methods (proper design, important designing principles, selection materials cathodic protection, metallic coatings (galvanizing, tinning) Organic Coatings, types, Paints, (Constituents of paints, Drying mechanism of oil). **UNIT-VI: POLYMERS (10 L)** Definition and classification of polymers (On the basis of origin, synthesis, thermal response, physical state, applications, chemical structure) Polymerization (Addition and condensation), Mechanism of free radical addition polymerization of vinyl chloride, Difference between thermoplastics and thermosetting. Thermoplastics (Preparation, properties and uses of PE, PVC, Nylons, PTFE) Thermosetting plastics (Preparation, properties and uses of bakelite, polyesters) Elastomers (Preparation, properties and uses of NR, BUNA rubbers), vulcanization.
Books*/References	1. Analytical Chemistry by G.D. Christian, John Wiley and Sons, New York. 2. Quantitative Analysis by R.A. Day and A.L. Underwood. 3. A Text Book of Engineering Chemistry by S.S. Dara, S. Chand & Co., New Delhi (India). 4. Engineering Chemistry by B.K. Sharma, Krishna Prakashan Media (P) Ltd., Meerut (India). 5. Engineering Chemistry by P.C. Jain, Dhanpat Rai Publishing Company, New Delhi.

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Course Work (Home Assignment & Quizzes	15 Marks
		Midsem Examination (1 Hour)	25 Marks
		Sessional Total	**40 Marks**
	Endsem Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Applied Chemistry**		
Course number	**AC-194**		
Credit Value	**2**		
Course Category	**DC**		
Pre-requisite	**Nil**		
Contact Hours (L-T-P)	**0-0-3**		
Type of Course	Practical		
Course Objectives	To train the students for the applications of the chemical sciences in the field of engineering and technology.		
Course Outcomes	After completion of the course the students shall be able to understand: 1. The basic methods of chemical analysis and the instrumentation involved. 2. To estimate the hardness of water. 3. To carry out the proximate analysis of coal and grade the coal for industrial purposes. 4. To estimate the drop point of grease and its applications. 5. To study and explore the nature of the corrosion and its control. 6. About the determination of the molecular weight by viscometer.		
Syllabus	**LIST OF EXPERIMENTS:** 1. Determine total, permanent and temporary hardness of water in ppm by versenate method. 2. To determine the amount of dissolved oxygen in water in ppm units. 3. To determine the cloud point, pour point and setting point of an oil. 4. To determine the percentage of available chlorine in the given sample of bleaching powder. 5. To carry out proximate analysis of the given sample of coal. 6. To determine the saponification value and percentage of fatty oil in the given sample of compounded oil. 7. To determine the aniline point of a given sample of an oil. 8. To determine the relative viscosity of an oil by redwood viscometer and to study the variation of viscosity with change in temperature. 9. To demonstrate and explore the electrochemical nature of aqueous corrosion. To study the electrochemical methods of corrosion control. 10. To determine the flash point of an oil by Abel's and Pensky Marten's apparatus. 11. Determination of iron in a given sample of water with 1, 10 phenanthroline by spectrophotometry.		
Books*/References	1. Lab Manuals provided by the Department.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Viva-Voce	60 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (2 Hours)		40 Marks
		Total	**100 Marks**

Course Title		**Mathematics -I**	
Course number		**AM-111**	
Credit Value		**04**	
Course Category		**DC**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To learn the fundamental concepts of matrices, differential and integral calculus, the theory of differential equations, applications.		
Course Outcomes	After completing this course the students should be able to: 1. apply tools of the theory of matrices to relevant fields of Engineering. 2. understand curve tracing and regions between different curves. 3. expand important mathematical functions in power series and their applications. 4. apply tools of integration to find length, surface area and volume. 5. express real life problems into mathematical models using differential equations and analyse their solutions.		
Syllabus	**UNIT-1** Rank of a matrix with applications to consistency of a system of linear equations, eigen-values and eigen vectors of a matrix, Caley-Hamilton theorem. **UNIT-2** Asymptotes and simple curve tracing. successive differentiation, Leibnitz's theorem, Taylor and Maclaurin series with remainder terms. **UNIT-3** Applications of integration to lengths of curves, surfaces and volumes of solids of revolution. **UNIT-4** Solution of exact differential equations, linear differential equations of second and higher order with constant coefficients, homogeneous differential equations, simultaneous linear differential equations, applications to physical problems.		
Books*/References	1. Chandrika Prasad , ″A First Course in Mathematics for Engineers″, Pothishala Pvt. Ltd., Allahabad. 2. Chandrika Prasad, ″ Mathematics for Engineers″, Pothishala Pvt. Ltd., Allahabad. 3. Erwin Kreyszig, ″Advanced Engineering Mathematics″, John Wiley & Sons, INC.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Course Work (Home Assignments)	15 Marks
		Midsem Examination (1 hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Mathematics –II**	
Course number		**AM112**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To learn partial differentiation, multiple integration, polar forms of conics, various forms of general equation of second degree and its tracing, applications.		
Course Outcomes	After completing this course the students should be able to: 1. understand the theory of functions of several variables and its applications . 2. understand double and triple integrals and use it to find surface area and volume. 3. learn various forms of general equation of second degree and its tracing. 4. understand polar forms of conics.		
Syllabus	**UNIT-1** Partial differentiation, Euler's theorem, total differential, small errors, change of variables, Jacobians. **UNIT-2** Taylor series of functions of two variables, approximate calculations, maxima and minima of functions of two variables, Lagrange's multipliers. **UNIT-3** Double and triple integrals, change of variables, change of order of integration, applications to area and volume. **UNIT-4** General equation of second degree, tracing of conics, introduction to polar form of conics.		
Books*/References	1. Chandrika Prasad, ″A First Course in Mathematics for Engineers″, Pothishala Pvt. Ltd., Allahabad. 2. Chandrika Prasad, ″ Mathematics for Engineers″, Pothishala Pvt. Ltd., Allahabad. 3. Erwin Kreyszig, ″Advanced Engineering Mathematics″ , John Wiley & Sons, INC. 4. Gorakh Prasad, ″ A text book of coordinate geometry″, Pothishala Pvt. Ltd., Allahabad.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	15 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Higher Mathematics**	
Course number		**AM223**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**AM111, AM112**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To learn complex analysis and various numerical methods to solve engineering problems.		
Course Outcomes	After completing this course the students should be able to: 1. understand and apply fundamental concepts of complex functions and their representation in Taylor and Laurentz series. 2. understand and apply complex integration. 3. apply numerical methods to solve linear, nonlinear equations and interpolation techniques in scientific computations including estimation of errors. 4. calculate derivatives and areas when functions are given in tabular forms and obtain numerical solutions of differential equations.		
Syllabus	**UNIT-1:** Functions of complex variable, analytic functions, Cauchy-Reimann equations, complex integration, Cauchy's theorem, Cauchy's integral formula. **UNIT-2:** Series and contour integration**:** Taylor series, Laurent's series, zeros and singular points, residues and residue theorem, evaluation of real integrals by contour integration. **UNIT-3:** Numerical solutions of algebraic equations: solution of algebraic and transcendental equations by Newton-Raphson and general iterative methods, solution of linear simultaneous equations by Gauss-elimination and Gauss-seidel methods, finite difference operators, Newton's forward and backward interpolation formulae. **UNIT-4:** Numerical solution of ordinary differential equations: Taylor's series method, Euler's and modified Euler's methods, Runge-Kutta fourth order method, solution of two point boundary value problems by finite difference methods.		
Books*/References	1. Chandrika Prasad, ″ Mathematics for Engineers″, Pothishala Pvt. Ltd., Allahabad. 2. M. K. Venkataraman, ″ Engineering Mathematics″, Third Year (Part A, B), National Publishing Co. Madras. 3. M. K. Jain, S.R.K. Iyenger and R.K. Jain, ″Numerical Methods for Scientific and engineering Computation″, New age International Publication (P) Ltd. 4. S.S. Sastry, ″Introductory Numerical Methods″, Prentice Hall India Ltd. 5. Erwin Kreyszig,″Advanced Engineering Mathematics″, John Wiley & Sons, INC.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	15 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Applied Physics**
Course number	**AP-111**
Credit Value	**4**
Course Category	**BS**
Pre-requisite(s)	**None**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives

To equip the student with a strong understanding of the fundamentals of physics so as to enable him/her to apply it to his/her field of study.

This course should enable the student to-

1. explain the behavior of the physical world around him/her
2. apply the concepts of physics in his/her field of study
3. relate the concepts of physics to the advancement of technology.
4. understand and relate the different phenomena in the world.
5. approach problems, predict their results in advance, and solve them in quantitative and qualitative manner.
6. gain a broader understanding of other sciences.

Course Outcomes

Upon completion of the course, the student will be able to:

1. recognize and present real life examples of the aforementioned concept and interrelate some of them.
2. describe the link between physics and the technology.
3. identify technological applications of some of the aforementioned concepts.
4. describe how he/she can harness the benefits of some of the aforementioned concepts to his /her area of specialization.
5. understand the professional and ethical responsibilities of the subject.
6. communicate effectively while speaking, employing graphics and writing.

Syllabus

UNIT 1. MASERS AND LASERS

Basic principle, Einstein coefficients for Induced absorption, Spontaneous emission and Induced emission, Ammonia maser and its applications, Ruby and He-Ne Lasers, Semiconductor laser, Spatial and temporal coherence, Characteristics of lasers and its applications based on these characteristics (such as in Industry, Science, Medicine, Communications, Surveying, Holography, Fusion reactors, Isotope separation, etc.). Fibre Optics: Basic principle, Fibre construction and dimensions, Light propagation in fibres, Numerical aperture of the fibre, Step index and graded index fibres, Signal distortion in optical fibres, Transmission losses, Light wave communication in optical fibres, Fibre optics in medicine and industry.

UNIT 2. SEMICONDUCTORS

Elemental and compound semiconductors, Energy bands, Direct and indirect semiconductors, Electrons and holes, Effective mass, Intrinsic material, Extrinsic material, Fermi level, Electron and hole concentration at equilibrium, Temperature dependence of carrier concentrations, Compensation and space charge neutrality, Conductivity and mobility, Hall effect in semiconductors.

Superconductivity: Zero resistivity, Meissner effect, Type I and Type II superconductors, High temperature superconductors, BCS theory (qualitative), Josephson effect, SQUIDS.

UNIT 3. PARTICLES AND WAVES

Mechanism of X- ray production (continuous and characteristic Xrays, Duane- Hunt limit), Compton effect, Pair production, Phase and group velocities, Uncertainty principle.

	Quantum Mechanics: Introduction to quantum mechanics, Wave function, Conditions necessary for physically acceptable wavefunction, Probability density and probability, Schrödinger equation (Time dependent form and Steady state or time independent form), Eigenvalues and eigenfunctions, Expectation values, Particle in a box (Infinite square potential well), Tunnel effect (qualitative). **UNIT 4. STATISTICAL MECHANICS** Statistical distributions, Maxwell–Boltzmann statistics, Molecular energies in an ideal gas, Quantum statistics, Specific heats of solids, Free electron in a metal, Electron- energy distribution. Nuclear Physics : Q-value and threshold energy of nuclear reactions, Cross section of a nuclear reaction and reaction rate, Breeder reactors, Fusion reactors, Nuclear detectors (names and general working principle), Gas filled detectors, Scintillation detectors.
Books*/References	1. Ben G. Streetman, "Solid State Electronic Devices" 5th edition (2000), Prentice-Hall of India Private Limited, New Delhi. 2. Arthur Beiser, "Concepts of Modern Physics" 6th edition (2003), Mc. Graw Hills Inc. International Edition. 3. M.R. Wehr, J.A. Richards Jr. and TW Adair III, "Physics of the Atom" 4th edition (1984), Addison Wesley / Narosa. 4. 4. M.R. Srinivasan, "Physics for Engineers" 1st edition (1996), New Age International (P) Limited, Publishers.

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Home Assignments	15 Marks
		Midsem Examination (1 hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Physics Lab**
Course number	**AP-194**
Credit Value	**2**
Course Category	**BS**
Pre-requisite	**None**
Contact Hours (L-T-P)	**0-0-3**
Type of Course	Lab

Course Objectives	This course should enable the student to- 1. build an understanding of the fundamental concepts with the help of experiments. 2. familiarize the student with the various experiments of the physical world around him/her. 3. apply the concepts of physics in his/her field of study. 4. relate the concepts of physics to the advancement of technology. 5. allow the student to gain expertise in design and maintenance of experiment setup.
Course Outcomes	Upon completion of the course, the student will be able to: 1. recognize and present real life examples of various experiment performed. 2. describe the link between physics and the technology. 3. understand and explain data analysis and identify technological applications of the experiments. 4. describe how he/she can harness the benefits of some of the experiments to his /her area of specialization. 5. understand the professional and ethical responsibilities of the subject. 6. communicate effectively while speaking, employing graphics and writing.
Syllabus	**LIST OF EXPERIMENTS** 1. To determine the moment of inertia, I of a flywheel about its axis of rotation. 2. To determine resistance per unit length, σ of a Carey Foster's Bridge wire and hence to find the difference between the two nearly equal unknown resistances. 3. To determine the modulus of rigidity of the material of a wire, η by statical (vertical) method. 4. To determine the refractive index, μ of the material of a prism for parrot green line in the mercury spectrum. 5. To study the variation of semiconductor resistance with temperature and hence to find the energy- gap, Eg of the semiconductor. 6. (a) To study the V-I and power characteristics of a solar cell and also to determine its fill factor. (b) To study the current versus voltage characteristics of two light emitting diodes (LED) and hence to determine their cut in voltages. 7. To determine the diameters of three thin wires with the help of a He-Ne Laser. 8. To determine the coefficient of thermal conductivity, K of rubber in the form of a tube. 9. To convert a Weston type galvanometer into an ammeter (ranges 5, 10 and 15 A) and a voltmeter (ranges 5, 10 and 15 V). 10. To determine the wavelength, λ of yellow line of shorter wavelength in the mercury spectrum with plane transmission grating. 11. To determine the specific rotation, αt of cane sugar solution in water using a biquartz polarimeter. 12. To calibrate a given thermo-couple with the help of a potentiometer. 13. To find the operating voltage of a G.M. counter and to determine the absorption coefficient, μ of copper for gamma rays from 137 Cs source. 14. (a). To draw the graph between various values of capacitance and the

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<tr><td colspan="2"></td><td colspan="2">corresponding frequencies of a given oscillator and to determine the value of unknown capacitance by using Lissajous Figures.
(b). To draw the graph between various values of inductance and the corresponding frequencies of a given oscillator and to determine the value of unknown inductance by using Lissajous Figures.
15. To determine Hall coefficient, RH and majority carrier concentration of a given semiconductor sample.</td></tr>
<tr><td colspan="2">Books*/References</td><td colspan="2">1. Prof. D.S. Srivastava & Dr. Ameer Azam, Laboratory Manual of Applied Physics Experiments, AMU, Aligarh
2. Indu Prakash and Ramakrishna, A Text Book of Practical Physics, Kitab Mahal, New Delhi.
3. D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. K. K. Dey, B. N. Dutta, Practical Physics, Kalyani Publishers, 1981, New Delhi.</td></tr>
<tr><td rowspan="5">Course Assessment/ Evaluation/Grading Policy</td><td rowspan="3">Sessional</td><td>Record book</td><td>42 Marks</td></tr>
<tr><td>Viva-Voce</td><td>18 Marks</td></tr>
<tr><td>Sessional Total</td><td>60 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (2 Hours)</td><td>40 Marks</td></tr>
<tr><td colspan="2">Total</td><td>100 Marks</td></tr>
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Course Title	**Environmental Studies**
Course number	**CE-111**
Credit Value	**4**
Course Category	**ESA**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	1. To understand the basic concept of ecology, atmospheric structure and its chemistry involved. 2. To have a knowledge about the air quality and its standards and how to control air pollution. 3. To have knowledge about Water Quality: Physical, Chemical and Biological parameters. 4. To understand the Water purification processes in natural systems and introduction to Water Treatment Technologies. 5. To know about the wastewater characteristics and wastewater treatment technologies. 6. To have a knowledge about the solid waste management.
Course Outcomes	Upon successfully completing this course in environmental studies, it is expected that student will be able to: 1. Understand fundamental physical and biological principles that govern natural processes. 2. Demonstrate an in-depth understanding of the sub disciplines within environmental studies (i.e. Biology. Chemistry, Physics etc). 3. Communicate environmental scientific information to both professional and lay audiences. 4. Demonstrate an understanding of current environmental challenges. 5. Develop a basic fundamental background for the higher environmental engineering courses offered in civil engineering department.
Syllabus	**UNIT I:** Concepts of Ecology: Ecosystem, Energy and nutrient flow in ecosystem, Food chain, Environmental Segments: Atmospheric Structure, classification of air pollutants, sources of air pollution and their effects on human health and property. Atmospheric chemistry, Photochemical Smog, Ozone depletion. **UNIT II:** Air Quality and Standards, Meteorological phenomena and their influence on Air Quality, Lapse rates, Dispersion of Pollutants. Air Pollution Control: Introduction to Particulate and Gaseous pollutant control. **UNIT III:** Water Quality: Physical, Chemical and Biological parameters. Water quality standards, Biochemical (BOD) and Chemical Oxygen Demand (COD). BOD/COD Calculations Environmental Analyses: pH, Alkalinity, Conductivity, Ammonia, Fluoride, Sulphate, Chloride. Analysis and measurement of gaseous pollutants. **UNIT IV:** Water purification processes in natural systems: Dissolved Oxygen (DO), Impact of wastewater discharge on streams, Oxygen Sag Curve. Introduction to Water Treatment Technologies: Sedimentation, coagulation and Flocculation, Hardness Reduction, Filtration and Disinfection. **UNIT V:** Wastewater Characteristics, Introduction to wastewater treatment technologies. Primary Treatment: Screening, Grit Removal, Flow measurement, Flow equalization. Secondary Treatment: Microbial growth curve, Suspended and

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<tr><td colspan="2"></td><td colspan="2">Attached growth systems.
UNIT VI:
Solid Waste: Classification, Sources and Characteristics. Waste Management: Solid Waste Generation, Collection, Processing and Disposal Methods. Resource Recovery in Waste Management, Biological and Thermal Conversion Processes.</td></tr>
<tr><td colspan="2">Books*/References</td><td colspan="2">1. Venugopala Rao, P., 2006, Principles of Environmental Science and Engineering, Prentice-Hall of India Private Limited, New Delhi.
2. Masters, G.M., 1991, Introduction to Environmental Engineering and Science, Prentice- Hall International, Inc., Englewood Cliffs, NJ.
3. Peavy, H.S., D.R. Rowe and G. Tchobanoglous, 1985, Environmental Engineering, McGraw-Hill Book Company, New York.
4. Henry, J.G. and G.W. Heinke, 1989, Environmental Science and Engineering, Prentice- Hall International, Inc., Englewood Cliffs, NJ.
5. Sawyer, C.N. and P.L. McCarty, 1978, Chemistry for Environmental Engineering, 3rd Edition, McGraw-Hill Book Company, New York.
6. Tchobanoglous, G., H. Theisen and S. Vigil, 1993, Integrated Solid Waste Management, McGraw-Hill Inc. Singapore.</td></tr>
<tr><td rowspan="4">Course Assessment/ Evaluation/Grading Policy</td><td rowspan="3">Sessional</td><td>Assignments (2 to 3)</td><td>15 Marks</td></tr>
<tr><td>Mid Term Examination (I Hour)</td><td>25 Marks</td></tr>
<tr><td>Sessional Total</td><td>40 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (3 Hours)</td><td>60 Marks</td></tr>
<tr><td colspan="2">Total</td><td>100 Marks</td></tr>
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Course Title		**COMPUTER PROGRAMMING LABORATORY**	
Course number		**CO-191**	
Credit Value		**2**	
Course Category		**ESA**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**0-1-2**	
Type of Course		Practical	
Course Objectives	To make the students familiar with the Programming concepts and to implement the algorithmic approach of problem solving in C language to gain working knowledge of C programming.		
Course Outcomes	Students will be able to: 1. Understand programming concepts. 2. Develop analytical skills for step by step solution for algorithms. 3. Solve problems through programming. 4. Relate and extend C programming concepts including control statements, strings, functions and programming techniques to solve computational problems.		
Syllabus	Introductory discussion of how a computer executes a program. A brief discussion of high level languages, e.g., C, and C++ and low level languages, e.g., assembly language and binary code. An introduction to the translation i.e. compilation process. Experiments to be conducted in the laboratory consist of, but not limited to, the following: 1. Practice of Turbo C as the development environment. 2. Simple introductory algorithms and programs for getting input, printing formatted output etc. 3. Programs introducing elementary C concepts, like variable and names. 4. Programs using operators. 5. Programs using control structures. 6. Programs for repetitive tasks and iterations. 7. Programs on arrays and strings. 8. Programs introducing the use of function calls. 9. Programs introducing basic concept of file handling. 10. Programs for using basic concepts of storage classes.		
Books*/References	1. Kemighan, Brian W., and Dennis M. Ritchie. "The C programming language."*Prentice-Hall, Englewood Cliffs, New Jersey (I978).* 2. Gottfried “Theory and Problem of Programming with C” Schaum’s Outline Series, TMC (Text book). 3. M. Inamullah and S. M. Zakariya. "CO191 Computer Programming Lab Course Content and Practice Schedule", *Department of Computer Engineering, A.M.U.* (This document can be obtained in PDF format from the instructor).		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Reports	40 Marks
		Viva-Voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (2 Hours)		40 Marks
		Total	**100 Marks**

Course Title	Basic Electrical and Electronics Engineering
Course number	**EE-111**
Credit Value	**4**
Course Category	**ESA**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives

The objective of this course is to set a firm and solid foundation in Electrical & Electronics Engineering with strong analytical skills and conceptual understanding of theorems and analysis methods in electrical and magnetic circuits, electronic devices, circuits, measuring instruments. The course will familiarize students with various motors, transformers, power generation system.

Course Outcomes

After successful completion of this course, the students will be able to:

1. Analyse electrical and magnetic circuits with moderate complexity applying fundamental laws and theorems in steady-state as well as transient operation.
2. Analyse AC circuits using phasors.
3. Converse with transformers, motors, measuring instruments.
4. Understand various methods of electrical generation
5. Identify schematic symbols and understand the working principles of electronic devices e.g. Diode, Zener Diode, LED, BJT, JFET and MOSFET etc.
6. Understand the working principles of electronic circuits e.g. Rectifiers, Amplifiers and Operational Amplifiers etc.
7. understand methods to analyse and characterize these circuits

Syllabus

PART A

UNIT I: Circuit and Transformers

Review of dc circuits and theorems, 1-phase circuits, superposition theorem, thevenin's theorem and norton's theorem for ac circuits, RLC series and parallel circuits, 3-phase balanced ac circuits. Magnetic circuits, magnetization curve, hysteresis & eddy current effect/losses. Transformer construction, equivalent circuit, calculation of losses and efficiency.

UNIT II: Introduction to Electrical Machines, Instruments and Power System

3-phase induction motor and 1-phase induction motors. Basic elements of an instrument: MC, MI instruments, dynamometer wattmeter, digital energy meter. Elements of power system, layout of thermal, hydro, nuclear and gas plants. Introduction to renewable energy sources and recent trends in generation.

PART B

UNIT III: Diode and BJT

Terminal characteristics of diodes, diodes models; Ideal, constant voltage and piecewise linear, load line concept, Diode applications; Rectifier, logic gates, Zener diode; Operation, characteristics, voltage regulation. Bipolar Junction Transistor; Construction, operation, configurations, characteristics of common emitter configuration, DC load analysis.

UNIT IV: MOSFET and OPAMP

Introduction to MOSFET; Depletion MOSFET construction, operation, Enhancement MOSFET construction, Operation, amplifiers, Operational Amplifiers; equivalent circuit, ideal behavior, open loop and closed loop concept, concept of virtual short, simple Opamp applications; Unity gain amplifier, inverting, non-inverting, integrator, differentiator, subtractor, summer.

Books/ References

1. Ashfaq Husain*: Fundamentals of Electrical Engineering, 3rd Edition, Dhanpat Rai & Sons.
2. R. Boylestad & L. Nashelsky*: Electronic Devices and Circuits, Prentice Hall, 1995.

<table>
<tr><td></td><td colspan="3">3. Hughes: Electrical Technology. 7th edition, Addison Wesley.
4. A.K. Sawhney: A course in Electrical & Electronics Meas. & Inst., Dhanpat Rai & Sons.
5. B.R. Gupta: Electrical Power Systems, Wiley Eastern.
6. Mathur, Chadda and Kulshresta: Electronic Devices, Applications and Integrated Circuits, Umesh Publications.</td></tr>
<tr><td rowspan="5">Course Assessment/ Evaluation/Grading Policy</td><td rowspan="4">Sessional</td><td>Assignments (2 to 3)</td><td>10 Marks</td></tr>
<tr><td>Quiz (3 to 4), Best two may be considered</td><td>05 Marks</td></tr>
<tr><td>Mid Term Examination (I Hour)</td><td>25 Marks</td></tr>
<tr><td>Sessional Total</td><td>40 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (3 Hours)</td><td>60 Marks</td></tr>
<tr><td colspan="3">Total</td><td>100 Marks</td></tr>
</table>

Course Title	**Electrical Machines-I**
Course number	**EE-211N**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	**Theory**

Course Objectives	To introduce the basic concepts of transformers (3-phase and single -phase), voltage regulation and testing of transformers, Parallel operation, Autotransformers, Phase transformation of transformers. To introduce the basic concepts of induction machines (3-phase and single -phase), production of rotating magnetic field, circle diagram, effects of space harmonics, induction generator.
Course Outcomes	At the end of the course the students will be able to: 1. apply the knowledge about the machines in the field. 2. machine based problems can be solved. 3. suggest the kind of machine suitable for field work. 4. can design and develop new machines. 5. can used Modern tools for control. 6. design the machines for environmental friendly. 7. can learn machine for life long.
Syllabus	**UNIT-I: Transformer-I** Introduction; Efficiency: maximum and all-day; Equivalent circuit of single-phase transformer, voltage regulation, Testing: load test, open circuit and short circuit tests, Sumpner's test. **UNIT-II: Transformer-II** Construction of three phase transformer and their phase groupings; Parallel operation; Harmonics in transformers; Autotransformers: Introduction, comparison with two winding transformers; Phase transformation: Three-phase to two-phase, single-phase, and six-phase. **UNIT-III: Three-Phase Induction Machines-I** Winding factors of ac windings; emf equation of ac machine; mmf wave of single and three phase windings; space harmonics; Construction and principle of operation of three-phase induction motor; production of rotating magnetic field, equivalent circuit and phasor diagram. **UNIT-IV: Three-Phase Induction Machines-II** Losses and power flow diagram; slip-torque curves; no load and blocked rotor tests; circle diagram; starting methods; effects of space harmonics; cogging, crawling, and noise; induction generator. **UNIT-V: Single-Phase Induction Motors** Principle of operation of single-phase induction motors; double revolving field and cross field theories; equivalent circuit; classification and starting of single-phase induction motors; testing.
Books*/References	1. *I. J. Nagrath and D. P. Kothari, Electric Machines, Tata McGraw Hill, 2004. 2. B. S. Guru and H. R. Hiziroglu, Electric Machinery and Transformers, 3rd ed, Oxford University Press (Indian Edition). 3. P. S. Bhimbra, Electric Machinery, Khanna Publishing House 4. Fitzgerald, Kingley and Uman, Electric Machinery, McGraw-Hill, Inc.

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Mid Term Examination (I Hour)	25 Marks
		Quiz	10 Marks
		Assignments	05 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Electrical Machines-II**	
Course number		**EE-213N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		**Theory**	
Course Objectives	To introduce the basic concepts of Synchronous Machines. The salient and non-salient pole machines, maximum power. Open circuit, short circuit and zero power factor tests, Slip test. Alternator load characteristics. To introduce the basic concepts of D.C. machines, function of commutator, simplex lap and wave windings, armature reaction, and Special motors: universal motor, permanent magnet dc machines, hysteresis motor, reluctance motor, and stepper motor.		
Course Outcomes	At the end of the course the students will be able to 1. Apply the knowledge about the machines in the field. 2. Machine based problems can be solved 3. Suggest the kind of machine suitable for field work. 4. Can design and develop new machines 5. Can used Modern tools for control 6. Design the machines for environmental friendly 7. Can learn machine for life long		
Syllabus	**UNIT I: Synchronous Machines-I** Construction, armature reaction and two reaction theory, synchronous reactance and phasor diagram, expression for power developed and power angle curve for salient and non-salient pole machines, maximum power. Open circuit, short circuit and zero power factor tests, Slip test. Alternator load characteristics. **Unit II: Synchronous Machines-II** Voltage regulation and its determination by synchronous impedance and Portier triangle methods, Synchronization of three phase alternators, effect of governor characteristics on load sharing of alternators, operation on infinite bus bars, active and reactive power control. **Unit III: Synchronous Machines-III** Synchronous motors: methods of starting, synchronizing power, hunting, V-curves, synchronous condenser, Transient and sub-transient reactances and time constants, Negative and zero sequence impedances. **Unit IV: D. C. Machines** Construction, function of commutator, simplex lap and wave windings, emf and torque equations, armature reaction and commutation. D. C. generator characteristics. **Unit V: D. C. Machines and Special Machines** Characteristics of dc motors, testing of dc machines, dc motor starters, Special motors: universal motor, permanent magnet dc machines, hysteresis motor, reluctance motor, and stepper motor.		
Books*/References	1. *I. J. Nagrath and D. P. Kothari, Electric Machines, Tata McGraw Hill, 2004. 2. B. S. Guru and H. R. Hiziroglu, Electric Machinery and Transformers, 3 ed, Oxford University Press (Indian Edition). 3. P. S. Bhimbra, Electric Machinery, Khanna Publishing House**.** 4. E. Openshaw Taylor,Performance and Design of A. C. Commutator Motors, A. H. Wheeler, New Delhi.		
Course Assessment/ Evaluation/G	**Sessional**	Mid Term Examination (I Hour)	25 Marks
		Quiz	10 Marks
		Assignments	05 Marks

rading Policy		**Sessional Total**	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Power System Engineering**
Course number	**EE-231N**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory
Course Objectives	To give an overview of power system and its various components and their importance. Calculation of line parameters, evaluation of line performance, mechanical aspects of overhead transmission line, underground cables, their constructional features and current rating. Sub-stations, its earthing various equipments used in them and their function.
Course Outcomes	After completing the course, the students should be able to know about the overhead and underground types of transmission systems, different mathematical models to represent different types of transmission lines and evaluate their performance. They should also be able to design an overhead transmission line including mechanical aspects. They will also know about different types of sub-stations, sub-station earthing and different components used in it and their objective.
Syllabus	**UNIT I:** Electrical Characteristics of O.H. Lines: Types of conductors for O.H. power transmission. Calculation of Line parameters; inductance and capacitance for single and double circuit lines, bundle conductors. Concept of GMD and GMR, Effect of earth on line capacitanc **UNIT II:** Performance of O.H. Transmission Lines: Representation of short, medium and long transmission lines; nominal-T, nominal-π and equivalent-π, Characteristic impedance, Z0 and SIL, ABCD parameters, Voltage regulation and efficiency, Compensation of line, Corona and radio interference. **UNIT III:** Insulators and Mechanical Design of O.H. Lines: Types of insulators; pin, disc and strain type. Voltage distribution and equalization; Arcing horns, Types of line supports, Air clearance. Sag calculations, effect of wind and ice loading. Ground clearance, Vibration of conductors and dampers. **UNIT IV:** Underground Cables: Construction of single core and three core cables, electrostatic stresses and grading of cables, thermal rating of cables, testing of cables, HVDC cables, cable failure. **UNIT V:** Substation: Classification, components and layout of substation (33 / 11 Kv). Package substations. Introduction to Gas insulated substations, Substation grounding and grounding methods.
Books*/Referencs	1. *Nagrath and Kothari Power System Engg. 3rd edition (TMH) 2. Cotton and Barbar Transmission and Distribution of Electrical Energy, (BI Publications). 3. Ashfaq Husain Electrical Power System; 4th edition (CBS). 4. WD Stevenson Elements of Power System Analysis (McGraw Hill). 5. CL WadhwaElectrical Power Systems (Wiley Eastern).

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2)	15 Marks
		Mid Term Examination (1Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Electrical Measurements**
Course number	**EE-251N**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	To introduce the concepts of measurement standards, measurement errors, operation of electrical and electronic measuring instruments and their testing and calibration, measurement of electrical quantities and circuit parameters.
Course Outcomes	At the end of the course the students will be able to 1. Understand the measurement standards and analyse the measurement errors. 2. Apply the knowledge about the instruments to use them more effectively. 3. Suggest the kind of instruments and instrumentation schemes suitable for typical measurements.
Syllabus	**Unit I** **Measurement Standards and Errors:** Classification of standards, standards of EMF, Resistance, Inductance, Capacitance. Inaccuracies in R, L, C components. Classification, types and applications of measurement systems. Characteristics of instruments & measurement system**.** Measurement errors and their analysis. **Unit II** **Electromechanical Instruments:** Review of PMMC, MI, Electrodynamometer, Thermal, and Electrostatic instruments. Errors and their remedies in the Electromechanical instruments. Working principles of Hall effect Ammeter and Wattmeter. Measurement of power in three phase systems. Measurement and adjustments in the single phase Induction type Energy meter. Dynamic behavior of D' Arsonval Galvanometer. **Unit III** **Bridges:** Bridges for measurement of low, medium, and high Resistances. Measurement of Inductance and Capacitance with the help of AC bridges. Multimeter, Ratiometer and Megger. Principle of AC potentiometers, Testing of Wattmeter and Energy Meter using phantom method of loading. **Unit IV** **Magnetic and Power System Measurements:** Determination of B-H curve of magnetic specimen. Measurement of Iron losses and their separation using Lloyd Fisher Square. Measurement of high voltage using Sphere Gap and Rectified Charging Current methods. Synchro-scope. Principle, construction and testing of Current Transformer and Potential Transformer **Unit V** **Electronic Instruments:** Average reading, RMS reading and True RMS reading voltmeters. Electronic potentiometer, Instrumentation Amplifier. Harmonic analysis of waveforms. Review of basic CRO circuit (Block Diagram). Probes, Oscilloscope control. Measurement of voltage, frequency, and phase using a CRO.
Books*/References	1. *Golding & Widis Electrical Measurement & Measuring Instruments, Pitman 2. *H. S. Kalsi Electronic Instrumentation, TMH 3. A. K. Sawhney Electric & Electronic Measurement & Instrumentation, Dhanpat Rai 4. David Bell Electronic Instrumentation & Measurement, PHI

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Circuit Theory**
Course number	**EE-276**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	To introduce the basic concepts of AC/DC Theorems, Transient and Steady State Response of R-L-C Circuits, Two port network parameters, Network functions and time response, basics of graph theory and formulation of network equations, state variable techniques and introduction to electric filters.
Course Outcomes	At the end of the course the students will be able to 1. solve R-L-C network problems using various AC/DC theorems and their transient response; 2. calculate parameters of various two port power or communication networks; 3. determine driving point and transfer functions of various networks, their poles and zeros and also their time response; 4. formulate multi-bus power network equations using Graph Theory; 5. formulate state space equations representing a system and design basic type of electric filters.
Syllabus	**UNIT I: Transient Response and Network Theorems** Transient response of R-L, R-C, R-L-C circuits to sinusoidal input, Maximum power transfer theorem, compensation theorem, reciprocity theorem, Millman and Tellengen's theorem. **UNIT II: Two Port Network and I A M** Various two port circuit parameters, relationship between different 2 port parameters, equivalent T and π networks, interconnection of 2 port networks, transmission parameters in terms of OC & SC parameters. **UNIT III: Network Functions** Natural frequencies, complex frequencies, Network functions, driving point and transfer functions, poles and zeros of network function, physical interpretation of poles and zeros, time domain response from pole zero plot. **UNIT IV: Graph Theory** Definition of various terms used in graph theory, Formulation of various network matrices and relationship between them, Formulation of network equations on the basis of loop, mesh, tree branch voltage and node pair voltage. **UNIT V: State Variable Analysis and Filters** Sate space representation, formulation of state equations, Solution of state equation, Introduction of electric filters, Constant K and m derived filters Low pass and high pass.
Books*/References	1. Choudhry D. Roy: Network and Systems, New Age International 2003. 2. Ashfaq Husain: Networks and Systems, Khanna Publishers, Delhi,

<table>
<tr><td colspan="2"></td><td colspan="2">2008.
3. Shankar and Shyam Mohan: Circuits and Network Analysis and Synthesis, Tata Mc Graw Hill, New Delhi, 2006
4. Kuo M.F: Network Analysis and Synthesis.
5. Aatre V.K: Network Theory and Filter Design</td></tr>
<tr><td rowspan="6">Course Assessment/ Evaluation/ Grading Policy</td><td rowspan="4">Sessional</td><td>Assignments (2 to 3)</td><td>10 Marks</td></tr>
<tr><td>Quiz (3 to 4), Best two may be considered</td><td>05 Marks</td></tr>
<tr><td>Mid Term Examination (I Hour)</td><td>25 Marks</td></tr>
<tr><td>Sessional Total</td><td>40 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (3 Hours)</td><td>60 Marks</td></tr>
<tr><td colspan="2">Total</td><td>100 Marks</td></tr>
</table>

Course Title	**Electrical Engineering Materials**
Course number	**EE-277**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Basic Electrical Engineering, Applied Mathematics & Applied Physics**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	The objective of the course is to introduce the concepts, atomic structure, electrical properties and applications of conducting, superconducting, insulating, dielectric and magnetic materials.
Course Outcomes	At the end of the course the students will be able to 1. Apply the knowledge about the Electrical Engineering Materials to use them more effectively. 2. Become familiar with the dielectric behavior in static as well as varying field and polarization mechanisms. 3. Understand the modern trends in electrical insulation. 4. Suggest different electrical engineering materials suitable for the construction of electrical appliances and electrical machines. 5. Fulfill the demand of the industry about the analysis and construction of Electrical Engineering Materials.
Syllabus	**UNIT 1** **Conductivity of Materials:** Free Electron Theory of Metals; Ohm's Law and the Relaxation Time of Electrons; Factors affecting Resistivity of Metals; Emission of Electrons from Metals; Thermal Conductivity of Metals; Thermoelectric Effects; Superconductivity; Band Theory of Solids; Conduction in Liquids. **UNIT 2** **Dielectric Properties of Materials-1:** The Static Dielectric Constant; Polarization and Dielectric Constant; Polarization Mechanisms; Behavior of Dielectrics in Alternating Fields; Complex Dielectric Constant; Dipolar Relaxation; Dielectric Losses-Loss Tangent; Temperature and Frequency Dependence of Dielectric Constant. **UNIT 3** **Dielectric Properties of Materials-2:** Breakdown Mechanisms in Gaseous, Liquid and Solid Dielectrics; Dielectric Strength; Temperature Classification of Insulating Materials; Properties of Insulators-Insulation Resistance; Volume Electrical Resistivity; Surface Electrical Resistivity; Ferro-Electricity; Piezoelectricity. **UNIT 4** **Magnetic Properties of Materials:** Magnetization; Atomic Magnetic Moments; Classification of Magnetic Materials; Diamagnetic, Paramagnetic and Ferromagnetic Materials; Ferromagnetic Domains; Magnetization Curve; Soft and Hard Ferromagnetic Materials; Losses in Magnetic Materials; Factors Affecting Permeability and Hysteresis Loss; Anti-Ferromagnetism; Ferrimagnetism; Magnetic Resonance. **UNIT 5** **Materials and their Applications:** Properties of Various Conducting, Insulating and Magnetic Materials and their Applications; Superconducting Materials and their Applications; Special Purpose Materials; Thermocouple

<table>
<tr><td colspan="2"></td><td colspan="2">Materials; Contact Materials; Electrode Materials; Materials for Electronic Components</td></tr>
<tr><td colspan="2">Books*/References</td><td colspan="2">1. J. Dekker, “Electric Engineering Materials”, Prentice Hall
2. L. Solymer and D. Walsh, “Electric Properties of Materials”, Oxford University Press, 2004
3. S. P. Seth, “A course in Electrical Engineering Materials”, Dhanpat Rai Publication</td></tr>
<tr><td rowspan="6">Course Assessment/ Evaluation/ Grading Policy</td><td rowspan="4">Sessional</td><td>Assignments (2 to 3)</td><td>10 Marks</td></tr>
<tr><td>Quiz (3 to 4), Best two may be considered</td><td>05 Marks</td></tr>
<tr><td>Mid Term Examination (I Hour)</td><td>25 Marks</td></tr>
<tr><td>Sessional Total</td><td>40 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (3 Hours)</td><td>60 Marks</td></tr>
<tr><td colspan="2">Total</td><td>100 Marks</td></tr>
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Course Title	**MATLAB for Engineers**		
Course number	**EE-278**		
Credit Value	**4**		
Course Category	**ESA**		
Pre-requisite	**Nil**		
Contact Hours (L-T-P)	**2-2-0**		
Type of Course	**Theory**		
Course Objectives	To aim at providing programming skills from basic level onwards using MATLAB software and its usage for data acquisition, data analysis, graphical visualization, numerical analysis, algorithm development, signal processing and many other applications.		
Course Outcomes	1. At the end of the course the students will be able to 2. Illustrate the direct connection between the theory and real-world applications encountered in the typical engineering and technology programs. 3. Develop their own program to solve their own problem and use this program to solve similar problems later on. 4. Develop simulink model of the given system.		
Syllabus	**UNIT I: Basics** MATLAB environment, Variables, Basic data types, Relational and Logic operators, Conditional statements, Input and Output, Loops and branching. **UNIT II: Matrices** Creating and Manipulating matrices, Matrix maths and Matrix functions, Colon operator, Linspace, Cross product, Dot product, Logical functions, Logical indexing, 3-dimensional arrays, Cell arrays, Structures, Plotting: 2-D and 3-D plots: Basic plots, subplots, Histograms, Bar graphs, Pie charts. **UNIT III: M-file scripts** Creating, saving and running an M-file, Creating and running of a function, Function definition line, H1 and help text lines, Function body, Sub-functions, Nested functions, File I/O handling, M-file debugging. **UNIT IV: Simulink** Introduction, Block diagram, Functions, Creating and working with models, Defining and managing signals, Running a simulation, analyzing the results. **UNIT V: Applications** Root finding, Data analysis, Statistical functions, Polynomials, Curve fitting, Interpolation, Ordinary differential equations, Integration and differentiation, Signal processing applications, Circuit analysis applications, Control system applications.		
Books*/References	1. *D Hanselman and B Littlefield, Mastering Matlab 7, Pearson Education. 2. A Gilat, Matlab: An Introduction with Applications, John Wiley and Sons, 2004. 3. Y Kirani Singh and B BChaudhari, Matlab Programming, Prentice Hall of India, 2007 4. *Steven T Karris, Introduction to Simulink with Engineering Applications, 2nd edition, Orchard Publication, 2008.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2)	5 Marks each
		Quiz (2), Best may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Signals and Systems**	
Course number		**EE-282N**	
Credit Value		**4**	
Course Category		**ESA**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	The course is aimed at introducing the fundamental concepts and techniques in signals and systems. The students are to be familiarized with techniques suitable for analyzing and synthesizing both continuous-time and discrete time systems.		
Course Outcomes	By the end of the course, students should be able to use signal transforms, system convolution and describe linear operations on these.		
Syllabus	**UNIT I: Introduction to signals and systems** Classification of signals, Basic operation on signals, Elementary signals, Representation and Classification of continuous and discrete time systems, Properties of systems, System Model: Input-Output Description, Sampling and recovery of signals **UNIT II: Time-domain analysis of systems** System Response to Internal Conditions: Zero-Input Response, System Response to External input: Zero-State Response, Impulse response and its properties for LTI systems, Convolution, State variable description for LTI systems **UNIT III: Fourier representation for signals** Fourier Series Representation – Trigonometric Fourier Series, Exponential Fourier Series, Fourier Transform and its properties, Transform of some useful functions. **UNIT IV: System analysis using Laplace transform** Unilateral and Bilateral Laplace Transform, Properties of Laplace Transform, Inversion of Laplace Transform, Solving Differential Equations with Initial Conditions, Transform analysis of LTI systems. **UNIT V: System analysis using Z-transform** Unilateral and Bilateral Z- Transform and its Properties, Region of Convergence, Inversion of Z-Transform, Transform Analysis of LTI systems.		
Books*/References	1. *S. Haykin and B. V. Veen, Signals and Systems, John Wiley and Sons. 2. A. V. Oppenheim and A. S. Wilsky, Signals and Systems, Prentice Hall of India . 3. B P Lathi, Signal Processing and Linear Systems, Oxford University Press. 4. R. E. Ziemer, W. H. Tranter and D. R. Fannim, Signals and Systems: Continuous and Discrete, IV edition, Prentice-Hall.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments	5-10 Marks
		Quiz	5-10 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Electromagnetic Field Theory**	
Course number		**EE-285N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Applied Mathematics and Basic Physics**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the concepts of different coordinate systems, Maxwell`s equations, static electric and magnetic fields and methods of solving for the quantities associated with these fields, time varying fields and displacement current, propagation of electromagnetic waves and their applications in practical problems.		
Course Outcomes	After completing the course, the students should be able: 1. To differentiate different types of coordinate systems and use them for solving the problems of electromagnetic field theory. 2. To describe static electric and magnetic fields, their behavior in different media, associated laws, boundary conditions and electromagnetic potentials. 3. To calculate capacitances, inductances and to solve the Laplace and Poisson's equations for electric potential. 4. To describe time varying fields, associated laws and equations, quasi-static electromagnetic fields, propagation of electromagnetic waves in different media, their sources & effects and to apply the theory of electromagnetic waves in practical problems. 5. To apply numerical methods for the estimation of electromagnetic field quantities. 6. To use integral and point form of Maxwell`s equations for solving the problems of electromagnetic field theory.		
Syllabus	**UNIT-I: Electrostatic Fields** Coordinate systems and their transformation; Electric Field Intensity; Gauss's Law and its application; Electric potential; Electric field in free space, conductors and dielectrics – Polarization; Boundary conditions; Poisson's and Laplace's equations; Capacitance; Energy density. **UNIT-II: Magnetostatic Fields** Ampere's circuital law and its applications; Scalar and Vector magnetic potentials; Magnetic flux density – Magnetization; Boundary conditions, Lorentz-force equation, Force and torque; Inductance; Energy density. **UNIT-III: Time Varying Fields** Faraday's Law; Transformer and motional EMF; Displacement current; Maxwell's equation in integral and point form; quasi-static Electromagnetic Fields. **UNIT-IV: Propagation of Electromagnetic Waves** Propagation of uniform plane waves in Free Space, Dielectrics and Conductors; Skin effect; Pyonting's theorem and Power flow; Reflection of waves; Transmission lines. **UNIT-V: Electromagnetic Waves and Applications** Sources and effect of electromagnetic fields; Applications of Electromagnetic waves; Numerical Methods for estimation of Electromagnetic field quantities.		
Books*/References	1. *W. H. Hayt & J.A Buck, Engineering Electromagnetics 7th Edition, McGraw Hill. 2. M. N. O. Sadiku, Elements of Electromagnetics; Oxford University Press.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Electrical Machines Lab-1**	
Course number		**EE-295**	
Credit Value		**2**	
Course Category		**DC**	
Pre-requisite		EE-111 Basic Electrical & Electronics Engineering; EE-211N Electrical Machine-I & II	
Contact Hours (L-T-P)		**0-1-2**	
Type of Course		Practical	
Course Objectives	For the enhancement of theoretical knowledge and to give the practical exposure of transformer and induction machines.		
Course Outcomes	1. Have knowledge of various parts of a transformer and induction machine. 2. Develop knowledge helpful for higher studies. 3. Ability to conduct different test on single phase transformers. 4. Ability to found performance parameters of a transformer. 5. Ability to Perform test on induction motor. 6. Ability to find different characteristics of induction machines.		
Syllabus	**List of Experiments** 1. To perform open-circuit and short-circuit test on a single phase transformer. 2. Determination of voltage regulation and efficiency of a single phase transformer by load test. 3. To perform phasing out of three-phase transformer windings. 4. To perform the load-test of a three-phase Induction Motor. 5. To perform parallel operation of a single phase transformer. 6. To find out the characteristics of wound rotor induction motor. 7. To perform Sumpner's test on a single phase transformer. 8. Determination of parameters of a single phase induction motor.		
Books*/ References	1. A.E. Fizgerald et al, Electrical Machinery, Tata McGraw-Hill, New Delhi. 2. D.P. Kothari & I.J. Nagrath, Electrical Machinery, Tata McGraw-Hill, New Delhi. 3. M. H. Rashid, Power Electronics, PHI Learning, 3rd ed, New Delhi. 4. M. S. Jamil Asghar, Power Electronics, PHI Learning, New Delhi. 5. http://www.alldatasheet.com (for power electronic devices/ thyristors).		
Course Assessment/Evaluation/Grading Policy	**Sessional**	Evaluation of each lab reports, Viva-voce held every week on each lab report	60 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (2 Hours)		40 Marks
		Total	**100 Marks**

Course Title	**Power Electronics**
Course number	**EE-301**
Credit Value	**4**
Course Category	**OE**
Pre-requisite	**EE111**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	To introduce the basic concepts of power electronics, types of converters, their characteristics, turn-on of SCR, gate characteristics, AC-DC Converters, DC - DC Converters, AC-AC and DC-AC Converters.
Course Outcomes	At the end of the course the students will be able to 1. Articulate the basics of power electronic devices 2. Express the design and control of rectifiers, inverters. 3. Design of power electronic converters in power control applications 4. Ability to express characteristics of SCR, BJT, MOSFET and IGBT. 5. Ability to express communication methods. 6. Ability design AC voltage controller and Cyclo-Converter. 7. Ability to design Chopper circuits. 8. Ability to design Inverter circuit.
Syllabus	**UNIT I: Power Semiconductor Devices** Applications of power electronics; types of converters, ideal switch; power diodes, SCR, Triac and their characteristics, di/dt, dv/dt limitations and snubber circuits, other power semiconductor devices and their characteristics. **UNIT II: Gate Drive Circuits** Methods of turn-on of SCR, gate characteristics, simple R, RC and UJT trigger circuits, driver and isolation circuits, cosine and ramp control circuits, simple digital trigger circuit, commutation of SCR **UNIT III: AC-DC Converters** Principle of ac phase control, circuit configurations, waveforms for 1-ph mid-point and bridge converters, full and semi converters, analysis of single phase ac-dc converter with R and RL loads, performance evaluation of phase controlled converters, introduction to three phase converters: semi and full converter topologies, dual-converters. **UNIT IV: DC - DC Converters** Basic principle of d.c. choppers: TRC and CLC methods; switching regulators: buck and boost converters, basic principles of SMPS and UPS, Introduction to resonant converters. **UNIT V: AC-AC and DC-AC Converters** Introduction to AC voltage regulators, integral cycle control and phase control, cyclo-converters. Series, parallel and bridge inverter circuits, PWM inverters: types of control and harmonic reduction.
Books*/References	1. *M.H. Rashid Power Electronics; PHI, Learning. 2. *G.K.Dubey, S.R.Doradla, A.Joshi and R.M.K.Sinha, Thyristorised Power Controllers; New Age International, New Delhi. 3. M.H. Rashid (Ch. Editor) Power Electronics Hand Book, Acedemic Press, California. 4. Jai P Agarwal Power Electronics Systems, Pearson. 5. M. S. Jamil Asghar Power Electronics, PHI Learning.

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments	10 Marks
		Quiz	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Power Electronics–I**	
Course number		**EE-321N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the concepts of Power Electronic Devices, different types of converters, triggering circuits and their control schemes, fourier analysis of power electronic converters.		
Course Outcomes	At the end of the course the students will be able to: 1. design different types of power electronic converters in industry. 2. apply various converter control strategies. 3. analyze different converter schemes as per the required application. 4. explore recent advancement and technologies in power electronics.		
Syllabus	**UNIT I: Thyristor and their Characteristic** Applications of power electronics; types of converters, ideal switch, latching and non-latching switches, Characteristic of power diodes, SCR, Diac, Triac, GTO, ratings of SCR, di/dtand dv/dt limitations, snubber circuits. **UNIT II: Triggering Circuit** Methods of turning ON, gate characteristics, simple R, RC, UJT and IC based triggering circuits, Driver and isolation circuits for thyristors. **UNIT III: Single phase ac-dc controlled converters** Principle of ac phase control, circuit configurations, waveforms for 1-phase mid-point and bridge converters, full and semi converters, use of free wheeling diode, analysis of single phase ac-dc converter with R and RL loads, performance evaluation of phase controlled converters, THD, pf, ripple factor. **UNIT IV: Three phase ac-dc controlled converters** Introduction, full converters with R and RL loads, Rectification and inversion operations, effect of free wheeling diode, semi converters. **UNIT V: Miscellaneous converters and control schemes** Switching angle control schemes: cosine, ramp, digital; dual-converters and cyclo-converters, matrix converters.		
Books*/References	1. *G.K.Dubey, et al, Thyristorised Power Controllers; New Age International, New Delhi. 2. *M.H. Rashid, Power Electronics; PHI Learning, New Delhi. 3. V.Subramanyam, Power Electronics, New Age International, New Delhi. 4. Jai P Agarwal, Power Electronics Systems, Addison Wesely. 5. V. R. Moorthy, Power Electronics, Oxford University 2007 Press. 6. M. S. JamilAsghar, Power Electronics, PHI Learning.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Power Electronics-II**	
Course number		**EE- 322N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the Power Electronic Devices, their gate drive circuits, design of commutation circuits, different types of dc-dc converters, ac regulators and their analysis, their control schemes and various types of inverter schemes.		
Course Outcomes	At the end of the course the students will be able to 1. Use different power semiconductor devices for particular applications along their gate drive circuits. 2. Apply the principles of integral cycle and ac-phase control schemes. 3. Design PWM based converter control schemes. 4. Design dc-dc converters and apply them effectively for industrial applications. 5. Implement power electronic circuits with minimal harmonics.		
Syllabus	**UNIT I: Power Semiconductor devices and their characteristics**: Characteristics of Power BJT, MOSFET, IGBT, IGCT and static induction devices and their relative merits, Gate drive circuit for MOSFET/IGBT **UNIT II: DC to DC Converters** Introduction to linear and switching converters, buck, boost, buck-boost, Cuk converters, flyback converter; their analysis and design, SMPS. **UNIT III: AC Regulators** Principle of integral cycle and ac phase control, analysis of single phase ac regulator with R, L and RL load, introduction to threephase ac regulators: various star and delta configurations. **UNIT IV: Thyristor based inverters** Forced commutation of SCR, series and parallel inverter, analysis of single phase bridge inverter, modified Mc Murray inverter. **UNIT V: PWM inverters** Different PWM techniques, Introduction to PWM transistor based inverters, Harmonic control, voltage control of single phase inverters, three phase inverters: 180 degree and 120 degree conduction schemes.		
Books*/References	1. *G.K.Dubey, et al, Thyristorised Power Controllers; New Age International, New Delhi. 2. M.H. Rashid, Power Electronics; PHI Learning, New Delhi 3. *Ned Mohan et al, Power Electronics, John Wiley and Sons 4. M. H. Rashid, Power Electronics Handbook, Academic Press, California 5. M. S. JamilAsghar, Power Electronics, PHI Learning		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**New and Renewable Energy Sources**	
Course number		**EE-325**	
Credit Value		**4**	
Course Category		**OE**	
Pre-requisite		**Basic Electrical and Electronics Engineering**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce fundamentals of various renewable energy source and their technologies used to harness usable energy from solar, wind, ocean and Biomass energy sources.		
Course Outcomes	At the end of the course the students will be able to 1. Identify renewable energy sources. 2. Understand the mechanism of solar, wind and ocean energy sources. 3. Demonstrate the understanding of various technologies involved in power generation from renewable energy sources. 4. Understand the methods to handle the biomass in a productive way.		
Syllabus	**UNIT-1**: **Introduction** Energy resources and their classification, oil crisis of late 20th century and its impacts on energy planning, consumption trend of primary energy sources, world energy future, energy audit and energy conservation, energy storage. **UNIT-2: Solar Energy Conversion** Solar resources, passage through atmosphere, solar thermal energy conversion: solar energy collectors, solar thermal power plant, solar PV conversion: solar PV cell, V-I characteristics, MPPT, Solar PV power plant and applications. **UNIT-3: Biomass Energy Conversion** Usable forms of Bio Mass, Biomass energy resources, biomass energy conversion technologies, ethanol blended petrol and diesel, biogas plants. Energy farming. **UNIT-4: Wind Energy Conversion** Wind Power: Energy estimation, Power extraction, lift and drag forces, horizontal axis wind turbine, vertical axis wind turbine, wind energy conversion and control schemes, environmental aspects. **UNIT-5: Other Alternate Energy Sources/Technologies**: Geothermal Energy: geothermal fields, types, geothermal energy generation systems, ocean tidal energy systems, fuel cell: basic operation and classification, principle of MHD generation, output voltage and power, environmental aspects.		
Books*/References	1. *B.H. Khan, Non conventional Energy Resources, 2nd edition, 2009. 2. G.D. Rai, Non Conventional Sources of Energy, (Khanna Publishers). 3. J.W. Twidell & A.D. Weir, Renewable Energy Resources, (ELBS / E. & F.N. Spon., London). 4. Godfrey Boyle, Renewable Energy, Oxford, 2nd edition 2010.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2)	15 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Electrical Power Generation and Utilization**
Course number	**EE-331**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	**Theory**

Course Objectives	To introduce the fundamentals of illumination engineering. Various types of batteries and their field of applications. Railway electrification, various types of services and their characteristics. Various types of conventional power plants and their suitability criterion, site selection, maintenance and operation.
Course Outcomes	At the end of the course the students will be able to 1. Have the knowledge of various types of conventional power plants and their working ,different equipments and instruments used for trouble free operation and maintenance ,and factors to be considered for proper site selection 2. Know about various types of lamps their working principle, construction, field of application. 3. Design the lighting system for various applications. 4. Various types of storage batteries and their field of applications. 5. Electro-plating and its applications and composition of electroplating baths. 6. Different types of traction systems particularly electric traction system, types of services and their characteristics, overhead line equipments and maintenance of line.
Syllabus	**UNIT I: Thermal Power Plants**: *Coal fired Plants*: Site selection, various components, parts and their operation, Steam and fuel cycles, Pollution control, Modern clean coal Technologies. *Nuclear Power Plants*: Site Selection, Principal of Fission, Main components of nuclear reactor, Fast Breeder and other reactors, Fuel extraction, enrichment and fabrication, Basic control of reactors, Environmental aspects. **UNIT II: Hydro and Gas Power Plants**: *Hydro Plants*: Site selection, Classification of Hydro plants, Main components and their functions, Classification of turbines, Pumped storage plants, Environmental aspects. *Gas Turbine plant*: Principle of operation, Open& closed cycle plants, Combined cycle plants, IGCC. **UNIT III: Cogeneration and Captive Power Plants**: Scope & Benefits Cogeneration Plants, Cogeneration Technologies, Scope & Benefits of Captive Plants (CPP), Types of CPP, Concept of Distributed Generation. **UNIT IV: Electric Traction**: Speed time curves, Tractive efforts and specific energy consumptions, Track electrification & traction substations, Current collectors, Negative boosters and control of traction motors. **UNIT V: Illumination and Electrolytic Effects**: *Illumination*: Definitions, Laws of illuminations, Principle of operation & construction of various lamps, Various aspects of illumination design, design examples with different lamps. *Electrolytic Effects*: Types of Batteries, their components, Charging & maintenance, Tubular batteries. Electroplating and its applications.
Books*/References	1. *B.R.Gupta, Generation of Electrical Energy (Eurasia Pub. House). 2. S.N.Singh, Electric Power Generation, Transmission & Distribution (PHI). 3. M.V.Deshpande, Elements of Electrical Power Station Design (Wheeler Pub. House). 4. *H.Pratab, Art & Science of Utilization of Electrical Energy (Dhanpat Rai & sons).

<table>
<tr><td></td><td colspan="3">5. C.L.Wadhwa, Generation, Transmission & Distribution of Electrical Energy(Wiley Eastern Pub).
6. N.V.Suryanarayana, Utilization of Electric Power (Wiley Eastern Pub.).</td></tr>
<tr><td rowspan="5">Course Assessment/ Evaluation/Grading Policy</td><td rowspan="3">Sessional</td><td>Assignments (2)</td><td>15 Marks</td></tr>
<tr><td>Mid Term Examination (I Hour)</td><td>25 Marks</td></tr>
<tr><td>Sessional Total</td><td>40 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (3 Hours)</td><td>60 Marks</td></tr>
<tr><td colspan="2">Total</td><td>100 Marks</td></tr>
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Course Title		**Power System Protection**	
Course number		**EE-333N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Basics of Electrical, Electrical Machines & Power System Engineering**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the basic concepts of different protection schemes, Relays, Circuit breakers together with the basics of Arc Interruption Theory and Power System Transients.		
Course Outcomes	At the end of the course the students will be able to: 1. Learn the fundamental concept of different types of protective relays. 2. Apply fundamental concepts of various protection schemes. 3. Use different types of circuit breakers according to their principle of operation, characteristics, ratings and their duties. 4. Become familiar with arc properties, their formation and extinction. 5. Become familiar with Power System Transients, Lightning arrestors, BIL and insulation coordination.		
Syllabus	**UNIT I: Protective Relay** Basic principles, construction and characteristics of electromagnetic relays; over current relay, differential relays, distance relay. Elements of static relays, µP based relays. **UNIT II: Protection Scheme** Protection of generators, transformers, bus bars, transmission line and motors. Computer aided protection **UNIT III: Arc Interruption Theory** Formation and extinction of arcs, arc properties, Re-striking and recovery voltage. Different methods and control devices for arc extinction, Resistance switching. **UNIT IV: Circuit Breakers** Oil, Air blast and SF_6 circuit breakers, vacuum switches, CB duties, ratings and testing. **UNIT V: Power System Transients** Over voltages in transmission lines, lightning and switching surges, Transmission, reflection and refraction of surges, Ground wires, Spark gaps, Lightning arrestors, BIL and insulation coordination.		
Books*/References	1. * Ravindranath and Chander, P.S. Protection & Switchgear, Wiley Eastern. 2. C.R. Mason, Art and Science of Protection Relaying, Wiley Eastern. 3. B. Ram and Vishwakarma, Power System Protection & Switchgear, TMH. 4. T.S.M. Rao, Power System Protection: Static Relay with Microprocessor Applications, 2nd Edition. 5. Pataithankar and Bhide, Fundamentals of Power System Protection, PHI.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (1 Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Power System Analysis**	
Course number		**EE-335N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the concepts of Load flow analysis, bus impedance/admittance matrix, load flow problem formulation and solution techniques, fault analysis, steady state and transient stability analysis, load frequency and voltage control and different type of distribution systems.		
Course Outcomes	At the end of the course the students will be able to: 1. solve load flow problems using per unit values systems. 2. develop power system network models. 3. formulate and solve load flow problems using various techniques as per the requirements of complexity, computational time and accuracy. 4. calculate power losses in power system and develop economical power system operation scheme. 5. differentiate various types of fault and calculate the associated fault values for symmetrical and unsymmetrical faults. 6. perform stability analysis and decide stability criteria as per a given problem. 7. differentiate various distribution systems.		
Syllabus	**UNIT I** Load Flow Analysis: Per unit system of calculation, Formation of network model – Y_{BUS} by inspection and by singular transformation, Formulation of load flow problem; type of buses, Solution techniques – Gauss-Seidel and Newton –Raphson. Representation of voltage controlled buses and transformers. Decoupled and fast-decoupled load flow. **UNIT II** Economic Operation of Power Systems: Study of economic dispatch problem in a thermal power station, consideration of transmission losses in economic dispatch, simplified method of loss-formula calculation, solution of coordination equation, unit commitment, Introduction to load frequency and voltage control. **UNIT III** Fault Analysis: Types of fault, calculation of fault current and voltages for symmetrical short circuit. Symmetrical components, Sequence impedance and networks of power system elements, unsymmetrical short circuits and series fault, Current limiting reactors. **UNIT IV** Stability Analysis: Introduction to steady state and transient stability of power systems, swing equation, equal area criteria, solution of swing equation, methods of improving stability, Introduction to voltage stability. **UNIT V** Distribution Systems: Different types of distribution systems. Distributors fed from one end and both ends, ring mains, unbalanced loading, Rural electrification.		
Books*/References	1. *Nagrath and Kothari, Power System Analysis, 3rd edition (TMH). 2. BR Gupta, Power System Analysis and Design. 3. Grainger and Stevenson, Power System Analysis (McGraw Hill). 4. Hadi Saadat, Power System Analysis, (TMH).		
Course Assessment/	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks

Evaluation/Grading Policy		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Dynamic System Analysis**	
Course number		**EE-341N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Circuit Theory& Signal and Systems**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	The objective of the course is to introduce the concepts in the analysis and design of control systems.		
Course Outcomes	At the end of the course the students will be able to 1. Apply the knowledge about the Automatic Control System to use them more effectively. 2. Fulfill the demands of the industry about the analysis and control of the dynamic systems. 3. Describe the State Space Analysis and use it for the stability analysis of the dynamic systems. 4. Differentiate different types of controllers and design them for specific applications. 5. Design Lag, Lead, Lag-Lead Compensator using Bode Plot and Root Locus techniques and suggest the relative stabilities of different dynamic systems.		
Syllabus	**UNIT I: Control Concepts and Mathematical Modeling** System Concepts, Effect of Feedback, System Modeling, Transfer Function, Modeling of Different Types of Physical Systems, Analogy between the Elements of Different Types of Systems. State Variable Representation. Relationship between State Model and Transfer Function. **UNIT II: System Representation and Control Components** Block Diagram Algebra. Signal Flow Graph and Mason's Gain Formula. State Diagram and Simulation. Introduction to Simulink. Working Principle and Control Applications of Synchros, Tachogenerator, Servomotor and Stepper Motor. **UNIT III: Time Response Analysis** Time response of First Order and Second Order Systems. Steady State Error and Error Coefficients. State Transition Matrix and Solution of State Equations. Concepts of Stability–Routh-Hurwitz Criterion of Stability. Root Locus Technique. **UNIT IV: Frequency Response Analysis** Correlation between Time and Frequency Response. Frequency Response of Second Order System. Bode Plots, Polar Plots, Nichols Chart and Nyquist Stability criterion – Gain Margin and Phase Margin. **UNIT V: Control System Design** Cascade and Feedback Compensation – Design of Lag, Lead, Lag-Lead Compensator Using Bode Plot and Root Locus. Introduction to P, PI and PID Controllers and their Tuning.		
Books*/References	1. Norman S. Nise, "*Control Systems Engineering*", Wiley Eastern, 2007. 2. K. Ogata, "*Modern Control Engineering*", Prentice Hall of India 2003. 3. B.C. Kuo, "*Automatic Control Systems*", Prentice Hall of India, 2002.		

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Electrical and Electronic Instrumentation**
Course number	**EE-352N**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Basic Electrical and Electronics Engineering**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	To introduce the concepts of digital measurement, data management, transducers and their applications in the measurement of physical quantities and understanding of latest instrumentation and measurement technologies.
Course Outcomes	After completing the course, the students should be able: 1. To implement the methods of digital instrumentation, data transmission and acquisition. 2. To use electrical transducers according to specific applications and requirements. 3. To apply different methodologies for the measurement of various physical quantities (pressure, temperature, flow etc). 4. To appreciate new instrumentation technologies (Wide Area Measurement Systems, Global Positioning System, Nano-Instrumentation, MEMS, Smart Sensors etc) and recent developments in these technologies.
Syllabus	**UNIT I: Digital Instruments and Measurement** Comparative Analysis of Digital Instruments and Analog Instruments, Digital Voltmeter, Digital Multimeter, Digital Measurement of Frequency, Time Period, Power and Energy. **UNIT II: Data Transmission and Acquisition** Modulation-Time Division and Frequency Division Multiplexing, Telemetry Principles and Applications, Analog and Digital Data Acquisition Systems, Data Logger and DSO. **UNIT III: Transducer-I** Advantages of Electrical Transducers, Classification, Characteristics, Selection of Transducers, Potentiometer, Strain Gauge, Resistance Thermometer, Thermistor, Thermocouples, LVDT, Capacitive, Piezoelectric, Hall Effect and Opto-electronic Transducers, Gyroscope. **UNIT IV: Transducer-II** Measurement of Temperature, Force, Pressure, Motion, Vibration, Flow and Liquid Level, Ultrasonic Transducers, Solid State Sensors, Fiber Optic Sensors, Digital Transducers. **UNIT V: Recent developments** Intelligent Instrumentation, Nano-Instrumentation, Robotics Instrumentation, Introduction to Virtual Instrumentation, MEMS based Sensors, Smart Sensors, GPS, Wide Area Measurement, Smart Meter.
Books*/References	1. *D.V.S Murty, “Transducers and Instrumentation”, PHI. 2. *T. S. Rathore, “Digital Measurement Techniques”, Narosa Publishing House. 3. Morris, “Principle of Measurement and Instrumentation”, PHI. 4. H. K. P Neubert, “Instrument Transducers”, Oxford University Press. 5. Rangan Mani and Sarma, “Electrical Instrumentation”, TMH.

Course Assessment/ Evaluation/ Grading Policy	**Sessional**	Assignments (2 to 3)	06 Marks
		Quiz (3 to 4), Best two may be considered	09 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**High Voltage Engineering**
Course number	**EE-361**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Electromagnetic field theory, Basics of Electrical Machines & Power System Engg.**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory
Course Objectives	To introduce the basic concepts of high voltage engineering including mechanism of electrical breakdown in gases, liquids and solids, high voltage ac/dc and impulse generation and measurement, measurement of partial discharges and loss tangent, high voltage testing and condition monitoring of power equipments.
Course Outcomes	At the end of the course the students will be able to: 1. learn the fundamental concept of electric breakdown in liquids, gases, and solids. 2. understand fundamental concepts of high voltage AC, DC, and impulse generation. 3. learn the techniques employed in high voltage measurements. 4. become familiar with non-destructive test techniques in high voltage engineering. 5. become familiar with testing and condition monitoring of power equipments.
Syllabus	**UNIT I: Breakdown Mechanisms in Dielectrics:** Gases – Townsend's theory, Streamer theory, breakdown in electronegative gases, Paschen's Law. Liquids - pure & commercial liquids, Suspended Particle mechanism, Cavitation & Bubble mechanism, Stressed Liquid Volume mech. Solids: Intrinsic breakdown, Streamer breakdown, Electromechanical breakdown, Thermal breakdown, Electrochemical breakdown, Tracking & Treeing. **UNIT II: Generation of High Voltages** Alternating Voltages: Testing transformers, resonant transformers, generation of high frequency voltages; DC Voltages: simple rectifier circuits, cascaded circuits- Cockcroft-Walton circuit, Electrostatic generators– Van-de-Graff generator; Impulse Voltages: Single stage and multistage impulse generator circuits: Marx generator, Tripping and control of impulse generators. **UNIT III: Measurement of High Voltages** High Voltage Measurement techniques; Peak Voltage Measurement by spark gaps- Sphere gaps, Uniform field electrode gaps, rod gaps; Generating voltmeters; Electrostatic voltmeters; Chubb-Fortescue Method; potential dividers; impulse voltage measurements. **UNIT IV** **Non Destructive Testing of Materials & Electrical Apparatus:** Measurement of d.c. Resistivity, Measurement of Dielectric Constant and Loss Factor, Partial Discharges -definition, types of partial discharges and its occurrence; recurrence and magnitude of discharges - quantities related to the magnitude of discharges **UNIT V: High Voltage Testing of Electrical Apparatus** Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Diverters, Condition Monitoring.
Books*/References	1. *E. Kuffel, , W.S. Zaengl, and J. Kuffel 2. High Voltage Engineering Fundamentals, Elsevier India Pvt. Ltd, 2005 3. *M.S. Naidu and V. Kamaraju

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<tr><td colspan="2"></td><td colspan="2">4. High Voltage Engineering, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy and Roshdy Radwan
6. High Voltage Engineering Theory and Practice- Second Edition- Revised and Expanded, Marcel Dekker, Inc., New York, 2000.</td></tr>
<tr><td rowspan="5">Course Assessment/ Evaluation/Grading Policy</td><td rowspan="4">Sessional</td><td>Assignments (2 to 3)</td><td>10 Marks</td></tr>
<tr><td>Quiz (3 to 4), Best two may be considered</td><td>05 Marks</td></tr>
<tr><td>Mid Term Examination (1 Hour)</td><td>25 Marks</td></tr>
<tr><td>Sessional Total</td><td>40 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (3 Hours)</td><td>60 Marks</td></tr>
<tr><td colspan="3">Total</td><td>100 Marks</td></tr>
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<tr><td colspan="2">Course Title</td><td colspan="3">Seminar</td></tr>
<tr><td colspan="2">Course number</td><td colspan="3">EE-380</td></tr>
<tr><td colspan="2">Credit Value</td><td colspan="3">2</td></tr>
<tr><td colspan="2">Course Category</td><td colspan="3">DC</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="3">Nil</td></tr>
<tr><td colspan="2">Contact Hours (L-T-P)</td><td colspan="3">0-2-0</td></tr>
<tr><td colspan="2">Type of Course</td><td colspan="3">Theory</td></tr>
<tr><td>Course Objectives</td><td colspan="4">1. Engage graduate students in a discussion with speakers and faculty on current topics.
2. Have graduate students gain experience in giving oral presentations on their research of interest.
3. Develop expression, communication skills and confidence.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">At the end of the course the students will be able to:
1. Think independently and creatively and also express their thoughts fearlessly.
2. Read and grasp the in depth meaning of technical and non-technical literature.
3. Communicate effectively
4. Show the understanding of impact of engineering solutions on the society and will also be aware of contemporary issues.
5. Develop confidence for self education and ability to engage in lifelong learning.</td></tr>
<tr><td>Books/References</td><td colspan="4">1. Current topics from web based resources.
2. IEEE transactions for recent research papers.</td></tr>
<tr><td rowspan="4">Course Assessment/ Evaluation/Grading Policy</td><td rowspan="2">Sessional</td><td colspan="2">Two presentations one based on current topic (student choice) and another based on technical paper on their research of interest.</td><td>30 marks each</td></tr>
<tr><td colspan="2">Sessional Total</td><td>60 Marks</td></tr>
<tr><td colspan="3">End Semester Examination</td><td>40 Marks</td></tr>
<tr><td colspan="3">Total</td><td>100 Marks</td></tr>
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Course Title	**Circuit and Measurement Lab**		
Course number	**EE-395**		
Credit Value	**1.5**		
Course Category	**DC**		
Pre-requisite	EE-111 Basic Electrical & Electronics Engineering; EE-276 Circuit Theory; EE-251N Electrical Measurement		
Contact Hours (L-T-P)	**0-0-3**		
Type of Course	Practical		
Course Objectives	For the enhancement of theoretical knowledge and to give the practical exposure of different electricalcircuits, transducers, ac bridges, instruments and measurement procedures.		
Course Outcomes	After completing the course, the students should be able to know performance of various electricalcircuits, transducers, ac bridges, instruments, measurement procedures using them and their practical aspects including accuracy and calibration of these instruments.		
Syllabus	**List of Experiments** 1. For a given circuit, verify experimentally: (a) Thevenin's Theorem and (b) Superposition Theorem. 2. To perform experiments for resonance of series RLC circuit and parallel RLC circuit, and to plot resonance curves. 3. For a given circuit: (a) Determine *z* and *h* parameters of two-port network and (b) Study the frequency characteristics of a passive low pass filter. 4. To determine the 'a', 'c' and 'G' constants of a D`Arsonval type galvanometer. 5. To determine the resistance of ferry alloy by Kelvin's double bridge method. 6. To determine inductance and resistance of a coil by Anderson bridge method at different frequencies. 7. Calibration for Wattmeter by D.C. potentiometer using Phantom method of loading. 8. Study of characteristics of thermal and optical transducers: (a) To study the resistance-temperature characteristics of the thermistor and (b) To study the resistance-insolation characteristics of a light dependent resistor (LDR).		
Books*/References	1. V. DelToro, Electrical Engineering Fundamentals, PHI Learning, New Delhi. 2. A.K. Sawhney, A course of Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai & Co (Pvt.) Ltd., Delhi, 1999.		
Course Assessment/Evaluation/Grading Policy	**Sessional**	Evaluation of each lab reports, Viva-voce held every week on each lab report	60 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (2 Hours)		40 Marks
		Total	**100 Marks**

Course Title	**ELECTRICAL MACHINE LAB - II**		
Course number	**EE-396**		
Credit Value	**2**		
Course Category	**DC**		
Pre-requisite	**Nil**		
Contact Hours (L-T-P)	**0-1-2**		
Type of Course	Laboratory course		
Course Objectives	The objective of this laboratory course is to make the student understand the construction, operation and control of various electrical machines by performing the experiments.		
Course Outcomes	At the end of the course the students will be able to 1. Understand the constructional details of various machines. 2. Have on-hand experience of running the machines. 3. Compare the obtained characteristics with the theoretical one. 4. Understand various method of speed control of motors. 5. Obtain the voltage regulation of alternators. 6. Convert three-phase system to single, two and six phase systems.		
Syllabus	**List of experiments:** 1. Speed control of dc shunt and compound motors. 2. Determination of various characteristic of a dc series motor. 3. Speed control of a separately excited dc motor by Ward – Leonard method. 4. Speed control of 3-phase induction motor by rotor resistance method. 5. Synchronization of an alternator to infinite busbar. 6. Slip test of an alternator and determination of voltage regulation. 7. Determination of voltage regulation by Potier's triangle method. 8. Phase conversion – From three phase to single, double and six phase systems.		
Books/ References	1. Nagrath & Kothari; Electrical Machines; Tata-McGraw Hill, New Delhi. 2. B.S. Guru & H.R. Hiziroglu; Electrical Machine and Transformers, Oxford University Press.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Laboratory Records	40 Marks
		Viva-voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title		**Power Electronics Lab**	
Course number		**EE-397**	
Credit Value		**1.5**	
Course Category		**DC**	
Pre-requisite		**Power Electronics**	
Contact Hours (L-T-P)		**0-0-3**	
Type of Course		Theory	
Course Objectives		To familiarize the different types of characteristics of various types Power Electronic Devices and realize various power electronic converters and triggering circuits for specific applications.	
Course Outcomes		At the end of the course the students will be able to: 1. Interpret different characteristics of an SCR. 2. Implement the phase controlled switching using DIAC and TRIAC. 3. To realize different type of triggering circuits for particular application. 4. To use UJT as a relaxation oscillator and for triggering circuits. 5. To implement different types of converters for various applications like speed control of DC motor.	
Syllabus		**List of Experiments** 1. Static Characteristics of SCR 2. TRIAC and AC phase control 3. UJT based relaxation oscillator and trigger circuit. 4. R, RC trigger circuits and speed control of Universal motor. 5. Uncontrolled AC-DC Converter. 6. Monostable based trigger circuits. 7. Speed control of DC motor by a phase controlled converter. 8. MOSFET based flyback DC-DC converter.	
Books*/References		1. *G.K.Dubey, et al, Thyristorised Power Controllers; New Age International, New Delhi. 2. *M.H. Rashid, Power Electronics; PHI Learning, New Delhi. 3. V.Subramanyam, Power Electronics, New Age International, New Delhi. 4. Jai P Agarwal, Power Electronics Systems, Addison Wesely.	
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Experiment Reports	40 Marks
		Viva-Voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title		**Power System and High Voltage Lab**	
Course number		**EE-398**	
Credit Value		**1.5**	
Course Category		**DC**	
Pre-requisite		**Electrical Power Systems**	
Contact Hours (L-T-P)		**0-0-3**	
Type of Course		Theory	
Course Objectives	To introduce the working of various power system components and testing and calibration of high voltage components.		
Course Outcomes	At the end of the course the students will be able to: 1. Equalize the voltage distribution across the disc insulators. 2. Simulate and calculate the transmission line parameters for various network configurations and study the effects of various line loading and line lengths on power system parameters. 3. Determine the flash over voltages for different types of insulators. 4. Calibrate a given voltmeter on low voltage side of high voltage testing transformers. 5. To analyze Power Quality for different loading conditions. 6. Study of steady-state stability limit of a transmission line. 7. Analyze various distribution networks.		
Syllabus	**List of Experiments** 1. Study the construction of disc insulators and determination of the voltage distribution across an artificial string of disc insulators 2. Study the construction of an artificial transmission line and determine ABCD constants with and without series compensation. 3. Determine ABCD, H, Z and image parameters of medium line for both T and π network/ Digital simulation of transmission line. 4. Determine dry one minute withstand and dry flash-over 50Hz voltages for an 11 kV pin insulator. 5. Calibration of a given voltmeter connected on low voltage side of testing transformer in terms of high voltage side, with help of sphere gap. 6. Power Quality Assessment 7. Study of steady-state stability limit of a transmission line. 8. Study and analysis of (i) Radial distribution network (ii) Ring main distribution network.		
Books*/References	1. *Nagrath and Kothari, Power System Analysis, 3rd edition (TMH). 2. BR Gupta, Power System Analysis and Design. 3. Grainger and Stevenson, Power System Analysis (McGraw Hill). 4. Hadi Saadat, Power System Analysis, (TMH).		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Experiment Reports	40 Marks
		Viva-Voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title	**ELECTRIC DRIVES**
Course Number	**EE 413N**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**EE211N, EE213, EE321N, EE322N, ~~EE341N~~**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory
Course Objectives	To introduce the basic concepts of dc electric drives and ac electric drives and their closed-loop operation including microprocessor based arrangements.
Course Outcomes	At the end of the course the students will be able to 1. Apply the knowledge of drives and use them effectively. 2. Suggest the particular type of AC/DC drive system for an application.
Syllabus	**UNIT I: Types of Drives and Loads** Introduction and classification of electric drives, comparision with other types of drives. Characteristics of different types of mechanical loads, stability of motor-load systems. Fluctuating loads and load equalization. Thermal loading of motors, estimation of motor rating for continuous, intermittent and short-time duty loads. **UNIT II: DC Drives I** Characteristics of dc motors and PM dc motor. Conventional methods of speed control: rheostatic, field and armature control. Electric braking of dc drives: Regenerative braking, plugging and Dynamic braking. Phase control of fully controlled dc drives, continuous and discontinuous conduction modes of operation. **UNIT III: DC Drives II** Chopper controlled drives. Comparison of phase and chopper controlled drives. Review of feedback control, Closed loop configurations in electric drives: current limit control, torque control, speed control of multi-motor drives and position control. Closed loop control of phase and chopper controlled dc drives. Microprocessor controlled electric drives. **UNIT IV: A.C. Drives I** Review of three phase induction motor characteristics. Electric braking of induction motor drives: Regenerative, Plugging, ac and dc dynamic braking. Methods of speed control of induction motors: stator voltage control, variable frequency control, pole changing and pole amplitude modulation. **UNIT V: A.C. Drives II** Speed control of wound rotor induction motor: rotor resistance control (conventional and static), slip power recovery schemes. Closed loop control of induction motor drives: VSI control, static rotor resistance control, static Scherbius and Kramer drives, current regulated VSI drives. Introduction to vector control.
Books*/ References	1. G. K. Dubey*, “Fundamentals of Electric Drives”, second edition, Narosa Pub. House, New Delhi. 2. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall. 3. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall of India. 4. Joseph Vithayathil, “Power Electronics, Principles and Applications”, McGraw-Hill, Inc.

	5. P. C. Sen, “Thyristorised Power Controller”, John Wiley & Sons.		
Course Assessment/ Evaluation/ Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (1 Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Power Semiconductor Controllers**
Course number	**EE-422**
Credit Value	**4**
Course Category	**DE**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	To give the practical exposure and the real world applications of different power electronic controllers.
Course Outcomes	After completing the course, the students should be able to know the practical aspect of different types of power electronic converters, their relative merits and demerits, the current state-of-the-art technological development and application of these converters.
Syllabus	**UNIT-I: Power Supplies** Introduction, ac power supplies: power quality, power supply protection, power conditioners, uninterruptible power supplies; dc power supplies: comparison of linear and switched-mode power supplies, dc to dc converters with electrical isolation: forward, push-pull and bridge converter, SMPS. **UNIT-II: Resonant Converters** Switched-mode inductive current switching, significance of ZVS and ZCS, classification of resonant converters, series and parallel load resonant converters, class-E converters, ZCS/ZVS resonant switch converters and their switch configurations, resonant dc link converters and their circuit configurations. **UNIT-III: Analysis and simulation of Power Electronic Circuits** Analysis of simple power electronic circuits with RL, RC and RLC type loads and dc / sinusoidal sources; performance of transformers for high frequency applications, computer simulation of power electronic devices and systems. **UNIT-IV: Recent Power Semiconductor Devices** Recent advances in power devices and their relative merits, power modules, protection of devices and converters, heat management. **UNIT-V: Applications of Different Controllers** Three-phase ac regulators, multiple converters, application of different converters in solar and wind energy systems as well as in dispersed generation, current trends in power electronics.
Books*/References	1. M. H. Rashid (Editor), Power Electronics Handbook, Academic Press, California. 2. N. Mohan, T.M. Undeland and W.P. Robins, Power Electronics, John Wiley, Singapore, 3rd ed. 3. M. H. Rashid, Power Electronics, PHI Learning, 3rd ed, New Delhi. 4. G.K. Dubey et al, ThyristorisedPower Controllers, New Age International, New Delhi. 5. P.T. Krein, Elements of Power Electronics, Oxford University Press. 6. M. S. Jamil Asghar, Power Electronics, PHI Learning, New Delhi. **Reference Materials** 1. B. K. Bose, Modern Power Electronics (collection of papers), Jaico Publications, New Delhi. 2. Effects of Harmonic Disturbances on Electrical Equipment, Electrical India, July 2005, pp. 48-54. 3. Power Quality Issues and Impacts, Proceedings of PICON-2011, 2011, pp. 85-93. 4. http://www.semiconductors.co.uk(D W Palmer) 5. Power Electronics Europe, Issue#7, 2008, International Rectifiers (http://www.irf.com)

	6. http://schemit-walter.fbe.fh-darmstadt.de/cgi-bin/smps-e.pl?ue-min=48 7. http://www.IEEEXplore.org /Xplore/home.jsp 8. http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=5456233 9. http://www.vispra.com/solar_hybrid_ups.phd		
Course Assessment/Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (**1 Hour**)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

COURSE DESCRIPTION FORM

Course Title	**Power System Deregulation**
Course number	**EE-431**
Credit Value	**4**
Course Category	**DE**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory
Course Objectives	The objectives of the course are to make the student understand the concept of reliability, energy policy, demand side management, power exchange, trading arrangements and different pricing structure.
Course Outcomes	At the end of the course the students will be able to a) Use various models for electrical supply such as central pool model, independent model etc. b) Use benefits of deregulation for efficient energy management. c) Converse with the concept of power exchanges for trading arrangement. d) Converse with different pricing methods for various conditions.
Syllabus	**Unit I:** **General:** Electricity demand operation and reliability, energy policy and cost, competitive market for generation, role of the existing power industry, renewable generation technologies, distributed generation, traditional central utility model, independent system operator (ISO), retail electric providers. **Unit II:** **Electricity Market and Management:** Wholesale electricity markets, characteristics, bidding market clearing and pricing, ISO models, market power evaluation, demand side management, distribution planning. **Unit III:** **Power Pool:** Role of the transmission provider, multilateral transaction model, power exchange and ISO- functions and responsibilities, classification of ISO types, trading arrangements, power pool, pool and bilateral contracts, multilateral traders. **Unit IV:** **Electricity Pricing-I:** Transmission pricing in open access system, rolled in pricing methods, marginal pricing methods, zonal pricing, embedded cost recovery, open transmission system operation and congestion management in open access transmission systems in normal operation. **Unit V:** **Electricity Pricing-II:** Predicting electricity costs, electricity cost derivation, electricity pricing of inter provincial power market, transmission policy.
Books/ References	1. L.L. Loi*: Power System Restructuring and Deregulation-Trading, Performance and Information Technology, John Wiley & Sons. 2. C.S. Frd, C.C Michael, D.T Richard and E.B. Roger: Spot Pricing of Electricity, Kluwer Academic Publishers 3. I. Marija, G. Francisco and F. Lester: Power System Restructuring: Engineering and Economics, Kluwer Academic Publishers

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

PEOs							
I.	**II.**	**III.**	**IV.**	**V.**	**VI.**	**VII.**	**VIII.**
x	**x**		**x**		**x**		

POs										
(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
x	**x**	**x**	**x**	**x**			**x**		**x**	**x**

COs											
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**
x	**x**			**x**					**x**	**x**	**x**

COURSE DESCRIPTION FORM

Course Title	**Digital Simulation of Power Systems**		
Course number	**EE-432**		
Credit Value	**4**		
Course Category	**DE**		
Pre-requisite	**Nil**		
Contact Hours (L-T-P)	**3-1-0**		
Type of Course	Theory		
Course Objectives	The objectives of the course are to make the student understand the operation and control of a modern power system, to introduce various problems encountered in proper operation of the system and their mitigation. Students will learn how to analyze a large interconnected power system through digital simulation.		
Course Outcomes	At the end of the course the students will be able to a) Model the power system for various studies. b) Analyze the system for different short circuit conditions. c) Address the problem of frequency and voltage control under varying load conditions of the system. d) Optimize the generation scheduling in a hydro-thermal mix including the effect of system losses and maintaining the desired operating conditions. e) Analyze large data, in an interconnected power system, obtained through SCADA and utilize them for state estimation, contingency analysis and security assessment.		
Syllabus	**Unit I:** **Network Matrices:** Graph-theoretic approach for the formation of network matrices – Y_{BUS}, Y_{BR} and Z_{LOOP}; Z_{BUS} building algorithms, Simulation example. **Unit II:** **Short Circuit Studies:** Representation of 3-phase networks. Short circuit studies using 3-phase Z_{BUS} matrix. Fault impedance and admittance matrices for various types of faults. Simulation example. **Unit III:** **Power System Control:** Automatic generation control (AGC). Voltage control methods. Reactive power compensation, static VAR systems, FACTS devices. **Unit IV:** **Optimal System Operation:** Unit commitment. Optimal power flow solution, Hydro–Thermal load scheduling; short range and long range. Determination of Loss-Formula. Simulation example. **Unit V:** **Computer Control and Automation:** Database for control: SCADA, State estimation. Contingency analysis and power system security assessment. Modern energy control centres.		
Books/ References	1. Hadi Sadat*: Power System Analysis; (McGraw Hill) 2. Nagrath and Kothari: Power System Analysis; 4th edition (TMH) 3. Grainger and Stevenson: Power System Analysis; (McGraw Hill) 4. El-Abiad and Stagg: Computer Methods in Power System Analysis; (McGrawHill) 5. Wood and Wollenberg: Power Generation Operation and Control; Wiley, NY		
Course Assessment/ Evaluation/ Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Power Station Practice**	
Course number		**EE-435**	
Credit Value		**4**	
Course Category		**DE**	
Pre-requisite		**Power System Analysis**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	The course has been designed to fulfill the requirement of power industry. The course aims to provide basic fundamentals of economics involved with power generation and Various techniques used optimization of generation cost.		
Course Outcomes	At the end of the course the students will be able to 1. Understand the economics of power generation. 2. 3. Apply design of various new technologies to optimize the economical relations. 4. Formulate and solve coordination problem of power system plants.		
Syllabus	**UNIT-1**: **Economics of Generation** Types of loads, demand factor, group diversity factor and peak diversity factor, load curve, load duration curve, load factor, capacity factor and utilization factor, base load and peak load stations, operating and spinning reserves, load forecasting, capital cost of power plants, depreciation, annual fixed and operating charges. **UNIT- 2**: **Tariff and Power Factor Improvement** General tariff form and different types of tariffs, Tariff option for DSM. Causes and effect of low power factor, necessity of improvement and use of power factor improvement devices. **UNIT-3: Coordinated Operation of Power Plants** Advantages of Coordinated operation of different types of power plants, hydrothermal scheduling: short term and long term. Coordination of various types of power plant. **UNIT-4: Electrical Equipments in Power Plants** Governors for hydro and thermal generators, excitation systems; exciters and automatic voltage regulators (AVR), bus bar arrangements. **UNIT-5: EHV Substation** Layout of EHV substation, brief description of various equipments used in EHV substations, testing and maintenance of EHV substations equipments. Gas insulated substations (GIS).		
Books*/References	1. *B.R. Gupta, Generation of Electrical Energy, (Euresia Publishing House). 2. M.V. Deshpande, Elements of Electrical Power Station Design, (Wheeler Publishing House). 3. S. Rao, Electrical Substation-Engineering and Practice, (Khanna). 4. S.N. Singh, Electric Power Generation, Transmission and Distribution (PHI).		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2)	15 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Control Systems**	
Course number		**EE-442N**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Signals and Systems (EE-282N) , Dynamic System Analysis (EE-341N)**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the state variable representation of continuous and discrete data control systems, stability analysis and time response analysis using state model, the concepts of controllability and observability, basic concepts of digital control systems, their stability analysis, use of state feedback for pole placement design, basic concepts and stability analysis of non linear systems.		
Course Outcomes	At the end of the course the students will be able to 1. Develop state models for different class of systems 2. Determine the system response using state model and test stability, controllability and observability 3. Develop pulse transfer function for discrete data systems and test stability in both z-domain and s-domain 4. Determine suitable state feedback required for pole placement 5. Design a suitable observer for a given system 6. Analyze non linear systems using describing function and phase plane techniques 7. Analyze system stability using Lyapunov's function		
Syllabus	**UNIT I: State Variable Techniques** System representation in State variable form; Controllability and Observability; Characteristic equation and state variable representation of transfer function; Phase variables, Physical variables and different Canonical form of representation, State diagram, System analysis using state variables (with and without input). **UNIT II: Discrete Data System-I** Introduction, Sampling theorem, Spectrum analysis of sampling process, Si gnal reconstruction, Pulse transformation, z- transform analysis of sampled data system, Block diagram reduction. **UNIT III: Discrete Data System-II** State variable representation of digital control system, State transition equation, Solution of state equation by z- transform technique, Digital controllers, Stability of digital control system. **UNIT IV: State Feedback Technique (continuous and discrete data systems)** Continuous system pole placement technique, Gain matrix by Ackerman's formula, Design example. Discrete data system Pole placement design by state feedback of digital systems. Pole placement by incomplete state feedback or output feedback Design of digital control systems with state feedback. **UNIT V: Non Linear Systems- their Analysis and Stability** Non-linear systems, Non-linear state equation, Phase plane and describing function techniques of analysis, Lyapunov's stability criteria, Methods of construction of Lyapunov's function.		
Books*/References	1. * Nagrath and Gopal Control System Engineering, TMH 2. K. Ogata, Modern Control Engineering, PHI 3. B. C. Kuo, Digital Control System, Oxford University Press 4. M. Gopal, State variable analysis of digital control systems, TMH 5. M. Rihan, Advanced Control Systems, Axioe		
Course	**Sessional**	Assignments-Skill Assessment Exercise	07 Marks

Assessment/ Evaluation/Grading Policy		Review Exercise (4)	08 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Process Instrumentation and Control**
Course number	**EE-453**
Credit Value	**4**
Course Category	**DE**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	Aim of this course is to provide the students the fundamentals of industrial process and the devices used for instrumentation.
Course Outcomes	At the end of the course the students will be able to 1. Identify the various steps involved in an industrial process. 2. Select and apply a particular actuator and controller for an industrial process. 3. Use various measurement equipments for an effective control of a process.
Syllabus	**UNIT I: Basics of Process Control**: Fundamentals of process control, Elements of process control loop, process characteristics: process lead, process lag, control lag, distance-velocity lag, transfer lag, Self Regulation. cascade control, feed forward control.: Modes of control action: two position, floating, proportional, proportional-integral, proportional integral and derivative. **UNIT II: Actuators and Controllers** Electric, Pneumatic and Hydraulic actuators, control valve, Electrical, Electronic, Pneumatic and Hydraulic controllers. **UNIT III: Measurement of Process Variables** Measurement of flow: magnetic, ultrasonic methods. Measurement of pressure, liquid level, humidity, viscosity and moisture in granular substances. **UNIT IV: Control and Display Techniques** Tuning of controller: Quarter Amplitude Criterion, controller performance criterion, Methods of process loop tuning, Process Reaction curve (open loop), Ziegler Nichols (closed loop), Frequency response method. Displays parameters Scanning, data logging. Computer supervisory control, Direct digital control **UNIT V: Programmable Logic Controllers** Introduction to PLC, Architecture, types of Input and output modules, Fixed and modular PLC, Specifications, Ladder logic diagram using standard symbols, PLC programming for process applications, Introduction to distributed control system (DCS).
Books*/References	1. *C.D. Johnson, Process Control Instrumentation Technology (PHI). 2. D. Patranabis, Principles of Industrial Instrumentation (Tata McGraw Hill). 3. Krishna Kant, Computer Based Industrial Control (PHI).

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**High Voltage Testing Techniques**	
Course number		**EE-463**	
Credit Value		**4**	
Course Category		**DE**	
Pre-requisite		**Electromagnetic field theory, Basics of Electrical Machines & Power System Engg., High Voltage Engg.**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce objectives of high voltage testing/procedures and standards, statistical evaluation of measured results, high voltage testing techniques for electrical equipment, non-destructive insulation test techniques and finally design, planning and layout of High Voltage laboratory.		
Course Outcomes	At the end of the course the students will be able to: 1. Learn the fundamental concept of high voltage testing/procedures and standards. 2. Understand how to evaluate/interpret statistically the measured results. Learn the techniques employed in high voltage testing of electrical equipments such as cable, transformers etc. 3. Become familiar with non-destructive test techniques in high voltage engineering. 4. Learn how to design modern High Voltage laboratory; Test facilities provided in H.V laboratory.		
Syllabus	**UNIT I: Introduction** Objectives of high voltage testing, classification of testing methods- self restoration and non-self restoration systems; test voltages; test procedures and standards. **UNIT II: Statistical Evaluation of Measured Results** Determination of probability values, Distribution function of a measured quantity, confidence limits of the mean values of disruptive discharges - 'Up and Down' method for determining the 50% disruptive discharge voltage. **UNIT III: Testing Techniques for Electrical Equipment** Testing of insulators, bushings, isolators, circuit breakers, transformers, surge diverters and cables- testing methodology and interpretation of test results. **UNIT IV: Non-Destructive Insulation Test Techniques** Loss in dielectrics; Measurement of conduction current at Direct Voltages; Measurement of Dissipation Factor at Alternating Voltages; Partial Discharge measurement: basic partial discharge (PD) circuit, PD quantities, PD instruments and measurements. **UNIT V: Design of High Voltage Lab** Dimensions of High Voltage Laboratory equipment - fencing, earthing and shielding; circuits for high voltage experiments; Construction Elements for High Voltage Circuits.		
Books*/References	1. *C.D. Johnson, Process Control Instrumentation Technology (PHI). 2. D. Patranabis, Principles of Industrial Instrumentation (Tata McGraw Hill). 3. Krishna Kant, Computer Based Industrial Control (PHI).		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Microprocessor Systems and Applications**	
Course number		**EE-473**	
Credit Value		**4**	
Course Category		**DC**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To know the one microprocessor family thoroughly and to prepare strong base, i.e. architecture, addressing modes, instruction format, data transfer devices, different interrupts, types of controllers, types of instructions, and programming.		
Course Outcomes	At the end of the course the students will be able to 1. Know about the basics of microprocessor 2. different instructions and programming of microprocessor 3. Different methods of data transfer between microprocessor and peripheral devices. 4. Different types of controllers and peripheral devices used to transfer data		
Syllabus	**UNIT I: Introduction to microprocessors** General architecture and brief description of elements, instruction execution, instruction format, and instruction set, addressing modes, programming system, higher lever languages. **UNIT II: Input Output Techniques and data transfer** Data transfers, interrupts, 8259 programmable interrupt controller, memory interfacing, DMA **UNIT III: Programmable peripheral Interface** Interfacing and programming of programmable peripheral chips, 8254, 8255, 8259, ADC / DAC interfacing. **UNIT IV: 8086 Microprocessor** 8086 architecture **,**instruction set, addressingmodes, constructing machine codes, Assembly language programming. **UNIT V: Programming applications of 8086** Assembler directives, pseudo instructions, 8086 interrupts, system design using 8086		
Books*/References	1. R S Gaonkar, Microprocessor Architecture , programming and Application with 8085 2. *Douglas V Hall, Microprocessor and Interfacing (TMH)		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (2 to 3), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Microprocessor Lab**	
Course number		**EE-492**	
Credit Value		**1.5**	
Course Category		**DC**	
Pre-requisite		**Microprocessor Systems and Applications**	
Contact Hours (L-T-P)		**0-0-3**	
Type of Course		Lab	
Course Objectives	How to operate microprocessor, to write programme, to know different instructions, convert them into machine language.		
Course Outcomes	At the end of the course the students will be able to 1. Know about the basics of programming of microprocessor systems and use them effectively in the industry 2. Add, subtract, multiply and division of signed and unsigned number and store at the appropriate memory locations 3. Arrange the given numbers in ascending or descending order and different mathematical operations, move a block of data from one memory location to another location. 4. Apply the knowledge of programming of microprocessor in protection scheme and also in drives systems		
Syllabus	**List of Experiments** 1. (a) Study of operation manual of the single board Microprocessor and practice of various operations through keyboard. (b) To add two 8-bit unsigned numbers available at memory locations 2000H and 2001H respectively. Store the result at memory locattion2002H 2. (a) To subtract two 16 bit unsigned numbers stored at memory locations 2400H and 2402H. Store the result at memory location 2404H. (b) To add two 8 bit BCD numbers stored at memory locations 2401H and 2402H respectively. Store the result at memory location 2403H. 3. (a) To subtract two 16 bit BCD numbers stored at memory location 5000H and 5002H respectively. Store the result at memory location 5004H onwards. (b) To move a block of data from memory location 3000H to 3010H to the location 3005H to 3015H. 4. To determine the largest of the given numbers stored at memory location 5000H onwards. Store the result at 6000H. 5. (a) To multiply two 8 bit unsigned numbers stored at 2000H and 2001H respectively by successive addition method. Store the result at 2002H onwards. (b) To multiply two 8 bit unsigned binary number stored at memory location 3000H and 3001H respectively by rotate and shift method. Store the result at 3002H onwards. 6. To perform division on 8 bit unsigned number stored at memory location 2000H and 2001H by successive subtraction method. Store the quotient at memory location 2002H and remainder 2003H. 7. To perform division on 8 bit unsigned number stored at memory location 3000H and 3001H by Rotate and Shift method. Store the quotient at memory location 3002H and remainder 3003H. 8. To obtain the expression $y = 1 + x + x^2 + x^3 + \cdots$ where x is stored at the memory location E404H. Use subroutine for the multiplication. Store the result at the memory location E404H. 9. To compute factorial of a number less than 6. 10. To arrange the given number in ascending/ descending order stored at memory location E500H onwards.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Viva	20 Marks
		Evaluation of report	40 Marks
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title		**Power System Protection Lab**	
Course number		**EE-493**	
Credit Value		**1.5**	
Course Category		**DC**	
Pre-requisite		**Power System and Power System Protection**	
Contact Hours (L-T-P)		**0-0-3**	
Type of Course		Theory	
Course Objectives	To introduce various power system protection schemes for the protection of power system equipments.		
Course Outcomes	At the end of the course the students will be able to: 1. Implement various power system protection schemes for alternators, transformers etc. 2. Use Buchholz relay for the protection of transformer. 3. Use different type of relays and MCBs as per requirement. 4. Test different type of relays and circuit breakers.		
Syllabus	**LIST OF EXPERIMENTS** **1.** Characteristics of two input amplitude comparator. 2. Study the performance of solid state time delay relay. 3. Study of differential protection scheme for three-phase alternator. 4. Study of constructional and operation of directional earth fault relay. 5. Biased differential protection transformer. 6. To study the operation of Buchholz relay. 7. Test an overcurrent directional relay (inverse) using ME2000 universal system. 8. Characteristics of Type B and Type C Miniature Circuit Breakers (MCB).		
Books*/References	1. * Ravindranath and Chander, P.S. Protection & Switchgear, Wiley Eastern. 2. C.R. Mason, Art and Science of Protection Relaying, Wiley Eastern. 3. B. Ram and Vishwakarma, Power System Protection & Switchgear, TMH. 4. T.S.M. Rao, Power System Protection: Static Relay with Microprocessor Applications, 2nd Edition. 5. Pataithankar and Bhide, Fundamentals of Power System Protection, PHI.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Experiment Reports	40 Marks
		Viva-Voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title		**Control Lab**	
Course number		**EE-495**	
Credit Value		**1.5**	
Course Category		**DC**	
Pre-requisite		**Dynamic System Analysis**	
Contact Hours (L-T-P)		**0-0-3**	
Type of Course		Theory	
Course Objectives	To introduce the basics of control systems, control schemes, time and frequency response of first order and second order system, sketch of Bode plot, Root locus, Nyquist plot using Matlab.		
Course Outcomes	At the end of the course the students will be able to: 1. Apply the basic knowledge about Synchros, Servomotor and Stepper motor in industry for controlling the practical systems. 2. Utilize the state space analysis of different physical realizable system and suggest the stability criterion. 3. Sketch Bode plot, Nyquist plot, Root locus with the help of Matlab and suggest the relative stability. 4. Apply the knowledge of different mechanism in solar PV system in real world scenario.		
Syllabus	**LIST OF EXPERIMENTS** 1. To determine the characteristics of a Synchro. 2. To determine the frequency response of a second order system. 3. To determine the characteristics of AC servomotor. 4. To determine the steps per revolution and step angle of a stepper motor. 5. To determine the time response of linear time invariant systems. 6. To study the effect of digital controller parameters on a given simulated system. 7. (i) For a given transfer function determine the state model. (ii) For a given state model determine the transfer function. (iii) Check controllability and observability of the state model. 8. For a given transfer function obtain (i) Root locus (ii) Bode Plot (iii) Nyquist plot 9. To study the power balance in standalone solar PV system 10. To study the loss of power generation due to mismatch of solar PV Panels.		
Books*/References	1. * Nagrath and Gopal Control System Engineering, TMH 2. K. Ogata, Modern Control Engineering, PHI 3. B. C. Kuo, Digital Control System, Oxford University Press 4. M. Gopal, State variable analysis of digital control systems, TMH 5. M. Rihan, Advanced Control Systems, Axioe		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Experiment Reports	40 Marks
		Viva-Voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title		**InstrumentationLab**	
Course number		**EE-496**	
Credit Value		**1.5**	
Course Category		**DC**	
Pre-requisite		**Electrical Instrumentation**	
Contact Hours (L-T-P)		**0-0-3**	
Type of Course		Theory	
Course Objectives	To introduce various measurement methods using electrical transducers, calibration and characteristics of transducers, measurement of iron losses, determination of BH curve of magnetic material and testing of CT.		
Course Outcomes	At the end of the course the students will be able to: 1. Measure the capacitance by different bridge methods. 2. Realize the characteristics of different types of electrical transducers. 3. Determine the B-H curve and separate iron losses in magnetic materials. 4. Use electrical transducers to measure physical quantities. 5. Test a given current transformer for finding different types of errors.		
Syllabus	**List of Experiments** 1. Measurement of capacitance by Schering Bridge. 2. Input characteristics of LVDT (Linear Variable Differential Transformer) 3. Calibration of given thermocouple Pyrometer. 4. Testing of CT by Petch Elliot method. 5. Measurement of Strain using Strain Gauge. 6. Determination of B-H Curve of Magnetic Material by a Ballastic Galvanometer. 7. Separation of Iron losses in Magnetic Sheet by Lloyd Fisher Square Method. 8. Characteristics of Optical Transducers.		
Books*/References	1. *Golding & Widis, Electrical Measurement & Measuring Instruments, Pitman. 2. A. K. Sawhney, Electric & Electronic Measurement & Instrumentation, Dhanpat Rai. 3. *H. S. Kalsi, Electronic Instrumentation, TMH. 4. David Bell, Electronic Instrumentation & Measurement, PHI.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Experiment Reports	40 Marks
		Viva-Voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title	**Project**		
Course number	**EE-499A**		
Credit Value	**3**		
Course Category	**DC**		
Pre-requisite	**Nil**		
Contact Hours (L-T-P)	**0-3-0**		
Type of Course	Project		
Course Objectives	To provide team work opportunity for solving the recent problems associated with the diverse field of electrical engineering and associated areas by software development and hardware design/implementation.		
Course Outcomes	At the end of the course the students will be able to 1. Apply the knowledge about the electrical engineering and associated fields more effectively in solving electrical engineering problems. 2. Work in a team with capability of leadership. 3. Manage and complete the project in a given time schedule.		
List of Projects	Attached		
Books/References	Electrical Engineering		
Course Assessment/ Evaluation/Grading Policy	**Sessional (Continuous Evaluation)**	30 Marks	
	Total	**100 Marks**	

Course Title	**Project**	
Course number	**EE-499B**	
Credit Value	**3**	
Course Category	**DC**	
Pre-requisite	**Nil**	
Contact Hours (L-T-P)	**0-3-0**	
Type of Course	Project	
Course Objectives	To provide team work opportunity for solving the recent problems associated with the diverse field of electrical engineering and associated areas by software development and hardware design/implementation.	
Course Outcomes	1. At the end of the course the students will be able to 2. Apply the knowledge about the electrical engineering and associated fields more effectively in solving electrical engineering problems. 3. Work in a team with capability of leadership. 4. Manage and complete the project in a given time schedule.	
List of Projects	Attached	
Books / References	Electrical Engineering	
Course Assessment/ Evaluation/Grading Policy	**Sessional (Continuous Evaluation)**	40 Marks
	End Semester Examination	30 Marks
	Total (EE-499A+EE-499B)	**100 Marks**

Course Title		**ELECTRONIC DEVICES AND CICUITS**	
Course number		**EL-201**	
Credit Value		**4**	
Course Category		**ESA**	
Pre-requisite		**Basics of Electrical and Electronics Engineering**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	The objective of this course is to help the student to understand the fundamental devices of electronics engineering such as diode, transistor, amplifier and oscillators etc. Further this course discusses the characteristics of amplifiers at low frequencies and high frequencies.		
Course Outcomes	After completing this course the students should be able to: 1. Understand the behaviour of fundamental electronic devices. 2. Understand different applications of electronic devices 3. Understand and analyse different types of transistor based circuits at low and high frequencies.		
Syllabus	**UNIT 1:** PN Junction Diode Characteristics and Parameters; Diode Resistance, Transition Capacitance and Diffusion Capacitance; Special Diode Types; Schottky Barrier Diode, Photo Diode, LED, Tunnel Diode, Varactor Diode and Their Applications. **UNIT 2:** Transistor as an Amplifier; Analysis Using Hybrid and T Models; High Frequency Hybrid Model; BJT and FET Characteristics, Parameters, Configurations and Applications; UJT and Its Applications. **UNIT 3:** Biasing of BJT and FET; Bias Stability; Biasing Circuits; Classification of Amplifiers; Frequency Response of RC Coupled Amplifier; Power Amplifiers with Their Classifications; Regulated Power Supply. **UNIT 4:** Feedback Concept; General Feedback Structure; Properties of Negative Feedback; Basic Feedback Topologies; Condition of Oscillation; BJT and FET Based Oscillator Circuits; Crystal Oscillators; Frequency Stability. **UNIT 5:** Differential Amplifier; Operational Amplifier Characteristics and Parameters; Slew Rate, CMRR, Offset Voltage and Its Removal; Application as Instrumentation Amplifier, Voltage to Current and Current to Voltage Converter, Log and Antilog Amplifier, Waveform Generator, Comparator		
Books*/References	1. M. M. Mano, Digital Logic and Computer Design, PHI 1986. 2. A.P. Malvino, Digital Principles and Application. 3. Ronald J. Tocci, Digital Systems- Principles and Applications, PHI, 1995.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Logic and Digital Circuits**	
Course number		**EL-203N**	
Credit Value		**4**	
Course Category		**ESA**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the concepts of logic gates, realization of combination and sequential circuits. To study data acquisition and conversion methods and circuits.		
Course Outcomes	At the end of the course the students will be able to 1. Implement the number system. 2. Realize logic circuits 3. Reduce the combinational circuits using K-map and Boolean algebra. 4. Encode, decode, multiplex and de-multiplex the data. 5. Successfully perform acquisition and conversion of signals using digital circuits.		
Syllabus	**UNIT I: Introduction** Number system: Decimal, Binary Octal, Hexadecimal; Base Conversion; Binary Arithmetic; Binary Codes; Boolean Algebra: Basic Theorems and Postulates; Basic AND, OR, NAND, NOR, EX-OR Gates. **UNIT II: Digital Circuits** Switching Characteristics of Semi- Conductor Devices: Realization of Various Logic Gates: DTL, TTL, HTL, ECL and MOS Logics; Comparison of Various Logic Families. **UNIT III: Design of Combination Circuits** Truth Table Representation; Canonical Forms; Minimization of Switching Functions- Karnaughs Maps; Design of Combinational Circuits; Encoders, Decoders, Multiplexers, ROMs. **UNIT IV: Sequential Logic Systems** Definition of Sequential Circuits; State table and Diagram Representation; Flip- Flops: SR,JK,T and D Type; Ripple Counter; Shift Registers; RAMs. **UNIT V: Data Acquisition and Conversion** A/D and D/A Converters; sample and Hold Circuits; comparators; Multivibrators- Astable and Distable.		
Books*/References	1. M. M. Mano, Digital Logic and Computer Design, PHI 1986. 2. A.P. Malvino, Digital Principles and Application. 3. Ronald J. Tocci, Digital Systems- Principles and Applications, PHI, 1995.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title		**Electronics Engg. Lab**	
Course number		**EL-294X**	
Credit Value		**2**	
Course Category		**ESA**	
Pre-requisite		**Power Electronics**	
Contact Hours (L-T-P)		**0-1-2**	
Type of Course		Theory	
Course Objectives	To familiarize the different types of characteristics of various types electronic devices, amplifiers, code converter and rectifier circuits.		
Course Outcomes	At the end of this course, students will be able to: 1. Understand the forward and reverse biased characteristics of semiconductor diode. 2. Understand the voltage regulation characteristic of zener diode. 3. Design inverting and non-inverting amplifier. 4. Implement 3-bit binary to gray and gray to binary code converter, 4-bit parity checker and generator and Mod-6 counter. 5. Realize rectifier circuit for particular application.		
Syllabus	**List of Experiments:** 1. To plot the forward and reverse biased characteristics of semiconductor diode. Also find out the cut-in voltage of the diode. 2. To determine the breakdown voltage of the given zener diode & plot its voltage regulation characteristics. 3. To trace the output of half-wave and full-wave rectifier with and without filter. 4. To plot the output characteristics of a given BJT. 5. To design and test inverting and non-inverting amplifier. 6. Design and implement a circuit to integrate Sine and Square waveforms. 7. To implement and test a 3-bit binary to gray and gray to binary code converter. 8. To implement and test a 4-bit parity checker and generator. 9. To design and test a Mod-6 synchronous counter.		
Books*/References	1. Adel S. Sedra, Keneth C. Smith, Microelectronic circuits, Oxford University Press, Sixth edition. 2. Morris Mano M., “Digital Circuits and Logic Design”, Prentice Hall of India, II Edition, 1996. 3. Materials provided in lab.		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Experiment Reports	40 Marks
		Viva-Voce	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title		**COMMUNICATION SKILLS**	
Course number		**EN-101**	
Credit Value		**4**	
Course Category		**HU**	
Pre-requisite		**Nil**	
Contact Hours (L-T-P)		**2-2-0**	
Type of Course		Theory	
Course Objectives		1. To introduce the chief features of writing various formal letters. 2. To inform and instruct about drafting letters of business communications and to acquaint students about the basic knowledge and techniques of academic/conventional writing. 3. It aims for the development and enhancement of verbal/spoken skills required in both business and academic setup.	
Course Outcomes		1. Student will be more eloquent and fluent in writing official letters either of business, academic or of any other kind. 2. Students will gain more confidence through oral communication learning which will help them in articulating themselves more efficiently and effectively which is prerequisite in the field of business and academia/academe. 3. The course will finally result in the overall enhancement and development of student`s skills and personality.	
Syllabus		**1. Writing offical letters** Basic principles, format and type: employment letters, placing orders enquiry and response letters, letters of complaint and apology, persuasive letters, curriculum vitae. **2. Business Working** (a) Glossary of business terms (b) Drafting business messages: memos, telexes, e-mails, press notice references, tenders and bids, employment advertisements. **3. Academic Writing** (a) Note-making and note-taking, abstracting, use of graphics (tables and free diagrams) preparing bibliography. (b) Writing academic papers and reports **4. Oral Communication in Business Setup** Attending interviews, telephonic conversation, reception of visitors, holding meetings. **5. Oral Communication in Academic Setup:** Participating in group discussions, Presenting prepared papers and reports, Seminar Strategies.	
Books*/References			
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Classwork	40 Marks
		Mid Term Examination (I Hour)	20 Marks
		Sessional Total	**60 Marks**
	End Semester Examination (3 Hours)		40 Marks
		Total	**100 Marks**

Course Title	**Basic Thermal Science**
Course number	**ME101**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**Nil**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	Theory

Course Objectives	At the end of this course the student will 1. Be able to have the basic concepts of thermal sciences and their application to in formulating the thermal engineering problems. 2. Have a good understanding of first and second laws of thermodynamics and will be in 3. a position to fully understand the analysis to be taught at the higher levels. 4. Be in a position to check the feasibility of proposed processes and cycles using the ideas of second law of thermodynamics and entropy. 5. Have the understanding of basic principles of heat transfer and related simple problems.
Course Outcomes	After taking this course the students shall be able to have: 1. The basic concepts of units and dimensions, systems(open and closed systems and control volumes) and its boundaries, properties, state, process, cycle, quasi-static process etc.- required as foundation for development of principles and laws of thermodynamics 2. Intuitive problem solving technique 3. Knowledge of two property rule and hence thermodynamic tables, thermodynamic diagrams and concept of equation of state; also their simple application. 4. Heat, work and first law of thermodynamics. Application of energy balance 5. Second law of thermodynamics and its corollaries viz. absolute (thermodynamic) temperature scale, reversibility, entropy, feasibility of a process based on first law and second law, isentropic efficiency of adiabatic machines. 6. Introductory knowledge of power and refrigeration cycles. Their efficiencies and coefficients of performance. 7. Introductory ideas of heat transfer in conduction, convection and radiation modes. Application of these concepts to heat transfer in single and combined modes.
Syllabus	**UNIT –I** Dimensions and units, system, boundary, types of systems and boundaries, property, cycle , thermodynamic equilibrium and quasi-static process.Pressure and its measurement, zero'th law of thermodynamics, temperature and its measurement, numerical problems. **UNIT-II** Thermodynamic and mechanics' definition of work, displacement work and its expressions, engine indicator and indicated work, introduction to 2-stroke and 4-stroke engines, heat, work and heat as energy interactions, Joule's experiment & mechanical equivalent of heat, first law of thermodynamics for cyclic and non cyclic processes, definition of energy as a property, internal energy, enthalpy, specific heats, first law for a control volume, steady flow energy Equation (SFEE), and it's applications, numerical

	problems. **UNIT-III** Pure substance, different phases of pure substance, two-property rule, property diagrams, tables and charts, equation of state of an ideal gas, t~τ , t~p, p~v, and p~h diagrams, phase boundaries, S-L-V region, CP and TP, dryness fraction and its measurement using throttling calorimeter, limitation of throttling calorimeter, separating & throttling calorimeter, numerical problems. **UNIT-IV** Limitations of first law , heat engine, heat pump, refrigerator, second law of thermodynamics- Kelvin Planck's and Clausius statements and their equivalence, efficiency of heat engine and coefficient of performance of heat pump and refrigerator, reversible and irreversible processes, Carnot cycle and its efficiency, corollaries of second law, the thermodynamic temperature scale. inequality of Clausius, entropy, principle of increase of entropy, isentropic process, t~s and h~s diagrams (Mollier chart), second law applications, air standard otto, diesel, dual, simple Brayton and steam power cycles (Rankine ycle), numerical problems. **UNIT V** Modes of heat transfer, Fourier's law of steady state heat conduction (one dimensional conduction), thermal conductivity and its unit, conduction through slab or plane wall, hollow cylinders and spheres conduction through composite walls and hollow cylinders and spheres with multi-layers, convective heat transfer, Newton's law of cooling, electrical analogy and overall heat transfer coefficient, combined conductive and convective heat transfer, radiation and radiation properties of surfaces, black body, emissive power, Stefan Boltzmann's law,, emissivity, monochromatic emissive power and monochromatic emissivity, grey body, Kirchoff's law, Wien's displacement law, numerical problems.
Books*/References	1. Thermodynamics, An Engineering Approach by Yunus A. Cengel and Michael A Boles. 2. Engineering Thermodynamics by D.B. Spalding and E. H. Cole. 3. Engineering Thermodynamics by R. Joel. 4. Engineering Thermodynamics by P.K.Nag. 5. Engineering Heat Transfer by C.P.Gupta and R. Prakash.

Course Assessment/ Evaluation/G rading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**

Course Title	**Applied Mechanics**
Course number	**ME-111**
Credit Value	**4**
Course Category	**DC**
Pre-requisite	**None**
Contact Hours (L-T-P)	**3-1-0**
Type of Course	**Theory**

Course Objectives	1. To give students practice in applying their knowledge of mathematics, science, and engineering and to expand this knowledge into the vast area of Applied Mechanics. 2. To enhance students' ability to design by requiring the solution of open ended problems. 3. To prepare the students for higher level courses such as courses in Mechanics of Solids, Mechanical Design and Structural Analysis.
Course Outcomes	After taking this course students should be able to: 1. work comfortably with basic engineering mechanics concepts required for analyzing static structures. 2. identify an appropriate structural system to study a given problem and isolate it from its environment. 3. model the problem using good free-body diagrams and accurate equilibrium equations 4. identify and model various types of loading and support conditions that act on structural systems. 5. apply pertinent mathematical, physical and engineering mechanical principles to the system to solve and analyze the problem. 6. communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem. 7. develop concepts of rigid body kinematics and dynamics with an emphasis on the modeling, analysis, and simulation of how forces produce motion of rigid body systems. 8. determine simple dynamic variables and solve simple dynamic problems involving kinematics, energy and momentum. 9. determine internal actions in statically determinate structures and draw internal action diagrams –Shear Force (SFD) and Bending Moment Diagrams (BMD) for these structures.
Syllabus	**UNIT 1:** Fundamental Concepts and principles of Mechanics. Reduction of a system of forces to a force couple system, Free body diagrams, equilibrium of rigid bodies in 3 dimensions, reactions, loading indeterminancy and solvability. Friction forces and laws of dry friction. Principle and application of virtual work. **UNIT 2:** Analysis of Multiple particle system: Aplication of Newton's laws, linear and angular momentum, kinetic energy and work energy principle, principle of impulse and momentum to a system of particles. **UNIT 3:** Translation and rotation about a fixed axis, general plane motion, absolute and relative velocity in plane motion, angular momentum of rigid body in plane motion. Problems of motion of rigid bodies and system of rigid bodies, principle of work and energy,conservation of energy for rigid body and a system of rigid bodies. **UNIT 4:** Analysis of stress and strain: Mechanical properties, analysis of simple state of stress and strains, elastic constants, example of state of tension,

<table>
<tr><td colspan="2"></td><td colspan="2">compression and shear.
UNIT 5:
Bending shear and torsion: Concept of bending and shear forces in simple beams, Relationship between load, bending moment and shear force. Bending and shear stresses in simple beams, concepts of torsion in circular shafts.</td></tr>
<tr><td colspan="2">Books*/References</td><td colspan="2">1. Beer Ferdinand P. and Johnston Jr. E Russel, Vector Mechanics of Engineering: Statics and Dynamics, Metric edition, Mc. Graw Hill, New Delhi.
2. Popov E., Engineering Mechanics of Solids, PHI, Delhi.
3. Merium, JL, Engineering Mechanics (Volume I and II), 3rd edition, (SI version) John Wiley and sons, Inc, NT.
4. Timoshenko S. and Young DH, Elements of strength of materials, DYNC, New York</td></tr>
<tr><td rowspan="4">Course Assessment/ Evaluation/Grading Policy</td><td rowspan="3">Sessional</td><td>Assignments</td><td>15 Marks each</td></tr>
<tr><td>Mid Term Examination (I Hour)</td><td>25 Marks</td></tr>
<tr><td>Sessional Total</td><td>40 Marks</td></tr>
<tr><td colspan="2">End Semester Examination (3 Hours)</td><td>60 Marks</td></tr>
<tr><td colspan="3">Total</td><td>100 Marks</td></tr>
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Course Title	**Engineering Graphics Lab**
Course Number	**ME-193**
Credits	**2**
Course Category	**DC**
Pre-Requisites(s)	**None**
Contact Hours	**0 – 0 – 3**
Type of Course	Lab

Course Objectives

1. To understand and appreciate the importance of Engineering Graphics.
2. To understand the basic principles of Technical/Engineering Drawing.
3. To understand the different steps in producing drawings according to BIS.
4. To learn basic engineering drawing formats.

Course Outcomes

After taking this course students should be able to:

1. Understand the theory of plane geometric projection and its classifications.
2. Use Plane/diagonal/isometric scales in engineering graphics.
3. Apply various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient.
4. Read and interpret drawings of simple machine parts/ sectional views in first and third angle of projection systems.
5. Explain the conventions and the methods of orthographic projection and isometric projection.
6. Improve their visualization skills so that they can apply these skills in developing new products.
7. Model simple machine parts in isometric projections.
8. Develop skills to communicate ideas and information through engineering drawing.

Syllabus

UNIT-1:
Introduction to graphic language, Instruments and their use, Conventional Lines and their uses. Printing of letters and numerals, Methods of dimensioning. Construction and use of scales, Construction of cycloidal curves and involutes.

UNIT-2:
Necessity for orthographic projections 1st & 3rd angle methods of projection. Projection of points & lines on three coordinate planes, Projections of plane surfaces.

UNIT-3:
Orthographic projections of simple machine parts on different planes. Choice of view, Hidden lines, Preparation of multi view drawings. Necessity of sectional views and their drawings.

UNIT-4:
Axonometric Projections. Drawing of isometric projection of simple solids; Development of surfaces of simple solids. Use and methods of drawing.

Books*/References

1. Beer Ferdinand P. and Johnston Jr. E Russel, Vector Mechanics of Engineering: Statics and Dynamics, Metric edition, Mc.
2. Graw Hill, New Delhi.
3. Popov E., Engineering Mechanics of Solids, PHI, Delhi.
4. Merium, JL, Engineering Mechanics (Volume I and II), 3rd edition, (SI version) John Wiley and sons, Inc, NT.
5. Timoshenko S. and Young DH, Elements of strength of materials, DYNC, New York

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments	60 Marks each
		Sessional Total	**60 Marks**
	End Semester Examination (2 Hours)		40 Marks
		Total	**100 Marks**

Course Title	**Manufacturing Process Laboratory-I**
Course Number	**ME 194**
Credits	**2**
Course Category	**DC**
Pre-Requisites(s)	**None**
Contact Hours	**0-0-3**
Type of Course	Laboratory

Course Objectives	1. Knowledge and understanding of various types of ferrous and non-ferrous materials used for manufacturing processes. 2. Understanding and selection of processes based upon jobs drawings used for manufacturing. 3. Basic knowledge of hot and cold working processes. 4. Selection and knowledge of various tools applied for cold and hot working processes. 5. Exposure and understanding of machine tools required for manufacturability. 6. Analyze the job manufactured from practical relevance point of view.
Syllabus	**List of Experiments** 1. To prepare through tennon and mortise joint. 2. To prepare a funnel of GI sheet. 3. To perform filling, drilling and tapping operations. 4. To perform electroplating. 5. Preparation of green sand mould and to perform casting process. 6. To prepare a square headed bolt. 7. To carry out gear cutting by simple indexing. 8. To prepare a single V-butt joint by arc welding and study of gas welding process. 9. To perform facing, simple turning, taper turning, threading and knurling operations on a lathe machine. 10. To perform plaining and slot cutting operations on shaper and slotter machines.

Course Assessment/ Evaluation/Grading Policy	**Sessional**	Reports/Viva Voce	60 Marks each
		Sessional Total	**60 Marks**
	End Semester Examination		40 Marks
		Total	**100 Marks**

Course Title		**Economics and Management**	
Course number		**ME-340**	
Credit Value		**4**	
Course Category		**HM**	
Pre-requisite		**Communication skills and Basic Mathematics**	
Contact Hours (L-T-P)		**3-1-0**	
Type of Course		Theory	
Course Objectives	To introduce the concepts of management, organization, planning, management strategies, leadership, engineering economy, forecasting, breakeven analysis, replacement studies, risk analysis, depreciation.		
Course Outcomes	At the end of the course the students will be able to 1. Manage and plan organizational design. 2. Appreciate leadership skills required in an organization. 3. Apply the engineering economy in industry. 4. Propose an organizational plan with minimal risk by using risk analysis. 5. Apply the knowledge of depreciation to determine the value of an asset.		
Syllabus	**UNIT-I** Management process, planning and strategic management, organizing, organizational design, organizational structure, power and authority. **UNIT-II** Leading, Leadership styles, motivation theories, controlling function. **UNIT-III** Introduction to engineering Economy, Economic Laws, Forecasting, Breakeven Analysis. **UNIT-IV** Money – Time relationships and their types, selection among alternatives. **UNIT-V** Replacement studies, risk analysis, depreciation.		
Books*/References	1. DeGarmo, E.P., Sullivan, W.G. and Bontadelhi, J.A., 1988. Engineering Economy, ed. VIII, Macmillon. 2. Riggs,J.I., Bedworth, D.B. and Randhawa, S.U., 1996, Engineering Economy, ed. VIII, Macmillan. 3. Stoner, J.A.F., Freeman, R.E. and Gilbert, D.R., 2003, Management, ed.vi, PHI		
Course Assessment/ Evaluation/Grading Policy	**Sessional**	Assignments (2 to 3)	10 Marks
		Quiz (3 to 4), Best two may be considered	05 Marks
		Mid Term Examination (I Hour)	25 Marks
		Sessional Total	**40 Marks**
	End Semester Examination (3 Hours)		60 Marks
		Total	**100 Marks**