SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

TEACHING AND EXAMINATION SCHEME

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

(W.e.f. Academic Year 2015-16)

Sr. No	Name of Subject	Credit	Teaching Scheme/Contact Hours per Week			Examination Scheme (Marks)				
			Theory	Tutorial	Practical	Paper	Test	TW	POE	Total
1	Engineering Mathematics-III	4	3	1	0	80	20	0	0	100
2	Electrical Machines – I	5	4	0	2	80	20	25	25	150
3	Electrical measurement and Instrumentation	4	3	0	2	80	20	25	25	150
4	Electronics Devices and circuits	4	3	0	2	80	20	25	25	150
5	Numerical Methods using MATLAB	4	3	0	2	80	20	25	25	150
6	Electrical Workshop and Seminar	1	0	0	2	0	0	50	0	50
	Total Part-I	22	16	1	10	400	100	150	100	750
Part-II										
7	Engineering Mathematics-IV	4	3	1	0	80	20	0	0	100
8	Electrical Machines – II	5	4	0	2	80	20	25	25	150
9	Analog and Digital Circuits	4	3	0	2	80	20	25	25	150
10	Network Analysis	4	3	0	2	80	20	25	25	150
11	Power Plant Engineering	4	4	0	0	80	20	0	0	100
12	Communication Skill	3	2	0	8	40	10	50	0	100
	Total Part-II	24	19	1	8	400	110	125	75	750
	Grand Total	46	35	2	18	800	200	275	225	1500

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Second Year Common to Electrical Engineering &Electrical, Electronics and

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Effective from 2015-16

1. ENGINEERING MATHEMATICS - III

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

Course Objectives:

1. To develop logical understanding of the subject.
2. To develop mathematical skill so that students are able to apply mathematical methods & principles in solving problems from engineering fields.
3. To produce graduates with mathematical knowledge & computational skill.

Course Contents:

Unit I: (7 Hours)

`Introduction to L.D.E.with constant coefficients, Definition, Complementary function & Particular integral,Shortcutmethods,Equations reducible to L.D.E. with constant coefficients (i) Cauchy's Homogeneous linear equation (ii) Legendre's Linear Equations, Applications of L.D.E. to electrical circuits.

Unit II: (6 Hours)

Differentiation of vectors, Gradient of scalar point function & Directional derivative, Divergence of vector function &Solenoidal vector fields, Curl of vector point function & irrotational

Unit III: (7 Hours)

Line integral ,Line integral independent of path, Line integral in parametric form, workdone, Green's theorem (without proof) ,its verification &applications, Surface Integral ,Stoke's theorem (without proof) &applications, Gauss Divergence theorem (without proof) & applications

Unit IV: **(7 Hours)**

Fourier Integral: Definition, complex form of Fourier integral, Fourier Sine &Cosine Integral,Fourier transforms, Fourier Sine & Cosine Transform

Unit V: **(6 Hours)**

P.D.E. of first order & first degree of type $f(p,q)=0$, $f(p,q,z)= 0$,$f(p,q,x,y) = 0$,$f(p,q,x,y,z) =0$ i.e. Lagrange's form $Pp + Qq = R$ &Clairaut's equation $z = px + qy + f(p,q)$.,Equations reducible to above standard types

Unit VI: **(7 Hours)**

Separation of variables, Vibrations of string, one dimensional heat equation

Course Outcomes:

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

1. Apply basic mathematical tools for solving engineering problems.
2. Provide skills in vector calculus & linear differential equations which would enable them to devise engineering solutions for given situations they may encounter in their profession.
3. Deploy skills effectively in the solution of problems, principally in the area of engineering

Text Books:

1) Higher Engineering Mathematics by Dr.B.S.Grewal(Khanna Publication Delhi)

2) Advanced Engineering Mathematics by H.K.Das(SChandPublication)

3) Advanced Engineering Mathematics by ErwinKreyszig

Reference Books:

1) A text book of AppliedMathematics: Vol.I,II& III by J.N.Wartikar&P.N.Wartikar,VidyarthiGrihaPrakashan .Pune.

2) Advanced Engineering Mathematics by R.K.Jain&S.R.K.Iyengar(Narosa Publication)

3) Higher Engineering Mathematics by B.V.Ramana (Tata McGraw Hill).

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2. Electrical Machines-I

Teaching Scheme		**L: 04 T: 00 P: 02**	
Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	80 Marks	**20 Marks**	**40%**

Course Objectives:

1. Introduce basic fundamentals of different electrical machines and transformers
2. Introduce the characteristics of different D.C. machines
3. Analysis and investigation of the major performance characteristics of different types of motors.
4. Investigation of motors' starting problems.
5. Allow the students to gain the proficiency to differentiate between the different types of motors, with the capability to select the proper motor for the proper application.
6. Provide the students with the proficiency to conduct and benefit from the testing procedures of electric motors with the ability to analyse data and to obtain the major characteristics

Course Contents:

Unit 1: Single Phase Transformer (8 Hours)

Transformer construction and practical consideration, Transformer reactance's and equivalent circuits, Engineering aspects of transformer analysis, effect of load on power factor, phasor diagrams, per unit quantities, Excitation phenomenon in transformers-Switching transients, Testing-Polarity test, Open Circuit Test (O.C.) Short Circuit Test (S.C.), Sumpner's Test, Variable frequency transformer, Instrument Transformer-Current transformer, Potential transformer, Pulse transformer and applications

Unit 2: Three Phase Transformers (8 Hours)

Special constructional features, three phase transformers connections, Labeling of transformers Terminals, Star/Star connection, Delta/Delta Connection, Star/Delta, Delta/Star connection, Delta/Zigzag Star, Star/Zigzag Star, Phase groups, Choice of transformers connections, Harmonics, Parallel operation of transformers, Three winding transformers and its equivalent circuits, Stabilization by Tertiary winding, Phase conversion/Open Delta connection, Three/Two phase conversion (Scott connection), Three/Six conversion, Three/One conversion, On-Off Load Tap changing transformers, cooling methodology, Types and Routing tests according to ISI.

Unit 3: Electromechanical Energy Conversion Principles (6 Hours)

Forces and torques in magnetic field systems Energy balance, Energy in Singly-Excited magnetic field systems, Determination of magnetic force and torque from energy, Determination of magnetic force and torque from co-energy, Multiply-Excited magnetic field systems, Forces and torques in systems with permanent magnets, Energy Conversion via electrical field, Electric field energy, Dynamic equations of electromechanical systems and Analytical Techniques.

Unit 4: DC Generators (8 Hours)

Construction of armature and field systems, Basic Principle of working, Emf equation, Types, Armature windings, Characteristics and applications of different types of DC Generators, Building of Emf in DC Shunt Generator and causes of failure, Armature reaction-Demagnetizing and Cross magnetizing mmf's and their estimations; Remedies to overcome the armature reaction; Commutation Process, Straight line commutation, Commutation with variable current density, under and over commutation, Causes of bad commutation and remedies; interpoles, Compensating windings.

Unit 5: D.C. Motors (10 Hours)

Principles of working, Significance of Back Emf, Torque Equation, Types, methods of excitation- Steady State Motor Circuit equation, Characteristics and Selection of DC Motors for various applications, Starting of DC Motors, Speed Control of DC Shunt and

Series Motors, Braking of DC Motors- Plugging, Dynamic Braking, Regenerative Braking; Losses and Efficiency, Condition for Maximum Efficiency, Effect of saturation and armature reaction on losses; Permanent Magnet DC Motors, Types and Routing tests according to ISI Specifications.

Unit 6: Variable-Reluctance Machines and Stepping Motors (6 Hours)

Basic VRM Analysis, Practical VRM analysis, Current waveform for torque production, Non-Linear Analysis, Stepping Motors.

Course outcome:

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

1. Design and conduct experiments as well as analyse the parameter of DC machine & transformer.
2. Develop understanding of professional & ethical responsibility of DC machine & transformer.

Text/Reference Books:

1. I J Nagrath, D P Kothari; "Electric Machines," Tata McGraw Hill Publication. Second Edition(Reprint) 2003.

2. A.E.Fitzgerald, C.Kingsley, S.D.Umans. "Electrical Machinery" Tata McGraw Hill.Sixth Edition 2002.

3. Nasser Syed.A "Electrical Machines and Transformers," New York, Macmillon 1984.

4. Langsdorf "DC Machines".

5. J. B. Gupta, "Electrical Machines", SK Kataria and Sons, New Delhi

6.SK Bhattacharya, "Electrical Machines", Tata McGraw Hill, New Delhi.

7.Ashfaq Hussein - Electrical Machines, DhanpatRai Publication (2012).

8.Bhimbra.P.S – Electrical Machines), Khanna Publication (2011).

Term work:

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

1. To perform open circuit and short circuit test on single phase transformer to find its core loss, full load copper loss and constants of its equivalent circuit.
2. To operate two single-phase transformers in parallel and how they share a load under various, conditions of their voltage ratios and leakage impedances.
3. To study V-connection of identical single-phase transformers for obtaining three phase transformation.
4. To study Scott-connection of single-phase transformer.
5. Sumpner's Test.
6. Study of no load current waveform of single-phase transformer.
7. Determination of magnetization, external and internal characteristics of a D.C.shuntgenerator,
8. Speed variation of a D.C. Shunt machine by- (i) armature voltage control & (ii) field current control method.
9. To study the performances of a D.C. shunt motor by Load/ Brake test.
10. To find efficiency of a D.C. shunt / compound machine by performing Swinburn's test.
11. To separate the losses in a D.C. shunt machines by performing the Retardation test.
12. Field test on two identical series machines to separate various losses and determine the efficiency of machines.
13. Hopkinson's Test.
14. Study of traditional and modern starters for DC motors

Practical Examination:

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

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3. ELECTRICAL MEASURMENT AND INSTRUMENTS

Teaching Scheme			**L: 03 T: 00 P: 02**
Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	80 Marks	**20 Marks**	**40%**

Course objectives:

1. To expose the students to a broad knowledge of experimental methods and measurement techniques
2. To train the students in the skill of operation of instruments in the electrical & electronic engineering applications
3. To understand the basic working of instruments used for measurement
4. To understand the errors in measurements and their rectification
5. To gain proficiency in the use of common measuring instruments
6. To compare theoretical predictions with experimental results and to resolve any apparent differences.

Course Contents:

Unit 1: (8 Hours)

Theory of measurement; accuracy, precession, errors. Measurement of electrical signals, Voltage measurement, current measurement, resistance measurement, and power measurement, by operating principles of electromechanical instruments [MI, MC, Induction type] and by methods of substitution. Measurement of flux. Energy meter

Unit 2: **(6 Hours)**

Measurement of low, medium and high resistance, D.C. potentiometer, Kelvin double bridge, bridge, megger. A.C bridges for measurement of inductance & capacitance: Maxwell bridge, Anderson bridge, De-sauty bridge, Schering bridge, Hay's bridge.

Unit 3: **(6 Hours)**

Systematic errors, Random errors, Total measurement system errors, system Disturbances due to measurement, modifying inputs, Random errors, total measurement system errors, Mean &median values, Std. Deviation and variance, concepts of histogram, bell shape distribution, frequency distribution of errors, and error boundaries

Unit 4: **(8 Hors)**

Instruments classification, characteristics of instruments, Selection of instruments, Functions of instruments, Comparison of analog and digital instruments. Electrical Instrument: multimeter, clampmeters, Power factor meter, Frequency measurement, Earth resistance and leakage current tester, Electrical resonance type frequency meter, Synchroscopes.

Unit 5: **(8 Hours)**

Instrument calibration reference standards, concepts and basic circuits like [amplification, attenuation, signal linearization, filtration, Bias shift etc.] for analog signal processing, introduction of Digital signal processing, manipulation needs and transmission of signals.

Unit 6: **(4 Hours)**

Sensors & transducers, classification of sensors, principle of operation of Temperature sensors (RTD, thermocouple), pressure sensors (load cells, resonant wire device,Pirani gauge), electromagnetic flow meters, ultra-sonic flow meters, fiber optic level sensors and LVDT. Photo & electromagnetic sensors. [This entire Unit VI has descriptive treatment only.]

Course outcome:

On completion of this course, students should be able to:

1. Discuss the operating principles of common electrical and electronic measuring instruments, devicesand circuits, and their application to testing;
2. Measure the performance of equipment and circuits;
3. Identify and classify error sources, and explain how their effects can be minimized in particularmeasurement situations;
4. Discuss human and environmental implications of measurement systems;
5. Analyze single- and three-phase circuits to determine voltage and current values;
6. Analyze test measurements and circuit performance mathematically in both time and frequencydomains;
7. Specify details of instrumentation and devices intended for a particular application;
8. Evaluate the results of tests and measurements taken from circuitry constructed by the student.

Text/Reference Books:

1. A.K. Sawhney, "A course in Electrical & Electronic Measurements & Instrumentation", Publication- DhanpatRai& Sons, Edition 1995.
2. E.W Golding; "Electric Measurement & Measuring Instruments", Publication - A. H. Wheeler & Co, Allahabad, Edition 1983.
3. Helfrick and cooper, "Modern Electronic Instrumentation & Measurement Techniques", Publisher- Pearson, Edition 2007.
4. M. A. Baldwin, "Fundamentals of Electrical Measurements", Publication - Lyall Book Depot, Ludhiyana, Edition 1985.
5. M.U. Reissland, "Electrical Measurements", Publication - Wiely Eastern Ltd, New Delhi, Edition 1992.
6. V. Popov; "Electrical Measurements" Publication – Mir, Moscow, Edition 1970.
7. Jones B.E.; "Instrumentation Measurement & Feedback", Publication – Tata McGraw Hill, New Delhi, Edition 1978.

Term Work:

Term work will consist of record of minimum eight experiments carried out of following

1. Measurement of power in a single phase circuit, using

a) Three ammeter method and

b) Three-voltmeter method.

2. Measurement of power in a three phase circuit, using two- wattmeter method,
3. Measurement of temperature using any one temperature sensor.
4. Measurement of inductance using Maxwell Bridge.
5. Measurement of capacitance by bridge methods
6. Measurement of current by substitution method.
7. Measurement of small (mili-) voltage by CRO.
8. Calibration of ammeter and voltmeter by using DC potentiometer
9. Measurement of resistance (high, medium, low)
10. Measurement of earth resistance
11. Calibration of energy meter at different power factors (3 phase /1 phase).
12. Measurement of displacement using LVDT.
13 Study of digital voltmeter, digital multimeter.

Practical Examination:

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

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4. ELECTRONICS DEVICS AND CIRCUITS

Teaching Scheme			**L: 03 T: 00 P: 02**
Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	80 Marks	**20 Marks**	**40%**

Course objectives:

The main objectives of the subject EDC is to provide a clear explanation of the operation of all important semiconductor devices such as P-N junction diode, Break down diode, transistor and FET in general use, and to impart knowledge of electronic circuits using these devices. Each device is introduced by presenting a single physical picture of the internal behavior of the device. This discussion leads to a characterization of the device in terms of appropriate external variables and allow small signal models at low frequency and high frequency to be constructed. Primary emphasis is on the BJT in both the analog and digital mode Methods of analysis design and feature that are common to many different devices and circuits are emphasized. For example Kirchhoff's current and voltage law, Thevenin's theorem and Miller's theorems are used. The frequency response of multistage amplifiers, Calculations of input and output resistances as well as current and voltage gains are made for a wide Variety of amplifier. Also compensation and stabilization techniques for transistor amplifier circuits are carried out.

Another objective is to show how different circuits and devices can be simulated using computer. Simulation of circuit is employed in circuit analysis and carried out using software MULTISIM. While graphical analysis is carried out using PSPICE software.

Course Contents:

Unit 1: Transistor Biasing: (7 Hours)

The early effect, Transistor as a switch, typical Transistor junction voltages, Transistor as an amplifier, Operating point, bias stability; Design of Fixed biasing, collector to base biasing and voltage divider biasing circuits;

Unit 2: Small Signal low frequency Transistor Model: (6 Hours)

Transistor hybrid model, h-parameters, Analysis of transistor amplifier circuits using h-parameters, Comparison of performance parameter with CB, CC and CE amplifier configurations; linear analysis, physical model of CB transistor; emitter follower, Miller's theorem and it's dual, High input resistance transistor circuits

Unit 3: Field effect transistors: (5 Hours)

An overview of JFET and MOSFET: pinch off voltage, pinch region formation, transfer characteristic, Threshold voltage, Transconductance; biasing arrangement of JFET.

Unit 4: Feedback amplifier: (6 Hours)

Classification of amplifiers, Feedback concept, Transfer gain with feedback, General characteristics of feedback amplifier, Input and output resistance, Method of analysis of feedback amplifier, Design of feedback amplifier; Voltage series, current series, voltage shunt and current shunt amplifiers.

Unit 5: Power Amplifiers: (8 Hours)

Types and applications of power Amplifiers, Transistor power dissipation, Heat transfer in semiconductor devices, Thermal Resistance, Derating; Amplifier classes and efficiency: CLASS A, CLASS B, CLASS C and CLASS AB; Principle of Push pull amplifiers, Push pull drivers, Harmonic distortion and feedback, distortion in push pull Amplifiers, Millimanhalkias

Unit 6: Voltage Regulators: (8 Hours)

Design of series voltage regulators using discrete components, protection circuit and pre regulator, Design of fixed voltage regulator using (IC 78XX & IC 79XX), Design of adjustable voltage regulators (LM 317, 337), precision voltage regulators (IC 723), basic switching regulators, block diagram of switching regulator IC μA -78S40.

Course outcome

On completion of this course, students should be able to

1. Able to identify, analyze op-amp circuit topologies and discuss the relative properties of op-amp circuits.
2. Able to demonstrate the operation of simple logic gates.
3. Able to combine simple gates into more complex circuit.

Text Books:

01. Millman's Electronic Devices and Circuits by MillmanHalkias&, Satyabratajit(2^{nd} edition, McGraw Hill Publications)
02. Integrated Electronics by Milliman and C.C. Halkias(Tata McGraw hill Publications)
03. Electronic Devices and Circuit Theory by Robert L. Boylestad (PHI Publications)

Reference Books:

01. Electronic Devices and circuits by Bogart Beasley Rico (LPE Publications)
02. Principle of Electronic Devices and circuit by Malvino Leach (Tata McGraw hill)
03. Electronic Devices and Circuits by David A. Bell (PHI Publications)

Term Work:

Term work will consist of record of minimum **eight** experiments carried out from following

1. Design and Comparison of biasing circuits.
2. Voltage series, current series feedback amplifier
3. Voltage shunt and current shunt feedback amplifiers.
4. V–I characteristic and transfer curve for JFET

5. Biasing circuit for JFET
6. Frequency response of CE amplifier
7. Design of transistorized series voltage Regulator
8. Design of voltage regulator using IC 723
9. Design of LM 317 and 337 IC adjustable voltage regulator.

Practical Examination:

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

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5. NUMERICAL METHODS USINGMATLAB

Teaching Scheme			**L: 03 T:00 P: 02**
Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	80 Marks	**20 Marks**	**40%**

Course objectives:

The following aspects are to be considered while dealing with topic from Numerical Methods.

1. Study of various methods of numerical analysis of linear and nonlinear problems
2. Use of method for solving the problems in engineering
3. Developing algorithm, flow-chart and computer program in any language

Course Contents:

Unit 1: Computer Arithmetic: (4 Hours)

Floating Point representation, Arithmetic operations with normalized floating point numbers, errors in numbers, Truncation error, round off error, inherent error, absolute and relative error

Unit 2: Solution of Non-linear equations: (6 Hours)

The method of successive bisection, the method of false position, Newton-Raphsoniterative method, Method of successive approximation, Comparison of iterative methods.

Unit 3: Interpolation and Solution of simultaneous algebraic equations: (10 Hours)

Lagrange's interpolation, difference table, Newton's Interpolation, Gauss elimination method, III-conditioned equations, The Gauss- Seidel iterative method, An algorithm to implement the Gauss-Seidel method, Comparison of direct and iterative methods.

Unit 4: Numerical Integration and Solution of Ordinary differential equation: (10 Hours)

Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Newton's cote's integration formula, error in these formulae, Comparisons of integration formulae.

Taylor series method, Picard's method, Euler method, Runge-Kutta method second and fourth order, predictor corrector method.

Unit 5: Numerical solution of partial differential equation: (6 Hours)

Finite difference, approximation to derivatives. Laplace equation, Iterative methods for the solution of equations.

Unit 6: Least square approximation of functions: (4 Hours)

Linear regression, Algorithm for linear regression, Polynomial regression, fitting exponential and trigonometric functions.

Course outcomes:

After completing this course student will be able to:

1. Solve various methods of numerical analysis of linear and non linear problems in MATLAB by writing program.
2. Develop algorithm, flow chart and computer program for solution of linear and non linear problems

Text/Reference Books:

1. V. Rajaraman - Computer Oriented Numerical Method- Prentice Hall of India.
2. S.S. Shastry- Introductory methods of numerical analysis., Prentice Hall of India
3. Thomas Richard Mecalla- Introduction to numerical Methods and FORTRAN programming- WilleyInternational Edition.

4. Steven C. Chapra and Raymond P. Canale, Numerical methods for Engineers, Mc-Graw-Hill Publication,2007.
5. B.S. Grewal- Numerical Methods in Engineering & Science, Khanna Publishers.
6. Steve Otto and James P. Denier - An Introduction to Programming and Numerical Methods in MATLAB- Springer
7. RudraPratap - Getting Started With Matlab 7 - Oxford University publications

Term work:

Practical examination shall be of 3 hours duration. The students have to write an algorithm, flow chart for the problem given by an examiner. He should develop program and execute it on the computer system and get its printout and face the oral based on above syllabus

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6. ELECTRICAL WORKSHOP AND MINI PROJECT

Teaching Scheme **L: 00 T: 00 P: 02**

Evaluation Scheme	ESE	MSE	Minimum Passing Marks
	80 Marks	20 Marks	40%

Term Work:

Term work will consist of hands on experience repairs/ development record of minimum two electrical &two electronic equipment's carried out of following.

1. Repairing of submersible water heater operated by single phase.
2. Rewinding of electrical motors.
3. Repairs of any indicating instruments like, ammeter/voltmeter.
4. Design, fabrication of heater for any application.
5. Repair of electronic device like, Doorbell/electronic toys.
6. Repair of electronic device like, audio amplifier.
7. Repair of electronic device like, experimental kits in lab.
8. Design & fabrication of any electronic usable circuit.
9. Repairing & maintenance of domestic appliances like mixer, ceiling fan, table fan, fluorescent tube, water gazer.

Reference Books:-

1. Flowler, Electricity-Principals & applications-Tata McGraw-Hill Publishing
2. Lab Manual –Electronics-Tata McGraw-Hill Publishing

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7. ENGINEERING MATHEMATICS - IV

Teaching Scheme **L: 03 T: 01 P: 00**

Evaluation Scheme	ESE	MSE	Minimum Passing Marks
	80 Marks	20 Marks	40%

Course objectives:

1. To develop logical understanding of the subject.
2. To develop mathematical skill so that students are able to apply mathematical methods & principles in solving problems from engineering fields.
3. To produce graduates with mathematical knowledge & computational skill.

Course Contents:

Unit-I : Laplace Transform: **(7 Hours)**

Definition, L.T. of standard functions,Properties: Linearity, First & Second shifting ,Change of scale ,Multiplication by t^n ,Division by t, L.T. of derivative & Integral, Inverse L.T.:- Partial fraction method, convolution theorem.

Unit-II: L.T.of special functions & Applications of L.T. **(7 Hours)**

Unit (Heaviside) stepfunction, Unit Impulse function (Dirac delta function),Periodicfunctions, Applications of L.T.to initial value problems, partial differential equations.

Unit-III : Complex Analysis-I **(6 Hours)**

Introduction, Analytic function ,Harmonic function, singular point, Cauchy Riemann equations in Cartesian & Polar form, Taylor's series & Laurent's series (without proof)

Unit-IV: Complex Analysis-II (7 Hours)

Line Integral ,contour integral ,Cauchy's integral theorem , Cauchy's integral formula Residues,Cauchy's residue theorem,Integration along unit circle & along upper half of semi-circle.

Unit-V: Z-transform (7 Hours)

Definition, Z-transform of elementary functions, Properties of Z –transform, Inverse Z – transform, Solution of difference equation by Z –transform.

Unit-VI : Statistics (6 Hours)

Correlation: Scatter diagram, Types of correlation, Karl Pearson's coefficient of correlation Regression: Lines of regression, Curve fitting: Fitting of curves by Least Square Method

Course Outcomes:

1. Students will demonstrate basic knowledge of Laplace transform-transform ,Bessel function & Complex Variable.
2. Students will show the understanding of impact of Engg.Mathematics on Electrical Engg.
3. Students who can participate & succeed in competitive exams like GATE, GRE.

Text Books:

1. Higher Engineering Mathematics by Dr.B.S.Grewal(Khanna Publication Delhi)
2. Advanced Engineering Mathematics by H.K.Das(S.Chand Publication)
3. Advanced Engineering Mathematics by Erwin Kreyszig

Reference Books:

1. A text book of Applied Mathematics :Vol.I,II & III by J.N.Wartikar&P.N.Wartikar, Vidyarthi GrihaPrakashan.Pune..
2. Advanced Engineering Mathematics by R.K.Jain &S.R.K.Iyengar (Narosa Publication)
3. Higher Engineering Mathematics by B.V.Ramana (Tata McGraw Hill)

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8. ELECTRICAL MACHINE – II

Teaching Scheme **L: 04 T: 00 P: 02**

Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	80 Marks	**20 Marks**	**40%**

Course objectives:

1. To introduce fundamentals, physical concepts, and operating principles of AC machines and special machines.
2. This course aims at building a strong foundation of student in synchronous machines and Induction motors with their advantages and disadvantages

Course Contents:

Unit 1: Synchronous Generators **(9 Hours)**

Classification of A.C. Machines, Production of 2- phase and 3-phase rotating magnetic fields, principle of operation and constructional (salient and non-salient pole) features of synchronous generators. Production of sinusoidal alternating EMF and its frequency, armature, winding, winding factor, EMF equation. Harmonics in voltage waveform, leakage reactance, armature reaction. Short circuit ratio, synchronous reactance, synchronous impedance, determination of voltage regulation (by Potier, EMF, MMF methods), Direct-axis & quadrature-axis synchronous reactance's, their determination by slip test.Phasordiagram of Salient-pole alternator & calculation of regulation. Power-power anglerelation for Salient-pole alternator.

Unit 2: Parallel Operation of Generators (4 Hours)

Power developed by synchronous generators, phasor diagrams, transient conditions, losses and efficiency. Conditions for parallel operation, Load sharing between two alternators in parallel, Parallel- Generator theorem Process of synchronizing an alternator with infinite bus-bars by lamp methods & by use of synchroscope. Synchronizing torque, power and current.

Unit 3: Synchronous Motors (7 Hours)

Construction & principle of operation, various methods of starting, phenomenon of hunting or phase–swinging– its remedies. Operation of 3-phase Synchronous motor with constant excitation & variable load. Significance of torque angle, load characteristics Phasor diagram on the basis of synchronous impedance. Power flow chart, losses.Operation of 3-phase synchronous motor with a constant mechanical load on its shaft & variable excitation.'V' Curves &'Inverted V' (pf) curves.Merits and demerits of synchronous motors & its application.

Unit 4: Three Phase Induction Motors (10 Hours)

Construction & principle of operation, types of I.M, slip, frequency of rotor current, rotor EMF, current, pf and torque. Phasor diagrams, different torque equations and relation between them. Torque-Slip, current-speed and Torque- Speed Characteristics, Losses and efficiency. Circle diagrams, starters. I.M tests, cogging and crawling, speed control, double cage rotor, and induction generator. Applications, advantages and disadvantages of I.M.

Unit 5: Single Phase Induction Motors (6 Hours)

Introduction, single phase induction motors, double revolving field theory, circuit model of single phase induction motor, determination of circuit parameters and types of single phase I.M. Torque-slip characteristics & applications. Comparison of 1-phase induction motor with 3-phase induction motor.

Unit 6: Special Motors **(4 Hours)**

Construction, principle of working, characteristics, ratings & applications of Brushless DC motors, Permanent Magnet motor, linear induction motors, and AC series motors, universal motors, repulsion type motors, hysteresis motor.

Course outcome:

1. Student will be able to determine performance of the induction motor.
2. Student will be able to design rating of induction motor for a given application
3. Student will be able to evaluate parameters of single phase induction motor
4. Student will be able to evaluate performance of three phase synchronous machines
5. Student will be able to design a three phase winding of AC machines
6. Student will be able to design the ratings of synchronous machines for given application.
7. Student will develop good ethical practices in the society for the operation of AC machines.

Text/Reference Books:

1. I J Nagrath, D P Kothari; "Electric Machines," Tata McGraw Hill Publication. Second Edition (Reprint) 2003.
2. A.E.Fitzgerald, C.Kingsley, S.D.Umans. "Electrical Machinery" Tata McGraw Hill. Sixth Edition 2002.
3. B.L.Theraja, A.K. Theraja, A Textbook of Electrical Technology, Vol-II, S.Chand&Co.New Delhi, 2005.
4. Say.M.G - Performance & Design of Alternating Current Machine.(English Language Book Society), CBS Publisher (2002).
5. Ashfaq Hussein - Electrical Machines, DhanpatRai Publication (2012).
6. Bhimbra.P.S – Electrical Machines), Khanna Publication (2011).
7. J.B. Gupta – Electrical Machines, SK Kataria& Sons Publication (2010).

Term work:

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

1. O.C. and S.C. test on Alternator: Determination of its regulation by the EMF method and MMF method.
2. Direct loading test on three phases Alternator.
3. Determination of axis reactance's of salient pole synchronous machine- Slip Test.
4. Zero power factor test on alternator: Regulation by Potier method and A.S.A. method
5. Synchronizing of alternators: Lamp Methods and use of synchroscope.
6. Load test on three phase squirrel cage induction motor.
7. Determination of Squirrel cage induction motor performance from Circle diagram.
8. Load test on three phase Slip ring induction motor.
9. Effect of rotor resistance on starting torque and maximum torque for three phase Slip ring induction motor.
10. Load test on single phase induction motor.
11. Operation of induction motor as induction generator.
12. "V" and "inverse V" curves of synchronous motor at no load and constant load.
13. Load test on Synchronous motor at various voltages and frequency.
14. Load test on Induction motor at various voltages and frequency.
15. Study of induction motor starters..

Practical Examination:

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

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9. ANALOG AND DIGITAL CIRCUIT

Teaching Scheme **L: 03 T: 00 P: 02**

Evaluation Scheme	ESE	MSE	Minimum Passing Marks
	80 Marks	20 Marks	40%

Course objectives:

1. Introduce students to the concepts and use of feedback and feedback (amplifier) design.
2. Extend student knowledge of the theory and applications of operational amplifier integrated circuits.
3. The primary goal is to provide in depth understanding of logic and system synthesis.
4. Enable student to implement simple logical operations using combinational logic circuits.
5. Impart the concepts of sequential circuits enabling student to analyse sequential systems in terms of state machines.
6. Enable student to implement synchronous state machines using flip-flops.

Course Contents:

Unit 1 : **(7 Hours)**

Operational- Amplifier: Block diagrams, ideal and practical parameters, open loop and close loop configuration of Op-Amp. Applications of Op-Amp Integrator, differentiator, Comparator, Schmitt trigger, Instrumentation amplifier, Precision rectifiers, Zero crossing detectors, V-I and I-V converters.

Unit 2 : **(5 Hours)**

Operational Amplifier Applications:Comparators, voltage limiters, Active filters-Its configuration with frequency response, Analysis of first order and second order low pass and high pass filters.

Unit 3: **(8 Hours)**

Waveform generation using Op-amp - sine, square, saw-tooth and triangular generator, peak detector, IC 555– construction, working and modes of operation – astable, monostable multi-vibrators, PLL, 565 PLL applications. Sequence generator, voltage regulators using ICs Viz. 78xx, 79xx, LM 317,

Unit 4: **(8 Hours)**

Boolean algebra and Minimization Techniques: Binary arithmetic: - addition and subtraction by 1's and 2's compliment. Revision of logic gates, Booleans algebra, De-morgon's theorem etc. K-map of two, three and four variable functions, minimizing SOP and POS expressions. Quine McClusky minimization.

Unit 5: **(6 Hours)**

Combinational Digital Circuits**:** Design of arithmetic circuits half adder and full adders, subtractors .Multiplexers, de-multiplexers, encoders, decoders, comparators,

Unit 6: **(6 Hours)**

Flip flops and its Applications:– R-S, Clocked S-R, D latches, Edge triggered D flip-flops, Edge triggered JK flip flops, JK Master - slave flip flop, Registers and Counters, Buffer registers, shift registers, controlled shift registers, asynchronous counters, synchronous counter, twisted ring counters, N - module counters. Memories: RAM-static& dynamic, ROM, PROMS and EPROMS, EEPROMS detailing.

Course outcomes:

After completing this course the student will be:

1. Able to identify, analyze op-amp circuit topologies and design the op amp circuits.
2. Able to demonstrate the operation of simple logic gates.

3. Able to combine simple gates into more complex circuit.

Text/Reference Books:

1. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuit Theory”, Eighth edition, PHI publishers, 2004.
2. J. Millman and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw-Hill Publishing Company, 1988.
3. R.A. Gayakwad, Op-Amps & Linear Integrated Circuits, PHI, Fourth Edition, 2012
4. R.P.Jain, “Modern Digital Electronics” Tata McGraw Hill, Third Edition, 2003.

Term work:

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

1. Measurement of op-amp parameters and comparison with op-amp data sheets.
2. Assembling of op-amp inverting, non-inverting and differential circuit to measure an input inthe range of mill volts to few volts.
3. Transistor amplifiers: frequency response of BJT, multistage BJT amplifier and FET amplifier.
4. Op-amp as square, sine and triangular wave generator.
5. Instrumentation amplifier using 3 - op amp CMRR measurement and precision rectifier
6. IC-555 applications- astable, monostable, multivibrator.
7. Study and verify shift register operation (IC 7495) and application of 7495 as pseudo random no. generation
8. Voltage regulation of IC VR 78xx, 79xx and LM317
9. Study of counters, ring counter and twisted ring counter.
10. A to D and D to A converter using ADC 0809 and DAC 0808.
11. Study of up - down counters (IC 74192/74193) and N- modulo counter. (IC 7490/7493).
12. Study of various flip-flops and verification of truth table.
13. Study of Multiplexer and De-multiplexer.
14. Study of active filters- Low pass and high pass filters

Practical Examination:

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

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10. NETWORK ANALYSIS

Teaching Scheme **L: 03 T: 00 P: 02**

Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	80 Marks	**20 Marks**	**40%**

Course objectives:

1. Study basic fundamentals, theorems used in circuit's analysis.
2. To study steady state analysis of different AC circuits, attenuators, filters and coupled circuits

Course Contents:

Unit 1: Development of Circuit Concepts: (06 Hours)

Charge & energy RLC parameters reference direction for current & voltage, active element convention, dot convention for coupled circuits. Network Equations: Source transformation formulation of network equation, loop variable analysis, node variable analysis, duality, state variable analysis.

Unit 2: Impedance Functions and Network Theorems: (08Hours)

The concept of complex frequency, transform impedance and transform circuits, series and parallel combination of elements, Thevenin's, Nortons,Superposition, Millman's, Tellegen's, Reciprocity, and Maximum power transfer theorems.

Unit 3: Initial Conditions in Networks: (06 Hours)

Use and study of initial conditions in various elements, a procedure for evaluating initial conditions. Transform of Other Signal Waveform: The shifted unit step function, ramp and impulse function, waveform synthesis, initial and final valve theorem, convolution integral, convolution as a summation.

Unit 4: Two Port Network (08 Hours)

Short circuit admittance, open circuit impedance, transmission and inverse transmission, hybrid and inverse hybrid parameters. Relation between parameter sets, T, π, Ladder, lattice, twin T networks. Input and output impedance in terms two port parameters. Interconnectionofnetworks. Symmetry and reciprocity.

Unit 5: Network Functions: **(06 Hours)**

Network function for one port and two port networks: ladder networks, general network, poles and zeros of network functions, Restriction on poles and zeros fordriving point functions and transfer functions.

Unit 6: Sinusoidal Steady-State Analysis: **(06 Hours)**

The sinusoidal steady-state, the sinusoid and solution using e±jωt, phasors and phasordiagrams. Input power, power transfer & Insertion loss of two port network, rms value, average power& complex power, problems in optimizing power transfer.

Course outcomes:

1. Student will able to work with basic fundamentals, theorems used in circuit's analysis.
2. Student will able to work with steady state analysis of different AC circuits, attenuators, filters and coupled circuit.

Reference Books:

1. Network Analysis- M.E.VanValkenburg - Prentice-Hall India Pvt.Ltd.
2. Networks & System- D.RoyChoudhury - New Age International.
3. Circuit Theory (Analysis and Synthesis) – A.Chakrabarti-DhanpatRai Publication.
4. Network Analysis – G.K.Mithal-Khanna Publication.

Term Work:

Term work shall consist of minimum 7 experiments from the list given below

1. Verification of Maximum power transfer theorem.
2. Verification of Thevenin's theorem.
3. Verification of Superposition theorem.
4. Verification of Reciprocity Theorem.
5. Verification of Tellegens Theorem.
6. Determination of parameters of a two-port network.
7. Plotting of behavior of RC circuit for step input.
8. Plotting of behavior of RL circuit for step input.
9. Plotting of behavior of RLC circuit for step input.

Practical Examination:

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

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11. POWER PLANT ENGINEERING

Teaching Scheme **L: 04 T: 00 P: 00**

Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	80 Marks	**20 Marks**	**40%**

Course objectives:

1. Describe sources of energy and types of power plants
2. List types, principles of operations, components and applications of steam turbines, steam generators, condensers, feed water and circulating water systems.
3. Describe basic working principles of gas turbine and diesel engine power plants. Define the performance characteristics and components of such power plants.

Course Contents:

Unit 1: Sources of Energy and Economics of Power Plant (06 Hours)

Sources of energy, Fuels,Types of fuels, Solid fuels, Liquid fuels, Gaseous fuels, Calorific value of fuels, Types of coal, Coal selection, Requirements of fuel ,Hydel Potential energy, Nuclear energy – Comparison of Sources of power – Non conventional sources of energy Solar energy, Wind energy, Tidal power and Bio gas. Types of loads. Economic load sharing, Economics in plant selection, Economic of power generation, Choice of power station, Energy rates

Unit 2 : Steam Power Plant (08 Hours)

Thermal Station: Introduction, selection of sites, Layout of Steam power Plant, Fuel and ash handling, Combustion for burning coal, Mechanical stackers, Pulverizes, Electrostatic Precipitators, Draughts-Different types, Surface condensers - Types of cooling towers, Steam turbines, Steam engines: Advantages of steam turbines over steam engines,

Boilers: Types of boilers, Principles of steam power plant design, Factors affecting steam plant design ,Thermal power plants environmental control, simple numerical examples

Unit 3: Hydro Electric Power Plant (06 Hours)

Lay out of Hydroelectric power plant: Elements of Hydroelectric power plan, Classification of Hydroelectric power plant, Advantages of Hydroelectric power plant, Mini and Micro hydro power plants, Types of Dams, Pen stock, Draft tube, Surge tank, Hydraulic turbines, Classifications, Turbine governing, Cavitations, Safety measures in Hydro power stations, Control room functions, Switch gear, Site selection, Comparison of Hydroelectric power plant and steam power plant., simple numerical.

Unit 4: Nuclear Power Plant (08 Hours)

Review of atomic physics (atomic number, mass number, isotopes, atomic mass, unit rate of radioactivity, mass equivalent number, binding energy and mass defects), Nuclear power plant layout, Elements of Nuclear power plant, Types of reactors ,Pressurized water reactor, Boiling water reactor, Waste disposal and safety, Advantages of Nuclear power plant, Comparison of Nuclear power plant and steam power plant, Site selection and Commissioning procedures, simple numerical, India's nuclear power program.

Unit 5: Diesel Engine & Gas Turbine Power Plant (06 Hours)

Types of diesel engine power plants, Layout and components, Diesel engine power plant auxiliaries, Engine starting methods, Advantages of Diesel engine power plant, Application of Diesel engine power plant, Site selection. Gas turbine power plant ,Classification, Elements of simple gas turbine power plant, Layout, Open and Closed cycles, Reheating, Regeneration and Inter cooling – Combined cycles - Applications and advantages of Gas turbine plant, simple numerical examples.

Unit 6: Combined working of power plants: (06 Hours)

Economics of combined working power plants, base load and peak load stations, pumped storage plants, inter- connections of power stations. Tariff: Fixed cost, running cost and

their interrelation for all types of conventional power plants, depreciable cost, different types of tariffs, numerical example based on above, effect of deregulation on pricing.

Course outcomes:

1. Knowledge of the operation, construction and design of various components of power plants
2. Calculate the performance parameters of various power plants
3. Define and calculate the various factors of plant load and economy.

Text Books:

1. Arora S.C and Domkundwar, “A Course in Power plant Engineering”,S, DhanpatRai, 2001.
2. Nag P.K, “Power Plant Engineering”, Third Edition, Tata McGraw – Hill, 2007

Reference Books:

1. El-Wakil M.M, “Power Plant Technology”, Tata McGraw-Hill.
2. NagpalG.R,“Power Plant Engineering”, Khanna Publishers.
3. Rai G.D, “Introduction to Power Plant Technology”, Khanna Publishers.

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12. COMMUNICATION SKILLS

Teaching Scheme **L: 02 T: 00 P: 02**

Evaluation Scheme	**ESE**	**MSE**	**Minimum Passing Marks**
	40 Marks	**10 Marks**	**40%**

Course Objective:

1. The objective of this course is to assist the students of engineering to acquire proficiency, both in spoken (oral) and written language.

2. At the end of the course, the students will be able to develop comprehension, improve vocabulary, grammatical ability, enhance writing skills, correspond with others and enhance skills in spoken English.

Course Contents

Unit 1:- Basics of Communication **(3 Hrs.)**

Definition; Elements of Communication; Cycle of Communication and Feedback. Types of Communication: Verbal and Nonverbal (Oral, Written, Graphic Language and Body Language) Upward and Downward; Formal and Informal. Media of communication: verbal non-verbal and audio-visual Principles of Effective Communication. Barriers of Communication.

Unit 2:- Listening Skills **(3 Hrs.)**

Active Listening: Basic Principles Listening and Note Making Listening to Conversations from IELTS: Book 1

Unit 3:- Reading Skills **(2 Hrs.)**

Active Reading: Types: Skimming, Browsing, etc. Reading and Note Making.

Comprehension

Unit 4:- Speaking Skills **(4 Hrs.)**

Basics of Presentation Techniques.GroupDiscussions. InterviewTechniquesPublic Speaking and Seminars. Pronunciation: Basics.

Unit 5:- Writing Skills **(4 Hrs.)**

Business Correspondence:BusinessLettersJobApplicationResumeParagraph (Technical, Business or General current issues)Reports.

Unit 6:-English Grammar and Vocabulary **(4 Hrs.)**

Tenses, Common Errors in English, Synonyms, Antonyms, One Word Substitution.

Course outcome:

1. After going through the content of the syllabus, the students will be able to focus on the development of their personality with the help of good communication skills.

2. At the end of the course, the students will be able to develop comprehension, improve Vocabulary, grammatical ability, enhance writing skills, correspond with others and enhance skills in spoken English.

Text Books:

1. Developing Communication Skills Mohan, Krishna.Meera Banerji, New Delhi

Macmillan

2. Communication Skills for Effective Management, DR. Anjali Ghanekar, Everest

Publishing House.

3. Communication Skills for Engineers, Sunita Mishra and C. Muralikrishna, Pearson

Education

4. Technical Communication, Meenakshi Raman and Sangeeta Sharma, Oxford UniversityPress.

5. Basic Communication Skills, Rutherford A. Person Education, New Delhi.

6. Communication Skills, B.V. Pathak, Nirali Publication.

7. Business Correspondence and Report Writing, R.C. Sharma and Krishnamohan, Tata McGraw Hill.

8. English in situation, R.O, Neill, Oxford University Press.

9. Organizational Behavior, Fred Luthans, McGraw Hill.

10. Spoken English for India, R.K, Bansal.

11. English Grammar and Composition, Pal and Suri, Sultan Chand & Son, Educational Publishers.

Term Work:-

Minimum Practical 8 out of 11 to be conducted and reported as Term Work

1. Draw a communication cycle showing all the elements.

2. Convert the verbal and numerical data into the suitable nonverbal form.

3. Listen to the presentation by the faculty or student and make running notes.

4. Listen to the pre-recorded conversation and answer the questions based on it.

(Ref. IELTS: Book 1: CD: 1 and 2.)

5. Read the given passage and answer the questions following it.

(Ref. Books for CAT or IELTS)

6. Introducing yourself (3 to 5 minutes)

7. Presentation for minimum 5 minutes on the given topic.

(Current Issues or Technical Topics)

8. Situational English (Dialogues and Role-plays)

9. Group Discussion: Live Session.

10. Mock-interview: Demo by expert panel.

11. Drafting: i) Business Letter, ii) Resume.

Note: Use of Language Lab and audio-visual modes of communication is strongly Recommended, where necessary.