B.Tech Third Year (Odd Semester)						
Scheme (Batch 2016-17) Electrical & Electronics Engineering						
Sr.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credit**
1	EE3CO11	Power System-I	3	1	0	4
2	EE3CO13	Electrical Machines-II	3	1	2	5
3	EE3CO15	Linear Control System	3	1	2	5
4		Elective-I	3	0	0	3
5		Elective-II	3	0	0	3
6		OE01	3	0	0	3
7	EN3MC01	Open Learning Course Name	1	0	0	0
8	EN3MC03	Technical Communication	2	0	0	0
9	EE3CO16	Software Lab	0	0	2	1
		Total	**21**	**3**	**6**	**24**
		Total Contact Hours	30			

EE3EL08	Reliability Engineering
EE3EL04	Energy Conservation & Management

Note: Open Elective will be given separately

Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
EE3CO11	Power System-I	3	1	0	4

UNIT I

General background, structure and components of power system, load curves, important terms and factors e.g. connected load, maximum demand, demand factor, average load, diversity factor, load factor, load duration curve, types of loads, load forecasting, selection of generating unit, interconnection of generating stations, economics of power generation, depreciation, tariff, power factor improvement.

UNIT II

Inductance resistance and capacitance of transmission line, skin effect calculation of inductance and capacitance for 1-φ and 3-φ, single and double circuit line, concept of GMR and GMD, symmetrical & asymmetrical conductor configuration, transposition of line, composite conductor, effect of ground on capacitance, bundle conductors.

UNIT III

Performance of transmission lines, representation of transmission lines. Short, medium & long transmission lines, nominal T, nominal π, equivalent T and equivalent π models, ABCD parameters. Regulation & efficiency, surge impedance loading, tuned power lines, power transfer, voltage profile and reactive power, Ferranti effect, corona effect.

UNIT IV

Distribution system, ac single phase, 3 phases, 3wire & 4 wire distribution system, kelvin's law for mosteconomical size of conductor, substation layout showing substation equipments, busbar single bus bar and sectionalized bus bar, main and transfer for bus bar system,sectionalized double bus bar system, ring mains.

UNIT V

Overhead transmission lines: Mechanical design, line support, types of conductors, line insulators, types of insulator-pin, suspension and strain insulators, insulator material, insulator string, calculation of voltage distribution and string efficiency, method of equalizing voltage, use of guard rings. Underground cable, comparison of cables and overhead transmission lines, classification of cables, capacitance of single and multi-core cable, heating of cables, thermal resistance of cables.

Text Books

1. W.D. Stevenson and John J Grainger, "Elements of Power System Analysis", McGraw Hill International.
2. C.L. Wadhwa, "Electrical Power System Analysis", New Age International Publishing Co. Ltd.
3. I. J. Nagrath and D. P. Kothari, "Modern Power System Analysis", Tata McGraw Hill.
4. Hadi Saadat, "Power System Analysis", TMH Edition.

Reference Books

1. C. A. Gross, "Power System analysis", John Wiley.
2. J. D. Glover and M. Sarma, "Power System Analysis and Design", Cole Publishing.
3. P.S. Satnam and P. V. Gupta, "Substation design and equipment", Dhanpat rai Pub.
4. B.R. Gupta, "Generation of Electrical Energy", S. Chand.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3CO13	Electrical Machines – II	3	1	2	5

UNIT I

D.C. generator, working principle, construction of DC Machines, armature windings, single and double layer winding diagrams, E.M.F. and torque equations, regulation, armature reaction, effect of brush shift, compensating winding, commutation, methods of improving commutation, methods of excitation of DC generators and their characteristics.

UNIT II

D.C. Motor, working principle, characteristics, starting of shunt and series motor, starters, speed control methods: field and armature control. Braking- plugging, dynamic and regenerative braking. Testing- Swinburn's test, Hopkinson test, field test. Estimation of losses and efficiency.

UNIT III

Synchronous generators- construction features, types of prime movers, excitation system and brushless excitation, poly phase distributive winding, integral slot & fractional slot winding, emf equation, generation of harmonics and their elimination. armature reaction, leakage reactance, synchronous reactance, equivalent circuit of alternator, relation between generated voltage and terminal voltage, determination of equivalent circuit parameters, short circuit ratio and its effect on performance, phasor diagrams, synchronous generator under load, effect of excitation variation, regulation curve, regulation by synchronous impedance method, mmf method, Zpf method.

UNIT IV

Salient pole machine, two reaction theory equivalent circuit model and phasor diagram, determination of X_d and X_q by slip test, regulation of salient pole alternator, power angle equation and characteristic. synchronizing alternator with bus-bar, synchronizing power, parallel operation and load sharing operation on infinite bus bar, effect of varying excitation and mechanical torque, effect of synchronizing current, hunting & damper winding, synchroscopes and phase sequence indicator. Analysis under sudden short circuit, transient parameters of synchronous machine, various transient & sub transient reactance, time constants.

UNIT V

Synchronous motor, construction, starting methods of synchronous motor, pull in torque, motor under load power and torque, reluctance torque, effect of excitation effect of armature reaction, power factor adjustment v curves, inverted v curves, synchronous motors as power factor correcting device, synchronous motors as frequency changer, super synchronous motors, efficiency and losses. Single phase synchronous motors- hysteresis motor, stepper motor.

Single phase induction motor; double revolving field theory, equivalent circuit and its determination, performance calculation, starting methods and types of single phase induction motors: their working principle and applications.

Text-Books

1. M.G. Say, "Performance & design of AC machines", CBS publishers & distributors.
2. P.S. Bhimbra, "Electrical Machines", Khanna Pub.
3. I.J. Nagrath and D.P. Kothari, "Electric Machines", Tata McGraw Hill.

Reference Books

1. A.E. Clayton & N.N. Nancock, "The Performance & design of DC machines", CBS publications & distributors.
2. E. Fitzerald & C. Kingsley & S.D. Umans, "Electric Machinery", Tata McGraw Hill.
3. P.S. Bhimbra, "Generalized theory of Electrical Machines", Khanna publishers.

Practicals List

1. To plot magnetization characteristics of DC generator.
2. To perform load test on DC shunt motor.
3. Speed control of DC motor using field control method.
4. Speed control of DC motor using armature control method.
5. To perform Swinburne's test on a DC machine and find out its efficiency under full load condition.
6. To obtain and plot the external characteristics of a dc shunt generator.
7. Regulation of 3-phase alternator by synchronous impedance method.
8. Determination of X_d and X_q of a salient pole synchronous machine.
9. Measurement of phase sequence impedances of 3-phase alternator.
10. To obtain and plot the 'V' and inverted 'V' curves for a 3-phase synchronous motor.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3CO15	Linear Control Systems	3	1	2	5

UNIT I

Modeling of dynamic systems, system classification, modeling of linear dynamic systems, concept of transfer function, masonic gain formula, block diagram algebra, open and closed loop systems. concept of transfer function, open and closed loop systems, signal flow graph control components, error detectors (synchros & potentiometer), servomotors (AC & DC), techo generators, power amplifier, stepper motors

UNIT II

Time – domain analysis of closed loop systems: Test signals, time response of first and second order systems, time domain performance specifications, steady state error & error constants feedback control actions: proportional, derivative and integral control.

UNIT III

Stability: Routh-Hurwit stability analysis, characteristic equation of closed loop system root loci, construction of loci, effect of adding, poles and zeros on the loci, stability by root loci. Frequency, domain analysis, bode plots, polar plot, nyquist stability analysis, relative stability : gain and phase margins.

UNIT IV

Compensation- necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation. Frequency- domain compensation-lead lag, lag-lead compensation, design of compensating networks.

UNIT V

State space analysis, solution of state equation: Eigen values & eigenvectors diagonalization, state transition matrix, controllability and observability.

Text-Books

1. I.J. Nagrath and M. Gopal, "Control System Engineering", New Age International.
2. Roy Chaudhary, "Modern Control Systems", PHI.
3. K. Ogata, Modern Control Engineering, PHI.

Reference Books

1. B.C. Kuo, Automatic Control systems, PHI
2. M. Gopal, Control System: Principles & Design, TMH.
3. R.T. Stefani, B. Shahian, C. J. Savant and G. H. Hostetter, "Design of feed back control System's", Oxford University Press.

Practical List

1. Study of Synchro transmitter and receiver.
2. Study of DC position of servo system.
3. Determination of transfer function of A-C servomotor
4. Calculation of transfer function of D-C servo motor.
5. Study state error constant for Type-0, Type-1, Type-2.
6. To plot the characteristics of magnetic amplifier.
7. Simulation of transfer function of using OP-AMP.
8. To draw the Root Lucas using MATLAB.
9. To draw the Bode plot using MATLAB.
10. To draw the Nyquist plot using MATLAB.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3EL08	Reliability Engineering	3	0	0	3

UNIT I

Introduction to reliability and indices, methods of reliability improvement, discrete and continuous random variable and their probability distribution functions. Truncated distribution functions. Introduction to probabilistic simulation, some important distribution functions, application of binominal and normal distribution functions.

UNIT II

Component reliability, hazard function, failure laws, exponential failure law, wear in period and its importance. Safety and reliability, effect of preventive maintenance on reliability.

UNIT III

Reliability evaluation of series, parallel, and series–parallel network. Complex network reliability evaluation using event space, decomposition, tie-set, cut-set method, stand by system and load sharing system, multi state models.

UNIT IV

Markov process, state diagram, availability and unavailability function. Evaluation of time Dependent and limiting state probabilities. MTTF calculation. Concept of frequency and durations, state enumeration method for evaluating failure frequency, MUT, MDT, frequency balance approach.

UNIT V

Data collection and classification, censoring, non-parametric and parametric method, MTTF calculation using data. Parametric estimation using least square estimals.

Text books

1. R. Billinton, R.N. Allon, "Reliability evaluation of engineering system: concept and techniques", Springer Int. edition.
2. C.E. Ebeling, "Reliability and maintainability engineering", TMH.
3. E.E. Lewis, "Introduction to reliability engineering", John Wiely and Sons.

Reference Books

1. David J. Smith, "Reliability maintainability and risk", Elsevier.
2. Joel A. Nochlas, "Reliability Engineering: Probability Models and maintenance methods", Taylor and Francis.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3EL04	Energy Conservation & Management	3	0	0	3

UNIT I

Commercial and non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy need of growing economy, long term energy, scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy strategy for the future, air pollution, climate change, energy conservation Act-2001 and its features.

UNIT II

General energy problem: Energy use patterns and scope for conservation. Energy audit: energy monitoring, energy accounting and analysis, auditing and targeting. energy conservation policy, energy management & audit, energy audit, types of energy audit, energy management (audit), qualities and function of energy managers, language of an energy manager, questionnaire, check list for top management, loss of energy in material flow, energy performance, maximizing system efficiency, optimizing, input energy requirements, energy auditing instruments, material load energy balance diagram.

UNIT III

Load curve analysis & load management DSM, energy storage for power systems (mechanical, thermal, electrical & magnetic) restructuring of electric tariff from energy conservation consideration, economic analysis depreciation method, time value of money, evaluation method of projects, replacement analysis, special problems inflation risk analysis. pay back period, energy economics, cost benefit risk analysis, pay back period.

UNIT IV

Electrical system: electricity billing, electrical load management, maximum demand controller, automatic power factor controller, energy efficient motors, variable speed drive, energy efficient transformer, energy conservation in transportation system especially in electric vehicle. energy flow networks, simulation & modeling, formulation & objective & constraints, alternative option, matrix chart.

UNIT V

Energy conservation task before industry, energy conservation equipments, co-generation, energy conservation process, industry sugar, textiles, cement industry etc electrical energy conservation in building, heating and lighting, domestic gadgets, electronic ballast, occupancy sensors, energy saving potential of each technology.

Text books

1. W.C. Turner, "Energy Management Hand Book", John Wiley.
2. P. O. Callagan, "Energy Conservation", Pergamon Press.
3. A. Chatrabarti, Energy Engineering and Management, PHI.

References Books

1. Dale R. Patrick, Stephen W Fardo, "Energy Conservation Guidebook", CRC Press.
2. K. V. Sharma and P. Venkataseshaiah, "Energy Management and Conservation", I K International Publishing House.
3. Giovanni Petrecca, "Energy Conversion and Management", Springer.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3EL05	Energy Resources & Technology	3	0	0	0

UNIT I

Fundamentals of Energy -Science and Technology: Energy consumption, oil crisis, classification of energy resources, consumption trend of primary energy resources, importance of non-conventional energy sources, energy chain, common forms of energy, advantages and disadvantages of conventional energy sources, salient features of non-conventional energy sources, environmental aspects of energy, environment-economy-energy and sustainable development, energy densities (heating values) of various fuels.

UNIT II

Energy sources: Introduction to nexus between energy, environment and sustainable development; energy transformation from source to services; energy sources, sun as the source of energy; biological processes; photosynthesis; food chains, classification of energy sources, quality and concentration of energy sources; fossil fuel reserves - estimates, duration; theory of renewability, renewable resources; overview of global/ India's energy scenario.

UNIT III

Other Sources: Small hydropower, nuclear fission and fusion-geothermal energy: origin, types of geothermal energy sites, site selection, geothermal power plants; ocean energy resources-ocean energy routes - principles of ocean thermal energy conversion systems-ocean thermal power plants principles of ocean wave energy conversion and tidal energy conversion, magneto-hydro-dynamic (MHD) energy conversion.

UNIT IV

Energy storage and hybrid system configurations: Need and importance of energy storage in conventional and nonconventional energy systems. Technical aspects (measurements, quantify) various forms of energy storage: thermal, chemical, mechanical, electrical and nuclear energy storage, battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators, battery management. Flywheel-energy relations, components, benefits over battery. Fuel cell energy storage systems. Ultra capacitors. Bio-mass and bio-fuels.

UNIT V

Emerging Technologies: Hydrogen as a renewable energy source, sources of hydrogen, fuel for vehicles. Hydrogen production- direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production. storage of hydrogen-gaseous, cryogenic and metal hydride, fuel cell – principle of working, construction and applications.

Text Books

1. B. H. Khan, "Non conventional sources of energy", McGraw Hill Education.
2. D. P. Kothari, "Renewable Energy Sources and Emerging Technologies, Prentice Hall India Learning Private Limited.

3. C. S. Solanki, "Renewable Energy Technologies: A Practical Guide for Beginners", Prentice Hall India Learning Private Limited.

Reference Books

1. Kreith and Kreider, "Solar Energy Handbook", Mc Graw Hill Pub.
2. R. Wilson & W. J. Jones, Energy, "Ecology and the Environment", Academic Press Inc.
3. J.M. Fowler, "Energy and the Environment", McGraw Hill.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3MC03	Technical Communication	2	0	0	0

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3CO16	Software Lab I	0	0	2	1

List of Practicals based on MATLAB/SCILAB

1. Creating a one-dimensional array (row / column vector)
2. Ccreating a two-dimensional array (matrix of given size)
3. Performing arithmetic operations - addition, subtraction, multiplication and exponentiation.
4. Obtaining modified matrix - inverse, transpose, with appended and deleted elements;
5. Relational operations - >, <, ==, <=, >=, ~= based exercise.
6. Logical operations - ~, &, |, XOR based exercise.
7. Generating and plots of trigonometric functions - sin(t), cos(t), tan(t), sec(t), cosec(t) and cot(t) for a given duration „t".
8. Logarithmic and other functions – log(a), log10(a), square root of A, real n^{th} root of A.
9. plotting the functions, x, x^3, $e^x$and $\exp(x^2)$ over the interval $0 < x < 4$
10. Plot of the functions, $f(x) = \sin(1/x)$ for $0.01 < x < 0.1$ and $g(x) = (\sin x) / x$.
11. Solving first order ordinary differential equation using built-in functions; and, creating an M x N array of random numbers using rand and setting any value that is < 0.2 to „0" and any value that is ≥ 0.2 to 1" by moving through the array, element by element.
12. Generating normal and integer random numbers (1-D & 2-D) and plotting them.
13. Storing/saving data, linking M-file with model file.
14. Writing a script (which keeps running until no number is provided to convert) that asks for temperature in degrees fahrenheit and computes the equivalent temperature in degrees celsius.
15. Writing brief scripts starting each script with a request for input (using input) to evaluate the function h(T) using if-else statement, where $h(T) = (T - 10)$ for $0 < T < 100$, $(0.45\ T + 900)$ for $T > 100$. Exercise: testing the scripts written using A). $T = 5$, $h = -5$ and B). $T = 110$, $h = 949.5$.
16. Also generating equivalent square wave from a sine wave of given amplitude and frequency.
17. Find the roots of polynomials $s^4 + 3s^3 + 15s^2 + 2s + 9 = 0$.

Text Books:

1. Rudra Pratap, "Getting Started with MATLAB - A Quick introduction for Scientists & Engineers", Oxford Univ. Press.
2. S. Jain, "Modelling and Simulation Using Matlab-Simulink", Willey India
3. Tejas B. Sheth, "Scilab: A Practical Introduction to Programming and Problem Solving", Create Space Independent Publishing Platform.

Reference Books

1. William Palm III, "Introduction to MATLAB 7 for Engineers", McGraw-Hill.
2. Raj Kumar Bansal, Ashok Kumar Goel, Manoj Sharma, "MATLAB and its Applications in Engineering", Pearson Education.
3. Sandeep Nagar, "Introduction to Scilab for Engineers and Scientists", Apress.