GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Electrical Engineering

Teaching and Evaluation Scheme

SE (Full-Time) in Electrical (Electronic & Power) Engineering

SEMESTER-I

(Implemented from 2015)

THEORY COURSES												
S. No.	**Course Code**	**Subject**	**Scheme of Teaching (Hrs/Week)**			**Total Credits**	**Scheme of Evaluation (Marks)**					
							Theory			**Term Work**	**Practical & Viva-voce**	**Total**
			L	**T**	**P**		**Test**	**TA**	**ESE**			
1	GE241	Engineering Mathematics-III	03	01		04	20	20	60			100
2	GE242	Environmental Studies	03			03	20	20	60			100
3	EE243	Transformers & DC Machines	03			03	20	20	60			100
4	EE244	Network Analysis	03	01		04	20	20	60			100
5	EE245	Electrical Measurement & Instrumentation	03			03	20	20	60			100
6	EE246	Generation, Transmission and Distribution of Electric Power	02			02	25	25				50
LABORATORY COURSES												
1	EE247	Lab Transformers & DC Machines			02	01				25	25	50
2	EE248	Lab Network Analysis			02	01				25	25	50
3	EE249	Lab Electrical Measurement & Instrumentation			02	01				25	25	50
4	EE250	Lab Generation of electrical Energy			04	02				50		50
A]	**Total of Semester I**		**17**	**02**	**10**	**24**	**125**	**125**	**300**	**125**	**75**	**750**

SEMESTER-II

THEORY COURSES												
S. No.	**Course Code**	**Subject**	**Scheme of Teaching (Hrs/Week)**			**Total Credits**	**Scheme of Evaluation (Marks)**					
							Theory			**Term Work**	**Practical & Viva-voce**	**Total**
			L	**T**	**P**		**Test**	**TA**	**ESE**			
1	GE	General Elective-II	03			03	20	20	60			100
2	GE	Engineering Mathematics-IV	03	01		04	20	20	60			100
3	EE 251	Asynchronous Machines	03			03	20	20	60			100
4	EE 252	Electromagnetic Field	03			03	20	20	60			100
5	EE 253	Electronic Devices and Circuits	03	01		04	20	20	60			100
6	EE 254	Renewable energy Technology	02			02	25	25				50
LABORATORY COURSES												
1	EE 255	Lab Asynchronous Machines			02	01				25	25	50
2	EE 256	Lab Electronic Devices and Circuits			02	01				25	25	50
3	EE 257	Lab Numerical Computational Techniques			02	01				25		25
4	EE 258	Lab Renewable energy Technology			02	01				25	25	50
5	EE 259	Lab Electrical workshop			01	01				25		25
B]	**Total of Semester II**		**17**	**02**	**09**	**24**	**125**	**125**	**300**	**125**	**75**	**750**
Total of Semester (A+B)			**34**	**04**	**19**	**48**	**250**	**250**	**600**	**250**	**150**	**1500**

L-Lectures, T-Tutorials, P-Practical's, TA-Teacher Assessment, ESE-End-Semester Examination

External Examiner may be appointed from the same university or other university

(Compulsory)
(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Total Credits	03	Teacher Assessment	20 Marks
		End-Semester Examination	60 Marks

Prerequisites:
EE 143 -Basics of Electrical Engineering
GE 151- EngineeringMathematics-II

Course Educational Objectives:
The objectives of the course are to learn

1. The principles electromechanical energy conversion.
2. Fundamental concepts of Transformer and DC machines.
3. The details of construction, operation, Characteristics and applications Transformer and DC machines
4. Basic knowledge to develop practical skills.

Course Outcomes:
Students will be able to

1. Explain Fundamental concepts electromechanical energy conversion
2. Explain fundamentals of Transformer and DC machines.
3. Develop practical skills through different tests, applications Transformer and DC machines.
4. Identify, formulate, and solve engineering problems of Transformers & DC Machines.

UNIT-1 Single Phase Transformers:
Transformer construction and practical consideration, Transformer reactance's and equivalent circuits, Effect of load on power factor, Phasor diagrams, Testing: Ratio And Polarity test, Open circuit test, Short circuit test, Sumpner's test, Auto Transformer, Pulse Transformer and applications.

UNIT-2 Three Phase Transformers:
Review of poly-phase circuit, Special constructional features, Three phase Transformer connections, Labeling of Transformer terminals, Star/Star connection, Delta/Delta Connection, Star/Delta, Delta/Star connection, Delta/Zigzag Star, Star/Zigzag Star, Phase groups, Choice of Transformer connections, 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, Type and routine tests according to ISI specifications.

UNIT-3 Electromechanical Energy Conversion Principles:
Forces and torques in magnetic field systems, Energy balance, Energy in singlyexcited magnetic field systems, Determination of magnetic force and torque from energy, Determination of magnetic force and torque from coenergy, MultiplyExcited 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:
Constructional features, Basic principle of working, EMF equation, Armature windings, Types, Characteristics and applications, Armature reaction, Commutation.

UNIT-5 DC Motors:
Principle of working, Significance of back EMF, Torque equation, Separately &self:excited motors, Characteristics and selection of DC Motors for various applications, Starting, Speed control, Various tests to find losses and efficiency.

TEXT AND REFERENCE BOOKS:

1. A. E. Fitzgerald & C. Kingsley & S. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 5th Edition.
2. A.E. Clayton & N.N. Nancock, "The Performance & Design of DC Machines", CBS Publications & Distributors, Delhi, 3rd Edition.
3. I. J.Nagrath& D. P. Kothari, "Electric Machines", Tata McGraw Hill, New Delhi, 2nd Edition.
4. Syed A. Nasar, "Electric Machines & Power Systems", Volume I, Tata McGraw Hill, New Delhi.
5. Dr. P. S. Bhimbra, Electric Machinery, 5th edition, Khanna Publishers, Delhi.

Assessment Methods:

Teacher assessments will be based on following(any two):

1.Assignments based on the theory/problems	10 Marks
2. Quiz.	10 Marks
3. Surprise test.	10 Marks
4. Technical/Industrial visit report.	10 Marks

Designed By : Dr. N. R.Bhasme&

Mrs. M. R.Bachawad

EE244: Network Analysis
(Compulsory)
(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Tutorials	01Hrs/Week	Teacher Assessment	20 Marks
Total Credits	04	End-Semester Examination	60 Marks

Prerequisites:
EE 143 - Basics of Electrical Engineering
GE 141 - Engineering Mathematics-I

Course Educational Objectives:
The objectives of the course are to

1. Provide the student with compression understanding of the basic law of electric circuit & theories.
2. To understand the needs of simplification technique to solve the complicated network.
3. To learn about the use of mathematics, needs of Laplace Transform & usefulness of differential equations for analysis network.
4. Enable students to identify and apply the correct analytical tools for a problem solving and Enhance student's ability to correctly and appropriately interpret and present the analysis result.

Course Outcomes:
Students will be able to

1. Critically evaluate, defend and apply spatial analytical method.
2. Design solutions for local, neighborhood and regional analyses problems.
3. Apply Laplace Transform to analyze dynamic circuit.
4. Real-life circuit design problems that are solved using the basic tools of circuit analysis.

UNIT-1 Basic Concepts:
Electrical parameters, Voltage and current sources, Classification of electrical elements, Topology of networks, Network equations on loop and node basis, Dot convention for coupled circuits, Concept of duality and dual networks.

UNIT-2 Solution of Network Equations:
Steady state and transient solution, Forced and free response, Time constants, Physical and mathematical analysis of circuit transients, Initial and final conditions in elements and in networks.

UNIT-3 Laplace Transform Method:
Solution of differential equations and network equations using Laplace transform method inverse Laplace transform, Transformed networks with initial conditions analysis of electrical circuits with applications of step, impulse and ramp functions, shifted and singular functions, The convolution integral Laplace transform of various periodic and non-periodic waveforms.

UNIT-4 Network Theorems:
Node, Mesh, Super mesh&Supernodeanalysis, Superposition, Thevenin`s and Norton, Reciprocity,

Substitution theorems, Maximum power theorem applied to networks with all types of sources, Fourier method of waveform analysis: application of Fourier series expansion for periodic nonsinusoidal waveforms.

UNIT-5 Two Port Networks:
Z,Y and transmission parameters H parameters, Interrelations between these parameters, Transfer function, Concepts of poles and zeros, Transform impedance, Transform admittance, Concept of complex frequency, Driving point and transfer impedance and admittances.

TEXT AND REFERENCE BOOKS:

1. William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, Tata McGraw:Hill, 6th edition.
2. M.E. Van Valkenburg, Network Analysis, Prentice Hall,2nd edition.
3. Boylestad Robert L. Charles E., Introduction to Circuit Analysis, Merril Publishing Company.
4. John R. OMalley, Circuit Analysis, Prentice Hall.

Assessments Methods:

Teacher assessments will be based onfollowing:

1. Multiple choices. 05 Marks
2. Numerical from exercise (unsolved problems from Text books). 10 Marks
3. Solving networks problems by MATLAB. 05 Marks

Designed By: Mr.P. S. Swami
&Mr. S. S. Mopari

EE245: Electrical Measurements and Instrumentation

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Total Credits	03	Teacher Assessment	20 Marks
		End-Semester Examination	60 Marks

Prerequisites:

EE 143 - Basics of Electrical Engineering

GE 142- Engineering Physics

GE 152- Engineering Chemistry

Course Educational Objectives:

The objectives of the course are to

1. Introduce the student fundamentals of Electrical and Electronics Instruments and Measurement providing an in-depth understanding of Measurement Bridge measurements, Digital instruments, Function Generator and Analyzer, Display devices and transducers.
2. Become familiar with methods of measurement /Instruments for measuring electrical and mechanical quantities
3. Become familiar with digital measurement.
4. Become familiar measurement of R, L, C, by using standard bridge.
5. Become familiar with measurement of mechanical quantity.

Course Outcomes:

Students will be able to

1. Describe operation of different electrical measuring instruments and their use for the measurement of electrical and non-electrical quantities.
2. Describe different terminology related to measurements and methods for measurements.
3. Calibrate different electrical and electronic measuring instruments.
4. Describe different recent terminology related measurement and instrumentation.
5. Selection of proper digital equipment for measurement purpose.

UNIT-1 Introduction:

Philosophy of Measurement:

Methods of measurement, Measurement system, Errors in measurement and its analysis, Review of Standards and units, Dimensional equations and applications.

Measurement of Electrical quantities:

Measurement of voltage, Current Measurement of three phase power under balanced and unbalanced condition, Measurement of reactive power, Measurement of energy.

UNIT-2 Measurement of R, L & C:

Measurement of Low, Medium and High Resistance, Kelvin's bridge, Loss of charge method. Measurement of Inductance, Quality Factor, Maxwell's bridge, Hay's bridge, Anderson's bridge, Owens's bridge Measurement of Capacitance and Loss Angle,Desauty bridge, Wien's bridge, Schering Bridge, Magnetic Measurements, Terms related to magnetic measurement, Hysteresis loop & B-H curve determination (using step by step method).

UNIT-3 Measuring Instruments:

General features of indicating, Recording & integrating instruments, Types of instruments, Construction, Principle of operation and torque equation of moving coil, Moving iron, Electrodynamometer, Induction, and Electrostatic type instruments. Principle of operation of thethermoelectric, Rectifier type instruments. Power factor meter.

AC Potentiometer:

Polar type & Coordinate type AC potentiometers, Application of AC Potentiometers in electrical measurement Construction and theory of instrument Transformers, Equations for ratio and phase angle errors of C.T. and P.T., Applications. Output power meters, Field strength meter, phase meter, Q-meter, LCR bridge, RX meters, Automatic bridges, Megger, Transistor tester.

UNIT-4 Instrumentation:

Purpose of instrumentation, Classification of instrumentation system, Basic elements of instrumentation. Transducers, Classification & selection of transducers, Strain gauges, Inductive & capacitive transducers, Piezoelectric and Halleffect transducers, Thermistors, Thermocouples, Photodiodes & phototransistors, Encoder type digital transducers, Signal conditioning and telemetry systems, Basic concepts of smart sensors and application. Measurement of non-electrical quantities such as torque, pressure, vibration, temperature, force, humidity etc.

UNIT-5 Digital Measurement of Electrical Quantities:

Concept of digital measurement, Study of digital voltmeter, Frequency meter, Power Analyzer and Harmonics Analyzer; Electronic Multimeter, Data Acquisition Systems, Data transmission system. Display Devices and Generators: X:Y recorders, LCD and LED displays, Signal generators and Function generators.

TEXT AND REFERENCE BOOKS:

1. E.W. Golding, Electrical Measurement and Measuring Instruments Sir Isaac Pitman and Sons, Ltd. London 1940.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani, Instrumentation Devices and Systems Tata McGraw:Hill Publishing Company Ltd.
3. B.C. Nakra, K.K. Choudhary, Instrumentation, Measurement and Analysis Tata McGraw:Hill Publishing Company Ltd.
4. A.K. Sawhney, Electrical and Electronic measurements and Instrumentation, DhanpatRai and Co.
5. Albert D. Helfrick, William D.Cooper, Modern Electronic Instrumentation and MeasurementTechniques Pearson Education.
6. John Bentley, Principles of Measurement Systems Pearson Education.
7. H. S. Kalsi, Electronic Instrumentation, Tata McGraw:Hill Publishing Company Ltd.

Assessment Methods:

Teacher assessments will be based onfollowing:

1. Multiple Choice Questions. 05Marks
2. PPT Presentation. 05 Marks

3.Design and fabricate the circuit for measurement of electrical/ mechanical quantities. 10 Marks

Designed By : Mr. P. S. Swami

EE246: Generation Transmissions and Distribution of Electrical Power

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	02Hrs/Week	Test	25 Marks
Total Credits	02	Teacher Assessment	25 Marks

Prerequisites:

GE 142- Engineering Physics

GE 152 -Engineering Chemistry

Course Educational Objectives:

The objectives of the course are to

1. Develop familiarity with power system operation.
2. Develop familiarity with the operation of various power plants, operation of transmission network and ways of distribution of Electrical energy.
3. Develop an understanding of the environmental aspects of power generation.
4. Develop professional skills required to design electrical power transmission system.
5. Develop professional skills that prepare them for modeling and analyzing transmission networks.
6. Develop professional skills required to formulate and solve numerical related to distribution systems.

Course Outcomes:

Students will be able to

1. Draw single line diagrams of various power plants.
2. Compare conductor cost for various transmission systems.
3. Design a transmission system by calculating sag and transmission efficiency.
4. Describe constructional and other aspects related to underground cables.
5. Model and analyze distribution network.
6. Understand power factor improvement scheme.

UNIT-1 Power Generation:

Conventional power generation:

Study of hydro, Thermal, Nuclear, Diesel engine & gas cycle power plants :working principle, Classification, functions of various component, advantages and disadvantages.

Nonconventional power generation:

Introduction to nonconventional power plants (Solar, Wind, Geothermal, Tidal, Biomass, MHD generation, etc.)

UNIT-2 General Structure of Power System :

Overview of transmission & distribution system, Various levels of power transmission, Voltage levels at generation, Transmission and distribution, Symmetrical three phase system, Alternator as a part of power grid, The power Transformer, HVAC and HVDC transmission, Ways of transmissionoverhead transmission lines and underground cables, Different overhead transmission systems, Effect of transmission voltage, Practical working voltage, Comparison of conductor cost for various transmission systems, Kelvin's law.

UNIT-3 Mechanical Design**:**

Overhead lines:

Introduction to mechanical design, Types of conductors, Line supports, Spacing between the conductors, Length of span, Calculation of sag ,Overhead line insulators – Materials, types of

insulators such as pin type, suspension type, strain type insulators, Voltage distribution along string of suspension insulators, Methods of improvement of string efficiency.
Underground cables:
Cable construction, Conductors, Insulation, Types of cable, Insulation resistance, Capacitance, Grading, Dielectric stress in cable, Heating, Current rating of cable.

UNIT-4 Distribution Systems:
Introduction, Primary & secondary distribution, Distribution system losses, Various methods of Distribution, general, radial and ring main systems, Calculations with concentrated and distributed Loads.
Substation:
Classification, Layout, Substation equipment's, Substation grounding & earthling, Merits & demerits of indoor & outdoor substation, Types of bus bar arrangement.

UNIT-5 Corona and Power Factor Improvement:
Corona:
Introduction, Theory of corona formation, Power loss due to corona, Advantages & disadvantages of corona, Effect of corona on line design, Factors affecting corona, Methods of reducing corona effect.
Power factor improvement:
Introduction, Power factor, Advantages of power factor improvement, Methods of improving power factor.

TEXT AND REFERENCE BOOKS:

1. Mahesh Verma, Power Plant Engineering, Metropolitan Book Co., Pvt. Ltd.
2. George W. Sutton (Editor), Direct Energy Conversion, Inter University Electronics Series Vol. : 3.
3. McGraw:Hill, C. L. Wadhawa, Generation,Distribution and Utilization of Electrical Energy, New Age International Publishers.
4. O.I. Elgerd, Electric Energy Systems Theory, Tata McGraw:Hill.
5. W.D. Stevenson, Elements of Power Systems Analysis, McGraw Hill.
6. I.J. Nagrath and D.P. Kothari, Modern Power System Analysis, Tata McGraw:Hill.
7. M.V. Deshpande, Elements of Elect Power, Transmission and Distribution, Tata McGraw:Hill.
8. Luces M. Faulkenberry and Walter Coffer, Electrical Power Distribution and Transmission, Pearson Education.
9. Allen J. Wood and B.F. Wollenberg, Power Generation, Operation and Control, John Wiley.
10. H. Cotton, Transmission and Distribution of Electrical Energy, ISAAC Pitman & Sons Ltd.

Assessment Methods:

Teacher assessment will be based onfollowing:

1. A Report representing generation, transmission and distribution system scenario (State, national, global). 05Marks
2. Assignments. 15 Marks
3. Quiz. 05 Marks

Designed By : Dr. V. A. Kulkarni

EE247: Lab Transformers and DC machines

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	02Hrs/Week	Term Work	25 Marks
Total Credits	01	Practical/Oral	25Marks

Term Work:

Term work shall consist of minimum eightexperiments from the following:

1. Determination of efficiency, regulation & constants of equivalent circuit using open circuit & short circuit test single phase Transformer.
2. Parallel operation of single phase/three phase Transformers.
3. Scott:connection of single phase Transformers.
4. Sumpner's test on Transformers.
5. Efficiency & regulation of single phase Transformer by direct loading.
6. Three phase Transformer connections & verification of voltage relationships.
7. Magnetization, external and internal characteristics of a DC shunt generator.
8. Speed control of a DC shunt machine by: (i) armature voltage control (ii) field control method.
9. Study of performance of DC shunt motor by load test.
10. Separation of losses of DC Motor.
11. Swinburne's test on DC Machines.
12. Hopkinson's test DC Machines.
13. Study of conventional and industrial starters for DC Motors.
14. Retardation test DC Machines.
15. Software based experiments on modeling & performance determination of DC Machines &Transformers.

Designed By: Mrs. M. R. Bachawad&
Dr. N. R. Bhasme

EE248: Lab Network Analysis

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	02Hrs/Week	Term work	25 Marks
Total Credits	01	Practical/Oral	25 Marks

Term Work:

Term work shall consist of minimum eight experiments from the following:

1. Loop and Nodal analysis.
2. Duality.
3. Time constants.
4. Initial and final conditions in networks.
5. Applications of Step, Impulse and Ramp functions.
6. Network Theorems (any two): Superposition, Thevenin's and Norton's, Reciprocity, Substitution theorems, Maximum power theorem applied to networks with all types of sources.
7. Fourier Method of Waveform Analysis.
8. Transfer function, Concepts of Poles and Zeros, Transform impedance, Transform admittance.
9. Complex frequency, driving point and transfer impedance and admittances.

Designed By: Mr.P. S. Swami &
Mr.S. S. Mopari

EE249: Lab Electrical Measurement and Instrumentation

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	02Hrs/Week	Term Work	25 Marks
Total Credits	01	Practical/Oral	25Marks

Term Work:

Term work shall consist of minimum eight experiments from the following:

1. Demonstration of working parts of different types of meters.
2. Study of operation of Oscilloscope and measurement of voltage, current using Oscilloscope.
3. Calibration of three phase wattmeter /single phase wattmeter.
4. Calibration of AC single phase and three energy meter / measurement of energy at different P.F.
5. Measurement of resistance using Kelvin's Double Bridge.
6. Measurement of power using Instrument Transformers.
7. Measurement of power in poly:phase circuits.
8. Measurement of insulation resistance by loss of charge method.
9. Measurement of frequency by Wien Bridge using Oscilloscope.
10. Measurement of Inductance by AC Bridges.
11. Measurement of Capacitance by AC Bridges.
12. Study of DC potentiometer, Megger, earth tester.
13. Experimental set up for measurement of non:electrical quantities.
14. Testing of C.T. and P.T.
15. Measurement of energy at different power factors.

Designed By : Mr. P. S. Swami

EE250:Lab Generation of Electrical Energy

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	04Hrs/Week	Term Work	50 Marks
Total Credits	02		

Term Work:

Term work shall consist of minimum eight experiments from the following:

1. Drawing sheet based on Different types of insulators.
2. Drawing sheet based on poles and towers.
3. Drawing sheet based on different types of cables.
4. Drawing sheet based on various distribution systems.
5. Drawing sheet based on substation layout.
6. Drawing sheet based on layout of power plant (any one to each student).
7. A report based on visit to DISTRIBUTION substation.
8. Experimental calculation of string efficiency of suspension insulator & verification using the simulation software.
9. Design problem on tower, sag calculation.

Group of four students will be formed. Each group will prepare any one laboratory based models outof following: Conventional, nonconventional power plants, various towers, insulators, substations.

Designed By : Dr. V. A. Kulkarni

EE251:Asynchronous Machines

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Total Credits	03	Teacher Assessment	20 Marks
		End-Semester Examination	60 Marks

Prerequisites:

EE243-Transformers and DC Machines

GE 151-Engineering Mathematics-II

Course Educational Objectives:

The objectives of the course areto learn

1. Fundamental concepts, operation and Characteristics, applications of Asynchronous Machines.
2. Design aspects of rotating machines.
3. Mathematical analysis of operation of Asynchronous Machine.
4. Basic knowledge to develop practical skills to solve engineering problems of Induction Machines.

Course Outcomes:

Students will be able to

1. Explain basic concepts of Asynchronous Machines.
2. Design the Asynchronous Machines.
3. Develop practical skills through different tests, applications of Induction Machines.
4. Identify, apply and solve engineering problems related to Asynchronous machines.

UNIT-1 Three Phase Induction Motors:

Construction, Types, Rotating magnetic field, Principle of operation, Torque equation, Torque:slip characteristics, Losses & efficiency , Energy efficient IM, Phasor diagram & equivalent circuit, No:load test, Block rotor test, Circle diagram, Speed control & Starting of Induction Motors, Harmonics, Starters used in industries and introduction to Induction Generator: working principle, equivalent circuit, types and operation.

Double Cage Induction Motor:

Construction, equivalent circuit, torque slip characteristics, comparison of single cage & double cage IM.

UNIT-2 Single Phase Induction Motors:

Double field revolving theory, Equivalent circuit, Torqueslip characteristics, Starting methods & types.

Universal Motor:

Construction, Principle of working, Speed control & applications.

UNIT-3 Design of Rotating Machines:

Choice of specific loading, Output equation of ac machines, Factors affecting the size of Rotating Machines, Separation of main dimensions.

UNIT-4 Introduction to Three Phase Induction Machine Design:
Principles of Design, Design Factors, Specifications, Standardization, Rating, Performance & other Criterion to be Considered, Different approaches in Computer Aided Design, Stator design, Selection of stator slots, Stator winding, Stator core, Air gap, Selection of rotor slots, Rotor bars/windings calculations, Design of end rings.
Magnetic Circuit Calculation:
Calculation of ampere turns of magnetic circuit for electrical machines.

UNIT-5 Design of Single Phase Induction Machine:
Introduction, Types of motors, Construction, Output equation, Main dimensions, Design of stator, Air gap length, Design of rotor, Operating characteristics, Parameters, Running performance, Pull out torque, Design of starting winding for all types of Induction Motor.

TEXT AND REFERENCE BOOKS:

1. M. G. Say, Performance & Design of A.C. Machines, 3rd edition , CBS Publisher &Distributors,Delhi.
2. E. Fitzgerald, Charles Kingsley & Stephen Umans, Electric Machinery, 5th edition, Tata McgrawHill.
3. Nagrath I. J. & Kothari D. P., Electric Machines, Tata McGraw Hill , New Delhi, 2nd edition.
4. Syed A. Nasar, Electric Machines & Power Systems, Volume I , Tata Mcgraw Hill.
5. Dr P. S. Bhimbra, Electric Machinery, 5th edition, Khanna Publishers, Delhi.
6. A.K. Sawhney& A. Chakrabarti, A Course in Electrical Machine Design, Dhanpatrai& Co.

Assessment Methods:

Teacher assessments will be based on following(any two):

1. Assignments based on the Theory/Problems.	10 Marks
2.Quiz.	10 Marks
3. Surprise test.	10 Marks
4. Technical/Industrial visit report.	10 Marks
5. Modeling and Simulation of Three Phase /Single Phase Induction Motors	10 Marks

Using different software such as MATLAB/SIMULINK, ANSYS, and EMTDC etc.

Designed By : Dr. N. R.Bhasme&
Mrs. M. R. Bachawad

EE252:Electromagnetic Fields

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Total Credits	03	Teacher Assessment	20 Marks
		End-Semester Examination	60 Marks

Prerequisites:

GE 142- Engineering Physics

GE 151-Engineering Mathematics-II

Course Educational Objectives:

The objectives of the course are to

1. Have an ability to determine and describe static and dynamic electric and magnetic fields for technologically important structures: the coil, charge distributions, the dipole, the coaxial cable, dielectric and conducting spheres.
2. Understand the coupling between electric and magnetic fields through Maxwell's equations.
3. Knowledge of, physical interpretation, and ability to apply Maxwell's equations.
4. Determine field waves, potential waves, and energy and charge conservation conditions.

Course Outcomes:

Students will be able to

1. Learn basic theory of electric and magnetic fields.
2. Learn Maxwell's equations.
3. Expose the students to the fundamentals of electromagnetic fields and their applications in Electrical Engineering.

UNIT-1 Static Electric Field:
Coulombs law, Electric field intensity due to different charge distribution, Electric flux density, Gauss' law, Divergence and Divergence theorem, Maxwell's first equation Potential and potential difference, Potential field of system of charges, Potential gradient, Dipole, The energy density in electric field.

UNIT-2 Static Electric Field in Dielectrics:
Continuity of current, Conductor properties and boundary conditions Nature of dielectrics, Boundary conditions for perfect dielectric material polarization and its effect in dielectric.

UNIT-3 Steady Magnetic Field:
BiotSavart law, Ampere's circuital law Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Nature of magnetic material, Magnetic field and magnetization, Boundary conditions in magnetic field.

UNIT-4 Time Varying Field:
Faraday's law, displacement current, Maxwell's equations in point form and integral form.

UNIT-5 Uniform Plane Wave:
Wave propagation in free space, in dielectrics, Pointing vector and power consideration, Wave propagation in good conductor: Skin effect Reflection of uniform plane waves at normal incidence, Standing wave ratio.

TEXT AND REFERENCE BOOKS:

1. William H. Hayt, Jr& John A. Buck, Engineering Electromagnetics, 7th edition, Tata McGraw:Hill.
2. D. Kraus, Electromagnetic 5th, McGraw Hill Book Company.
3. Sadiku, Elements of Electromagnetics, Oxford Press.

Assessment Methods:

Teacher assessments will be based on following:

1.Assignments based on the Theory/Problems.	05 Marks
2.Quiz.	05 Marks
3. Surprise test.	10 Marks

Designed By : Mr. S. M. Shinde

EE253: Electronic Devices and Circuits

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Tutorials	01Hrs/Week	Teacher Assessment	20 Marks
Total Credits	04	End-Semester Examination	60 Marks

Prerequisites:

GE 142 - Engineering Physics
EE 244- Network Analysis
EE143 - Basics of Electrical Engineering

Course Educational Objectives:

The objectives of the course are to

The ability to formulate and solve the differential equation the describing time behavior of circuit containing energy storage elements.

1. Provide the basic concepts of diode circuits i.e. clippers and clampers, analysis of DC circuits using diode, basics of TRANSISTOR& MOSFET and applications of MOSFETs.
2. Analyze and design DC and small signal equivalent circuits of different types of amplifiers.
3. Analyze and design power amplifiers of class- A series fed and Transformer coupled class- B push pull amplifiers, complimentary symmetry circuits, analysis of class- AB operation etc.
4. Understanding the basic of frequency response of transistor amplifier.

Course Outcomes:

Students will be able to

1. Apply knowledge of mathematics to solve numerical based on the DC and AC analysis of BJT Amplifier circuits and are capable to solve problems based on various feedback topologies.
2. Develop ability to design the circuits involving BJT Circuits and verify performance.
3. Demonstrate the ability to construct and test BJT amplifiers by determining stable Q point and measuring the performance parameters of various amplifier circuits.
4. Analyze complimentary symmetry power amplifier Circuits, feedback topologies, behavior of transistor at high frequencies, frequency Response etc.
5. To identify the various amplifier circuit & able to solve the problem theoretically & practically.
6. To understand the impact of electronic circuits in various electronic appliances used in day to day life.

UNIT-1 Review of Semiconductor Devices, DC Power Supply:
Rectification, Half wave, Full wave, Bridge, Expression for ripple factor, Efficiency, Diode Ratings, Filters, Capacitor, Inductor, LC Filters, Simple Voltage regulator, Series regulators, IC regulators.

UNIT-2 Small Signal Amplifiers:
CC, CB, CE configurations, CE Amplifiers, Biasing techniques, Stabilization of operating point, h-parameters, Concept of load lines, Loading effect at the input and output, Bootstrapping methods of

coupling, DC coupled amplifier, RC coupled amplifier, Transformer coupled amplifier, Analysis of RC coupled amplifier, 3dB bandwidth.

UNIT-3 FET and Feedback Amplifiers:
FET as voltage variable resistor, Comparison with BJT, Multistage amplifier, Negative and positive feedback, Types of feedback amplifiers, Voltage series/shunt, Current series/shunt amplifiers.

UNIT-4 Power Amplifiers Classification: Class:A, Class:B, Class:AB, Class:C, Transformer less Push Pull amplifier, Complementary symmetry power amplifier.
Oscillators:
Bark Hausen's criteria, RC, Phase shift, LC, Hartley, Colpitts Oscillators.

UNIT-5 Pulse Circuits:
Pulse characteristics, wave shaping using RC circuits, Clipping, Clamping, Transistor as a switch, Sweep circuits, Voltage, Current sweep, Miller sweep circuit, Bootstrap sweep circuit, Multivibrators:Astable, Monostable&Bistable.

TEXT AND REFERENCE BOOKS:

1. Millman and Halkias, Electronic Devices and Circuits', McGraw Hill
2. Millman and Halkias, Integrated Electronics, McGraw Hill
3. Allan Mottorshed, Electronic Devices and Circuits', Tata McGraw Hill
4. Boylestad and Neshelsky, Electronic Devices and Circuits', Tata McGraw Hill
5. Schilling and Belove, Electronic Devices and Circuits, McGraw Hill

Assessment Methods:

Teacher assessments will be based on following:
Teacher assessment will be based on following:

1. Multiple Choice Objective. 05Marks
2. PPT presentation. 05Marks
3. Surprise test. 10 Marks

Designed By : Mr.S. S. Dhamse
& Mr.S. S. Mopari

EE254: Renewable Energy Technology

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Lectures	02Hrs/Week	Test	25 Marks
Total Credits	02	Teacher Assessment	25 Marks

Prerequisites:

EE246-Generation, Transmission and Distribution of Electric Power
GE 142- Engineering Physics
GE 152- Engineering Chemistry

Course Educational Objective:

The objectives of the course are to

1. Understand problems and limitations of fossil fuels for electrical power generation.
2. Impact concept of distributed generation.
3. Study and make aware about Photovoltaic power systems.
4. Create awareness about renewable energy sources.
5. Sensitize impact of electrical power generation from wind turbines.
6. Make aware about Biomass and Fuel cells.

Course Outcomes:

Students will be able to

1. Understand concept of distributed power generation.
2. Classify wind turbines.
3. Calculate maximum output power from wind turbine.
4. Understand Micro-Hydro Power system.
5. Plot I-V Characteristics of solar cell.
6. Distinguish between stand alone and grid connected PV systems.
7. Understand standard test conditions and impacts of shading on I:Vcurves of solar cell.

UNIT-1 Basics of Energy:

Energy and power, Estimation of energy bill, Different types of energy sources, Quality of fossil fuels, Environmental impact of fossil fuels, Solar energy, Tidal and geothermal energy, Worldwide energy production, Energy scenario in India.

Solar spectrum, Environmental radiation, Radiation on earth surface, Earth's orbit, Annual variation of the sun, Diffuse, Direct, and reflected solar radiation, Solar radiation at given location, Optimal tilt for solar equipment, Monthly averaged global radiation at optimal tilt.

UNIT-2 Introduction to Solar PV Technology:

Basics semiconductor physics, Equivalent circuit of PV cells, From cells to modules to arrays, Currentvoltage curves for loads, Shading impact on I:V curves, Different types of P:V system.

UNIT-3 Solar Thermal Technology:

Solar thermal energy systems, Absorption and radiation, Solar cooking system, Types of solar cooking system, Solar distillation system, Solar heating system, Maintenance.

UNIT-4 Wind Energy:

Introduction, Historical development of wind turbine, Types of wind turbine, Power in the wind, Impact of tower height, Maximum rotor efficiency, Generators used in wind turbine, Speed control of maximum power , Wind farm, Modes of wind power generation, Advantages and disadvantages of wind energy.

UNIT-5 Biomass and Fuel Cells:

Introduction to biomass energy, Types of biomass and their applications, Biomass as source of energy, Structure and design of biomass plant. Introduction to fuel cells, Basic operation of fuel cells, Different types of fuel cells, Output characteristic of fuel cells, Tidal energy.

TEXT AND REFERENCE BOOKS:

1. Chetan Singh Solanki, 'Renewable Energy Technologies: Practical Guide ForBeginneers, PHI publication Ltd.
2. Gilbert M. Masters, Renewable and Efficient Electric Power Systems, Wiley:IEEE Press August 2004.
3. D. P. Kothari, K. C. Singhal, RakeshRanjan ,' Renewable energy sources and emerging technology', PHI publication.
4. Principal of solar engineering by D. Yogi Goswami, Frank Kreith& Jan F. Kreider, 2nd edition Taylor & Frances, 2000 ISBN:10:1:56032:714:6.
5. Solar Photovoltaic Fundamentals, Technology & Applications by Chetan Singh Solanki 2nd Edition PHI Publication.
6. 'Solar Energy Principals of Thermal Collection and Storage' TATA McGraw: Hill Education.

Assessment Methods:

Teacher assessments will be based on following:

1. Simulation of grid connected PV system using MATLAB. 10 Marks
2. Model of solar cooker, concentrated solar concentrator etc. 10 Marks

Designed By: Mr.S. M. Shinde

EE255: Lab Asynchronous Machines

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	02Hrs/Week	Term work	25 Marks
Total Credits	01	Practical/Oral	25 Marks

Term Work:

Term work shall consist of minimum eight experiments performed from the following list.

1. Effect of variation of applied voltage on the performance of IM & torque-slip characteristics.
2. Load Test on IM.
3. Circle diagram & determination of parameters of equivalent circuit of 3:phase IM.
4. Study of IM starters.
5. Speed control of slip ring IM using rotor resistance starter.
6. Speed control of IM by pole changing method.
7. Study of various types of single phase IM's.
8. Determination of equivalent circuit parameters of single phase IM.
9. Load test on single phase IM.
10. Circle diagram of Induction Motor.
11. Study of Induction Generator.
12. Measurement of slip of IM.
13. Torque /speed characteristics of Universal motor.

Designed By: Dr. N. R. Bhasme&
Mrs.M. R. Bachawad

EE256:Lab Electronic Devices and Circuits

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	02Hrs/Week	Term work	25 Marks
Total Credits	01	Practical/Oral	25 Marks

Term Work:

Term work shall consist of minimum eight experiments performed from the following list.

1. Regulation characteristics of half wave and full wave rectifier with and without filter.
2. Measurement of line regulation and load regulation of shunt regulator.
3. Measurement of line regulation and load regulation of series regulator.
4. Measurement of h:parameters of CE amplifier.
5. Frequency response of RC coupled amplifier.
6. Frequency response of Transformer coupled amplifier.
7. Study of RC low passes circuit.
8. Study of RC high passes circuit.
9. Study of clipper.
10. Study of clamper.
11. Study of Bistablemultivibrator.
12. Study of Astable and monostablemultivibrator.

Designed By: Mr. S. S. Mopari

EE257: Lab Numerical Computation Techniques

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	02Hrs/Week	Term Work	25Marks
Total Credits	01		

Term Work:

Term work shall consist of minimum eight computer programs with flow charts and listing with results in MATLAB or C/C++/ Script.

List of Programs:

1. Find Roots of Polynomial Equation Using
   - i. Bisection Method
   - ii. Secant Method
   - iii. Newton Raphson Method
   - iv. Regula-Falsi Method
2. Solve Linear Simultaneous Equation Using
   - i. Gauss Elimination Method
   - ii. Gauss Siedal Method
   - iii. Gauss Jordan Method
3. Curve Fitting Using Various Interpolation Techniques
   - i. Newton's Forward / Backward /Divided Difference
   - ii. Stirling Bessel's Interpolation
   - iii. Least Square ,Lagrange's ,Inverse Interpolation
4. Numerical Differentiation Using
   - i. Newton –Gregory
   - ii. Lagrange's
5. Numerical Integration Using
   - i. Trapezoidal
   - ii. Simpson's Rule(1/3, 3/8)
6. Ordinary Differential Equation Using Euler's Method
   - i. Taylor's Series
   - ii. Runge:Kutta (2nd ,3rd , 4th Order)
   - iii. Predictor Corrector Method

Designed By: Mrs.M. R. Bachawad

EE258:Lab Renewable Energy Technology

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	02Hrs/Week	Term work	25 Marks
Total credits	01	Practical/Viva-voce	25 Marks

Term Work:

Term work shall consist of minimum eight experiments performed from the following list.

1. To study single PV module I-V and P-V characteristics. (With radiation and temperature changing effect).
2. To study I-V and P-V characteristics with series and parallel combination of modules.
3. To study effect of shading.
4. To study effect of tilt angle.
5. To study battery charging and discharging characteristics.
6. To study Demo of only DC load system with and without battery (with variable rated capacity of system) with standalone system.
7. To study demo of only AC load system with and without battery with standalone system.
8. To study Combine AC and DC load system with and without battery with standalone system.
9. Study of power generation formula for wind& Betz limit.
10. Study of biomass.
11. Identify & measure the parameters of Solar PV module in the field.
12. To measure the spectral response of a solar cell & to learn about quantum efficiency.
13. Study of Solar resource assessment station.

Designed By S. M. Shinde

EE259:Lab Electrical Workshop

(Compulsory)

(Implemented from 2013)

Teaching Scheme:		**Evaluation Scheme:**	
Practical	01Hrs/Week	Term work	25Marks
Total Credits	01		

Term Work:

Term work shall consist of minimum eight experiments from the followings:

1. Introduction of tools, electrical materials, symbols and abbreviations.
2. Armature winding of ceiling fan.
3. Assembling small Transformer cores from the given lamination plates.
4. Dismantling, repairing, assembling and testing of domestic appliance like electric iron, room heater, electric toaster, water heater, electric kettle, electric oven, ceiling fan, Table Fan, regulators, alarm bell, agricultural pump.
5. Wiring of different lamp control, stair casing circuits, button wiring, cleat wiring and conduit wiring.
6. Soldering electrical elements with the necessary switches microswitches and extension terminals
7. Wiring of different lamp control, stair casing circuits, button wiring, cleat wiring and conduit wiring
8. Soldering wire jointing of different types.
9. Wiring and testing of alarm and indicating relays, indicating lights etc.
10. Connection of table and ceiling fans with regulators.
11. Assembly and interchange wiring of fluorescent tube light.

Designed By : Dr. A.G. Thosar

EE 260: Entrepreneur Development Programme

(General Elective)

Teaching Scheme		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Credit	03	Teacher Assessment	20 Marks
		End Semester Examination	60 Marks

Course description: This course prepares student for entrepreneurship. The contents focus on motivating student for entrepreneurship and to creativity .

Course Objectives:

The objectives of the course are to

1. Introduce various qualities required for entrepreneurship.
2. Explain various entrepreneurship models.
3. Organize interaction with successful entrepreneur.

Course Outcomes:

Students will be able to

1. Write project proposal.
2. Identify qualities for entrepreneurship.
3. Use various entrepreneurship models.
4. Understand various schemes supporting entrepreneurship.

Course Contents:

UNIT-1 Introduction to entrepreneurship, concept of Market Survey

UNIT-2 Project report preparation

UNIT-3 Introduction to various rural entrepreneurship

UNIT-4 Introduction to import-export

UNIT-5 Environmental Protection and social responsibility of entrepreneur, discuss on source of entrepreneurship, Factory visit and meeting with entrepreneur

References:

1. Dr. Gupta and Dr. Srinivasan, *Entrepreneurship development in India*
2. Vasant Desai, *Dynamics of Entrepreneurial Development and Management*
3. Sarugadharan and Resia Begum, *Women Entrepreneurship; institutional support and problems*
4. Ravi J. Mathai, *Rural Entrepreneurship A Frame Work in Development Entrepreneurship-A Handbook*
5. Venkateshwara Rao and UdaiPareek,(Eds)*Developing Entrepreneurnship*-A Handbook
6. RajaGopal, *Agriculture Business and Entrepreneurship*

7. H.Sadhak, *industrial development in Backward Regions in India*
8. M.W.Deshpande, *Entrepreneurship of small Scale Industries*
9. D.L. Saxon and RW Smilor(eds), *The Art and Science of Entrepreneurs*

Teacher Assessment:

The assessment shall be based on following

1. Case study writing 10 Marks
2. Mock project proposal for setting up of small scale industry 10 Marks

Designed By: Dr. A. G. Thosar

EE-261 Technical Writing

(General Elective)

Teaching Scheme		**Evaluation Scheme:**	
Lectures	03Hrs/Week	Test	20 Marks
Credit	03	Teacher Assessment	20 Marks
		End Semester Examination	60 Marks

Course outcomes:

1. To create documents for job
2. To prepare report in leaves includes email report uses manual documents
3. To apprise the team work
4. To communicate effectively

Course Contents:

UNIT-1 Introduction to technical writing:
Producing the product, Objectives in technical writing, audience recognition and involvement.

UNIT-2 Correspondence: Email and memos, letters, job search.

UNIT-3 Usual: Document design, graphics.

UNIT-4 Technical applications:
Thesis, Broucher and newsletters, handbook, report strategy.

UNIT-5 Electronic communications.

Books:

1. S.J.Gerson, S.M.Gerson, *Technical Writing Process and Product,* Pearson Education

Teachers Assessments:

Assessments shall be based on followings

1. Mini project10 marks
2. Individual technical report 10 marks

Designed By: Dr. A. G. Thosar