GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Electrical Engineering

Teaching and Evaluation Scheme

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

SEMESTER-I

(Implemented from 2015)

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			
THEORY COURSES												
1	EE 441	Advanced Microprocessors and Microcontrollers	03			03	20	20	60			100
2	EE 442	Energy Conservation and Management	02			02	25	25				50
3	EE 443	Electrical Drives	03	01		04	20	20	60			100
4	EE 444	Power System Operation and Control	03	01		04	20	20	60			100
5	EE 445	Electrical Materials	02			02	25	25				50
6	EE 446-455	Elective I	03			03	20	20	60			100
LABORATORY COURSES												
1	EE 456	Lab Advanced Microprocessors and Microcontrollers			02	01				25	25	50
2	EE 457	Lab Electrical drives			02	01				25	25	50
3	EE 458	Lab Energy			02	01				25	25	50
4	EE 459	Project Phase I			04	02				75		75
5	EE 460	*In-plant Training seminar			01	01				25		25
A]		**Total of Semester I**	**16**	**02**	**11**	**24**	**130**	**130**	**240**	**175**	**75**	**750**

SEMESTER-II

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			
THEORY COURSES												
1	EE 461	Digital Signal Processing	03			03	20	20	60			100
2	EE 462	High Voltage Engineering	03			03	20	20	60			100
3	EE 463	Industrial Organization and Management	02			02	25	25				50
4	EE 464	*Modern Trends in Electrical Engineering	02			02	25	25				50
5	EE 465-473	Elective II	03			03	20	20	60			100
LABORATORY COURSES												

1	EE 474	Lab Digital Signal Processing			02	01				25	25	50
2	EE 475	Lab Electrical Equipment Specification and Design			02	01				50		50
3	EE 476	Lab soft skill			02	01				25		25
4	EE 477	Lab High Voltage Engineering			02	01				25		25
5	EE 478	Project Phase II			06	06				100	100	200
6	EE 479	Comprehensive viva voce				01					25	25
B]		**Total of Semester II**	**13**	**00**	**14**	**24**	**110**	**110**	**180**	**200**	**150**	**750**
		Total of Semesters (A+B)	**29**	**02**	**25**	**48**	**240**	**240**	**420**	**375**	**225**	**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

* Student will submit the report on in-plant training and deliver seminar.

	List of Electives				
1	EE 446	Electrical Machine Modeling and Analysis	12	EE 465	Flexible A.C. Transmission Systems
2	EE 447	Energy and Environmental Engineering	13	EE 466	Biomedical Instrumentation
3	EE 448	Industrial Automation and Control	14	EE 467	Communication Engineering
4	EE 449	HVDC Transmission	15	EE 468	Reliability and Condition Monitoring
5	EE 450	Computer Aided Power System Analysis	16	EE 469	Advanced Switchgear and Protection
6	EE 451	Illumination Engineering	17	EE 470	Digital Control System
7	EE 452	Project Management	18	EE 471	Wind energy system
8	EE 453	Artificial Intelligence	19	EE 472	Optimization Techniques
9	EE 454	Solar Thermal & PV Technology	20	EE 473	Embedded system
11	EE 455	Robotics	21	CS	Data structure
			22	ET	Image Processing

***Modern trends in Electrical engineering: Faculty may add contents to the topics mentioned in various streams:-**

Electrical Machines: BLDC, linear induction motor, Hysteresis motor.

Power System: Islanding, smart grid.

Power electronics: Latest devices, matrix converters.

Control systems: Fuzzy logic, neural network, robust control, predictive, preventive.

EE441: Advanced Microprocessors and Microcontrollers

(Compulsory)

(Implemented from 2015)

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

Prerequisites:-

EE357 - Microprocessor & Interfacing Techniques

Course Objectives:

The objectives of the course areto

1. Study the concepts and basic architecture of 8086, 8051 and other micro-controllers
2. Know the design aspects of basic microprocessor
3. Write assembly language programs in microprocessor and microcontrollers for various applications

Course Outcomes:

Students will be able to

1. Understand the architecture of 8086 and 8051
2. Write assembly language program in 8086 and 8051 for various applications
3. Design memory for microprocessor
4. To interface peripheral devices with techniques using 8086 and 8051

UNIT-1 Advanced Microprocessors:

Architecture Of Typical 16 Bit Microprocessor(Intel 8086), Memory Address Space And Data Organization, Segment Registers And Memory Organization, Addressing Modes,8086 Configurations, Minimum Mode, Maximum Mode, Comparison of 8086 And 8088, Bus Interface, Interrupts and Interrupt Priority Management.

UNIT-2 Programming 8086:

Instruction Set, Assembly Language Programming, Input/ Output Operations, Interfacing Of Peripheral Devices Like 8255, 8259, LED etc.

UNIT-3 Multiprocessor System:

Queue Status And Lock Facility Of 8086 Based Multiprocessor System, 8087 Coprocessor, Concept, Architecture, Instruction Set And Programming.

UNIT-4 Microcontrollers:

Introduction, Evolution, Architecture, Comparison With Microprocessor, Selection Of A Microcontroller, MCS 51 Family, 8051 Architecture, I/O Ports And Memory Organization Addressing Modes, Instruction Set, Interrupts, Real World Interfacing.

Overview of Atmel Microcontrollers 89CXX.

UNIT-5 Application of Microcontrollers and its interfacing:

Solenoids- Relay control and clamping pick/hold heaters, LED, LCD, DAC, Actuators.

Motors- I)Stepper Motors- bipolar and unipolar operation, half stepping and micro-stepping, stepper motor driver circuit ii) DC Motors- driving dc motors, BLDC motor and its driving, DC motor controller Case Studies- Case study of 8051 based systems like Numerical Protection relays, Intelligent Transformer, Intelligent Switchgear, High efficiency Induction Motors, Electronic speed governors, Auto synchronizing unit.

TEXT AND REFERENCE BOOKS

1. MykePredko, “Programming and customizing the 8051 Microcontroller”, Tata McGraw Hill, New Delhi.
2. Badri Ram, “Advanced Microprocessor and interfacing”, Tata McGraw Hill, New Delhi.
3. Barry B Brey, “The Intel Microprocessor 8086 to Pentium architecture programming and interfacing”, Tata McGraw Hill, New Delhi.
4. M.A. Mazidi&G.M. Mazidi,” The 8051 Microcontroller and Embedded System “, Pearson education, 3rd Indian reprint.
5. Ajay Deshmukh, “Microcontrollers”, Tata McGraw Hill, New Delhi.
6. Embedded Microcontroller Intel Manual
7. Intel Data Handbook for MCS96 Family
8. Kenneth Ayala, 8051 Microcontroller, Pen ram international, IInd edition
9. Online reference www.microchip.com

Teacher Assessments:

Assessments should be based on –

1. Write the ALP programme for real time application using microcontroller/processor 05 Marks
2. Design prototype model and simulation 10 Marks
3. PPT presentation 05 Marks

Designed By : Mrs. S. S. Kulkarni

EE442: Energy Conservation and Management

(Compulsory)

(Implemented from 2015)

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

EE353 - Switchgear and Protection

Course Objectives:

The objectives of the course are to

1. To explain the current energy scenario and need of energy conservation.
2. To demonstrate the advantages of demand side management.
3. To introduce various standards for illumination.
4. Introduction to captive power generation and co-generation

Course Outcomes:

Students will be able to

1. To implement energy conservation techniques to its surrounding.
2. To understand various kinds of tariffs in DSM.
3. Explain HVAC systems.

UNIT-1 Energy scenario:

Introduction, energy problems, energy use trends in developing countries, prospects of changes in energy supply, strategies for sustainable development, finite fossil reserve, Energy and environment, Need for renewable and energy efficiency, Energy conservation principles, Energy conservation in industries, generation, transmission and distribution, household, commercial sectors, transport, agriculture.

UNIT-2 Energy audit**:**

Energy flow diagram, strategy of energy audit, comparison with standards, considerations in implementing energy with conservations programmes, instruments for energy audit, energy audit of illumination system, energy audit of electrical system, energy audit of heating ventilation and air conditioning systems, energy audit of compressed air system, energy audit of building, energy audit of steam generation, distribution and utilization system, economic analysis. Bench marking, energy conservation Act 2003.

UNIT-3 Demand side management**:**

Scope of demand side management, DSM concept, DSM planning and implementation, load management as a DSM strategy, tariff options for DSM, customer acceptance, implantation issues, implementation strategies, DSM and environment, case studies of DSM,Maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses.

UNIT-4 Energy efficiency in electrical utility:

Losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

Compressed Air systems: Types of air compressors, compressor efficiency, Efficient

compressor operation, compressed air systems component, capacity assessment, leakage test, factors affecting the performance and saving opportunities. HVAC and refrigeration systems, Vapour compression refrigeration cycle refrigerants, coefficient of performance, capacity factors affecting refrigeration and air conditioning systems performance and saving opportunities. Vapour absorption refrigeration systems, principle types, saving potential, fan and Blower, types, performance evaluation.

UNIT-5 Captive power generation:

Types of captive power plants, financing of captive power plants, captive power plants in India, energy banking, energy wheeling , carbon credits

Cogeneration- Cogeneration technologies, industries suitable for cogeneration, allocation of costs. Sale of electricity to utility, impact of pricing of cogeneration, electric power plant reject heat, agricultural uses of waste heat, use of power plant reject heat for waste water treatment, integrated energy system, Potential of cogeneration in India.

TEXT AND REFERENCE BOOKS

1. B. R. Gupta,"Generation of Electrical Energy" S.Chand Publication.
2. S. Rao& Dr. B. B. Parulekar, " Energy Technology: Non-conventional,Renewable and Conventional" Khanna Publishers
3. Frank Kreith and George Burmeister, "Energy Management &Conservation", Amazon Publishers
4. Beggs and Clive, " Energy Management Supply and Conservation", Wall Mart Publishers
5. K.Bhattacharya, MHJBollen, J.E.Dalder, " Operation of Restructured Power System", Kluwer Academic Publications
6. Electricity Act 2003
7. Energy Conservation Act 2001
8. Bureau of Energy Efficiency India web-site http://www.bee-india.com

Teacher Assessments:

Assessments should be based on -

1. Visit and data collection of industry (such as co-generation plant), any manufacturing industry(understanding the scope of Energy conservation) 10 Marks
2. Quiz, Multiple choice objective test, data collection of latest energy saving Equipment's/apparatus 10 Marks
3. Numerical from Bureauof Energy Efficiency India. 05 Marks

Designed By : Mr. S. M. Shinde &
Mr. S. S. Mopari

EE443:Electrical Drives

(Compulsory)

(Implemented from 2015)

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

Prerequisites:

EE243 - Transformers & DC Machines

Course Objectives:

The objective of the course is to learn

1. Fundamentals of electrical Drives.
2. Control & operation of AC & DC Drives.
3. Use of drives for various industrial applications.

Course Outcomes:

Students will be able to

1. Technical expertise of electrical machines & drives.
2. Apply the knowledge to practical industrial systems.
3. Capable of self-learning new technology of electrical drives.
4. Analyze and solve numerical problems on electrical drives.
5. Write technical reports & give presentation on industrial drive systems.

UNIT-1 Introduction:
Concept of electrical drives, classification of electrical drives, Dynamics of electrical drives, Control of electrical drives, Selection of motor power rating, types of loads

UNIT-2 DC motor drives:
DC motors & their performance, starting, braking, transient analysis, speed control

UNIT-3 AC motor drives:
Three phase Induction motors & their performance, starting & braking, single phase Induction motors, starting & braking, speed control

UNIT-4 Thyristor control:
Controlled rectifier & chopper fed DC drives, Slip power recovery of induction motor

UNIT-5 Industrial applications:
Solar & Battery powered drives, important features of traction drive

TEXT AND REFERENCE BOOKS

1) G. K. Dubey, “Fundamental of Electrical Drives”, Second Edition. Narosa Publishing House, New Delhi. India
2) M. H. Rashid, “Power Electronics”, III Edition (Low Price), Pearson Education PVT LTD. New Delhi, India.
3) B. K. Bose, “Modern Power Electronics and AC Drives”, Low Price Edition, Pearson Education Pvt. LTD. New Delhi, India.
4) R. Krishnan, “Electrical Motor Drives: Modeling, analysis and control”, Low Price Edition, Prentice Hall of India, New Delhi, India.

Teacher Assessment:

The teacher’s assessment should be based on mentioned contents and any two of the following methods

1. Assignments 10 Marks
2. Objective type test 10 Marks
3. Modeling of synchronous machine using any electrical software 10 Marks
4. Technical/Industrial visit report 10 Marks

Designed By : Dr. N. R. Bhasme

EE444: Power System Operation and Control

(Compulsory)

(Implemented from 2015)

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

Prerequisites:

EE343- Power System Analysis

Course Objectives:

The objectives of the course are to

1. Explain concepts of power system stability to students.
2. Describe transient stability and methods of analysis.
3. Enumerate excitation systems to student.
4. Introduce the concept of reactive power and voltage control.
5. Explain optimal operation of generating units & grid management.

Course Outcomes:

Students will be able to

1. Describe stability conditions of power systems.
2. Determine transient stability under various fault conditions.
3. Employ excitation methods.
4. List reactive power and voltage control methods.
5. Find the optimum unit commitment for a power system.

UNIT-1 Power system Stability:

Brief review of synchronous machine equations and parameters, concept of steady state, transient and dynamic stability , Modelling of synchronous machine, the stability problem, power angle equation, node elimination techniques ,Steady state stability limit, methods to determine steady state stability limit- Clarke diagram etc., methods of improvement.

UNIT-2 Transient stability analysis:

Swing equation , point by point solution of the swing equation, one machine connected to infinite bus, critical clearing angle and time; equal area criterion for stability and its application to one machine infinite bus and two finite machines problems, concept of multi-machine system; effect of type of fault, grounding, reclosing on transient stability limit , methods of improvement.

UNIT-3 a] Excitation Systems:

Excitation System requirements, Elements of an excitation system Types of excitation systems.

b] Improvement of stability:

Transient stability enhancement, small signal stability enhancement.

UNIT-4 Control of voltage and reactive power:

Necessity, Various Methods, Load Frequency Control: Load frequency problem, speed governing system, automatic voltage control

UNIT-5 Optimal system operation**:**
System constraints, economic load sharing of units in power stations and in interconnection; incremental fuel cost method. Grid Management.

TEXT AND REFERENCE BOOKS

1. W.D. Stevenson, ” Elements of Power Systems Analysis”, McGraw Hill
2. WadhawaC.L, “Electrical Power System”, Wiley Eastern ltd.
3. I.J. Nagrath and D.P. Kothari, ” Modern Power System Analysis”, Tata McGraw-Hill
4. Hadi Sadat, “ Power System Analysis”, Tata McGraw-Hill
5. O.I. Elgerd, ” Electric Energy Systems Theory” , Tata McGraw-Hill
6. Stevenson W.D. and Grainger J.J., “Power System Analysis”, McGraw-Hill
7. PrabhaKundur , ” Power System Stability And Control”, Tata McGraw-Hill

Teacher Assessments:
Assessment should be based on -

1. Presentation on latest topics/Real life problems related with the subject. 05 Marks
2. MCQ test based on GATE questions. 10Marks
3. Quiz to test the theoretical knowledge gained. 05Marks

Designed By: Mrs. A. A. Bhole

EE445: Electrical Materials

(Compulsory)

(Implemented from 2015)

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

Prerequisites:

GE 142 –Engineering Physics

EE 141- Basics of Electrical Engineering

Course Objectives:

The objectives of the course are to

1. Know the fundamental science and engineering principles relevant to materials.
2. Understand the relationship between nano/microstructure, characterization, properties and processing and design of materials.
3. Have the experimental and computational skills for a professional career or graduate study in materials.
4. Possess knowledge of the significance of research, the value of continued learning and environmental/social issues surrounding materials.

Course Outcomes:

Students will be able to

1. Apply core concepts in Materials Science to solve engineering problems.
2. Be knowledgeable of contemporary issues relevant to Materials Science and Engineering.
3. Select materials for design and construction.
4. Understand the importance of life-long learning.
5. Design and conduct experiments, and to analyze data.
6. Understand the professional and ethical responsibilities of a materials scientist and engineer.
7. Work both independently and as part of a team.
8. Possess the skills and techniques necessary for modern materials engineering practice.

UNIT 1 Conductivity of Metals:

Structure of the Atom, Crystalline, Anisotropy Factors affecting the resistivity of electrical materials, Motion of an electron in an electric field, Fermi-Dirac distribution, Photo- electric emission, Superconductivity, Electrical conducting materials, Thermoelectric effects, Operation of thermo-couple.

UNIT 2 Dielectric Properties:

Effect of a dielectric on the behaviour of a capacitor, polarization, Frequency dependence of electronic polarisability, Dielectric losses, Significance of the loss tangent, Dipolar relaxation, Frequency and temperature dependence of the dielectric constant of polar dielectrics, Dielectric properties of polymeric systems, insulating materials, ferroelectricity, piezoelectricity.

UNIT 3 Magnetic properties of Materials**:**

Classification of magnetic materials, The origin of permanent magnetic dipoles, Diamagnetism, Paramagnetism, ferromagnetism, The origin of ferromagnetic dipoles, ferromagnetic domains, the

magnetic curve, Magnetization curve, the hysteresis loop, magnetostriction, factors of affecting permeability and hysteresis loss, common magnetic materials, anti-ferromagnetic , ferromagnetic, magnetic resonance

UNIT 4 Semi-conductors:

Energy bands in solids, the Einstein relation, Hall Effect, electrical conductivity of doped materials, materials for fabrication of semi-conductor devices, Measurement of electrical and magnetic properties: conductivity measurements, dielectric measurements, magnetic measurements, Measurement of semi-conductor parameters Conduction in liquids- Faraday's law of electrolysis, ionic velocities, chemical cells and concentration cells, irreversible and reversible cells, practical cell, electrolytic depositions, corrosion of metals, nature of corrosion.Optical properties of solids- Photo-emission, photo-emission materials and types of photo-cathodes, definitions of terms, electroluminescence, electroluminescent panels.

UNIT 5 Materials for electric components**:**

Introduction, resistors, capacitors, inductors, relays, Mechanical properties, the stress/strain relationship, plastic behaviour, block slip theory, hardening, ductility

TEXT AND REFERENCE BOOKS

1. Indulakar," Engineering Material", S. Chand Publications
2. M. F. Ashby, David R H Jones, "Engineering Materials".
3. Mathew Philip, William Bolton, "Technology of Engineering Materials".
4. J. A. Charles, F. A. Crane, J. A. G. Furness "Selection and use of Engineering Materials".
5. Joachim, Rosler, Harald, Harders, Martin Baker "Mechanical Behaviour of Engineering Materials"
6. Krishna Kumar Chawla, "Composite Materials: Science & Engineering

Teacher Assessments:

Assessments based on the following topics

1. Multiple choice questions 10 Marks
2. PPT presentation10 Marks
3. Quiz 05 Marks

Designed By : Mr. V. P. Dhote

EE446: Electrical Machines Analysis and Modelling

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 243- Transformers and DC Machines

EE 251- Asynchronous Machines

EE 341- Synchronous Machines

Course Objectives:

The objective of this course is to provide the students,

1. In-depth understanding of generalized machine theory which forms the basis of Machine modeling.
2. Concept of transformation of variables to develop mathematical model of machines.
3. A good initiation to develop Mathematical modeling and analysis.
4. The concepts & techniques of Speed control of electrical machines which are essential for high performance drives.
5. An in-depth exposure to the various equivalent circuits and their application to performance analysis of Electrical Machines

Course Outcomes:

At the end of the course, the student will able to:

1. Explain generalized machines theory and linear transformations as applied to Electrical machines.
2. Develop mathematical models of electrical machines.
3. Design machines and analysis of their performance as per applications.
4. Use tools like MATLAB, Simulink, and ANSYS for analysis.
5. Suggest the proper drive as per need of industrial application.

UNIT-1 Basic Principles of Electrical Machine Analysis:
Magnetically Coupled Circuits, Electromechanical Energy Conversion, Machine Windings and Air-gap MMF, Winding Inductances and Voltage equations

UNIT-2 Elementary Direct-Current Machine:
Voltage and Torque Equations in Machine Variables, Basic Types, Block Diagram, Static, Dynamic Characteristics, Linearized Machine Equations, Speed Control

UNIT-3 Reference Frame Theory:
Equations of Transformation Change of Variables, Stationary Circuit Variables Transformed to the Arbitrary Reference Frame, Commonly Used Reference Frames, Transformation between Reference Frames, Transformation of a Balanced Set, Balanced Steady State Phase Relationships, Balanced Steady State Voltage Equations, Variables Observed from Several Frames of Reference

UNIT-4 Theory of Symmetrical Induction Machines and Synchronous Machines:
Voltage Torque Equation in Machine Variables, Equations of Transformation for Rotor Circuits, Voltage Equations in Arbitrary Reference-Frame Variables, Torque Equation in Arbitrary Reference-Frame Variables, Commonly Used Reference Frames.

UNIT-5 Per Unit System:

Analysis of Steady State Operation, Free Acceleration Characteristics, Free Acceleration Characteristics Viewed from Various Reference Frames, Dynamic Performance During Sudden Changes in Load Torque, Dynamic Performance During a Three-Phase Fault at the Machine Terminals, Approximate Transient Torque Versus Rotor Angle Characteristics , Comparison of Actual and Approximate Transient Torque-Angle Characteristics during a Sudden Change in Input Torque, First Swing Transient Stability Limit, Comparison of Actual and Approximate Transient Torque-Angle Characteristics, Critical Clearing Time, Equal-Area Criterion

TEXT AND REFERENCE BOOKS

1. P.C. Krause, “Analysis of Electric Machinery”, McGraw Hill, NY, 1987
2. C.V. Jones, “The unified Theory of Electrical Machines”, Butterworth,-London, 1967
3. Stevenson, “Power System Analysis”, McGraw Hill, NY
4. DharR.N., “Computer Aided Power System Operation and Analysis”, Tata McGraw Hill
5. P.S. Bhimbra,” The Generalised Theory of Electrical Machines”, Tata McGraw Hill

Teacher Assessments:

Assessments based on the following topics,

1. MCQ 10 Marks
2. Modeling of electrical machine using MATLAB/any software 10 Marks

Designed By : Mr. P. S. Swami

EE447: Energy and Environmental Engineering

(Elective)

(Implemented from 2015)

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

Prerequisites:

GE 152- Engineering Chemistry

Course Objectives:

The objectives of the course are to

1. Discuss energy and environment issues
2. Discuss global and local environment issues
3. Urban energy planning and management
4. Discuss rural energy planning and management
5. Illustrate technological opportunities

Course Outcomes:

At the end of the course, the student will able to:

1. Feel environment policies
2. Identify global and local environment related problems
3. Develop solution for urban energy planning
4. Develop solution for rural energy planning
5. Judge various technological options

UNIT-1 Energy and Environment basic issues:
Overview of global and local energy and environment scenario and policy, Concept of energy economics, concepts of environment economics, energy-environment–economy linkages, emission assessment and policy relevance integrated assessment of energy and environment: framework and models

UNIT-2 Global and Local environmental issues:
overview of global climate changes, clean development mechanism, green buildings, Kyoto protocol, global warming, Effect of various power plants on environment, new instruments for energy and environment policies, Carbon trading

UNIT-3 Urban Energy planning and management:
Challenges faced by the urban environment, integration of conventional and renewable energy urban infrastructure, examples of cities or establishments that display sustainable urban environment and energy planning and management.

UNIT-4 Rural energy planning and management:
integration of non-conventional and renewable energy technology

UNIT-5 Technological options:
Technology, policies and measures for long –term energy and environment, renewable energy issues and policies.

TEXT AND REFERENCE BOOKS

1. B.R.Gupta, “Generation of Electrical Energy” S. Chand Publication.

2. S.Rao & Dr.B.B.Parulekar,“Energy Technology: Non-conventional, Renewable and Conventional” Khanna Publishers

3. Frank Kreith and George Burmeister, “Energy Management & Conservation” Amazon Publishers

4. Beggs and Clive, “Energy Management Supply and Conservation” Wall Mart Publishers

5. K.Bhattacharya, MHJ Bollen, J.E.Dalder, “Operation of Restructured Power System” Kluwer Academic Publications

6. Electricity Act 2003

7. Energy Conservation Act 2001

8. Bureau of Energy Efficiency India web-site http://www.bee-india.co

Teacher Assessment:-

Assessments based on the following topics,

1. Assignment 10 Marks
2. MCQ 10 Marks

Designed By : Dr. A. G. Thosar

EE448: Industrial Automation and Control

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 345- Control System-I

Course Objectives:

The objectives of the course are to

1. Describe various measurement systems using sensors
2. Explain various process control configuration
3. Illustrate various controllers used in industry
4. Explain PLC, SCADA, PDC systems
5. Describe and Illustrate valves used in Industry

Course Outcomes:

Students will be able to

1. use various sensors for measurement of physical parameters
2. analyze various control configurations used in process control
3. use controller such as P, PI, PID
4. design systems using PLC, SCADA, DDC configuration as control values for application

UNIT-1 Introduction to Industrial Automation and Control

Architecture of Industrial Automation Systems, Introduction to sensors and measurement systems, Temperature measurement, Pressure and Force measurements , Displacement and speed measurement, Flow measurement techniques, Measurement of level, humidity, pH etc., Signal Conditioning and Processing

UNIT-2 Introduction to process Control:

Evolution of Process Control Concept , Definition and Types of Processes Benefits, Difficulties and Requirements of Process Control Implementation , Classification of Process Variables, Open-loop Vs Closed Loop control, Servo Vs Regulator Operation of Closed Loop System, Feedback and Feed forward Control Configuration, Steps in Synthesis of Control System, process dynamics and Mathematical Modelling, Aspects of the process dynamics, Types of dynamic processes, Common systems, Mathematical Modelling, Cascade, Feed forward, and Ratio Control, multi loop Cascade Control, Feed forward Control, Feed forward- Feedback control configuration, Ratio Controller

UNIT-3 Type of Controllers:

Introduction, PID control, Classification of Controllers, Controller Terms, Introduction, Transfer functions of closed loop, Proportional controller in closed loop, Integral controller in closed loop, Proportional-integral controller in closed loop, Proportional-derivative controller in closed loop, Proportional-integral-derivative controller in closed loop, Integral windup and Anti-windup, Comparison of various controller configurations, Controller Tuning

UNIT-4 PLC, DCS and SCADA system:

Introduction, Basic parts of a PLC, Operation of a PLC, Basic symbols used in PLC realization, Difference between PLC and Hardwired systems, Difference between PLC and computer, Relay logic to ladder logic, Ladder commands, Examples of PLC ladder diagram realization, PLC timers, PLC counters and examples, Classification of PLCs.

History of DCS, DCS concepts, DCS hardware & software, DCS structure, Advantages and disadvantages of DCS, Representative DCS, SCADA, SCADA hardware & software,

DDC, Components and Working of DDC, Benefits of DDC, Digital controller realization, discrete domain analysis, Networking of sensors, Actuators, controllers, CANBUS, PROFIBUS AND MODBUS.

UNIT-5 Control Valves:

Introduction, Common abbreviations in the valve industry, Definitions of terms associated with valves, Control Valve characteristics, Valve classifications & types, Selection criteria for control valves, P and I diagram, Definitions of terms used in P and I diagrams, Instrument identification, Examples of P and I diagram, various automation devices used in industry, Control of Machine tools, Analysis of a control loop, Introduction to Actuators : Flow Control Valves, Hydraulic Actuator Systems : Principles, Components and Symbols, Pumps and Motors, Proportional and Servo Valves

Pneumatic Control Systems, System Components, Controllers and Integrated Control Systems, Electric Drives,Energy Saving with Adjustable Speed Drives.

TEXT AND REFERENCE BOOKS

1. DobrivojiePopovic, Vijay P.Bhatkar, “Distributed Computer Control for Industrial Automation”, Dekker Publications.
2. Webb and Reis,” Programmable Logic Controllers: Principles and Applications”, PHI.
3. S.K. Singh, “Computer Aided Process Control”, PHI
4. Garry Dunning, “Introduction to Programmable Logic Controllers”, Thomson Learning.
5. N. E. Battikha, “The Management of Control System: Justification and Technical Auditing”, ISA
6. Krishna Kant, “Computer Based Process Control”, PHI
7. Fu, Lee, Gonzalez, “Robotic Control, sensing and Intelligence”, Tata McGraw-Hill

Teacher Assessments:

Assessments based on the following topics,

1. Assignment 10 Marks
2. MCQ 10 Marks

Designed By: Dr. A. G. Thosar

EE449: HVDC Transmission Systems

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 343- Power System Analysis

EE 356- Power Electronics

Course Objectives:

The objectives of the course are to make familiar with the principle, control, design, solution and protection of HVDC systems

Course Outcomes:

Students will be able to

1. Select essential components of HVDC system.
2. Discriminate significance of HVDC over EHVAC transmission systems
3. Identify best converter topologies HVDC converters
4. Apply appropriate methods for HVDC converter control.
5. Analyse effect of faults on DC and AC side of HVDC system.
6. Analyse harmonic effect in HVDC and neighbouring system and identify protection methods.

UNIT-1 Principles of HVDC Transmission:

Terminal Equipments and Their Controls, Reactive Power Control. Analysis of HVDC Converters, Choice of Converter Configuration, Analysis of Graetz Circuit, Converters Bridge Characteristics, Twelve Pulse Converters, Detailed Analysis of Converter

UNIT-2 HVDC System Control:

DC Link Control, Converter Control Characteristics, Control of Firing Angle, Current, Extinction Angle and Power

UNIT-3 Harmonics and Filters:

Generation of Harmonics, Design of AC and DC Filters, Carrier Frequency and Rl Noise. Multi-Terminal DC Systems, Potential Applications, Types, Control and Protection

UNIT-4 Analysis of AC/DC Systems:

Converter Model and Control, Modelling of AC and DC Networks, Modelling of DC Links, Solution of DC Load Flow, Per Unit System for DC Quantities, Solution of AC - DC Power Flow

UNIT-5 Protection:

Converter Faults, Protection Against Over Currents, Over Voltages, HVDC Circuit Breakers, Protection by DC Reactors, Insulation Coordination. Earth Return: Use of Earth and Sea Return, Advantages and Problems.

Simulation of HVDC Systems**:** Digital Dynamic Simulation of Converters and DC Systems, Some Case Study of HVDC Installation.

TEXT AND REFERENCE BOOKS

1. Arillaga, High Voltage Direct Current Transmission Engineering, Peter Peregrinus Ltd.UK.
2. C.Adamson and N.G. Hingorani, High Voltage Direct Current Power Transmission, Garraway publications, 1960.
3. E. W. Kimbark, Direct Current Transmission - Vol. I & II, John Wiley & Sons.
4. K.R.Padiyar, HVDC power transmission systems - Technology and System Interactions, New Age International Ltd.
5. S. S. Rao, EHV - AC &HVDC transmission Engg, & Practice, Khanna Publishers
6. E. Uhlman, Power Transmission by Direct Current, Springer-Verlag.
7. B. J. Cory, HVDC Power Converters and Systems, Mc Donald publishers.

Teacher Assessments:

Assessments based on the following topics,

1. Multiple choice objective test, quiz 10 Marks
2. Seminar on subject related with HVDC transmission system 05 Marks
3. Design, fault analysis, harmonic analysis problem by using software like MATLAB etc. 05 Marks

Designed By : Mr. S. S. Mopari

EE450: Computer Aided Power System Analysis

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 343- Power System Analysis

Course Objectives:

The objectives of the course are to

1. Understand graph theory for power system applications.
2. Develop and solve the positive, negative and zero sequence network for a given system.
3. Recognise the common cause of faults in power system.
4. Formulate the power flow problems using load flow methods

Course Outcomes:

Students will be able to

1. Determine impedance & admittance matrix of a given system
2. Draw the sequence network for a given system
3. Estimate Fault currents under different fault conditions
4. Determine power flow for a given system
5. Apply sparse matrix techniques to solve large power systems

UNIT-1 Network Modeling:

System graph, loop, cut set and Incidence matrices, Primitive network and matrix, Formation of various network matrices by singular transformation. Bus Impedance Algorithm: Singular transformation, Direct inspection, Building Block algorithm for bus impedance matrix, Addition of links, addition of branches, (considering mutual coupling), modification of bus impedance matrix for network changes, Formation of bus admittance matrix and modification, Gauss elimination, Node elimination (Kron's reduction)

UNIT-2 Analysis of symmetrical & unsymmetrical Faults:

Shunt Faults,Shunt Fault Calculations, Series Faults, Sequence Impedances of Transmission Lines, Sequence Capacitance of Transmission Lines, Sequence Impedance of Synchronous and Induction Machines, Transformers, Three Winding Transformers

UNIT-3 Computer Solution of Power Flow Problem:

Solution using Admittance and Impedance Matrix, Comparison of Admittance and Impedance Matrix Techniques. Power-Flow Problem, Gauss-Seidal, Newton-Raphson Methods, Power Flow Studies in System Design and Operation, Decoupled Power Flow Method

UNIT-4 State Estimation:

method of least squares, statistics, errors, estimates, test for bad data, structure and formation of Hessian matrix, power system state estimation

UNIT-5 Sparse Matrix techniques for large scale power systems:
Optimal ordering schemes for preserving sparsity, Flexible packed storage scheme for storing matrix as compact arrays – Factorization by Bi-factorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

TEXT AND REFERENCE BOOKS

1. J. J. Grainger and W.D. Stevenson, "Power System Analysis", McGraw Hill, 1994
2. G.W. Stagg and A. H. EI-Abiad, "Computer methods in Power System Analysis", McGraw Hill 1968
3. I.J. Nagrath and D.P.Kothari, "Modern Power System Analysis", Tata McGraw Hill, 1980
4. G.L.Kusic, "Computer Aided Power Systems Analysis", Prentice Hall, 1986

Teacher Assessments:

Assessments based on the following topics,

1. Presentation on various topics / real life problems related with subject	05 Marks
2. MCQ test on GATE questions	10 Marks
3. Quiz to test theoretical knowledge gain	05 Marks

Designed By: Prof. A. A. Bhole

ME 455: Robotics

(Elective)

(Implemented from 2015)

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

Prerequisites:

Course Objectives:

The objectives of the course are to

Course Outcomes:

Students will be able to

UNIT-1 Introduction brief History:

Types of robots, uses of robots, Present status and future trends in robotics, Overview of robot subsystems, Issues in designing and controlling robots resolution, repeatability and accuracy, transmission, Robot configurations and concept of workspace, Mechanisms and transmission.

UNIT-2 Robot Anatomy:

End effectors and actuators Different types of grippers, vacuum and other methods of gripping, Pneumatic, hydraulic and electric actuators

UNIT-3 Robot Anatomy: Sensors and controllers

Internal and external sensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder, camera. Micro-controllers, DSP, centralized controllers, real time operating systems.

Task specification, Point to point and continuous motion specifications for typical applications, joint interpolation, task space interpolation, executing user specified tasks

UNIT-4 Robot analysis:

Position and orientation of rigid bodies, spatial mechanism description, Denavit-Hartenberg notation, homogenous transformation, Forward and inverse position analysis, velocity mapping, static force analysis, singularities, acceleration mapping, Robot control, Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, issues in nonlinear control, force feedback, hybrid control , Motion planning, Obstacle avoidance, configuration space, road map methods, graph search algorithms, potential field methods

UNIT-5 Robot vision:

Camera model and perspective transformation, image processing fundamentals for robotic applications, image acquisition and pre-processing, Segmentation and region characterization, object recognition by image matching and based on features, Problem of bin-picking., Futuristic topics in Robotics, Micro-robotics and MEMS (Micro electro

mechanical systems), Fabrication technology for micro-robotics, stability issues in legged robots, under-actuated manipulators
Case studies1. Robot in assembly (Puma) 2. Mobile robot (Nataraj)

TEXT AND REFERENCE BOOKS

1. Robotics: Discover the Science & Technology of the Future by Kathy Ceceri and Sam Carbaugh
2. Introduction to Robotics: Analysis, Control, Applications, 2nd Edition, by Saeed B. Niku, WILEY INDIA PVT. LTD.-NEW DELHI

Teacher Assessments:

Assessments based on the following topics,

1. Assignment 10 Marks
2. MCQ 10 Marks

Designed By: Dr. A. G. Thosar

EE451: Illumination Engineering

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 346- Utilization of Electrical Energy

Course Objectives:

The objectives of the course are to

1. To explain how light bulbs can transfer energy and the concepts behind different light bulb technologies, and to use ideas about reflection to design a flood light reflector.
2. To evaluate the impact of different technologies on society and different technological approaches to a challenge.
3. To conduct cost benefit analysis and evaluate different solutions using set criteria.
4. Students will be able to compare the relative proportions of light and heat released by different types of bulbs.
5. To design lighting scheme for indoor and outdoor

Course Outcomes:

Students will be able to

1. Students will have analyzed two different sorts of bulb in terms of how they work and how Energy efficient they are.
2. Students will have used ideas about reflectors to design and test one of their own to meet a particular brief.
3. Students will have decided how to apply multiple success criteria.
4. Students understand how the efficiency of the bulbs compare.
5. Students will be able to calculate efficiency of a system and explain its significance.

UNIT-1 Importance of Lighting in Human Life:

Optical systems of human eye ,Dependence of human activities on light, performance characteristics of human visual system, Artificial lighting as substitute to natural light, Ability to control natural light,

Construction and working principles of spectroradiometer, spectrophotometer and colorimeter. Retro reflection& its application.

Colorimetry-Different colour specification systems and their limitations. Measurement of CRI, CRI of radiation due to multiple sources. Pigment colour and mixing of pigments in paint industries.

UNIT-2 Light Source:

Lamp materials: Filament, glass, ceramics, gases, phosphors and other metals and non-metals.Solid Sodium Argon Neon lamps, SOX lamps, Electro luminescent lamps, LEDs characteristics, features and applications, LASERS, characteristics, features and applications, non-lighting lamps, Induction lamps. Optical fiber, its construction as a light guide, features and applications.

UNIT-3 Photometric Control of Light Sources and their Quantification**:**
Luminaries design considerations, optical control schemes, design procedure of reflecting and refracting type of luminaries. Lighting Fixture types, use of reflectors and refractors, physical protection of lighting fixtures, types of lighting fixtures according to installation type, types of lighting fixtures according to photometric usages, ingress protection code, and luminary's standard. Indian standard recommendations.

UNIT-4 Factors of Good Lighting Design:
Indoor Lighting Design: Zonal cavity method for general lighting design, coefficient ofUtilization determination for zonal cavities and different shaped ceilings. Using COU (coefficient of utilization), using beam angles and polar diagrams, glare calculations. Typical applications: office, educational facility, theatre, residential, hospital. Indian Standard recommendation for indoor lighting, selection criteria for selection of lamps and luminaries, design consideration and design procedure. (Problems on COV, beam angles and polar diagrams).
Designing problem and solution and designing documentation. Exterior lighting system-Road lighting system and highway lightingSystem.

UNIT-5 Outdoor Lighting Design**:**
Road classifications according to BIS, pole arrangement,
terminology, lamp and luminaries selection, different design procedures, beam lumen method, point by point method, isolux diagram, problems on point by point method.
Energy Efficient Lighting-Comparison between different light sources, comparison between different control gears, overcoming problems in energy efficient lighting, payback calculation, life cycle costing, (problems on payback calculations, life cycle costing).
Solar Lighting-Day Lighting, Photovoltaic Lighting
Emergency Lighting:-Central Systems, Standalone systems
Cold Lighting-Concept, Method of generation – Optical Fiber cable (OFC), filters, Application

TEXT AND REFERENCE BOOKS

1. H. S. Mamak, "Book on Lighting", Publisher International lighting Academy
2. Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to Lasers"
3. M. A. Cayless, A. M. Marsden, "Lamps and Lighting"
4. "BIS, IEC Standards for Lamps, Lighting Fixtures and Lighting", ManakBhavan, New Delhi
5. D. C. Pritchard, "Lighting", 4th Edition, Longman Scientific and Technical, ISBN 0-582-23422-0
6. Elmer, "Design of Reflectors"
7. "IES Lighting Handbook", (Reference Volume 1984), Illuminating Engineering Society of North America
8. "IES Lighting Handbook", (Application Volume 1987), Illuminating Engineering Society of North America

Teacher Assessments:

Assessments based on the following methods,

1. MCQ	05 Marks
2. Design of illumination scheme (Report)	10 Marks
3. PPT presentation	05 Marks

Designed By: Mr. P. S. swami

EE452: Project Management

(Elective)

(Implemented from 2015)

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

Prerequisites:

Course Objectives:

The objectives of the course are to

Course Outcomes:

Students will be able to

UNIT-1 Project Management:
An Overview Project selection, Project Identification and Screening,

UNIT-2 Project Planning:
Development of Project Network, Project Representation, Consistency and Redundancy in Project Networks

UNIT-3 Project Scheduling:
Basic Scheduling with A-O-A Networks, Basic Scheduling with A-O-N Networks, Project Scheduling with Probabilistic Activity Times

UNIT-4 Time / Cost Tradeoffs in Projects:
Linear Time-Cost Tradeoffs in Projects: A Heuristic Approach, Resource Considerations in Projects, Resource Profiles and leveling, Limited Resource Allocation

UNIT-5 Project implementation:
Project Monitoring and Control with PERT / Cost, Team Building and Leadership in Projects, Project Completion, Review and Future Directions

TEXT AND REFERENCE BOOKS

1. Project Management by Panneerselvam R. , Senthil Kumar P.phi publications
2. Making Things Happen: Mastering Project Management by Scott Berkun

Assessments

Assessments based on the following topics,

1. Assignment	10 Marks
2. MCQ	10 Marks

EE 453: Artificial Intelligence
(Elective)
(Implemented from 2015)

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

Prerequisites:

Course Objectives:
The objectives of the course are to

Course Outcomes:
Students will be able to

UNIT-1 Biological foundations to intelligent systems I:

Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

UNIT-2 Biological foundations to intelligent systems II:
Fuzzy logic, knowledge representation and inference mechanism

UNIT-3 Genetic algorithm

UNIT-4 Fuzzy neural networks

UNIT-5 Fuzzy and expert control standard, Takagi-Sugeno, mathematical characterizations, design example

TEXT AND REFERENCE BOOKS

1. Intelligent Systems and Control: Principles and Applications by LaxmidharBehera, IndraniKar, oxford publications
2. Intelligent Control Systems Using Soft Computing Methodologies by Ali Zilouchian, Mo Jamshidi

Teacher Assessments:
Assessments based on the following topics,

1. Assignment 10 Marks
2. MCQ 10 Marks

Designed By : Dr. A. G. Thosar

EE454: Solar Thermal and PV Technology

(Elective)

(Implemented from 2015)

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

EE 356- Power Electronics

Course Objectives:

To familiarize students with the characteristics of solar radiation, its global distribution, and conversion methods of solar energy to heat and power

Course Outcomes:

Upon successful completion of the course the students will be able to understand and apply

1. The characteristics and world distribution of solar radiation.
2. The solar radiation and measurement techniques.
3. The methods of calculation of solar radiation availability at a given location.
4. The fundamentals of thermal and direct conversion of solar energy to power.

UNIT-1 Introduction to Solar Energy Historical Perspective:
Energy Use in the India, Solar Energy; Obstacles and Outlook The Solar Spectrum, The Earth's Orbit, Altitude Angle of the Sun at Solar Noon, Solar Position at Any Time of Day, Sun Path Diagrams for Shading Analysis, Solar Time and Civil (Clock) Time, Sunrise and Sunset, Clear Sky Direct-Beam Radiation, Solar Radiation Measurements, Average Monthly Insolation

UNIT-2 PN junction solar cell generation of photo voltage:
Light generated current, I-V equation of solar cell Solar cell characteristics, cell parameters short circuit current, open circuit voltage, fill factor, efficiency. The PV I–V Curve under Standard Test Conditions (STC), Impacts of Temperature and Insolation on I – V Curves, Shading Impacts on I–V Curves

UNIT-3 Crystalline Silicon Technologies:
Thin-Film Photovoltaic Generic advantages of thin film technologies, materials for thin film technologies, common features of thin film technologies, amorphous Si solar cell, Cadmium Telluride solar cell, Current–Voltage Curves for Loads,

UNIT-4 Concentrator PV Cell systems:
optics for concentrator-trough concentrator modules, compound parabolic trough concentrator, parabolic reflector, Fresnell'slenses concentrator, tracking requirements of CPV Grid-Connected Systems, Grid-Connected PV System Economics, Stand-Alone PV Systems, PV-Powered Water Pumping

UNIT-5 Devices for thermal collection and storage:
Liquid flat plate collectors, Solar air heaters, central receiver collector,solar pond, Solar distillation

TEXT AND REFERENCE BOOKS

1. Renewable and Efficient Electric Power Systems, Gilbert M. Masters, Wiley Interscience publication
2. Solar Photovoltaics' Fundamentals, Technologies and Applications, Chetan Singh Solanki, Second edition, PHI Publication
3. "Principle of Solar Engineering" by D. Yogi Goswami, Frank Kreith and Jan F. Kreider, 2nd ed. Taylor & Francis, 2000, ISBN-10: 1-56032-714-6, ISBN -13:978-156032-714-1
4. Power Generation Renewables by PEP (Professional Engineering Publishers) Wiley publications
5. "Modeling Daylight Availability and Irradiance Components from Direct and Global Irradiance" by R. Perez, P. Ineichen, R. Seals, J. Michalsky and R. Stewart, Solar Energy 44 (5) pp. 271-289
6. Solar Energy principles of thermal collection and storage, S.P.Sukhatme& J.K.Nayak Third edition Tata McGraw Hill publication

Teacher Assessments:

Assessments based on the following topics,

Policy initiatives regarding solar, Concerns about Global Warming, visits to installed sites, working Models of tracking system, Numerical from exercise

Designed By : Mr. S. M. Shinde

EE456: Lab Advanced Microprocessors and Microcontrollers

(Compulsory)

(Implemented from 2015)

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

Term Work:

The term-work shall consist of a record of minimum eight experiments from the following list

1. To perform an experiment to study of 8086 Microprocessor Kit
2. To perform an experiment to Execution of simple programs (Data transfer, arithmetic, logical operations)
3. To perform an experiment to Interfacing of 8255 to 8086
4. To perform an experiment to Interfacing of LED, LCD display to 8086
5. To perform an experiment to Interfacing of 8259 to 8086
6. To perform an experiment to Study of 8051 Microcontroller.
7. To perform an experiment to Interfacing of 8255 to 8051.
8. To perform an experiment to Interfacing of LED, LCD display to 8051
9. To perform an experiment to Interfacing of stepper motor to 8051
10. To perform an experiment to Interfacing of ADC/DAC to 8051

Designed By: Mrs. S. S. Kulkarni

EE457: Lab Electrical Drives

(Compulsory)

(Implemented from 2015)

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

Term Work:

The term-work shall consist of a record of six experiments from the following list.

1. Three experiments based on study and / or simulation of electric drives (mentioned in the syllabus) using MATLAB/SIMULINK/PSPICE
2. Study of DC motor control
3. Study of V/F induction motor control
4. Study of vector control of induction motor
5. Study of synchronous motor drive
6. Study of brushless motor drive

Designed By: Mr. S. S. Dhamse

EE458: LabEnergy
(Compulsory)
(Implemented from 2015)

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

Term Work:

EE459: Project Phase I

(Compulsory)

(Implemented from 2015)

Teaching Scheme		**Evaluation Scheme**	
Practical	04Hrs/Week	Term work	75 Marks
Total Credits	01		

Term Work:

Students should give the seminar on the project topics

EE460:In plant Training Seminar

(Compulsory)

(Implemented from 2015)

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

Term Work:

SEMESTER II

EE461: Digital Signal Processing

(Compulsory)

(Implemented from 2015)

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

Prerequisites:

EE244-Network Analysis
EE 251-Asynchronous Machines
EE 354-Control Systems II

Course Objectives:

The objectives of the course areto

1. Introduce the basic concepts and techniques for processing signals on a computer.
2. Be familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
3. Emphasizes intuitive understanding and practical implementations of the theoretical concepts.

Course Outcomes:

Students will be able to:

1. Plot discrete-time signals, evaluate their energy and power, check for periodicity, and evaluate the period of a signal.
2. Identity properties of discrete-time systems such as time-invariance, stability, causality, and linearity.
3. Draw block diagrams of discrete-time systems.
4. Compute the linear and circular convolutions of discrete-time sequences
5. Evaluate the discrete-time Fourier transform (DTFT) of a sequence.
6. Understand the Transform domain and its significance and problems related to computational complexity.
7. Specify and design any digital filters using MATLAB.

UNIT-1 Signals and Signal Processing**:**

Characterization and Classification of Signals, Typical Signal Processing Operations, Examples of Typical Signals, Typical Signal Processing Applications, Why Digital Signal Processing.

Discrete-Time Signals and Systems in the Time-Domain**:** Discrete-Time Signals, Typical Sequences and Sequence Representation, the Sampling Process, Discrete-Time Systems, Time-Domain Characterization of LTI Discrete-Time Systems, Finite-Dimensional LTI Discrete-Time Systems, Correlation of Signals, Random Signals.

UNIT-2 Transform-Domain Representations of Discrete-Time Signals:

The Discrete-Time Fourier Transform, Discrete Fourier Transform, Relation Between the DTFT and the DFT, and Their Inverses, Discrete Fourier Transform Properties, Computation of the DFT of Real, Sequences, Linear Convolution Using the DFT, The z-Transform, Region of Convergence of a Rational z-Transform, The Inverse z-Transform, z-Transform Properties, Transform-Domain Representations of Random Signals

LTI Discrete-Time Systems in the Transform-Domain**:**

Finite-Dimensional LTI Discrete-Time Systems, The Frequency Response, The Transfer Function, Types of Transfer Functions, Simple Digital Filters, All-pass Transfer Function,

Minimum-Phase and Maximum-Phase Transfer Functions, Complementary Transfer Functions, Inverse Systems, System Identification, Digital Two-Pairs, Algebraic Stability Test, Discrete-Time Processing of Random Signals, Matched Filter.

UNIT-3 Digital Processing of Continuous-Time Signals:
Introduction, Sampling of Continuous-Time Signals, Sampling of Band pass Signals, AnalogLow pass Filter Design, Design of AnalogHigh pass, Band pass, and Band stop Filters, Anti-Aliasing Filter, Design of Sample-and-Hold Circuit, Analog-to-Digital Converter, Digital-to-Analog Converter, Reconstruction Filter Design, Effect of Sample-and-Hold Operation.

UNIT-4 Digital Filter Structures:
Block Diagram Representation, Equivalent Structures, Basic FIR Digital Filter Structures, Basic IIR Filter Structures, Realization of Basic Structures using MATLAB, All pass Filters, TunableIIR Digital Filters, IIR Tapped Cascaded Lattice Structures, FIR Cascaded Lattice Structures, Parallel All pass Realization of IIR Transfer Functions, Digital Sine-Cosine Generator.

UNIT-5 Digital Filter Design:
Preliminary Considerations, Bilinear Transform Method of IIR Filter Design, Design of Low pass IIR Digital Filters, Design of High pass, Band pass, and BandstopIIR Digital Filters, Spectral Transformations of IIR Filters, FIR Filter Design Based on Windowed Fourier Series, Computer-Aided Design of Digital Filters, Design of FIR Filters with Least-Mean-Square Error, Digital Filter Design Using MATLAB,
Applications of Digital Signal Processing- Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non-stationary Signals, Spectral Analysis of Random Signals.

TEXT AND REFERENCE BOOKS

1. Proakis, “Digital Signal Processing”, Pearson Education Limited
2. R. Babu. , “Digital Signal Processing”, Laxmi Publication Ltd.
3. Oppenheim and Schafer, “Discrete-Time Signal Processing”, Prentice-Hall, 1989.
4. A. Ambardar, “Digital Signal Processing: A Modern Introduction”, Penram International Publishing (India) Pvt. Ltd.
5. Rabiner, R. Lawrence, “Theory and Application of Digital Signal Processing”, Gold, Bernard, Prentice-Hall

Teacher Assessments:

Assessments should be based on,

1) Multiple choice question 05 Marks
2) Matlab based assignment projects requiring some independent reading, Programming, simulations and technical writing –10 Marks
3) PPT presentation - 05 Marks

Designed By: Mr.V.P.Dhote

EE462: High Voltage Engineering

(Compulsory)

(Implemented from 2015)

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

Prerequisites:

EE 246-Generation, transmission and distribution of electric Power

EE353-Switchgear and Protection

Course Objectives:

The objectives of the course are to

1. develop an understanding of breakdown phenomenon in case of solid, liquid and gaseous insulating medium
2. develop familiarity with various methods of generation of high voltages
3. develop familiarity with various methods of measurement of high voltages
4. develop an understanding of over voltage phenomenon & concepts of insulation coordination
5. develop an understanding of importance of testing of power apparatus
6. develop an understanding of safety practices in laboratories

Course Outcomes:

Students will be able to

1. decide the suitability of various insulating materials for power systemapplications
2. understand the breakdown phenomenon in case of various insulating materials
3. understand the concepts of generation of high voltages & currents
4. understand the causes and protection from over-voltages and the concept of insulation coordination
5. explain the direct and indirect testing methods
6. exhibit safe working practices in laboratory

UNIT-1 Conduction & break down in gases:
Ionization process & current growth, Townsend's criterion for break down, Determination of alpha & gamma co-efficient, Streamer theory of break down in gases, Paschen's law, Breakdown in non-uniform field & corona discharge, Conduction & break down in pure liquid & commercial liquid, Breakdown in solid dielectrics

UNIT-2 Generation of high voltage& currents:
Generation of high d. c. voltages, High alternating voltages & impulse voltages, Generation of impulse currents

UNIT-3 Measurement of high voltages & currents:
Measurement of high direct current voltages, High alternating voltages, & impulse voltages, Measurement of high direct currents, High alternating currents & high impulse currents, Dielectric loss & partial discharge measurements

UNIT-4 Over voltage phenomenon & insulation co-ordination:
Natural causes for over voltages, lightning phenomenon, over voltages due to switching surges, system faults & other abnormal conditions, principles of insulation co-ordination on high voltage & extra high voltage power systems

UNIT-5 High voltage testing of power apparatus

TEXT AND REFERENCE BOOKS

1. M. S. Naidu , V. Kamaraju, “High Voltage Engineering” , Tata McGraw –Hill publications
2. E. kuffel, W.S. Zaengl, J. Kuffel, “High Voltage Engineering fundamentals”, Butterworth – Heinemann publishers
3. D. kind, K. Feser, “High Voltage Test Techniques”, Viewer/ SBA publications
4. M. Khalifa, “High Voltage Engineering- Theory & Practices”, Dekker publications

Teacher Assessments:

Assessments based on -

1. Assignments expecting calculations of Townsend’s coefficients, analysis of impulse generator *etc.* and subjective questions 10 Marks
2. Assignments consisting questions based on indirect testing methods and concepts of overvoltage-causes and protection 05 Marks
3. Quizzes 05Marks

Designed By : Dr. V. A. Kulkarni

EE463: Industrial Organization and Management

(Compulsory)

(Implemented from 2015)

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

Prerequisites:

EE343-Power System Analysis

Course Objectives:

1. Students are able to understand the concepts of difference between management, administration and organization and its levels of management
2. Students are able to understand concepts of different types of industrial ownerships and rules and regulation of acts related to industrial ownership
3. Understand the function of management like, planning, forecasting, decision making and industrial safety
4. Able to improve different types of costing and depreciation
5. Able to understand concepts of replacement equipment, machineries with economic justification

Course Outcomes:

1. Capable to plan and administrate the organization
2. Capable to understand the types of industrial ownership and methods of fund generation for industries establishment
3. Capable to understand the different functions of management
4. Capable to calculate the cost, price and value of product and depreciation
5. Capable to decide reasons for replacement and effects of replacement of machine, equipment's in terms of profit/loan

UNIT-1 Theories of Management:

Scientific Management (Taylor and the Scientific Management Movement), Classical Theory (Fayol, Urwick, Gulick and others) Bureaucratic Theory (Weber and his critics). Ideas of Mary Parker Follett and C.I. Barnard; Human Relations School (Elton Mayo and others). Behavioral Approach, Systems approach.

UNIT-2 Administrative Behavior:

Decision making with special reference to H. Simon, communication and control, leadership theories. Theories of motivation (Maslow and Herzberg)

UNIT-3 Organization:

Hierarchy, Principles of organization- Unity of command, Span of control, Authority and Responsibility, Co-ordination, Centralization and Decentralization, Delegation, Supervision, Types of organizations, structures

UNIT-4 Personnel Administration:
Position classification, Recruitment, Training, Promotion, Pay and Service conditions, Administrative Ethics

UNIT-5 Administrative Systems:
Comparative management features of USA, Great Britain, France and Japan (Riggs concept)

TEXT AND REFERENCE BOOKS

1. O. P. Khanna, "Industrial Organization and Management, Khanna Publications
2. D. Ravindra Prasad and V. S. Prasad, Admistrative Thinkers, Sterling Publishers, New Delhi
3. Paul Hersey, Management of organisation behavior, Pearson Prentice Hall
4. D. Gvishiyani, Organisation and Management, Progress Publishers, Moscow

Teacher Assessments:

Assessments should be based ontopics such as

1. Assignment 10 Marks
2. MCQ 10 Marks
3. PPT 05 Marks

Designed By : Mr. U.V. Hambire

EE464: Electrical Materials

(Compulsory)

(Implemented from 2015)

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

Prerequisites:

GE 142 –Engineering Physics

EE 141- Basics of Electrical Engineering

Course Objectives:

The objectives of the course are to

5. Know the fundamental science and engineering principles relevant to materials.
6. Understand the relationship between nano/microstructure, characterization, properties and processing and design of materials.
7. Have the experimental and computational skills for a professional career or graduate study in materials.
8. Possess knowledge of the significance of research, the value of continued learning and environmental/social issues surrounding materials.

Course Outcomes:

Students will be able to

9. Apply core concepts in Materials Science to solve engineering problems.
10. Be knowledgeable of contemporary issues relevant to Materials Science and Engineering.
11. Select materials for design and construction.
12. Understand the importance of life-long learning.
13. Design and conduct experiments, and to analyze data.
14. Understand the professional and ethical responsibilities of a materials scientist and engineer.
15. Work both independently and as part of a team.
16. Possess the skills and techniques necessary for modern materials engineering practice.

UNIT 1 Conductivity of Metals:

Structure of the Atom, Crystalline, Anisotropy Factors affecting the resistivity of electrical materials, Motion of an electron in an electric field, Fermi-Dirac distribution, Photo- electric emission, Superconductivity, Electrical conducting materials, Thermoelectric effects, Operation of thermo-couple.

UNIT 2 Dielectric Properties:

Effect of a dielectric on the behaviour of a capacitor, polarization, Frequency dependence of electronic polarisability, Dielectric losses, Significance of the loss tangent, Dipolar relaxation, Frequency and temperature dependence of the dielectric constant of polar dielectrics, Dielectric properties of polymeric systems, insulating materials, ferroelectricity, piezoelectricity.

UNIT 3 Magnetic properties of Materials**:**

Classification of magnetic materials, The origin of permanent magnetic dipoles, Diamagnetism, Paramagnetism, ferromagnetism, The origin of ferromagnetic dipoles, ferromagnetic domains, the magnetic curve, Magnetization curve, the hysteresis loop, magnetostriction, factors of affecting permeability and hysteresis loss, common magnetic materials, anti-ferromagnetic , ferromagnetic, magnetic resonance

UNIT 4 Semi-conductors:

Energy bands in solids, the Einstein relation, Hall Effect, electrical conductivity of doped materials, materials for fabrication of semi-conductor devices, Measurement of electrical and magnetic properties: conductivity measurements, dielectric measurements, magnetic measurements, Measurement of semi-conductor parameters Conduction in liquids- Faraday's law of electrolysis, ionic velocities, chemical cells and concentration cells, irreversible and reversible cells, practical cell, electrolytic depositions, corrosion of metals, nature of corrosion.Optical properties of solids- Photo-emission, photo-emission materials and types of photo-cathodes, definitions of terms, electroluminescence, electroluminescent panels.

UNIT 5 Materials for electric components**:**

Introduction, resistors, capacitors, inductors, relays, Mechanical properties, the stress/strain relationship, plastic behaviour, block slip theory, hardening, ductility

TEXT AND REFERENCE BOOKS

1. Indulakar," Engineering Material", S. Chand Publications
2. M. F. Ashby, David R H Jones, "Engineering Materials".
3. Mathew Philip, William Bolton, "Technology of Engineering Materials".
4. J. A. Charles, F. A. Crane, J. A. G. Furness "Selection and use of Engineering Materials".
5. Joachim, Rosler, Harald, Harders, Martin Baker "Mechanical Behaviour of Engineering Materials"
6. Krishna Kumar Chawla, "Composite Materials: Science & Engineering

Teacher Assessments:

Assessments based on the following topics

1. Multiple choice questions	10 Marks
2. PPT presentation	10 Marks
3. Quiz	05 Marks

Designed By: Mr. V. P. Dhote

EE465: Flexible A.C. Transmission Systems

(Elective)

(Implemented from 2015)

Teaching Scheme		**Evaluation Scheme**	
Lectures	03Hrs/Week	Test	20 Marks
Total Credits	03	Teacher Assessment	20 Marks
		Total	60 Marks

Prerequisites:

EE246- Generation, transmission and distribution of electric Power
EE 343- Power System Analysis
EE 356- Power Electronics
EE 345- Control Systems I

Course Objectives:

The objectives of the course are to

1. Explain various types of FACT controller
2. Discuss series compensation to power system
3. Discuss shunt compensation to power system
4. Illustrate appropriate power devices and converter topologies for implementation of FACTS controller
5. Explain combined controllers such as UPFC, IPFC

Course Outcomes:

Students will be able to

1. Compare various types of facts controller
2. Apply shunt compensation
3. Apply series compensation
4. Apply combined compensation
5. Apply static voltage and phase angle regulator

UNIT-1 FACTS Concepts:
Flow of Powers in AC System, Dynamic Stability Consideration of Transmission Interconnection, Relative Importance of Controllable Parameters, FACTS Controllers

UNIT-2 Static Shunt Compensator:
Methods of Controllable VAR Generation, Static VAR Compensators, Static VAR Systems

UNIT-3 Static Series Compensator:
Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators, External Control for Series Reactive Compensators

UNIT-4 Combined Compensators:
Unified Power Flow Controller, Interline Power Flow Controller, Generalized and Multifunctional FACTS Controllers

UNIT-5 Static Voltage and Phase Angle Regulators:
TCVR and TCPAR, Objectives of voltage and phase angle regulators, Approaches to Thyristor-controlled voltage and phase angle regulators (TCVRs and TCPARs), switching converter based voltage and phase angle regulators, Hybrid phase angle regulators.
Special Purpose FACTs controllers: NGH-SSR damping scheme and thyristor-controlled

braking resistor, sub synchronous resonance, NGH-SSR damping scheme, Thyristor-controlled braking resistor (TCBR), Application Examples

TEXT AND REFERENCE BOOKS

1. N.G. Hingorani, ”Understanding FACTS”, IEEE Press, 1999
2. Yang hue song, “Flexible AC Transmission Systems (FACTS)”, IEEE Press, 1999)

Teacher Assessments:

Assessments will be based on following,

1. Assignment	10 Marks
2. MCQ	10 Marks

Designed By : Dr. A. G. Thosar

EE466: Biomedical Engineering

(Elective)

(Implemented from 2015)

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

Prerequisites:

Course Objective:

The objectives of the course are to

Course Outcomes:

Students will be able to

UNIT-1 Introduction:

Biomedical instrumentation, Introduction to human body systems, Cell, Electrophysiology, Biomedical signals and their ratings and features, The body as a control system.

Electrodes and Transducers for Biomedical measurements-Electrodes for Biophysical sensing, Electrode model circuit, Medical surface electrodes, Microelectrodes, Cup electrodes, Disposable electrodes, Transducers used in Biomedical Instrumentation.

UNIT-2 Bioelectric Amplifiers:

Operational amplifiers, High-impedance PH probe amplifier, Balanced piezoelectric infrared (heat) detector, Circuit for driving large capacitive loads, Low-droop positive peak detector, Multiple input amplifier, Differential amplifier, Instrumentation amplifier with NPN and FET inputs, PH probe electrometer instrumentation amplifier, Bridge amplifier, load cell weighing scale instrumentation amplifier, Input protection circuit, signal processing circuits, Offset null methods, Auto-zero amplifier, Isolation amplifier, Reduction of interference in an isolation amplifier (IA), Comparison of CMRR and IMRR(Isolation-mode rejection ratio), Carrier-type isolation amplifier, synchronous demodulator, Optically coupled circuits, Current-loading type of IA, Differential-capacitive IA, Fiber optic IA using voltage- to- frequency Converter, Right-leg-driven ECG amplifier with defibrillator protection and calibrator, Isolation power line monitor, Thermocouple amplifier with grounded loop elimination chopper stabilized amplifier, Input guarding, current source using voltage reference and op-amp.

UNIT-3 Electrographs:

The heart as a potential source, the ECG waveform, standard lead system, ECG preamplifier, Defibrillator protection circuit, Electro surgery unit interference filter, multichannel physiological monitoring system, five patient electrode (6-lead) ECG system, QRS and pacer pulse detector system, ECG machine mechanism, patient cables, ECG machine maintenance, ECG faults and trouble shooting.

UNIT-4 Other Cardiovascular Measurements:

Cardiac output measurement, Dilution methods, Input circuit for a thermo dilution cardiac output computer, Right side heart pressures, Plethysmography, Blood flow measurements, phonocardiography, Vectorcardiogaphy (VCG).

Cardiac stimulation and life support equipments-Defibrillator, Defibrillator circuits,Testing Defibrillators, Pacemakers. Heart lung machines, Audiometers, Hearing aids, EMG, Artificial kidney, endoscope, Different therapeutic instruments (electronic pain killer,

ultrasound therapy).

UNIT-5 Respiratory system**:**

Human respiratory system, Gas laws, internal (cellular) respiration, External (Lung) respiration, Organs of respiration, Mechanics of breathing, parameters of respiration, regulation of respiration, Unbalanced and diseased stages, Major measurements of pulmonary functions, Respiratory Instrumentation: Respiratory transducers and instruments, Spiro meters, Respiratory therapy equipment, oxygen therapy, artificial mechanical ventilator.

Instrumentation for measuring Brain parameters-Organization of the nervous system, the neuron, cerebral angiography, computerized axial tomography (CAT),EEG,EEG electrodes and the 10-20 system, EEG amplitude and frequency bands, EEG diagnostic uses, EEG amplifiers, EEG telemetry systems.

Medical laboratory Instrumentation-Blood components, Blood tests, colorimeter, plane photometer, spectrophotometer, Blood cell counter, PH/ Blood Gas analyzers, chromatograph, auto analyzer, medical ultrasound, endoencephelograph, Echo cardiograph, Fetal meter, Doppler flow detector.

Radiology and nuclear Medicine equipments-Physics of sound waves, Ultrasound energy, ultrasound transducer, Types and uses of X-Ray and Nuclear Medicine equipments. Generation of X-Ray in an X-Ray tube, Block diagram and operation of X-Ray machine.

Electrical safety in the Medical environment**-**Definition of electrical safety, Macro shock, Design considerations for reducing electric hazards, Line isolation system, Equipotential grounding systems, Ground fault interrupters, Electric safety test equipments.

TEXT AND REFERENCE BOOKS

1. Joseph J. Carr and John M. Brown, " Biomedical Instrumentation"
2. R.S. Khandpur, "Handbook of Biomedical Instrumentation"
3. Leslie Cromwell and Weibell ,"Biomedical Instrumentation and Measurements"
4. B.H. Brown and R.A. Smallwood, "Medical physics and physiological measurements"

Teacher Assessments:

Assessments will be based on following,

1. Assignment 10 Marks
2. MCQ 10 Marks

Designed By : Mrs..S. S. Kulkarni

EE467: Communication Engineering

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 244-Network analysis

EE 253-Electronic devices and circuit

Course Objectives:

The objectives of the course are to

1. Modern Communication and information system
2. Acquire knowledge of worldwide information services

Course Outcomes:

Students will be able to

1 .Learn and understand Modern Communication and information system

2. Develop and design information systems

UNIT-1 Introduction of Signal Transmission and Filtering:
Elements and Limitations of Communications Systems, Information, Messages, and Signals, Modulation and Coding, Modulation Methods, Modulation Benefits and Applications Coding Methods and Benefits, Response of LTI Systems, Signal Distortion in Transmission, Distortionless Transmission, Linear Distortion Equalization Nonlinear Distortion and Commanding Transmission Loss and Decibels Power Gain Transmission Loss and Repeaters, Filters and its types, Correlation and Spectral Density, Correlation of Power Signals, Co-relation of Energy Signals Spectral Density Functions

UNIT-2 Linear CW Modulation:
Band pass Signals and Systems Analog Message Conventions, Band pass Transmission Double-Sideband Amplitude Modulation AM Signals and Spectra DSB Signals and Spectra Tone Modulation and Amplitude Modulation.

UNIT-3 Exponential CW Modulation:
Phase and Frequency Modulation, PM and FM signals, Transmission Bandwidth and Distortion Transmission Bandwidth Estimates, Linear Distortion, Nonlinear Distortion and Limiters Generation and Detection of FM and PM Phase Modulators and Indirect FM Triangular-Wave FM Frequency Detection Interference Interfering.

UNIT-4 Sampling and Pulse Modulation:
Sampling Theory and Practice Chopper Sampling Ideal Sampling and Reconstruction Practical Sampling and Aliasing Pulse- Amplitude Modulation Flat-Top Sampling and PAM Pulse-Time Modulation Pulse-Duration and Pulse-Position Modulation PPM Spectral Analysis.

UNIT-5 Analog Communication Systems**:**
Receivers for CW Modulation Super heterodyne Receivers Direct Conversion Receivers Special-Purpose Receivers Receiver Specifications Scanning Spectrum Analyzers Multiplexing Systems Time-Division PLL Operation Detection and Frequency Synthesizers Linearized PLL Models and FM Detection Television Systems Video Signals, Resolution,

and Bandwidth Monochrome Transmitters and Receivers Color Television HDTV Introduction, Working of Telephone exchange, Types of Telephone exchanges, advances in telephony.

TEXT AND REFERENCE BOOKS

1. A. Bruce Carlson, “Communication systems”, 4/e, McGraw Hill, 2001
2. H. Taub, D. Schilling, “Principles of Communication systems”, TMH, Second Edition
3. Simon Haykin, “Communication systems”, 4/e. John Wiley, 2001
4. G. Kennedy, “Electronic Communication Systems”, McGraw Hill.
5. D. Roddy and J. Coolen, “Electronic Communication”, PHI Publication

Teacher Assessments:

Assessments based on,

1. Assessment of report based on visit of information system/ network/EPBX system 10 Marks
2. Designing of Prototype Model of network system 10 Marks

Designed By : Mrs. S. S. Kulkarni

EE468: Reliability and Condition Monitoring

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 345- Control System I

GE 241- Engineering Mathematics

CourseObjective:

The objectives of the course are to

1. To Know engineering system monitoring and fault diagnosis and explains the basic concepts of condition monitoring.
2. To know how modern technology, quality control and environmental issues have affected current thinking.
3. To protect themselves and others in the workplace and focuses on the safety measures needed when carrying out monitoring activities, especially those for isolating equipment.
4. To Know how to use a range of condition monitoring equipment and will develop the skills and knowledge required for the location and identification of faults in engineering systems.
5. Learners will be required to select the appropriate monitoring technique and equipment based on the type of plant or equipment being monitored and the conditions checked.

Course Outcomes:

Students will be able to

1. Know the health and safety requirements relevant to monitoring and fault diagnosis of engineering Systems.
2. Know about system monitoring and reliability.
3. Use monitoring and test equipment
4. Carry out fault diagnosis on electrical engineering equipment.

UNIT-1 Introduction to the field of machine condition monitoring:
methods, tools used to monitor a machine, diagnostics and prognostics, reliability, maintenance practices, health usage monitoring, Frequency of monitoring, infrared thermography, Ultrasounds .

UNIT-2 Failure analysis:
Failure mode-effect and criticality analysis, fault tree analysis. Breakdown mechanisms in gases, liquids, vacuum, solids. maintenance strategies (breakdown, preventive, planned, scheduled, diagnostic, total productive maintenance, reliability centered maintenance) organization for maintenance, maintenance requirements, maintenance planning and work control, maintenance records, frequency of maintenance, cost of maintenance, maintenance effectiveness

UNIT-3 Condition Monitoring of Transformer:
Type of faults, duration and the impacts Interpretation of gases generated in Oil-Immersed Transformer ,Transformer winding and core deformation detection utilizing SFRA technique, Methods of Dissolved Gas Analysis (DGA), partial discharge

measurement, On-Line/ Off-Line Monitoring

UNIT-4 Diagnosis of electrical equipment:
Motors, generators, Configuration, problems, diagnosis and solutions, Causes of motor failure, remedies. Signature analysis, condition monitoring of induction motor, power cables

UNIT-5 Substation Maintenance:
Types – Routine, Preventive, Planned, Predictive, Break-down, Emergency maintenance, on-line maintenance of different equipments, Condition monitoring of power apparatus, New advanced techniques in diagnosis and monitoring of electrical equipment.

TEXT AND REFERENCE BOOKS

1. Advances in high voltage engineering, edited by A. Haddad and D. Warne, IEE Power and Energy Series, 2004.
2. Electrical Insulation in Power Systems, N.H.Malik, A. A. Al-Arainy and M. I. Qureshi, Marcel Dekker, 1997.
3. Insulation of High Voltage Equipment, V.Y. Ushakov, Springer-Verlag, 2004.
4. High Voltage Engineering Fundamentals, Kuffel Zaengel Kuffel, Newnes
5. K. B. Raina, S. K. Bhattacharya, Electrical Design, Estimation and costing, wiely eastern limited New Delhi 1991.
6. S.L.Uppal- Electrical Power- Khanna Publishers Delhi.
7. Condition Monitoring and Assessment of Power Transformers Using Computational Intelligence,W.H. Tang, Q.H. Wu ,ISBN: 978-0-85729-051-9
8. Handbook of Condition Monitoring: Techniques and MethodologyEdited by A. Davies
9. Advances in Electrical Engineering and Electrical MachinesEditors: Dehuai Zheng, ISBN: 978-3-642-25904-3

Teacher Assessments:

Assessments based on,

1. MCQ10 Marks
2. Industry Visit reported related to maintenance and testing and equipments05 Marks
3. PPT 05 Marks

Designed By : Mrs. P. S. swami

EE469: Advanced Switchgear and Protection

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE353-Switchgear and Protection

Course Objective:

The objectives of the course are to

1. Impart knowledge related to the function of switchgear in power system and the function of different types of circuit breaker.
2. Demonstrate the relay time grading scheme, current grading scheme for relay operation.
3. To know the application of carrier current protection to transmission line.
4. Deliver knowledge related to system protection against transients and surges.
5. To know about the recent technology in protection.

Course Outcomes:

Students will be able to

1. Identify various types of fault in power systems.
2. Illustrate various protection scheme to electrical equipments.
3. Know different types of circuit breakers and relay in power systems.
4. Recognize application of appropriate relay.
5. To develop skill for operating various controls and switchgear in power system.
6. To design remedial measures for faults/abnormalities in machines/equipment in power system using appropriate diagnostic instrument/devices.

UNIT-1 Arc Interruption Theories:

The details study of – Slepian's theory, Prince's theory's, Cassies theory's, Mayr's theory, Browne's combined theory

Switching Transients:Closing of a line, Reclosing of a line, Interruption of small capacitive currents, Interruption of Inductive load currents, Current chopping, Interruption of short line fault, Traveling waves : Velocity and characteristic impedance, Energy contents of Traveling waves, Reflection and Refraction of Traveling waves

UNIT-2 Design of circuit Breakers**:**

Standards of Circuit Breakers,Design aspect of Vacuum Interrupters, contact shape and size, contact material, contact travel. Time-travel characteristics of moving contact of Vacuum circuit breaker, Contact Pressure, Contact Erosion

Testing of Circuit Breakers:Introduction, Classification, Description of a simple testing station, Equipments used in the station, Testing procedure, Direct testing, Test report, Indirect testing.

UNIT-3 Static Relays:

Introduction, Basic components, Classification, Comparators: amplitude and phase comparator, duality between amplitude and phase comparators.

(i) Static Over Current Relays: Instantaneous over current relay, definite time over current relay, inverse-time over current relay, directional over current relay.

(ii) Static Differential Relays: Differential relay scheme, singlephase static comparator, polyphase differential protection. Differential protection for generator and transformer.

(iii) Static Distance Relays: Impedance relay, reactance relay and mho relay using amplitude and phase comparators. Protection of EHV lines against short circuit and over voltages. Distance and carrier aided schemes. Stability of protection on power swing. Out of step blocking and tripping schemes. (With emphasis on implementation using static relays)

UNIT-4 Digital Protection:

Introduction to digital protection, block diagram of digital relay, sampling theorem, correlation with a reference wave, Fourier analysis of analogue and discrete signals, least error squared technique, digital filtering – low pass, high pass, finite impulse response and infinite impulse response fillers. Introduction to digital over-current, transformer differential and transmission line distance protection.

UNIT-5 Philosophy of Numerical relaying:

Characteristics - Functional Diagrams - Architecture and algorithms -Anti –aliasing Filters, sampling, Measurements principles using Fourier and other algorithms and its application for implementation of various numerical relays. SCADA based protection systems

Embedded protection systems:

General architecture & Essential requirements of an embedded protection system – metering, protection, automation and control modules; model/component based approach in designing an embedded system

TEXT AND REFERENCE BOOKS

1. B. Ravindranath, M. Chander,"Power system protection and switchgear", New Age International Ltd.
2. Y. G. Paithankar , Marcel Dekker," Transmission Network Protection "
3. Y.G. Paithankar, S. R. Bhide,"Fundmentals of Power System Protection",Prentis Hall of India
4. T.S.MadhavRao, "Power System Protection Static Relays with Microprocessor Applications", MH 2nd Edition
5. C. Russell Mason," Switchgear: The art and science of Protective Relaying", Wiley Eastern Ltd.
6. L. P. Sing, "Digital Protection"

Teacher Assessments:

Teacher assessment will be based on following:

1. Multiple Choice Questions 05 Marks
2. Quiz. 05 Marks
3. Surprise test. 10 Marks

Designed By : Mr. P. S. Swami

EE470: Digital Control Systems

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE 355 Linear Integrated Circuit
EE 345 Control System I
EE 342 Digital Electronics
GE 152 Engineering Mathematics-II

Course Objective:

The objectives of the course are to

1. Explain sampling and reconstruction
2. Illustrate transform analysis of sampled data system
3. Explain the design of digital controls
4. Describe self-tuning
5. Illustrate the control applications of microprocessor based control system

Course Outcomes:

Students will be able to

1. To apply ADC and DAC conversion
2. To analyze sampled data systems for stability
3. To design in ω and z plane
4. To realize digital PID controller
5. To apply principles for self-tuning regulator
6. To design small applications in digital

UNIT-1 Sampling and Reconstruction:

Sampled data control system, Digital to Analog conversion, Analog to Digital conversion, Sample and Hold operation

UNIT-2 Transform analysis of Sampled Data systems:

Linear difference equation, The pulse response, The Z-transform, The pulse transform, Block diagram analysis of sampled data systems, Z-domain equivalents to S-domain compensator, Stability analysis, Systems with dead time

UNIT-3 Transform design of Digital Controls:

Design specification, Design on ω plane, Design on z plane, Digital PID controller, Discrete time state equations similarity transformation

UNIT-4 Self-tuning control:

Identification problem, principle of least squares, self-tuning regulators

UNIT-5 Case studies, Temperature control system, Stepping motors

TEXT AND REFERENCE BOOKS

1. Digital Control Engineering, M. Gopal, New Age International Publications, Second Edition

Teacher Assessments:

Teacher assessment will be based on following:

1. Assignments 10 Marks
2. MCQ 10 Marks

Designed By: Dr. A. G. Thosar

EE471: Wind Energy Systems

(Elective)

(Implemented from 2015)

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

Prerequisites:

EE243 Electrical Machines,
EE Applied Mechanics
EE 152 Engineering Mathematics,

Course Objective:

The objectives of the course are to

1. Illustrate different types of wind turbines
2. Discuss generators used in association with wind turbines
3. Explain wind power probability density function
4. Describe wind speed cumulative distribution function using real power curves with weibull characteristics
5. Determine Capacity factor to estimate energy produced

Course Outcomes:

Students will be able to

1. Describe different types of wind turbines
2. Identify generators used in association with wind turbines
3. Calculate wind power probability density function
4. plan wind speed cumulative distribution function using real power curves with Weibull characteristics
5. Estimate Capacity factor to estimate energy produced

UNIT-1 Historical development of wind power:
types of wind turbines , aerodynamic construction of blade, power in the wind and Betz's limit, Impact of tower height, maximum rotor efficiency, Altitude and temperature correction for air density , Multiple gear box

UNIT-2 Wind turbine generators:
synchronous generator, The asynchronous Induction generator, Speed control for maximum power, importance of variable rotor speeds, pole changing induction generator, variable slip induction generator, indirect grid connection system

UNIT-3 Discrete wind histogram:
wind power probability density function, waybill and Rayleigh statics, Estimates of wind turbine energy, Annual energy calculations, specific wind turbine performance calculations

UNIT-4 Idealized wind turbine power curve:
optimizing rotor diameter and generator rated power, wind speed cumulative distribution function using real power curves with weibull characteristics

UNIT-5 Capacity factor to estimate energy produced:
capital cost and annual cost, Annualized cost of electricity from wind turbines, environmental impacts of wind turbine, wind farms

TEXT AND REFERENCE BOOKS

1) Renewable and Efficient Electric Power Systems, Gilbert M. Masters, Wiley Interscience publication

Teachers Assessments:

Assessments based on the following topics,

Policy initiatives regarding Use of renewable energy sources, Concerns about Global Warming, visits to installed sites, workingModels, Numerical from exercise

Designed By: Mr. S. M. Shinde

EE 472: Optimization Techniques

(Elective)

(Implemented from 2015)

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

Prerequisites:

GE152 Engineering Mathematics I

GE241

Engineering Mathematics II

EE343 Power System Analysis

Course Objective:

The objectives of the course are to

1. To give students the basic knowledge and tools to recognize, classify and solve different questions related to optimization problems as they appear in engineering.
2. Topics to be covered include basics of convex analysis, least-squares, linear and quadratic programs, semi definite programming, optimality conditions, duality theory, and interior point methods.
3. Applications to a variety of electrical engineering problems will be presented.
4. The emphasis will be on training students to translate question in optimization to the correct mathematical formalization and to apply the correct techniques to solve such questions.

Course Outcomes:

Students will be able to

1. Recognize and formulate problems that arise in engineering in terms of optimization problems.
2. Present the basic theory of such problems related to power system.
3. Understanding tools and some experience of how such problems are solved
4. Implemented different technique to electrical engineering field
5. Translate engineering problems in optimization to the correct mathematical formalization and to apply the correct techniques to solve such problems.

UNIT-1 Linear Programming:
Simplex Method, Revised Simplex Method, Duality, Sensitivity Analysis

UNIT-2 Nonlinear Programming:
One-Dimensional Minimization, Elimination Methods. Fibonacci Method, Golden Section Method, Interpolation Methods, Quadratic and Cubic Interpolation Methods

UNIT-3 Unconstrained Optimization Methods:
Univariate and Pattern Search Methods, Rosenbrocks Method of Rotating Coordinates, Simplex Method. Descent Methods, Steepest Descent Method, Conjugate Gradient Method (Fletcher- Reeves Method), Davidon- Fletcher- Powell Method

UNIT-4 Constrained Optimization:
Complex Method, Cutting Plane Method, Method of Feasible Directions**,** Integer Programming, Quadratic Programming, Introduction to Genetic Algorithm.

TEXT AND REFERENCE BOOKS

1. S. S. Rao, “Optimization Theory and Applications”, New Age International (P) Ltd. Publishers
2. H. A. Taha, “Operation Research”, Prentice Hall of India Pvt. Ltd., Seventh Edition
3. R. L. Fox, “Optimization Methods for Engineering Design”, Addison-Wesley, 1971
4. D. E. Goldberg,” Genetic Algorithms in Search, Optimisation”, and Machine Learning, Addison-Wesley, 1989
5. The Mathworks,Optimisation Toolbox Users Guide, 1996
6. Himmelblau, D.M. “Applied Nonlinear Programming”, McGraw-Hill, New York, 1972

Teachers Assessments

Assessments will be based on following,

1. Assignment 10 Marks
2. MCQ 10 Marks

Designed By : Prof. P. S. Swami

EE473: Embedded System

(Elective)

(Implemented from 2015)

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

Prerequisites:

Course Objective:

The objectives of the course are to

Course Outcomes:

Students will be able to

UNIT-1 Introduction to Embedded Systems**:**

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

UNIT-2 Devices and Buses for Devices Network**:**

I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - „12C", „USB", „CAN" and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT-3 Programming Concepts and Embedded Programming In C, C++:

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, „C" Program compilers – Cross compiler – Optimization of memory codes.

UNIT-4 Real Time Operating Systems – Part I**:**

Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organization and Implementation – I/O Subsystems – Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks - INTER PROCESS COMMUNICATION AND SYNCHRONISATION – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – Remote Procedure Calls (RPCs).

UNIT-5 Real Time Operating Systems – Part II:

Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS – Understanding Case Definition – Multiple Tasks and their functions – Creating a list of tasks – Functions and IPCs – Exemplary Coding Steps.

TEXT AND REFERENCE BOOKS

1. Rajkamal, "Embedded Systems Architecture, Programming and Design", TMH, 2003
2. Steve Heath, "Embedded Systems Design", Second Edition-2003, Newnes,
3. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, First Indian Reprint 2000
4. Wayne Wolf, "Computers as Components; Principles of Embedded Computing System Design", Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001

Teacher Assessments:

1. Assignment 10 Marks
2. MCQ 10 Marks

Designed By: Mrs. S .S.Kulkarni

EE 474: POWER QUALITY

(Elective)

(Implemented from 2015)

Teaching Scheme		**Evaluation Scheme**	
Lectures	03Hrs/Week	CLASS Test	20 Marks
Total Credits	03	Teacher Assessment	20 Marks
		End Sem Exam	60 Marks

Prerequisites:

EE356 - Power Electronics

Course Educational Objectives:

The objectives of the course are to

1. Understand electrical power quality problems
2. Develop ability for effective measurement of power quality problems
3. Understand harmonic problem in system
4. Overcome harmonics in system by designing harmonic filters
5. Make aware about power quality measuring instruments /devices
6. Identify the test location and duration of test for power quality problem, custom power devices, Power quality standards, losses in system because of power quality disturbance

Course Outcomes:

Students will be able to

1. Understand definitions of power quality, power quality standards.
2. Classify power quality problems.
3. Identify power quality disturbances.
4. Distinguish between voltage sag and swell.
5. Understand the methods to mitigate harmonics in system
6. Design Passive filters.
7. Instruments/ devices to measure power quality
8. Know test locations and duration for power quality measurements.
9. Introduced to custom power devices.

UNIT-1 Introduction to Power Quality: Definition of Power Quality, Power Quality Terminology, Power Quality Issues, Susceptibility Criteria, Cause and Effect, power quality disturbances, power quality standards
Harmonics:
Definition & indices, harmonic sources, power system responses to harmonics, resonance, harmonic analysis methods, problems and challenges in the area of harmonics, mitigation: filter and filter design, mitigation: other methods

UNIT-2 Sag & swell:
fault caused sags & swells, motor starting sags, calculation methods, mitigation of sag & swell disturbances

UNIT-3 Transients:
capacitor-switching transients and lightning transients, circuit analysis of cap-switching transients, simulation, mitigation of transients

UNIT-4 Custom Power:

Basic components and configurations, static circuit breaker, static shunt and series compensator, active harmonic filter

UNIT-5 Power Quality Measurement Devices:
Harmonic Analyzers, Transient-Disturbance Analyzers, Oscilloscopes, Data Loggers and Chart Recorders, True RMS Meters, Power Quality Measurements
Number of Test Locations, Test Duration, Instrument Setup, Instrument Setup Guidelines

TEXT AND REFERENCE BOOKS

1. M. H. J. Bollen, "Understanding power quality problems, voltage sags and Interruptions", IEEE Press, New York, 2000
2. R.C. Dugan, M.F. Mc Granaghan, S. Santoso, H.W. Beaty, "Electric power systems quality", 2nd Edition, New York, McGraw Hill, 2002
3. Roy Billinton, Ronald W. Allan and Luigi Salvaderi, "Applied Reliability Assessment in Electric Power Systems", IEEE Press, 1991
4. J. Endrenyi, "Reliability Modeling in Electrical Power Systems", Wiley, New York, 1978
5. IEEE Recommended Practice for the "Design of Reliable Industrial and Commercial Power Systems" IEEE GOLD BOOK
6. IEEE Recommended Practices and Requirements for "Harmonic Control in Electrical Power Systems",IEEE Std. 519-1992
7. IEEE Recommended Practice for Evaluating Electric Power System Compatibility With Electronic Process Equipment

Teacher Assessment:

Teacher's assessment will be based on following topic,

1. Assignments 10 Marks
2. Objective type test 10 Marks

Designed By: Mr. S. M. Shinde

474: Lab Digital Signal Processing

(Compulsory)

(Implemented from 2015)

Teaching Scheme		**Evaluation Scheme**	
Lectures	02Hrs/Week	Test	25 Marks
Total Credits	01	Practical/ Viva-Voce	25 Marks

Term Work

The term work shall consist of record of minimum six experiments from the list given below.

1. Architecture of DSP chips-TMS 320C 6713 DSP Processor
2. Linear convolution
3. Circular convolution
4. FIR Filter (LP/HP) Using Windowing technique
5. Rectangular window
6. Triangular window Kaiser window
7. IIR Filter(LP/HP) on DSP processors
8. N-point FFT algorithm
9. Power Spectral Density of a sinusoidal signals
10. FFT of 1-D signal plot
11. MATLAB program to generate sum of sinusoidal signals
12. MATLAB program to find frequency response of analog filters (LP/HP)
13. Simulation of Position and Speed Control of Stepper Motor,
14. Simulation of DC Motor Speed Control

EE475: Lab Electrical Equipment Specification and Design

(Compulsory)

(Implemented from 2015)

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

Term Work:

Students will carry out survey and write down the specification of following electrical equipment and design, rating, and manufacturing process of any one.

Each student will at least do of eight equipments and above

List of the equipment as follows:-

1. Various types of circuit breakers
2. Various light
3. Distribution transformers
4. Instrument transformers
5. Solar water heater
6. All fans(industrial and domestic)
7. D-G sets
8. All pumps
9. Relays
10. All types of fuses

EE476: LabSoft Skill

(Compulsory)

(Implemented from 2015)

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

Term Work:

Students will be trained soft skills such as -

1. Aptitude
2. Communication skill
3. Reading skill
4. Listening skill
5. Group discussion
6. Interview techniques
7. Time management
8. Stress management
9. Writing skill
10. Presentation skill
11. Negotiation skill

EE 477: Lab High Voltage Engineering

(Compulsory)

(Implemented from 2015)

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

Term Work:

The term work shall consist of record of minimum six experiments from the list given below.

1. Measurement of dielectric strength of transformer oil
2. Measurement of High A.C. Voltage using sphere gap
3. Measurement of breakdown strength of solid insulating material
4. Impulse voltage test on insulator
5. Power frequency test on insulator
6. Tan δ measurement of insulator
7. Study of Impulse Generator

EE478: Project Phase II

(Compulsory)

(Implemented from 2015)

Teaching Scheme		**Evaluation Scheme**	
Practical	06Hrs/Week	Term work	100 Marks
Total Credits	06	Practical/Oral	100 Marks

Students will demonstrate the project and present the seminar on the project.

EE 481:Comprehensive Viva-Voce

(Compulsory)
(Implemented from 2015)

Teaching Scheme		**Evaluation Scheme**	
		Practical/viva-voce	25 Marks
Total credit	01		