B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING
Course Structure R-20

SEMESTER V

S. No.	Class	Course Code	Name of the Subject	L	T	P	Credits
1	**PC**	C25PC1	Power Electronics	3	1	0	4
2	**PC**	C25PC2	Electrical Measurements and Instrumentation	3	0	0	3
3	**PE**	C25PE3	Professional Elective-I	3	0	0	3
4	**PC**	C25PC4	Power System-II	3	0	0	3
5	**OE**	C25OE5	Open Elective-I	3	0	0	3
6	**PC**	C25PC6	Electrical Systems Simulation Lab	0	0	2	1
7	**PC**	C25PC7	Power Electronics Lab	0	0	2	1
9	**HS**	CHSE3	Advanced English Communication Skills Lab	0	0	4	2
8	**PC**	C25PC8	Electrical Measurements and Instrumentation Lab	0	0	2	1
10	MC	MC005	MOOCs/Online Course	0	0	0	**S**
		Total Credits					21

Mandatory Course: MOOCs/Online Course

The student should register for any one of the MOOCs course offered by NPTEL,COURSERA, UDEMY, student should submit the completion certificate to clear this course.

Professional Elective-I (Semester – V)

1. Electrical Machine Design
2. Power System Dynamics and Control
3. Digital Signal Processing

Open Elective – I (Semester – V)

1. Smart Grid Technologies
2. Electrical Engineering Materials
3. Nanotechnology

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

POWER ELECTRONICS –C25PC1

B.Tech. V Semester
L/T/P/C

3/1/0/4

COURSE OBJECTIVES:

1. Understand the characteristics and performance of various power electronic devices.
2. Analyze single and three phase controlled rectifier circuits.
3. Understand choppers circuits and AC voltage controllers
4. Understand the performance of single phase and three phase inverter circuits.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Understand the characteristics and performance of various power electronic devices.
2. Analyze single and three phase controlled rectifier circuits.
3. Understand choppers circuits and AC voltage controllers
4. Understand the performance of single phase inverter circuits.
5. Analyse the operation of three phase voltage source inverters.

UNIT-I

Power switching devices: Thyristor, MOSFET, IGBT, GTO: static and dynamic Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT-II

Thyristor rectifiers: Single-phase half-wave, full-wave and semi controlled rectifiers with R-load, highly inductive load and E-load; Three-phase half wave, full wave and semi controlled bridge thyristor rectifier with R-load and highly inductive load and E-load; Input current wave shape and power factor, distortion factor.

UNIT-III

DC-DC Converters: Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit and operation of buck, boost and buck-

boost converters in continuous conduction mode, duty ratio control of output voltage.
AC-AC Converter: Power circuit and operation of single phase AC Voltage Controller with R , RL & RLE Load, Midpoint and bridge type Cycloconverter.

UNIT-IV

Single-phase inverter: Basic Series and parallel inverter, Power circuit and operation of single-phase voltage source inverter in square wave mode, sinusoidal pulse width modulation (Unipolar and bi-polar), relation between modulation index and output voltage. Calculation of performance parameters of inverter.

UNIT-V

Three-phase inverter: Power circuit and operation of three-phase voltage source inverter in 180^0 and 120^0 modes, Bi-polar sinusoidal pulse width modulation, relation between modulation index and output voltage. Elementary operation of CSI, Comparison of Voltage Source Inverter and Current Source Inverter.

TEXTBOOKS

1. M. H. Rashid, "*Power electronics: circuits, devices, and applications*", Pearson Education India,2009.

2. P S bimbhra ,"Power electronics" khanna publishers,3^{RD} edition, 2018.

REFERENCE BOOKS

1. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons,2007.
2. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media,2007.
3. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India,2009.

Web Source:

1. NPTEL Material –Power Electronics

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION –C25PC2

B.Tech. V Semester
L/T/P/C

3/0/0/3

PRE-REQUISITE: Basic Electrical Engineering, Electrical Circuit Analysis& Electromagnetic fields.

COURSE OBJECTIVES:

1. To introduce the basic principles of all measuring instruments
2. To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.

COURSE OUTCOMES: After completion of this course, the student will be able to

1. Understand different types of measuring instruments, their construction, operation and characteristics.
2. Identify the instruments suitable for typical measurements.
3. Analyze the measuring instruments for power and energy.
4. Design DC & AC bridges.
5. Apply the knowledge about transducers to use them effectively.

UNIT- I:

Introduction to Measuring Instruments: Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – extension of range of E.S. Voltmeters.

UNIT– II:

Potentiometers & Instrument transformers: Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications. CT and PT – Ratio and phase angle errors.

UNIT –III:

Measurement of Power & Energy: Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers –

Measurement of active and reactive powers in balanced and unbalanced systems. Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S. meter. Three phase energy meter – tri-vector meter, maximum demand meters.

UNIT – IV:

DC & AC bridges: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge - Owen's bridge.Measurement of capacitance and loss angle –Desaunty's Bridge - Wien's bridge – Schering Bridge.

UNIT-V:

Transducers: Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes.

Measurement of Non-Electrical Quantities: Measurement of strain, Gauge sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow and Liquid level.

TEXT BOOKS:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", DhanpatRai& Co. Publications, 2005.
2. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", 5th Edition, Wheeler Publishing, 2011.

REFERENCE BOOKS:

1.G.N.Srinivas and S. Narasimha" "Electrical and Electronics Measurements and Instrumentation" BS Publications.2018
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
3. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
4. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
5. "G. K. Banerjee", "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2 nd Edition, 2016
6. "S. C. Bhargava", "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

ELECTRICAL MACHINE DESIGN (Professional Elective-I)–C25PE3

B.Tech. V Semester
L/T/P/C

3/0/0/3

PREREQUISITE: Electrical Machines-I & II

COURSE OBJECTIVES: The main objectives of the course are

1. To introduces the basic concepts of machines and transformer
2. To teach the modeling of induction motor and synchronous motor
3. To develop Computer aided Design of machines

COURSE OUTCOMES: At the end of this course, students will demonstrate the ability to

1. Understand the construction and performance characteristics of electrical machines.
2. Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
3. Understand the principles of electrical machine design and carry out a basic design of an ac machine.
4. Use software tools to do design calculations.

UNIT I:

Introduction: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT II:

Transformers: Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT III:

Induction Motors : Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotors lots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT IV:

Synchronous Machines: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

UNIT V:

Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation.Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

TEXTBOOKS:

1. A. K. Sawhney, “A Course in Electrical Machine Design”, DhanpatRai and Sons, 1970.
2. M.G. Say, “Theory & Performance & Design of A.C. Machines”, ELBS London.

REFERENCE BOOKS:

1. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and
IBH Publishing, 2006.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

POWER SYSTEM DYNAMICS AND CONTROL (Professional Elective-I)–-C25PE3

B.Tech. V Semester
L/T/P/C

3/0/0/3

COURSE OBJECTIVES: The main objectives of course are

1. To analyze the performance of Power system with stability criteria
2. To study the numerical methods to study the performance of system
3. To study and modeling of Synchronous motor with power system components

COURSE OUTCOMES: At the end of this course, students will demonstrate the ability to

1. Understand the problem of power system stability and its impact on the system.
2. Analyse linear dynamical systems and use of numerical integration methods.
3. Model different power system components for the study of stability.
4. Understand the methods to improve stability.

UNIT-I:

Introduction to Power System Operations: Introduction to power system stability. Power System Operations and Control. Stability problems in Power System. Impact on Power System Operations and control.

UNIT-II :

Analysis of Linear Dynamical System and Numerical Methods: Analysis of dynamical System, Swing Equation, Concept of Equilibrium, Small and Large Disturbance Stability. Equal area criteria to investigate transient, Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. Issues in Modeling: Slow and Fast Transients, Stiff System.

UNIT-III:

Modeling of Synchronous Machines and Associated Controllers : Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. Park Transformation, Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus, Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control, Automatic Voltage Regulator, Prime Mover Control Systems. Speed Governors.

UNIT-IV :

Modeling of other Power System Components: Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage Dependence of Loads. Other Subsystems – HVDC and FACTS controllers, Wind Energy Systems.

UNIT-V:

Stability Analysis And Enhancing System Stability: Rotor Angle stability analysis in SMIBS and MMBS – Modes of operation of area. Frequency Stability: Concept of Inertia and Virtual inertia. Load Sharing: Governor Droop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs. Planning Measures. Stabilizing Controllers (Power System Stabilizers).Operational Measures-Preventive Control. Emergency Control.

TEXTBOOKS:

1. P-M-Anderson Fouad ,Power-Systems-Control-and-Stability-2nd-Edition
2.K.R. Padiyar, “Power System Dynamics, Stability and Control”, B. S. Publications, 2002.

REFERENCE BOOKS

1. P. Kundur, “Power System Stability and Control”, McGraw Hill, 1995.
2. P. Sauer and M. A. Pai, “Power System Dynamics and Stability

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

DIGITAL SIGNAL PROCESSING (Professional Elective-I)–C25PE3

B.Tech. V Semester **L/T/P/C**
3/0/0/3

PREREQUISITES: To have knowledge of Signals and Systems.

COURSE OBJECTIVES: The objective of this subject is to

1. Provide background and fundamental material for the analysis and processing of digital signals.
2. Study fundamentals of time, frequency and Z plane analysis and to discuss the inter relationships of these analytic method.
3. Study the design and structures of digital filters from analysis to synthesis for a given specifications.
4. Acquaint in FFT algorithms, multi rate signal processing techniques and finite word length effects.

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

1. Acquire knowledge on various types of continuous and discrete time signals, solves linear constant coefficient difference equation also can realize digital filters.
2. Calculate time domain and frequency domain of signals using DFS,DFT and develop FFT Algorithm for faster realization of signals and systems
3. Design digital IIR filters from analog filters using various techniques.
4. Design digital FIR filters using Window techniques, Fourier methods and frequency sampling techniques.
5. Design Interpolator and Decimator, knows the impacts of Finite Word Length Effects in Filter design

UNIT –I:

INTRODUCTION: Introduction to Digital Signal Processing, Applications, Discrete time signals & sequences, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations, Frequency domain representation of discrete time signals and systems.

Z-TRANSFORMS: Review of Z-transforms, Applications of Z – transforms, solution of difference equations of digital filters, system function, stability criterion, frequency response of stable systems.

UNIT – II :

DISCRETE FOURIER TRANSFORMS: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT: Over-lap save, Over-lap add methods, Relation between DTFT,DFS and Z-transform.

FAST FOURIER TRANSFORMS: Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT, and FFT for composite N, Linear filtering approach for computing DFT.

UNIT–III:

IIR DIGITAL FILTERS: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters-Backward difference algorithm, Step and Impulse invariant techniques, Bilinear transformation method, spectral transformations, Realization of IIR Digital filters, applications.

UNIT–IV:

FIR DIGITAL FILTERS: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Fourier series method, Window Techniques, Frequency Sampling technique, Realization of FIR Digital filters, Comparison of IIR & FIR filters.

UNIT –V :

MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, sampling rate conversion, Multistage implementation of Interpolator and Decimator, Applications.

Finite Word Length Effects: Limit cycles, Overflow oscillations, Round-off noise in IIR digital filters, computational output round off noise, Methods to prevent overflow. Trade off between round off and overflow noise, Dead band effects.

Text Books

1.Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.

2.Discrete Time Signal Processing-A.V.Oppenheim and R.W.Schaffer, PHI,2009

Reference Books

1. Analog and Digital Signal Processingby Ashok Ambardar -2nd Edition, Brooks/Cole Publishing Company,2006
2. Digital Signal processing-S.Shalivahanan, A.Vallavaraj and C.Gnanapriya,TMH,2009.
3. Fundamentals of Digital Signal processing- LoneyLudeman, John Wiley,2009
4. .Digital Signal processing –Tarun Kumar Rawat,Oxford University Press,2015

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

POWER SYSTEMS-II –C25PC4

B.Tech. V Semester
L/T/P/C

3/0/0/3

PRE-REQUISITE: Mathematics and Electrical Circuit Analysis.

COURSE OBJECTIVES:

1. To compute inductance/capacitance of transmission lines and to understand the
2. Concepts of GMD/GMR.
3. To study the short and medium length transmission lines, their models and Performance.
4. To study the performance and modeling of long transmission lines.
5. To study the effect of travelling waves on transmission lines.
6. To study the factors affecting the performance of transmission lines and power factor Improvement methods.
7. To discuss sag and tension computation of transmission lines as well as to study the
8. Performance of overhead insulators.

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

1. Understand parameters of various types of transmission lines during different Operating conditions.
2. Understand the performance of short and medium transmission lines.
3. Understand travelling waves on transmission lines.
4. Understand various factors related to charged transmission lines.
5. Understand sag/tension of transmission lines and performance of line Insulators.

UNIT–I:

Transmission Line Parameters: Conductor materials - Types of conductors – Calculation of resistance for solid conductors –Calculation of inductance for single phase and three phase– Single and double circuit lines–Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition–Bundled conductors-Numerical Problems–Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance – Capacitance calculations for symmetrical and asymmetrical single and three phase–Single and double circuit lines- Bundled conductors–Numerical Problems.

UNIT–II:

Performance of Short and Medium Length Transmission Lines: Classification of Transmission Lines – Short, medium, long line and their model representations –Nominal-T– Nominal-Pie and A, B, C, D Constants for symmetrical and Asymmetrical Networks– Numerical Problems– Mathematical Solutions to estimate regulation and efficiency of all types of lines – Numerical Problems.

UNIT–III:

Performance of Long Transmission Lines: Long Transmission Line–Rigorous Solution – Evaluation of A,B,C,D Constants–Interpretation of the Long Line Equations, regulation and efficiency—Surge Impedance and SIL of Long Lines–Wave Length and Velocity of Propagation Of Waves – Representation of Long Lines – Equivalent-T and Equivalent Pie network models (Numerical Problems).

UNIT – IV:

Travelling Wave Phenomenon: Incident, Reflected , Refracted Waves and their coefficients.

Power System Transients: Types of System Transients – Travelling or Propagation of Surges – Attenuation–Distortion–Reflection and Refraction Coefficients – Termination of lines with different types of conditions – Open Circuited Line–Short Circuited Line – T-Junction– Lumped Reactive Junctions.

Various Factors governing the Performance of Transmission line: Skin and Proximity effects – Description and effect on Resistance of Solid Conductors –Ferranti effect – Charging Current –Shunt Compensation –Corona – Description of the phenomenon–Factors affecting corona–Critical voltages and power loss – Radio Interference.

UNIT–V:

Sag and Tension Calculations and Overhead Line Insulators: Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice on weight of Conductor–Numerical Problems – Stringing chart and sag template and its applications– Types of Insulators – String efficiency and Methods for improvement–Numerical Problems – Voltage distribution–Calculation of string efficiency– Guard ring, Capacitance grading and Static Shielding.

TEXT BOOKS:

1. Electrical power systems – by C.L.Wadhwa, New Age International (P) Limited, Publishers, 1998.
2. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4th edition

REFERENCE BOOKS:

1. Modern Power System Analysis by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2ndEdition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3.A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta,U.S.BhatnagarA.Chakrabarthy, DhanpatRai& Co Pvt. Ltd.
4. Electrical Power Systems by P.S.R. Murthy, B.S.Publications.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

ELECTRICAL SYSTEMS SIMULATION LAB–C25PC6

B.Tech. V Semester **L/T/P/C**
0/0/2/1

PREREQUISITE: Electrical circuits, Power System Analysis & Power Electronics

COURSE OBJECTIVES:

1. To Simulate and analyse electrical and electronic systems**.**
2. To evaluate the performance of transmission lines.
3. To Analyze various Faults in power systems
4. To Model, simulate and analyze the performance of DC Machines and Induction Motors.
5. To Analyze performance of feedback and load frequency control of the systems

COURSE OUTCOMES: After completion of this course, the student will be able to

1. Design and Analyze electrical systems in time and frequency domain
2. Analyze various transmission lines and perform fault analysis
3. Model Load frequency control of Power Systems
4. Design various Power Electronic Converters and Drives.

Any 10 of the following experiments are required to be conducted using suitable software

1. Design of first and second order circuits in time and frequency domain
2. Performance evaluation of long transmission lines
3. Symmetrical component analysis
4. Transmission Line Fault Analysis
5. Fault analysis of single machine connected to bus bar through transformer.
6. Short Circuit studies of Power system models
7. Speed Control of DC Motor
8. Speed Control of Induction motor
9. Design and analysis of feedback control system
10. Transient analysis of open ended line and short circuited line
11. Load frequency control of single area and two area power system

12. Economic Dispatch of Thermal Units
13. Design of Single Phase and Three Phase Inverters
14. Design of Single Phase and Three Phase Full Converters
15. Solution of first order differential equation using RK 4th order method.
16. Single phase Cycloconverter for 1/3 and ¼ frequencies.

REFERENCE BOOKS

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age InternationalPub. Co.,2001.
2. Hadi Sadat: Power System Analysis –Tata McGraw Hill Pub. Co.2002.
3. "I. J. Nagrath& M. Gopal", Control Systems Engineering, New Age International Pub. Co., 5th Edition2009.
4. A.E. Clayton & C.I. Hancock Performance and Design of DC Machines,CBS Publisher, 1st Edition2000.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

POWER ELECTRONICS LAB -C25PC7

B.Tech. V Semester
L/T/P/C

0/0/2/1

COURSE OBJECTIVES:

1. Apply the concepts of power electronic converters for efficient conversion/control of power from source to load.
2. Design the power converter with suitable switches meeting a specific load requirement.

COURSE OUTCOMES: After completion of this course, the student is able to

1. Understand the operating principles of various power electronic converters.
2. Use power electronic simulation packages& hardware to develop the power Converters.
3. Analyze and choose the appropriate converters for various applications

Any eight experiments should be conducted

1. Study of Characteristics of SCR, MOSFET & IGBT,
2. Gate firing circuits for SCR's
3. Gate firing circuits for MOSFET, IGBT
4. Single Phase half controlled bridge converter with R and RL loads
5. Single Phase Fully controlled bridge converter with R and RL loads
6. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
7. Single Phase series and parallel inverter with R and RL loads
8. Operation of MOSFET based chopper.
9. Three Phase half controlled bridge converter with R-load
10. Single phase cyclo converter with R and RL loads

Any two experiments should be conducted

1. DC Jones chopper with R and RL Loads
2. Single Phase AC Voltage Controller with R and RL Loads
3. Three Phase fully controlled bridge converter with R-load
4. Single Phase dual converter with RL loads
5. Simulation of single phase Full rectifier and AC voltage controller
6. Simulation of single phase inverter with PWM control.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

ADVANCED ENGLISH COMMUNICATION SKILLS LAB– CHSE3

B.Tech. V Semester **L/T/P/C**

0/0/4/2

Course Objectives:

1. To improve students' fluency in spoken English.
2. To enable them to listen to English spoken at normal conversational speed
3. To help students develop their vocabulary
4. To read and comprehend texts in different contexts
5. To communicate their ideas relevantly and coherently in writing
6. To make students industry-ready
7. To help students acquire behavioral skills for their personal and professional life
8. To respond appropriately in different socio-cultural and professional contexts
9. To sensitize the importance of Soft Skills and people skills

Course Outcomes:

1. Acquire vocabulary and use it contextually
2. Listen and speak effectively
3. Develop proficiency in academic reading and writing
4. Increase possibilities of job prospects
5. Communicate confidently in formal and informal contexts
6. Develop interpersonal communication skills

UNIT-I

Inter-personal Communication and Building Vocabulary – Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations – Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.

What are soft skills? Active listening –self motivation -effective communication- assertive communication-controlling emotions-team player attitude-ability to work under pressure – openness to feedback

UNIT-II

Reading Skills and Appropriate English usage–General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, Skimming, Scanning, Inferring Meaning and practice with different texts.

Grammatical Accuracy

Use of tense in scientific writing-active vs. Passive voice –number agreement (singular and plural)-agreement of subject with verb in person and number - using phrases and clauses to construct simple complex and compound sentences-verb patterns-Eliminating ambiguity

UNIT-III
Writing Skills –

Structure and Presentation of Different Types of Writing – Letter writing / Resume Writing/ e-correspondence/ Technical Report Writing/Styles-Types-Report in Manuscript format.Writing an SOP and Portfolio Assessment

How to write a project –what is a scientific project-how to prepare the title, abstract, introduction, how to review literature –body of the project –how to write the results and conclusion-correct form and grammar ethics to be followed –avoiding plagiarism.

UNIT-IV

Group Discussion and Presentation Skills

Group Discussions-Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation- Concept and Process
Presentation Skills – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ emails/Assignment.

UNIT-V
Interview Skills – Pre-interview Planning, Opening Strategies, Answering Strategies, Interview through Tele-conference & Video-conference and Mock Interviews.

References:
1.Rizvi, M Ashraf. Effective Technical Communication. Mc Graw – Hill
2. Kumar, Sanjay and PushpLata. English for Effective Communication, OUP,2015
3. Konar, Nira. English Language Laboratories – A Comprehensive Manual,PHI Learning Pvt Ltd,2011.
4. Shiv Khera, You can Win, Macmillan Books, New York, 2003.
5. Jeff Butterfield, Soft Skills for Everyone, Cengage Learning, 2015
6. Barbara Gastel and Robert "A Day How to write and publish a scientific paper, Greenwood, 2016.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

ELECTRICAL MESEARUEMENTS AND INSTRUMENTATION LAB–C25PC8

B.Tech. V Semester **L/T/P/C**
0/0/2/1

COURSE OBJECTIVES:

1. To calibrate LPF Watt Meter, energy meter, P. F Meter using electro dynamo meter type instrument as the standard instrument
2. To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A. C Bridges
3. To determine three phase active & reactive powers using single wattmeter method practically
4. To determine the ratio and phase angle errors of current transformer and potential transformer.

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

1. Design and validate DC and AC bridges.
2. Analyze the dynamic response and the calibration of few instruments.
3. Learn about various measurement devices, their characteristics, their operation and their limitations.
4. Understand statistical data analysis.
5. Understand computerized data acquisition.

Any 10 of the following experiments are required to be conducted

1. Calibration and Testing of single phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering bridge& Anderson bridge.

7. Measurement of 3 – Phase reactive power with single wattmeter.
8. Measurement of displacement with the help of LVDT. In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted
9. Calibration LPF wattmeter – by Phantom testing.
10. Measurement of 3-phase power with single watt meter and two CTs.
11. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
12. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
13. Resistance strain gauge – strain measurements and Calibration.
14. Transformer turns ratio measurement using AC bridges.
15. Measurement of % ratio error and phase angle of given CT by comparison.

TEXT BOOKS

1.A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", DhanpatRai& Co. Publications, 2005.
2. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", 5th Edition, Wheeler Publishing, 2011.

REFERENCE BOOKS

1. "G. K. Banerjee", "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2 nd Edition, 2016
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
3. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
4. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
5. "S. C. Bhargava", "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

SEMESTER VI

S. No.	Class	Course Code	Name of the Subject	L	T	P	Credits
1	**HS**	CHSM1	Business Economics and Financial Analysis	3	0	0	3
2	**PC**	C26PC1	Power System Protection	3	0	0	3
3	**PC**	C26PC2	Power System Operation and Control	3	0	0	3
4	**PC**	C26PC3	Microprocessors & Microcontrollers	2	0	0	2
5	**PE**	C26PE4	Professional Elective-II	3	0	0	3
6	**OE**	C26OE5	Open Elective-II	3	0	0	3
7	**PC**	C26PC6	Power System Lab	0	0	2	1
8	**PC**	C26PC7	Microprocessors & Microcontrollers Lab	0	0	2	1
9	**ES**	C26ES8	Python Programming Lab	0	0	4	2
10	**MC**	MC006	1. Personality Development/Skill Development 2. Technical Events 3. Internships	0	0	0	**S**
		Total Credits					21

Mandatory Course : The satisfactory report should be submitted either for 1 or 2 or 3 given below.

1.Personality Development/Skill Development: Student should participate in personality development/communication skills programme, student should submit the completion certificate for clearing this course.

2. Technical Events: The student should participate in any technical event organized by any College/Organization/Industry and submit the participation certificate for clearing this course.

3. Internships: The Student should submit the completion certificate from the respective organization. Where he/she performs their internship.

Professional Elective-II(Semester – VI)

1. Electrical Energy Conservation and Auditing
2. Computer Architecture
3. Line-Commutated and Active Rectifiers

Open Elective – II (Semester – VI)

1.Reliability Engineering
2.Optimization Techniques
3. Renewable Energy Sources

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS- CHSM1

B.Tech. VI Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES

1. To learn the basic business type of the organization.
2. To acquire the knowledge and impact of the economy on business firms.
3. To analyze the business from the financial perspective.
4. To know the financial position of the company.

COURSE OUTCOMES

1. Analyze the total structure of the business and able to identify and classify the Different types of business entities.
2. Asses the demand and supply analyses with the help of various measures and types of
   Elasticity of demand.
3. Infer the knowledge about production and cost analysis for product and services.
4. Interpret the fundamental concepts related to financial accounting.
5. Predict the financial position by analyzing the financial statement of the company Through various ratios.

UNIT – I

Introduction to Business and Economics:

Business: Define Business, characteristics of business, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company..

Economics: Significance of Economics, Micro and Macro Economic Concepts, and Importance of National Income, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist,

UNIT – II

Demand Analysis:Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Steps in Demand Forecasting, Methods of Demand Forecasting.

UNIT- III

Production, Cost, Market Structures & Pricing:

Production Analysis: production function, Law of returns to scale, Internal and External Economies of Scale.
Cost analysis: Cost concepts, Types of Costs. Break-even Analysis (BEA)
Pricing: Types of Pricing, product life cycle, **GST** (**Goods & service Tax**)
Market Structures- Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition, oligopoly.

UNIT - IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT – V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.
4. Rakesh garg,sandeepgarg,Hand book of GST in India
5. A.R. Aryasri (2011), Managerial Economics and Financial Analysis, TMH, India.

REFERENCES:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

POWER SYSTEM PROTECTION-C26PC1

B.Tech. VI Semester
L/T/P/C

3/0/0/3

PREREQUISITE: Power Systems - I & Power Systems - II

Course Objectives:

- To introduce all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from Over voltages and other hazards.
- To describe neutral grounding for overall protection.
- To understand the phenomenon of Over Voltages and it's classification.

Course Outcomes: At the end of the course the student will be able to:

- Compare and contrast electromagnetic, static and microprocessor based relays
- Apply technology to protect power system components.
- Select relay settings of over current and distance relays.
- Analyze quenching mechanisms used in air, oil and vacuum circuit breakers

UNTI-I:

PROTECTIVE RELAYS

Introduction, Need for power system protection, effects of faults, evolution of protective relays, zones of protection, primary and backup protection, essential qualities of protection, classification of protective relays and schemes, current transformers, potential transformers, basic relay terminology.

OPERATING PRINCIPLES AND RELAY CONSTRUCTION: Electromagnetic relays, thermal relays, static relays, microprocessor based protective relays.

UNTI-II:

OVER-CURRENT PROTECTION

Time-current characteristics, current setting, over current protective schemes, directional relay, protection of parallel feeders, protection of ring mains, Phase fault and earth fault protection, Combined earth fault and phase fault protective scheme, Directional earth fault relay.

DISTANCE PROTECTION: Impedance relay, reactance relay, MHO relay, input quantities for various types of distance relays, Effect of arc resistance, Effect of power swings, effect of line length and source impedance on the performance of distance relays, selection of distance relays, MHO relay with blinders, Reduction of measuring units, switched distance schemes, auto re-closing.

UNTI-III:

PILOT RELAYING SCHEMES

Wire Pilot protection, Carrier current protection.

AC MACHINES AND BUS ZONE PROTECTION: Protection of Generators, Protection of transformers, Bus-zone protection, frame leakage protection.

UNTI-IV:

STATIC RELAYS

Amplitude and Phase comparators, Duality between AC and PC, Static amplitude comparator, integrating and instantaneous comparators, static phase comparators, coincidence type of phase comparator, static over current relays, static directional relay, static differential relay, static distance relays, Multi input comparators, concept of Quadrilateral and Elliptical relay characteristics.

MICROPROCESSOR BASED RELAYS: Advantages, over current relays, directional relays, distance relays.

UNIT-V:

CIRCUIT BREAKERS

Introduction, arcing in circuit breakers, arc interruption theories, re-striking and recovery voltage, resistance switching, current chopping, interruption of capacitive current, oil circuit breaker, air blast circuit breakers, SF6 circuit breaker, operating mechanism, selection of circuit breakers, high voltage d.c. breakers, ratings of circuit breakers, testing of circuit breakers.

FUSES: Introduction, fuse characteristics, types of fuses, application of HRC fuses, discrimination.

TEXTBOOKS

1.Badriram and DN vishwakarma,"power system protection and switch gear" Tata McGraw-Hill Education, 01-Apr-2001

2. TS madhava rao ,power system protection Tata McGraw-Hill Education

REFERENCE BOOKS

1. Y. G.Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.

2.. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.

3. D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.

4. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

POWER SYSTEM OPERATION AND CONTROL–C26PC2

B.Tech. VI Semester
L/T/P/C

3/0/0/3

COURSE OBJECTIVES:

1. To have an overview of power system operation and control.
2. Economic operation of Power Systems, Hydrothermal scheduling and modeling of turbines, generators and automatic controllers
3. To model power-frequency dynamics and to design power-frequency controller.
4. To model reactive power-voltage interaction and t-he control actions to be implemented for maintaining the voltage profile against varying system load.
5. To study the economic operation of power system.
6. To teach about SCADA and its application for real time operation and control of power systems.

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

1. Understand the economic load dispatch
2. Analyze the unit commitment problems, constraints and hydrothermal scheduling of power plants
3. Analyze the load frequency control
4. Understand reactive power and voltage control of a power system
5. Apply the computer control techniques for the power systems.

UNIT-I:

Economic Operation of Power Systems: Optimal operation of Generators in Thermal Power Stations, – heat rate Curve — Cost Curve — Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses — Loss Coefficients, General transmission line loss formula.

UNIT-II:

Hydrothermal Scheduling: Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling problems-Short term hydrothermal scheduling problem.

Modeling: Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models.

Modeling of Governor: Mathematical Modeling of Speed Governing System — Derivation of small signal transfer function. Modeling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model.

UNIT-III:

Single Area & Two Area Load Frequency Control: Necessity of keeping frequency constant, Definitions of Control area Single area control Block diagram representation of an isolated power system — Steady state analysis Dynamic response — Uncontrolled case,

Load frequency control of area system: Uncontrolled case and controlled case, tie1ine bias control.

Load Frequency Controllers: Proportional plus Integral control of single area and its block diagram representation, steady state response — Load Frequency Control and Economic dispatch control.

UNIT-IV:

Reactive Power Control: Overview of Reactive Power control — Reactive Power compensation in transmission systems — advantages and disadvantages of different types of compensating equipment for transmission systems. Load compensation: Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation. (Qualitative treatment)

UNIT-V:

Computer control of Power System: Need for computer control of power systems - concept of energy control centre - functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

TEXT BOOKS

1.Operation and Control in Power Systems, PSR Murthy, BS Publications.

2.Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.

REFERENCE BOOKS

1. Power systems stability and control, PrabhaKundur, The McGraw — Hill companies.
2. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
3. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
4. AbhijitChakrabarti, SunitaHalder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

MICROPROCESSORS & MICROCONTROLLERS– C26PC3

B.Tech. VI Semester
L/T/P/C

2/0/0/2

Course Objectives:

1. To familiarize the architecture of microprocessors and micro controllers
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors

Course Outcomes: Upon completion of this course the student will be able to:

1. Acquire the knowledge of internal architecture, organization of 8086 processor and can develop assembly language programming.
2. Analyze internal architecture, memory organization of 8051 controller and can develop programming.
3. Construct interfacing techniques to 8086 and 8051 and define various serial communication standards.
4. Interpret the internal architecture and organization of ARM processor, and can develop programming.
5. Build the knowledge of the internal architecture and organization of advanced ARM Processors.

UNIT–I

8086Architecture:8086 Architecture-Functional diagram, Register Organization, 8086 Flag register, Memory Segmentation, Physical Memory organization, Pin diagram of 8086,Signal description of 8086- Common function signals, Minimum and Maximum mode signals, addressing modes, Instruction set, Assembler directives, Programming.

UNIT– II

Introduction to Microcontrollers: Overview of 8051 microcontroller, Architecture, I/O ports, Memory Organization, Addressing modes, Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the serial communication Interrupts, Programming 8051 Timers and Counters.

UNIT– IV

I/O And Memory Interface: 8255 PPI, stepper motor interfacing to 8086,LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication standards, Serial data transfer schemes, Onboard Communication Interfaces- I2C Bus, SPI Bus, UART; External Communication Interfaces- RS-232, USB.

UNIT–IV

ARM Architecture: ARM Processor Fundamentals, ARM Architecture- Register, CPSR, Pipeline, exception and interrupts, Interrupt vector table, ARM instruction set- Data processing, Branch Instructions, load store instructions, Software interrupt instructions, Program Status register instructions, loading constants, Conditional execution, Simple programs, Introduction to Thumb Instructions.

UNIT-V

Advanced ARM Processors: Introduction to CORTEX Processor, OMAP Processor and its Architecture.

TEXT BOOKS:

1. Advanced microprocessors and peripherals, A.K. Ray and K Bhurchandani, MHE. 2ND edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning., 3rd Ed.
3. ARM system Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012.

REFERENCE BOOKS

1. Microprocessor and Interfacing , D.V.Hall,MGH, 2nd Edition 2006.
2. Introduction to Embedded Systems, ShibuK.V. MHE,2009.
3. The 8051 Microcontrollers, Architecture and Programming and Applications – K. Uma Rao, Anhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

ELECTRICAL ENERGY CONSERVATION AND AUDITING

(Professional Elective II)–C26PE4

B.Tech. VI Semester

L/T/P/C
3/0/0/3

COURSE OBJECTIVE:

1. To explain Energy resources and pricing
2. To illustrate energy auditing and management
3. To Study energy efficiency in industrial systems

COURSE OUTCOMES: After completion of this course, the student will be able to

1. Understand the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy management.
3. Understand the methods of improving energy efficiency in different electrical systems.
4. Understand the concepts of different energy efficient devices.

UNIT-I:

Energy Scenario

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

UNIT-II:

Basics of Energy and its various forms

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-III:

Energy Management & Audit

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Demand side management.

UNIT-IV:

Energy Efficiency in Electrical Systems

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses.

UNIT -V:

Energy Efficiency in Industrial Systems

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Energy Efficient Technologies in Electrical Systems Maximum demand controllers,occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

TEXT/REFERENCE BOOKS

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)
3. S.C.Tripathy,"UtilizationofElectricalEnergyandConservation",McGrawHill,1991.

Web Source:

1. NPTEL Material – Electrical Energy Conservation and Auditing

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING -R20

COMPUTER ARCHITECTURE (Professional Elective II)–C26PE4

B.Tech. VI Semester

L/T/P/C

3/0/0/3

Course Objective:

The Computer Architecture course aims to describe a broad range of architectural designs and to contrast them, highlighting the design decisions

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concepts of microprocessors, their principles and practices.
- Write efficient programs in assembly language of the 8086 family of microprocessors.
- Organize a modern computer system and be able to relate it to real examples.
- Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.
- Implement embedded applications using ATOM processor.
-

Unit1: Introduction to computer organization

Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

Unit 2: Memory organization

System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.

Unit 3: Input – output Organization

Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

Unit 4: 16 and 32 microprocessors

80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

Unit 5: Pipelining

Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.

Text Books:

1. V. Carl, G. Zvonko and S. G. Zaky, **"**Computer organization**"**, McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, **"**The Intel microprocessors**"**, Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, **"**Computer Architecture A Quantitative Approach**"**, Morgan Kauffman, 2011.

Reference Books:

1. W. Stallings, **"**Computer organization**"**, PHI, 1987.
2. P. Barry and P. Crowley, **"**Modern Embedded Computing**"**, Morgan Kaufmann, 2012.
3. N. Mathivanan, **"**Microprocessors, PC Hardware and Interfacing**"**, Prentice Hall, 2004.
4. Y. C. Lieu and G. A. Gibson, **"**Microcomputer Systems: The 8086/8088 Family**"**, Prentice Hall India, 1986.
5. J. Uffenbeck, **"**The 8086/8088 Design, Programming, Interfacing**"**, Prentice Hall, 1987.
6. B. Govindarajalu, **"**IBM PC and Clones**"**, Tata McGraw Hill, 1991.
7. P. Able, **"**8086 Assembly Language Programming**"**, Prentice Hall India.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

LINE-COMMUTATED AND ACTIVE RECTIFIERS (Professional Elective II)–C26PE4

B.Tech. VI Semester
L/T/P/C

3/0/0/3

PRE-REQUISITE: Power Electronics

COURSE OBJECTIVES:

1. Explain different rectifiers suing diodes and Thyristors
2. Study Multi-Pulse converters for HVDC applications
3. Analyze different DC-DC converters

COURSE OUTCOMES: After completion of this course, the student will be able to

1. Analyse controlled rectifier circuits.
2. Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
3. Understand the operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

UNIT-I:
Diode rectifiers with passive filtering
Half-wave diode rectifier with R L and RC loads; 1-phase full-wave diode rectifier with C and LC filter; 3-phase diode rectifier with C filter; continuous and discontinuous conduction, effect of source inductance; commutation overlap.

UNIT-II:
Thyristor rectifiers with passive filtering
Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with LC filter; 3-phase thyristor rectifier with LC filter; continuous and discontinuous conduction.

UNIT-III:
Multi-Pulse converter
Review of transformer phase shifting, generation of Idealized 6-pulse ac voltage from 3-phase ac, and 12-pulse converters with inductive loads, commutation overlap, notches during commutation.

UNIT-IV:
Single-phase ac-dc single-switch boost converter

Review of non isolated dc-dc boost converter, power circuit of single-switch ac-dc buck boost converter.

Isolated single-phase ac-dc fly back converter

Basic isolated fly back converter, Power circuit of ac-dc fly back converter, Voltage and current waveforms and output voltage as a function of duty ratio and transformer turns ratio.

UNIT-V:

AC-DC bidirectional boost converter

Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase ac-dc boost converter, isolated bidirectional single phase ac-dc converter ,bidirectional closed-loop control structure.

TEXT BOOKS

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India,2009.
2. P S bimbhra ,"Power electronics" khanna publishers,3RD edition, 2018.

REFERENCE BOOKS

1. L.Umanand,"Power Electronics: Essentials and Applications",WileyIndia,2009.
2. N.MohanandT.M.Undeland,"PowerElectronics:Converters,ApplicationsandDesign", John Wiley&Sons,2007.
3. R.W.Ericksonand D.Maksimovic, Fundamentals of Power Electronics", Springer Science&Business Media,2001.
4. G.De,"Principles of ThyristorisedConverters",Oxford&IBH PublishingCo,1988.
5. J.G. Kassakian,M. F. SchlechtandG.C. Verghese,"Principles of Power Electronics", Addison-Wesley,1991.
6. "Bin Wu, A", "High-Power Converters and Ac Drives" John Wiley & Sons, Inc., Publication (Free down load from rapidshire.com) 2006.
7. J. D. M. **Murphy and** F. G. Turnbul, "Power electronics:

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

POWER SYSTEM LAB -C26PC6

B.Tech. VI Semester
L/T/P/C

0/0/2/1

PREREQUISITE: Power Systems & Electrical Machines.

COURSE OBJECTIVES:

1. Perform testing of CT, PT's and Insulator strings
2. To find sequence impedances of 3-Φ synchronous machine and Transformer
3. To perform fault analysis on Transmission line models and Generators.

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

1. Test different types of relays and their characteristics.
2. Apply various load flow techniques for the power flow studies.
3. Understand Different protection methods
4. Analyze various faults, ABCD constants, Regulation and transient stability of transmission line.

The following experiments are required to be conducted as compulsory experiments:

Part-A

1. Characteristics of IDMT over Current Relay.
2. Differential protection of 1-Φtransformer.
3. Characteristics of Microprocessor based Over Voltage/Under Voltage relay.
4. Testing of CT, PT's and Insulator strings.
5. Finding the sequence impedances of 3-Φ synchronous machine.
6. Finding the sequence impedances of 3-Φ Transformer.

In addition to the above six experiments, at least any four of the experiments from the following list are required to be conducted.

Part-B

1. Formation of Y_{bus}
2. Load Flow Analysis using Gauss Seidal (GS) Method.
3. Load Flow Analysis using Fast Decoupled (FD) Method.
4. Formation of Z_{bus}.
5. LG, LL and 3-Φ fault analysis of 3-Φ synchronous machine.
6. Power circle diagrams of a 3-Φtransmission line model.
7. ABCD constants and Regulation of a 3-Φ transmission line model.
8. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point method.

Reference Books:

1. C.L. Wadhwa: Electrical Power Systems–Third Edition, New Age International Pub.Co.,2001
2. Hadi Sadat: Power System Analysis–Tata McGrawHill Pub.Co.2002.
3. D.P.Kothari: Modern Power System Analysis-TataMcGrawHillPub.Co.2003

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

MICROPROCESSORS & MICROCONTROLLERS LAB - C26PC7

B.Tech. VI Semester
L/T/P/C

0/0/2/1

Course Objectives:

- To develop an understanding of the operations of microprocessors and micro controllers; machine language programming and interfacing techniques.

Course Outcomes:

1. Apply the fundamentals of assembly level programming for microprocessors/microcontrollers.
2. Develop programs on a microprocessor using instruction set of 8086.
3. Develop the assembly level programming using 8051 instruction set.
4. Able to understand how different I/O devices can be interfaced to microprocessor and microcontroller.
5. Develop programs using instruction set of ARM.

Note: - Minimum of 12 experiments to be conducted.

List of Experiments:

1. Programs for 16 bit arithmetic operations 8086(using various addressing modes)
2. Programs for sorting an array for8086.
3. Programs for searching for a number of characters in a string for8086.
4. Programs for string manipulation for8086.
5. Parallel communication between two microprocessor kits using8255.
6. Serial communication between two microprocessor kits using8251.
7. Interfacing to 8086 and programming to control stepper motor.
8. Programming using arithmetic, logical and bit manipulation instructions of8051.
9. Program and verify Timer/Counter in8051.
10. Program and verify interrupt handling in8051.
11. UART operation in8051.
12. Communication between 8051 kit and PC.
13. Interfacing LCD to8051
14. Programs for arithmetic operations using ARM7.
15. Program for Digital output (blink LEDs) using ARM7.
16. Program to display message on LCD using ARM7.
17. Interfacing seven segment display to ARM7.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING –R20

PYTHON PROGRAMMING LAB - C26ES8

B.Tech. VI Semester
L/T/P/C

0/0/2/1

COURSE OBJECTIVE:

To write and execute the programs based on operators, functions, simple data structures, basic packages using python programming constructs.

COURSE OUTCOMES:

After completion of course the student will be able to

1. Implementthefundamentalprogrammingelements:operators,statements,conditional and control flow statements.
2. Use predefined functions and build functions.
3. Use python modules and implement data structures to solve various computing problems.
4. Apply oops concepts using python.

List of programs

1. Write a python program to print “HelloWorld”.
2. Running instructions in Interactive interpreter and a Python Script.
3. Write a Python Programming to demonstrate the Indentation.
4. Write a Python program to calculate number of days between two dates.
5. Write a python program that takes 2 numbers as command line arguments and prints its product.
6. Write a Python program to test whether a given letter is a vowel or not.
7. Write a Python program to create a pattern.

```
*
**
***
****
*****
```

8. Write a Python program to count the number 6 in a given list.

9. Write a python program to find the sum of the first n positive integers.
10. Write a Python program to calculate the sum of the digits in an integer
11. Write a Python program that prints all the numbers from 0 to 50 except multiples of 10 (10,20,30,40,50)
12. Write a Python program to check if a number is positive, negative or zero.
13. Write a Python program that will accept the base and height of a triangle nd compute the area.
14. Write a Python program to compute the greatest common divisor (GCD) of two positive integers.
15. Write a Python program Make a Simple Calculator
16. Write a Python program to count the number of even and odd numbers from a series of numbers.
17. Write a Python function to calculate the factorial of a number(anon-negative integer).The function should accept the number as an argument.
18. Write a Python function that accepts a string and calculate the number of upper case letters and lower case letters.
19. Write a Python function that checks whether a passed string is palindrome or not.
20. Write a Python program to get the Fibonacci series between 0 to 50usingrecursion
21. Write a Python program to calculate the value of 'a' to the power 'b' using recursion.
22. Write a Python program to get the factorial of a non-negative integer using recursion
23. Write a Python program to calculate the length of a string.
24. Write a Python program to count occurrences of a substring in a string.
25. Write a Python program to count and display the vowels of a given text.
26. Write a program to count the numbers of characters in the string and store them in a dictionary data structure
27. Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.
28. Write a program combine lists that combines these lists into a dictionary.
29. Write a Python program for binary search.

30. Write a Python program to sort a list of elements using the bubble sort algorithm
31. Write a Python program to sort a list of elements using the quick sort algorithm.
32. Write a Python program to count the frequency of words in a file.
33. Write a Python program to print last n lines of a file.
34. Write a Python program to combine each line from first file with the corresponding line in second file.
35. Write a Python program to assess if a file is closed or not.
36. Write a Python program to get the Python version you are using.
37. Write a Python program to display the current date and time.
38. Write a Python program to print the calendar of a given month and year.
39. WriteaPythonclasswhichhastwomethodsget_Stringandprint_String.get_Stringacceptа string from the user and print_String print the string in uppercase.
40. Write a Python class named Rectangle constructed by length and width and a method which will compute the area of a rectangle.
41. Solve the following linear equations using scipy library X+3y+5z=10 2x+5y+z=8 2x+3y+8z=3
42. Find the determinant for a 2 * 2 matrix using scipy library module.
43. Find the mean and variance for the following data using scipy [2,23,45,56,78,89,13,33,66,89]
44. Draw a barchart with the following data using matplot lib Men_mean=[20,35,30,35,27] Women_mean=[25,32,34,20,25] Men_std=[2,3,4,1,2] Women_std=[3,5,2,3,3]
45. Using matplot lib and scipy libraries, apply the following operations on an image.

    a) Display the image crop image

    b) flip

    c) rotate

    d) display the statistical information of the image

    e) turn upside down

B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING

R20- REGULATION

LIST OF OPEN ELECTIVES OFFERED BY EEE DEPARTMENT (B.TECH. III & IV YEAR)

S. No.	Open Elective – I (Semester – V)	Open Elective – II (Semester – VI)
1	1)Smart Grid Technologies 2)Electrical Engineering Materials 3)Nanotechnology	1)Reliability Engineering 2)Optimization Techniques 3)Renewable Energy Sources

B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING-R20

SMART GRID TECHNOLOGIES- C25OE5

(OPEN ELECTIVE – I)

B. TECH V SEMESTER **L T P C**

3 0 0 3

Prerequisite: Power Systems, Electrical Measurements, Power Quality

Course Objectives:

- Understand concept of smart grid and its advantages over conventional grid
- Know smart metering techniques
- Learn wide area measurement techniques
- Understanding the problems associated with integration of distributed generation & its solution through smart grid.

Course Outcomes: At the end of the course, the student is able to:

- Appreciate the difference between smart grid & conventional grid
- Apply smart metering concepts to industrial and commercial installations
- Formulate solutions in the areas of smart substations, distributed generation and wide area measurements
- Come up with smart grid solutions using modern communication technologies

UNIT-I:

Introduction to Smart Grid, Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Concept of Robust &Self Healing Grid Present development & International policies in Smart Grid. Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation .

UNIT-II:

Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring& protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU)

UNIT-III:

Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of micro-grid, Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines, Captive power plants, Integration of renewable energy sources

UNIT-IV:

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit

UNIT-V:

Advanced Metering Infrastructure (AMI), Home Area Network(HAN), Neighborhood Area, Network(NAN), Wide Area Network (WAN), Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband over Power line (BPL), IP based protocols

TEXT BOOKS:

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE, 2011

2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRCPress , 2009

REFERENCES:

1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, “Smart Grid: Technology andApplications”, Wiley 2012

2. Stuart Borlase, “Smart Grid: Infrastructure, Technology and solutions “ CRC Press

3. A.G.Phadke, “Synchronized Phasor Measurement and their Applications”, Springer

B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING -R20

ELECTRICAL ENGINEERING MATERIALS- C25OE5

(OPEN ELECTIVE – I)

B. TECH V **SEMESTER**

L	T	P	C
3	0	0	3

Prerequisite: Engineering chemistry and Engineering Physics – II

Course Objective: To understand the importance of various materials used in electrical engineering and obtain a qualitative analysis of their behavior and applications.

Course Outcomes: After completion of this course, the student will be able to

1. Understand various types of dielectric materials, their properties in various conditions.
2. Evaluate magnetic materials and their behavior.
3. Evaluate semiconductor materials and technologies.
4. Acquire Knowledge on Materials used in electrical engineering and applications.

UNIT- I

Dielectric Materials: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT – II

Magnetic Materials: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis

UNIT – III

Semiconductor Materials: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI).

UNIT – IV

Materials for Electrical Applications: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT – V

Special Purpose Materials: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI

Text Books:

1. "R K Rajput", " A course in Electrical Engineering Materials", Laxmi Publications, 2009
2. "T K Basak", " A course in Electrical Engineering Materials", New Age Science Publications 2009

Reference Books:

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
2. "AdrianusJ.Dekker", Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011

B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING-R20

NANOTECHNOLOGY- C25OE5

(OPEN ELECTIVE – I)

B. TECH V SEMESTER **L T P C**

3 0 0 3

Course Objectives: Nano Technology is one of the core subjects of multidisciplinary nature. This has extensive applications in the field of energy, electronics, Biomedical Engg. Etc. Built to specifications by manufacturing matter on the atomic scale, the Nano products would exhibit an order of magnitude improvement in strength, toughness, and efficiency. The objective here is imparting the basic knowledge in Nano Science and Technology.

Course Outcomes: The present syllabus of "Introduction to Nano Technology" will give insight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.

UNIT - I

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects.

UNIT - II

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations,

Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility.

Magnetic Properties: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

UNIT- III

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self-assembly, **Top down approaches:** Mechanical alloying, Nano-lithography, **Consolidation of Nanopowders**: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT - IV

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope(STM),Field Ion Microscope (FEM),Three-dimensional Atom Probe (3DAP), Nanoindentation.

UNIT - V

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defense and Space Applications, Concerns and challenges of Nanotechnology.

TEXT BOOKS:

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS:

1. Nano: The Essentials by T. Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L. Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S., S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING-R20

RELIABILITY ENGINEERING- C26OE5

(OPEN ELECTIVE – II)

B. TECH VI SEMESTER	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Prerequisite: Mathematics

Course Objectives:

- To comprehend the concept of Reliability and Unreliability
- Derive the expressions for probability of failure, Expected value and standard deviation of Binominal distribution, Poisson distribution, normal distribution and weibull distributions.
- Formulating expressions for Reliability analysis of series-parallel and Non-series parallel systems
- Deriving expressions for Time dependent and Limiting State Probabilities using Markov models.

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

- Apply fundamental knowledge of Reliability to modeling and analysis of series-parallel and Non-series parallel systems.
- Solve some practical problems related
- Understand or become aware of various failures, causes of failures and remedies for failures in practical systems.

UNIT-I:

RELIABILITY AND PROBABILITY: Rules for combining probabilities of events, Definition of Reliability. Significance of the terms appearing in the definition. Probability distributions: Random variables, probability density and distribution functions. Mathematical expectation, Binominal distribution, Poisson distribution, normal distribution, exponential distribution weibull distribution.

UNIT-II:

HAZARD RATE: Derivation of the reliability function in terms of the hazard rate. Failures:Causes of failures, types of failures (early failures, chance failures and wear-out failures). Bath tub curve. Preventive and corrective maintenance. Modes of failure. Measures of reliability: mean time to failure and mean time between failures.

UNIT-III:

CLASSIFICATION OF ENGINEERING SYSTEMS: series, parallel and series-parallel systems- Expressions for the reliability of the basic configurations.Reliability evaluation of Non-series-parallel configurations: Decomposition, Path based and cutest based methods, Deduction of the Paths and cut-sets from Event tree.

UNIT-IV:

DISCRETE MARKOV CHAINS: General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation of one component repairable model. Absorbing states.

Continuous Markov Processes: Modeling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating time dependent and limiting state Probabilities of one component repairable model. Evaluation of limiting state probabilities of two component repairable model.

UNIT-V:

FREQUENCY AND DURATION TECHNIQUES: Frequency and duration concepts, application to multi state problems, Frequency balance approach. Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. "Reliability evaluation of Engineering systems", Roy Billinton and Ronald N Allan, BS Publications.
2. "Reliability Engineering", Elsayed A. Elsayed, Prentice Hall Publications.

REFERENCES:

1. "Reliability Engineering: Theory and Practice", By Alessandro Birolini, Springer Publications.

2. "An Introduction to Reliability and Maintainability Engineering", Charles Ebeling, TMH Publications.

3."Reliability Engineering", E. Balaguruswamy, TMH Publications.

B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING-R20

OPTIMIZATION TECHNIQUES- C26OE5

(OPEN ELECTIVE – II)

B. TECH VI SEMESTER **L T P C**
3 0 0 3

Prerequisite: Mathematics –I, Mathematics –II

Course Objectives:

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

Course Outcomes: After completion of this course, the student will be able to

- explain the need of optimization of engineering systems
- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

UNIT-I:

INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES

Statement of an Optimization problem – design vector – design constraints – constraint surface –objective function – objective function surfaces – classification of Optimization problems.

CLASSICAL OPTIMIZATION TECHNIQUES: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints.

Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT-II:

LINEAR PROGRAMMING

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

TRANSPORTATION PROBLEM: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT-III:

UNCONSTRAINED NONLINEAR PROGRAMMING

One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method

UNCONSTRAINED OPTIMIZATION TECHNIQUES: Uni-variant method, Powell's method and steepest descent method.

UNIT-IV:

CONSTRAINED NONLINEAR PROGRAMMING

Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT-V:

DYNAMIC PROGRAMMING

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.

2. H. S. Kasene& K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

REFERENCES:

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.

2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.

3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING-R20

RENEWABLE ENERGY SOURCES- C26OE5

(OPEN ELECTIVE – II)

B. TECH VI SEMESTER	L	T	P	C
	3	0	0	3

Pre-requisites: None

Course Objectives:

- To recognize the awareness of energy conservation in students
- To identify the use of renewable energy sources for electrical power generation
- To collect different energy storage methods
- To detect about environmental effects of energy conversion

Course Outcomes: At the end of the course the student will be able to:

- Understand the principles of wind power and solar photovoltaic power generation, fuel cells.
- Assess the cost of generation for conventional and renewable energy plants
- Design suitable power controller for wind and solar applications
- Analyze the issues involved in the integration of renewable energy sources to the grid

UNIT - I

Introduction

Renewable Sources of Energy-Grid-Supplied Electricity-Distributed Generation-Renewable Energy.Economics-Calculation of Electricity Generation Costs –Demand side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems.

Wind Power Plants

Appropriate Location -Evaluation of Wind Intensity -Topography -Purpose of the Energy Generated -General Classification of Wind Turbines-Rotor Turbines-Multiple-Blade Turbines Drag Turbines –Lifting Turbines-Generators and Speed Control used in Wind Power Energy Analysis of Small Generating Systems.

UNIT - II

Photovoltaic Power Plants

Solar Energy-Generation of Electricity by Photovoltaic Effect -Dependence of a PV Cell Characteristic on Temperature-Solar cell Output Characteristics-Equivalent Models and Parameters for Photovoltaic Panels-Photovoltaic Systems-Applications of Photovoltaic Solar Energy-Economical Analysis of Solar Energy.

Fuel Cells: The Fuel Cell-Low and High Temperature Fuel Cells-Commercial and Manufacturing Issues Constructional Features of Proton Exchange-Membrane Fuel Cells – Reformers-Electro-lyzer Systems and Related Precautions-Advantages and Disadvantages of Fuel Cells-Fuel Cell Equivalent CircuitPractical Determination of the Equivalent Model Parameters -Aspects of Hydrogen as Fuel.

UNIT - III

Induction Generators

Principles of Operation-Representation of Steady-State Operation-Power and Losses Generated-SelfExcited Induction Generator-Magnetizing Curves and Self-Excitation Mathematical Description of the Self-Excitation Process-Interconnected and Stand-alone operation -Speed and Voltage Control - Economical Aspects.

UNIT - IV

Storage Systems

Energy Storage Parameters-Lead–Acid Batteries-Ultra Capacitors-Flywheels – Superconducting Magnetic Storage System-Pumped Hydroelectric Energy Storage - Compressed Air Energy Storage - Storage Heat -Energy Storage as an Economic Resource.

UNIT - V

Integration of Alternative Sources of Energy

Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection.

Interconnection of Alternative Energy Sources with the Grid:

Interconnection Technologies - Standards and Codes for Interconnection – Interconnection Considerations - Interconnection Examples for Alternative Energy Sources.

TEXT BOOKS:

1. Felix A. Farret, M. Godoy Simoes, “Integration of Alternative Sources of Energy”, John Wiley&

Sons, 2006.

2. Solanki: Renewable Energy Technologies: Practical Guide for Beginners, PHI Learning Pvt.

Ltd., 2008.

REFERENCE BOOKS:

1. D. Mukherjee: Fundamentals of Renewable Energy Systems, New Age International

publishers, 2007.

2. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photovoltaic and

Wind Power Systems, John Wiley & Sons, 2011.

3. Gilbert M. Masters: Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004.