Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute under Mumbai University)
Andheri (W), Mumbai – 400058

COURSE CONTENTS

Sem. V

T. Y. B.Tech. (ELECTRICAL) ENGINEERING

Academic Year: 2018-19

List of Courses

Course Code: PC-BTE501 Course:-Electromagnetic Field and Waves (AY 2018-19)

Course Objectives:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on concepts of electrostatics, electric potential, energy density and its applications.
3. To impart knowledge on concepts of magneto statics, magnetic flux density, scalar and vector magnetic potential and its applications.
4. Explain time varying electric and magnetic fields and wave theory

Course Outcomes: Students will demonstrate the ability to

1. Understand the basic laws of electromagnetism.
2. Obtain the electric and magnetic fields for simple configurations under static conditions.
3. Analyze time varying electric and magnetic fields.
4. Understand Maxwell's equation in different forms and different media.
5. Understand the propagation of EM waves

Course Contents:

Module	Details	Hours
1	Review of Vector Calculus Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, Three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, Partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another	**06**
2	Static Electric Field Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density	**06**
3	Conductors, Dielectrics and Capacitance Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.	**06**
4	Static Magnetic Fields Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors	**06**
5	Magnetic Forces, Materials and Inductance	**06**

	Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.	
6	Time Varying Fields and Maxwell's Equations Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.	**06**
7	Electromagnetic Waves Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.	**06**

Text/ Reference Books:

1. W.Hayt, "Engineering electromagnetic", McGraw Hill.
2. Edminister, "Schaum's series in electromagnetic", McGraw Hill publications.
3. N.NarayanRao, "Elements of electromagnetic", PHI publication.
4. E.C.Jordan &K.G.Balmain,"Electromagnetic Waves and Radiating Systems", Prentice Hall of India.
5. S.seely, "Introduction to electromagnetic fields", McGraw Hill.
6. David K. cheng, "Field and electromagnetic", Addison Wesley.
7. Corson and lerrain, "Electromagnetic", CBS publications.

Sr. No.	Examination	Modules
1	**Test 1**	**1,2**
2	**Test 2**	**3,4**
3	**End Semester**	**1-7**

Course Code: PC-BTE502 Course:-Control System (AY 2018-19)

Course Objectives:

1. Introduction to control problem
2. Time response, frequency response and state variable analysis
3. Discuss Controller design
4. Introduction to optimum and nonlinear control

Course Outcomes: Students will demonstrate the ability to

1. Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers

Course Contents:

Module	Details	Hours
1	Introduction to control problem Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.	**04**
2	Time Response Analysis Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response.	**06**
3	Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.	**04**
4	Frequency-response analysis Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.	**06**
5	Introduction to Controller Design Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controller	**10**
6	State variable Analysis Concepts of state variables. State space model. Diagonalization of State	**06**

	Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.	
7	Introduction to Optimal Control and Nonlinear Control Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis.	**06**

Text/ Reference Books:

1. Norman Nise, "Control Systems Engineering".
2. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Pvt.Ltd
3. I.G. Nagrath & M. Gopal, "Control Systems Engineering", Wiley Eastern Ltd.
4. J.J. D'Azzo, C.H.Houpis and S.N. Sheldon, "Linear Control System Analysis and Design with MATLAB", Marcel Dekker.
5. G.F Franklin, "Feedback Control of Dynamic Systems", Pearson higher Education.

Sr. No.	**Examination**	**Modules**
1	**Test 1**	**1,2,3**
2	**Test 2**	**4,5**
3	**End Semester**	**01-07**

Course Code: PC-BTE503 Course:-Electrical Machines II (AY 2018-19)

Course Objectives:

1. Discuss the principle and operation of generating machine both 1-phase and 3-phase
2. Demonstrate the behavior of generating and motoring machine for different operating conditions.
3. Demonstrate the principle of fractional kilowatt machine
4. Discuss the special types of machines and applications (motors and generators)

Course Outcomes: Students will demonstrate the ability to

1. Illustrate the fundamental concept of electrical machine in electrical power generation
2. Analyze synchronous machine performance using trigonometry, complex algebra, and phasors to find correct solutions.
3. Apply the knowledge of basic machines to understand the operation of single phase induction machines and special machines

Course Contents:

Module	Details	Hours
1	Three Phase Induction Machine: (i) Construction and principle of operation of squirrel cage & slipring Induction motor (ii) Equivalent circuit, phasor diagram, no load and blocked rotor test, circle diagram (iii) Steady state analysis: Torque -speed characteristics, maximum torque, starting torque. Starting methods	06
2	Synchronous Machines: Construction, emf induced, winding factors, Armature reaction, Phasor diagrams of cylindrical pole synchronous generator at different power factor, Methods of voltage regulation of alternator	08
3	(i) Principle of operation of Synchronous Motor, starting methods. Power flow and maximum power of synchronous machines, (ii) Excitation & power circles, V & O curves, power angle characteristics, synchronizing power and torque, hunting, synchronous condenser	06
4	Operation on infinite bus for a change in excitation for motors and generators, Parallel operation of alternators, Load sharing	04
5	Salient pole machine: Blondel's two reaction theory, Measurement of Xd& Xq, Power flow equation.	06
6	Fractional kW machines: Construction, principle of operation. and	06

	applications of Single phase induction motor, capacitor start, capacitor run motor, Shaded pole motor.	
7	Special purpose Machines: Construction, principle of operation and applications of Stepper motor and their types, Permanent Magnet Synchronous Motor, Brushless DC motor.	06

Text/ Reference Books:

1. Nagrath and Kothari, "Electrical Machines", TMH Publicatio.
2. Sen P. C., "Principles of Electric Machines & Power Electronics".
3. Bimbhra P.S, "Electrical Machinery", Khanna Publisher, VII Edition.
4. Bimbhra P.S., "Generalized Theory of Electrical Machines", Khanna Publisher.
5. Gross Charles A., "Electrical Machines", CRC Press.

Sr. No.	**Examination**	**Modules**
1	**Test 1**	**1,2**
2	**Test 2**	**3,4,5**
3	**End Semester**	**1-7**

Course Code: PC-BTE504 Course:-Power System I (AY 2018-19)

Course Objectives:

1. Understand the basic structure, components, growth, and load curves of an electrical power system.
2. Understand the parameters, performance and characteristics of power system components.
3. Understand the behavior of the power system under symmetrical and unsymmetrical fault condition using symmetrical components.
4. To study Neutral grounding , Earthing and safety techniques in power system.

Course Outcomes: Students will demonstrate the ability to

1. Evaluate and compare the load curves of power systems.
2. Identify and select and configure the components of transmission system to improve efficiency and economy.
3. Understand the effect on power system parameters with varying load conditions.
4. Understand the power system behavior under symmetrical and unsymmetrical fault conditions
5. Understand the safety measures of power system.

Course Contents:

Module	Details	Hours
1	Power System Representation Brief introduction to generating stations, Basic structure of power system voltage levels at different stages of power transmission. Need for EHV transmission, Growth of power system in India, present Indian power industry, GRID formation, concept of National GRID. Transmission System Transmission & distribution network systems. Conductor configuration spacing and clearance, span lengths, sag& tension, Types of insulator, Voltage distribution over insulator string, Methods to improve string efficiency. Types of underground cables (including AC and DC) Economics of Power System Load curves, connected load, maximum demand, demand factor, Average load, load factor, diversity factor, Tariff	**06**
2	Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance and Inductance calculations for simple configurations	**07**
3	Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines.	**06**

4	Transformers: Three-phase connections and Phase-shifts. Three-winding transformers, autotransformers, Neutral Grounding transformers. Tap-Changing in transformers. Transformer Parameters. Single phase equivalent of three-phase transformers. Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations.	**08**
5	Symmetrical Components: Unbalanced system Analysis using symmetrical components, Power in terms of symmetrical components, Sequence circuits of transmission lines, transformer and Synchronous Machines, Phase shift in star delta transformer, Formation of Sequence Networks	**05**
6	Symmetrical and Unsymmetrical Fault Analysis: (i) 3 phase Short circuit of a synchronous machine: no load and loaded conditions, 3 phase fault on a transmission line, Short circuit MVA Capacity of a bus. (ii) Fault analysis using symmetrical components, Single line to ground (SLG) fault, Line to line (LL) fault, Double line to ground (LLG) fault, Open conductor fault. Neutral grounding	**06**
7.	Earthing and Safety Techniques Soil resistivity, earth resistance, Tolerable limit of body currents-tolerable step and touch voltage-actual step and touch voltage, Design of tower footing – Resistance, Measurement of earth resistance, soil resistivity-Impulse behavior of earthing.	04

Text/ Reference Books:

1. Kothari D. P Nagrath I. J., "Modern Power System Analysis", TMH Publications.
2. Wadhawa C. L., "Electrical Power Systems", New Age International.
3. Grainger J. J., Stevenson Jr W. D., "Power System Analysis", McGRAW-HILL International
4. George Kausic., "Computer Aided Power System Analysis", Prentice Hall Pub.
5. Saadat Hadi, "Power System Analysis, "TMH Edition.
6. Prabha Kundur, "Power System Stability and Control'', TMH Publication.
7. IEEE 80 – IEEE guide for safety in substation grounding

Sr. No.	Examination	Modules
1	Test 1	1,2
2	Test 2	3,4
3	End Semester	01-07

Course Code: PC-BTE505 Course:-Power Electronics (AY 2018-19)

Course Objectives:

1. Explain controlled converters
2. Analyze current and voltage inverters and demonstrate the operation and control of inverter circuits
3. Discuss DC to DC converters
4. Discuss need and application of AC filters

Course Outcomes: Students will demonstrate the ability to

1. Understand the behavior of semiconductor devices operated as power switches.
2. Analyze and design rectifier circuit.
3. Analyze DC/DC converter circuits.
4. Analyze DC/AC inverter circuit.

Course Contents:

Module	Details	Hours
1	Silicon Controlled Rectifiers: Principle of operation of SCR, Static & Dynamic characteristics, Gate characteristics, pulse firing	**03**
2	Other Switching Devices: Principle of operation, characteristics, rating and applications of Triac, MOSFET, IGBT and power diodes, GTO. Comparison of devices on the basis of turn on, turn off time.	**05**
3	Rectifiers: Introduction to Half wave uncontrolled and controlled rectifiers with differnt load Full wave controlled rectifiers with different load (single phase and three phase) Power factor improvements in rectifiers. Effect of load and source inductances	**10**
4	AC Filters: AC filter for grid connected converter, AC inductor design and need of LCL filter, LCL filter design	**04**
5	Inverters: (i) Principle of operation, Performance parameters, Single phase bridge Inverters with RL, R-L-E and pure L load. 3 phase bridge Inverters: 180 degree conduction mode. (ii) Voltage control of single phase and three phase inverters using PWM techniques, Connection of three phase inverter to grid, concept of active and reactive power flow between inverter and grid (iii) Current source inverters (iv) Space vector modulation	**08**
6	Choppers: Switching mode regulators – Buck, Boost, Buck-Boost and Cuk regulators, Bi-directional Chopper	**06**

7	AC Voltage Controllers: Principle of Phase Control, Single Phase bidirectional control with R-L load, Three phase full wave controllers, AC voltage controllers with PWM control, Applications	**06**

Text/ Reference Books:

1. Muhammad H. Rashid, "Power Electronics, Circuits Devices and Applications", Prentice-Hall of India.
2. Ned Mohan et. al,"Power Electronics: Converters, Applications and Design", John Wiley Pub.
3. Alok Jain, "Power Electronics & its Applications," Penram International Publishing (India) Pvt. Ltd.

4. Cyril W. Landers, "Power Electronics", McGraw Hill.
5. M. D. Singh, K. B. Khanchandani, "Power Electronics" Tata McGraw Hill.
6.. P.C.Sen, "Power Electronics", Tata McGraw-Hill Education.

Sr. No.	**Examination**	**Modules**
1	**Test 1**	**1,3**
2	**Test 2**	**4,5**
3	**End Semester**	**01-07**

Course Code: PC-BTE506 Course:-Control System Laboratory (AY 2018-19)

Course Objectives:

1. Time response, frequency response and state variable analysis
2. Discuss Controller design
3. Introduction to optimum and nonlinear control

Course Outcomes: Students will demonstrate the ability to
Simulate and analyze

1. First, second and higher order systems
2. Bode plot, Nyquist plot, solution of state equations, non linear system
3. Compensator controller and observer designs

Course Contents:

Module	**Details**	**Hours**
Simulation assignments to study, analyze or design		
1	First, Second and Higher order systems' performance in frequency domain	02
2	Study of second order system with different damping ratio and natural frequency of oscillations	02
3	Bode plot, Nyquist plot analysis	04
4	Design of Compensators	04
5	Study of state space model	02
6	Controller Design	04
7	Observer Design	04
8	Non linear system analysis	04

Course Code: PC-BTE507 Course:-Electrical Machines II Laboratory (AY 2018-19)

Course Objectives:

1. To perform load test on three phase induction motor
2. To observe the effect of rotor resistance and supply voltage on torque speed characteristic of induction motor
3. To study and evaluation of Voltage Regulation for synchronous generator volt
4. To conduct experiment to draw V and inverted V curves for synchronous motor
5. To calculate Xd and Xq of a salient pole synchronous machine.

Course Outcomes: Students will demonstrate the ability to

1. Perform load test on three phase induction motor and understand variation in torque speed characteristics with different parameters
2. Perform experiments on synchronous machines with defined procedures and safety.
3. Understand the voltage regulation in synchronous generator and different methods to find it.
4. Analyze the V curve and inverted V-curve for synchronous motor under various load conditions.
5. Determine Xd and Xq parameters of salient pole synchronous machine.

Course Contents:

Module	Details	Hours
1	To perform load test on 3 Phase Induction Motor.	02
2	To study the effect of rotor resistance on torque speed characteristic of 3 Phase Induction Motor.	02
3	To study the effect of supply voltage on torque speed characteristic of 3 Phase Induction Motor.	02
4	Voltage Regulation of synchronous generator by EMF/MMF method	02
5	Voltage Regulation of synchronous generator by ZPF method	02
6	Voltage Regulation of synchronous generator ASA Method	02
7	Voltage regulation of synchronous generator by direct loading	02
8	Slip Test on salient pole synchronous generator	02
9	V-curves and inverted V- Curves F-curves of synchronous motor	02
10	Performance characteristics of single phase induction motor	02

Course Code: PC-BTE508 Course:-Power Electronics Laboratory (AY 2018-19)

Course Objectives:

1. To simulate various converter circuits.
2. To familiarize the students by introducing MATLAB simulation and help them to Simulate and analyze different Converters

Course Outcomes: Students will demonstrate the ability to

1. Simulate uncontrolled and controlled rectifiers on software
2. Observe and analyze various converter waveforms for different loads.
3. Apply knowledge of dual converter in DC motor applications.
4. Execute three phase bridge rectifier connections and analyze waveforms
5. Identify difference in ideal and practical power electronics circuits

Course Contents:

Expt No.	Title	Hours
1	Half wave diode converter	02
2	Half wave SCR converter	02
3	Single phase Full wave fully controlled SCR converter with resistive load	02
4	Single phase Full wave fully controlled SCR converter with RL load.	02
5	3 phase full wave fully controlled SCR converter with resistive load	02
6	Separately excited DC motor speed control using Dual Converter	02
7	Single phase Inverter	02
8	Two MATLAB simulations of uncontrolled & controlled converters	02

Course Code: PE-BTE501 Course:-Digital Signal Processing (AY 2018-19)

Prerequisite: Course Signals and Systems

Course Objectives:

1. Introduce discrete time signals and systems
2. Frequency analysis including fast algorithms
3. Discuss digital filters and different design methods of digital filters

Course Outcomes: Students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
2. Analyze discrete-time systems using z-transform.
3. Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
4. Design digital filters for various applications.
5. Apply digital signal processing for the analysis of real-life signals

Course Contents:

Module	Details	Hours
1	Discrete-time signals and systems Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.	**06**
2	Z-transform z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.	**06**
3	Discrete Fourier Transform (10 hours) Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Circulation convolution, comparison between linear and circulation convolution,, Circulation convolution using DFT / IDFT, Response of LTI system (linear convolution or linear filtering) using circulation Convolution, Response of LTI system (linear convolution or linear filtering) using DFT / IDFT	**10**
4	Fast Fourier Transform Algorithms Comparison of computation complexity of direct computation of DFT and FFT., Radix-2 Decimation in Time and Decimation in Frequency algorithms, IDFT using FFT algorithms	**04**
5	FIR Filter Designing Introduction: Linear Phase FIR Filters, Frequency response of different types of linear phase FIR Filters, Locations of definite zeros of different types of FIR Filters. Designing of FIR filters using windowing technique, Gibbs Phenomenon (Hamming, Hanning, Rectangular, Bartlett, Kaiser window functions), Designing of FIR filters using frequency sampling	**06**

	technique, Half Band FIR Filers.	
6	IIR Filter Designing Introduction, Designing of analog IIR filters using Butterworth and Chebyshev approximations, Analog to analog spectral transformations, Designing of IIR digital filters using impulse invariance and bilinear transformation methods, stability properties. Designing of IIR digital filters using matched z-transformation method, backward difference algorithm	**06**
7	Applications of Digital Signal Processing Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using, ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	**04**

Text/ Reference Books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons.

Sr. No.	Examination	Modules
1	**Test 1**	**1,2**
2	**Test 2**	**3,4**
3	**End Semester**	**01-07**

Course Code: PE-BTE502 Course:-Computer Architecture (AY 2018-19)

Course Objectives:

1. Introduction to computer, memory and input-output organization
2. Discuss pipelining
3. Explain different architectures

Course Outcomes: Students will demonstrate the ability to

1. Understand the concepts of microprocessors, their principles and practices.
2. Understand various data types, integer and floating point arithmetic, CPU operation and implementation
3. Understand various architectures and microprocessors.

Course Contents:

Module	Details	Hours
1	Introduction to computer organization Architecture and function of general computer system, CISC Vs RISC,	**02**
2	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.	**06**
3	Memory organization System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks	**06**
4	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.	**08**
5	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	**08**
6	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.	**06**
7	Different Architectures VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming	**06**

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

Sr. No.	**Examination**	**Modules**
1	**Test 1**	**1,2,3**
2	**Test 2**	**4,5**
3	**End Semester**	**1-7**

Value Added Courses

1. **Soft Computing I Introduction to MATLAB/SCILAB (VL-BTE01)**

   Course Objective: Provide knowledge of MATLAB/ SCILAB.

   Course Outcome: Students will be able to develop good applications using MATLAB/ SCILAB

   Course content: Basic Introduction and Overview, Variables and Data types, Operation,. Control Structure, Function, Introduction to different tool boxes available, introduction to MATLAB simulink

2. **Introduction to Python (VL-BTE02)**

   Course Objective: Provide knowledge of Python

   Course Outcome: Students will be able to develop good applications using Python

   Course content: Basic Introduction and Overview, Variables and Data types., Operations in Python, Control Structure, List, Tuples and Dictionary, Function, Introduction to turtle and some introduction to modules, Exception handling, Object oriented in python, Numpy, Matplotlib.

3. **Finite Element Methods for Electrical Engineering (VL-BTE05)**

   Course objective: Introduce how the finite element method can be used as a numerical tool to solve differential equations.

   Course Objective: Students will be able to solve Electrical engineering problems using finite element methods

   Course content: Introduction to the mathematical description of Electrical engineering problems, Revision of numerical solutions to differential and algebraic equations, Overview of the finite element method - Variational approach, Ritz technique, Galerkin method, Approximation functions for one, two and three-dimensional elements, Application of the FEM to Analyzing electrical circuits Programming FEM in open source

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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Andheri (W), Mumbai – 400058

COURSE CONTENTS

Sem. VI

T. Y. B.Tech. (ELECTRICAL) ENGINEERING

Academic Year: 2018-19

List of Courses

Course Code: PC-BTE601 Course:-Power System II (AY 2018-19)

Prerequisite: Courses: Power System I:

Course Objectives:

1. Understand the mathematical model of power system network
2. To study load flow analysis using different computational methods.
3. To understand the behaviour of power system during transient condition.
4. To study the behaviour of power system with different receiving end conditions under steady state
5. To study different methods of control and monitoring power system parameters.
6. To understand the basic pricing principle in power system economics and management.

Course Outcomes: Students will demonstrate the ability to

1. Derive mathematical model of the power system network.
2. Analyse the power system behaviour under steady state and transient conditions.
3. Suggest suitable methods to control power system parameters.
4. Suggest suitable pricing method to have power system economy and management

Course Contents:

Module	Details	Hours
1	Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications	**04**
2	**Load Flow Studies**: Power Flow Problem, Gauss Seidel (GS) method, Newton Raphson (NR) method, Decoupled & Fast Decoupled method, Comparison of different load flow methods	**06**
3	**Stability and Stability Constraints in synchronous grids** Power System Stability: Classification of Stability, Dynamics of synchronous machine, Power angle equation, Node elimination technique, Stability study of simple systems, Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of wing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability. Travelling waves in transmission lines: wave equation, reflection and refraction of waves, Bewely Lattice Diagram, typical cases of line terminations.	**10**

4	**Control of Voltage:** Voltage and Reactive Power Flow Control: Production and absorption of reactive power, means of voltage control in power systems, Automatic Voltage Regulators, generator excitation systems and reactive power characteristics of power system components Droop Control and Power Sharing. Shunt Compensators, Static VAR compensators and STATCOMs Tap Changing Transformers. Power flow control using embedded dc links, phase shifters	**08**
5	**Control of Frequency** • Relationship between generator rotor speeds and "system frequency" during transients, • Calculation of system frequency, frequency control, speed governor, automatic generation control (AGC) Frequency dependence of loads.	**05**
6	**Monitoring and Control** Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control.	**04**
7	**Power System Economics and Management** Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.	**05**

Text/ Reference Books:

1. Kothari. D. P, Nagrath. I. J., "Modern Power System Analysis", TMH Publication.
2. Chakrabarti .A, Halder. S, "Power System Analysis- Operation and Control", PHI.
3. Prabha Kundur,"Power System Stability and Control", TMH Publication.
4. Hingorani N.G.., "Understanding of Facts", Wiley Publications.
5. Allen. J. Wood., Bruce. F. Wollenberg, "Power Generation operation and Control", Wiley India.

Sr. No.	Examination	Modules
1	**Test 1**	**1,2, Part of 3**
2	**Test 2**	**Part of 3, 4**
3	**End Semester**	**1-7**

Course Code: PC-BTE602 Course:-Switchgear and Protection (AY 2018-19)

Course Objectives:

1. Discuss components of a protection system and types of relays
2. Discuss equipment and system protection, digital protection
3. Discuss principles of circuit breakers and different types of circuit breakers

Course Outcomes: Students will demonstrate the ability to

1. Understand the different components of a protection system.
2. Understand the protection schemes for different power system components.
3. Understand the basic principles of digital protection.
4. Understand principles of circuit breakers.

Course Contents:

Module	Detail	Hours
1.	**Basics of protection** Protective zones. Attributes of relays, Primary and back up protection, remote and local back up, Desirable qualities. CT and PT **Typical relays:** Electromagnetic type, static type and numerical relay	4
2.	**Principle and characteristics of:** Over current Relays - Time setting, plug setting, Different characteristics like IDMT, very Inverse etc., Directional Relay, Distance Relay- Reactance, Impedance, MHO relay, Differential Relay, Earth Fault Protection **Introduction to Analogue and Digital Static Relays:** Comparison of static and electro-mechanical relays, Static Over Current Relays, Static Distance Relays	4
3.	**Power Apparatus Protection:** **Protection of Transmission lines & feeders**- over current protection and relay coordination, Distance relay application, Power swings and distance relaying, Pilot protection **Protection of Transformer**-The problems and hazard in transformer, Differential relay for 3 phase transformer winding protection, Magnetizing inrush, Restricted Earth fault protection, Buchholz relay. **Protection of Generator**-The problems and hazard in generator, Differential protection for stator faults, Protection against loss of prime mover and loss of excitation, field suppression, out of step protection. **Motor Protection**- The problems and hazards in Induction motor, Protection against single phasing, Thermal over load and short	12

	circuit protection using Type 2 coordination, Under voltage protection **Synchronous motor protection**. **Bus Protection**- Different bus arrangements with breakers, Ring bus arrangement, One and a half breaker arrangement and High impedance bus differential relay.	
4.	**Principles of Circuit Braking:** D.C and A.C. circuit breaking, arc voltage and current waveforms in an A.C. circuit., Definition of transient recovery voltage, rate of rise of TRV, expression for TRV for different values of arc resistance, current chopping, capacitance switching, ratings and specifications of circuit breakers, making and breaking capacity	4
5.	**Basics of Arc Extinction**: Ionisation of Gases, Deionization, Arc Formation in AC Circuit Breakers, Modes of Arc Extinction, Arc Interruption Theories, Arc Extinction in Oil, Vacuum, Air Blast and SF6 Gas, Arc Time Constant **Air Break Circuit Breaker**: Construction, arc control devices, Lengthening of Arc, Operating Mechanism, Series Connected Over-Load Trip Coil Arrangement **Fundamentals of:** a) Air Blast Circuit Breaker b) SF6 Circuit Breaker c) SF6 Insulated Metal Clad Switchgear – Sub Station d) MOCB i.e. Minimum Oil Circuit Beaker and Bulk Oil Circuit Breaker e) Vacuum Interrupter and Vacuum Circuit Breaker	6
6.	**HRC Fuses and their Applications:** Characteristic of a Fuse, Protection of Motor, Discrimination, Equipment Incorporating Fuses, High Voltage Current Limiting Fuses, Expulsion Type High Voltage Fuse, Drop Out Fuse, Test On Fuse. Metal Enclosed Switchgear, Control Gear and Contactor: Medium Voltage Metal Enclosed Switchgear with SF6 CB and VCB	4
7.	Modern Protection System, Microprocessor Based Substation Protection Control and Monitoring Application of Switch-Gear & Electrical Safety Short Circuit Testing of Circuit Breakers: Direct and Indirect testing concepts in detail. **Protection against over voltage surges:** Lightening phenomenon, over voltages due to lightning, different types of lighting arresters, Insulation Co-ordination between different devices, BIL.	8

Text/ Reference Books:

1. J. L. Blackburn, “Protective Relaying: Principles and Applications”, Marcel Dekker,New York, 1987.
2. Y. G.Paithankar and S. R. Bhide, “Fundamentals of power system protection”, Prentice Hall, India, 2010.
3. A. G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, John Wiley & Sons, 1988.
4. A. G. Phadke and J. S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer, 2008
5. D. Reimert, “Protective Relaying for Power Generation Systems”, Taylor and Francis,2006.

Sr. No.	Examination	Modules
1	Test 1	1, 2, Part of 3
2	Test 2	Part of 3, 4
3	End Semester	01-07

Course Code: PC-BTE603 Course:-Switchgear and Protection Laboratory (AY 2018-19)

Course Objectives:

1. To demonstrate theoretical knowledge.
2. To conduct experiment based on overcurrent protection scheme.
3. To conduct experiment based on generator protection, earth fault protection.

Course Outcomes: Students will demonstrate the ability to

1. Understand operating characteristics of electromagnetic relays, circuit breaker and other protective devices.
2. Understand various protection scheme used in power system equipments.
3. Analyze performance of electromagnetic, numerical and microprocessor based relay.
4. To develop an ability and skill to design the feasible protection systems needed for each main part of a power system

Course Contents:

Module	Details	Hours
1	IDMT characteristic of non-directional over voltage relay	02
2	Study of Miniature Circuit Breaker HRC fuse, MCCB: components identification and Applications	02
3	Study of Power Contactor	02
4	Air Circuit Breaker: components identification and Applications.	02
5	Simulation of 2O/C+ 1E/F protection scheme.	02
6	Numerical Relay: Study and Application	02
7	Generator protection	02
8	Differential protection using static relay	02
9	Microprocessor based distance protection	02

Course Code: PE-BTE601 Course:-Electrical Machines Design (AY 2018-19)

Prerequisite: Courses: Electrical Machines I and II

Course Objectives:

1. Discuss the design of transformers, induction motors and synchronous machines
2. Introduction to computer aided design

Course Outcomes: 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.

Course Contents:

Module	Details	Hours
1	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	**08**
2	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.	**08**
3	Induction Motors Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots 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.	**08**
4	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	**08**
5	Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables,	**10**

	constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.	

Text/ Reference Books:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programs", Oxford and IBH Publishing, 2006.

Sr. No.	Examination	Modules
1	Test 1	1, Part of 2
2	Test 2	Part of 2, 3
3	End Semester	01-05

Course Code: PE-BTE602 Course:-Control System Design (AY 2018-19)

Prerequisite: Control System

Course Objectives:

1. Discuss design specifications
2. Design of classical control system in time and frequency domain
3. Explain PID controller design and controller design in state space
4. Introduction to controllability, observability and non linearities

Course Outcomes: Students will demonstrate the ability to

1. Understand various design specifications.
2. Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).
3. Design controllers using the state-space approach.

Course Contents:

Module	Details	Hours
1	Design Specifications Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.	**06**
2	Design of Classical Control System in the time domain Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.	**08**
3	Design of Classical Control System in frequency domain Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.	**08**
4	Design of PID controllers Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.	**06**
5	Control System Design in state space Review of state space representation.	**02**
6	Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.	**06**
7	Nonlinearities and its effect on system performance	**06**

	Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.	

Text/ Reference Books:

1. N. Nise, "Control system Engineering", John Wiley, 2000.
2. I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
3. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
4. K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.
5. B. C. Kuo, "Automatic Control system", Prentice Hall, 1995.
6. J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill, 1995.
7. R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", Saunders College Pub, 1994.

Sr. No.	Examination	Modules
1	Test 1	1,2
2	Test 2	3,4
3	End Semester	1-7

Course Code: OE-BTE601 Course:-Project Management (AY 2018-19)

Prerequisite:

Basics of Electrical Engineering, Basics of statistics and mathematics, general knowledge about working of organizations

Course Objectives:

1. Get familiarized with basics of project management, its organization and project management framework.
2. Learn five important project management process groups, namely: initiating, planning, executing, monitoring & control, closing and ten important project management knowledge areas.
3. Understand the relationship between project management process groups and knowledge areas.

Course Outcomes: Students will demonstrate the ability to

1. Explain basics of Project Management, its organization and project management framework.
2. Perform project management process group and knowledge area mapping.
3. Solve a case study using step-by-step process of managing projects and explain why each step is necessary.

Course Contents

Module	Details	Hours.
1	**Introduction** • Basics of project management, operations management and organizational strategy, • Project management framework, organizational structures, • Project Management Processes – Initiating, Planning, Executing, Monitoring & Control, Closing.	04
2	**Project Integration Management** • Integrated change control, Developing project management plan and project charter, • Project selection, corrective action, preventive action, defect repair, change control board, • Cost benefit analysis, Net present value, internal rate of return, payback period, present value, economic value added, • Opportunity costs, sunk costs, law of diminishing returns, working capital, depreciation.	05

	Project Scope Management • Scope baseline, WBS, Project scope statement, WBS dictionary, benefits and uses of WBS • Requirement documentation, requirements traceability matrix, requirements management plan	
3	**Project Time Management** • Schedule baseline, schedule compression, Network diagram, • Precedence Diagramming Method (PDM), Three point estimating, analogous estimating, parametric estimating, • Schedule management plan, resource optimization, Critical path method, Program Evaluation Review Technique (PERT). **Project Cost Management** • Earned value measurement, cost baseline, cost budget, Cost management plan, • Reserve analysis, contingency reserve, management reserves, cost risk, • Variable / fixed costs, direct / indirect costs, life cycle costing, value analysis, control thresholds, cost of quality, Return of Interest (RoI), and discounted cash flow. **Project Quality Management** • Seven basic quality improvement tools – control chart, Pareto diagram, Cause and effect diagram, flow chart, scatter diagram, histogram. • Quality assurance tools and techniques – Affinity diagram, tree diagrams, process decision program charts, matrix diagrams, prioritization matrices, network diagrams.	10
4	**Project Human Resource Management** • Role of PM, sponsor, stakeholders, functional manager, portfolio manager, program manager, • HR management plan, recognition and reward systems, team building, stages of team formation and development, team types. • Conflict Management, • Responsibility Assignment Matrix (RAM), RACI Chart, • Motivation theory, Management and Leadership styles, **Project Communication Management** • Communication models, channels, method, communication blockers.	05
5	**Project Risk Management** • Risk management plan, risk response strategies, threats, opportunities, risk register, contingency plans, fallback plans, residual risks, secondary risks,	07

	• Risk types and categories, SWOT analysis, **Project Procurement Management** • Procurement management plan, types of agreements and contract types, advantages and disadvantages of each contract type, • PM's role in procurement, procurement documents : RFP, IFB, RFQ, RFI, • Types of procurement, procurement negotiations, centralized / decentralized contracting, contract interpretation, price, profit, cost, target price, sharing ratio, ceiling price	
6	**Project Stakeholder Management** • Stakeholder analysis, stakeholder register, stakeholder expectations, stakeholder engagement, • Power and interest grid, stakeholders engagement assessment matrix	04
7	**Professional and Social Responsibility** • Project management traits in professional and social responsibility, • Code of Ethics and Professional conduct w. r. t. responsibility, respect, fairness, honesty. **Project Management Case Study / Activity**	05

Text/ Reference Books:

1. Gower Handbook of People in Project Management, Dennis Lock and Lindsay Scott, Routledge Publishers, NY, USA, 2016.
2. Project Management – Essentials You Always Wanted to Know, Kalpesh Ashar, Vibrant Publishers, 2012.
3. Projects: Planning, Analysis, Selection, Financing, Implementation and Review, Prasanna Chandra, McGraw Hill India, 2014.
4. A Guide to the Project Management Body of Knowledge (PMBOK Guide), 5th Ed., Project Management Institute, USA.
5. Project Management: Processes, Methodologies and Economics, 2nd Ed., Avraham Shtub, J. F. Bard, S, Globerson, PH Inc., USA.
6. Project Management Handbook,, 2nd Ed., David Cleland, Wiley, 1988.

Sr. No.	Examination	Modules
1	**Test 1**	**1,2, Part of 3**
2	**Test 2**	**Part of 3,**
3	**End Semester**	**01-07**

Course Code:OE-BTE602 Course:-Artificial Intelligence (AY 2018-19)

Course Outcome: Students will demonstrate the ability to

1. Develop a basic understanding of AI building blocks presented in intelligent agents
2. Choose an appropriate problem solving method and knowledge representation technique
3. analyze the strength and weaknesses of AI approaches to knowledge – intensive problem solving
4. Design models for reasoning with uncertainty as well as the use of unreliable information

Module	Details	Hours
1	Introduction to Artificial Intelligence (AI) History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI	04
2	Intelligent Agents Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Age	04
3	Problem solving 1 Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems. Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening(DFID), Informed Search Methods: Greedy best first Search ,A* Search , Memory bound edheuristic Search.	07
4	Problem solving 2 Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search, Genetic algorithms. Adversarial Search: Games, Optimal strategies, The minimax algorithm, Alpha-Beta Pruning.	07
5	Knowledge based Agents, The Wumpus World, The Propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining, Knowledge Engineering in First-Order Logic, Unification, Resolution, Introduction to logic programming (PROLOG), Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief network, Inference in belief network.	10
6	Planning and Learning The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning, Learning: Forms of Learning, Inductive Learning, Learning Decision Tree, Expert System: Introduction, Phases in building Expert Systems, ES Architecture, ES vs Traditional System.	06
7	Applications Natural Language Processing(NLP), Expert Systems.	04

Text/Reference Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education.
2. SarojKaushik "Artificial Intelligence" ,Cengage Learning.
3. George F Luger "Artificial Intelligence" Low Price Edition , Pearson Education., Fourth edition.
4. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
5. Elaine Rich and Kevin Knight "Artificial Intelligence" Third Edition
6. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
7. Hagan, Demuth, Beale, "Neural Network Design" CENGAGE Learning, India Edition.
8. Patrick Henry Winston , "Artificial Intelligence", Addison-Wesley, Third Edition.
9. Han Kamber, "Data Mining Concepts and Techniques", Morgann Kaufmann Publishers.
10. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press

Sr. No.	Examination	Modules
1	**Test 1**	**1,2, Part of 3**
2	**Test 2**	**Part of 3,4, Part of 5**
3	**End Semester**	**01-07**

Course Code: OE-BTE603 Course:-Communication Engineering (AY 2018-19)

Course Objectives:

1. Discuss analog and digital modulation
2. Discuss importance of source and channel coding
3. Explain utilization of media bandwidth

Course Outcomes: Students will demonstrate the ability to

1. Apply different analog and digital modulation demodulation techniques
2. Understand source and channel coding
3. Select different media based on application
4. Appreciate use of multiplexing and spreading methods

Course Contents:

Module	Details	Hours
1	Amplitude Modulation Systems Need for modulation, normal AM, generation and demodulation (envelope & synchronous detection), modulation index, DSBSC: generation and demodulation, Effect of phase and frequency offset on demodulation, SSB: Generation using filter and phasing method, detection. Frequency division multiplexed systems using SSB.	08
2	Angle Modulation Systems Concept of frequency and phase modulation, frequency deviation and modulation index, FM spectra, Carson‟s rule, narrowband FM, generation of Wideband FM Armstrong method, direct FM generation. Demodulation of FM-discriminatory, PLL	08
3	Sampling and Discrete time Modulations Sampling Theorem – low pass and band pass, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM) their generation and detection-phase time division multiplying.	04
4	Digital Communication PCM, quantization noise, bandwidth, advantages over analog communication, PCM system, Differential PCM, Delta Modulation, Digital Modulation – ASK, FSK, PSK, DPSK, QAM	06
5	Information theory – Information, Entropy, Rate of information, Channel capacity, Shannon theorem, Huffman coding	06
6	Channel Coding – Linear block code, Cyclic code, Convolution code.	06
7	Utilization of Media Bandwidth Guided and unguided media – Twisted pair cable, Coaxial cable, Fiber optic, Radio waves, Microwaves, Infrared waves, Light waves, Multiplexing – FDM, TDM Spreading – DSSS, FHSS,	04

Text/ Reference Books:

1. Haykin S., "Communications Systems", John Wiley and Sons.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers..
6. Proakis J.G., ``Digital Communications'', McGraw Hill.

Sr. No.	Examination	Modules
1	Test 1	1, Part of 2
2	Test 2	Part of 2,3,4
3	End Semester	01-07

Course Code: OE-BTE604 Course:-VLSI Circuits (AY 2018-19)

Course Objectives:

1. To introduce the fundamental principles of VLSI circuit design and layout techniques.
2. To highlight the circuit design issues in the context of VLSI technology.
3. To examine the basic building blocks of large-scale digital integrated circuits

Course Outcomes: Students will demonstrate the ability to

1. Demonstrate a clear understanding of choice of technology and technology scaling.
2. Design MOS based circuits and draw layout.
3. Realize logic circuits with different design styles.
4. Demonstrate a clear understanding of system level design issues such as protection, timing and power dissipation

Course Contents:

Module	Details	Hours
1	Technology Trend: Technology Comparison: Comparison of BJT, NMOS and CMOS technology. MOSFET Scaling: Types of scaling, Level 1 and Level 2 MOSFET Models, MOSFET capacitances.	06
2	MOSFET Inverters Circuit Analysis: Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load and CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters, CMOS Latch-up Logic Circuit Design: Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter.	06
3	MOS Circuit Design Styles Design Styles: Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS. Circuit Realization: SR Latch, JK FF, D FF, 1 Bit Shift Register, MUX, decoder using above design styles.	06
4	Semiconductor Memories SRAM: ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation 3T, 1T, operation modes, leakage currents, refresh operation, Input-Output circuits), Flash (mechanism, NOR flash, NAND flash)	06
5	Data Path Design Adder: Bit adder circuits, ripple carry adder, CLA adder Multipliers and shifter: Partial-product generation, partial-product accumulation, final addition, barrel shifter	06
6	VLSI Clocking Clocking: CMOS clocking styles, Clock generation, stabilization and distribution.	06

	Low Power CMOS Circuits: Various components of power dissipation in CMOS, Limits on low power design, low power design through voltage scaling.	
7	System Design IO pads and Power Distribution: ESD protection, input circuits, output circuits, simultaneous switching noise, power distribution scheme Interconnect: Interconnect delay model, interconnect scaling and crosstalk	06

Text/ Reference Books:

1. Sung-Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits Analysis and Design", Tata McGraw Hill.
2. Neil H. E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education
3. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education.
4. Etienne Sicard and Sonia Delmas Bendhia, "Basics of CMOS Cell Design", Tata McGraw Hill.
5. Debaprasad Das, "VLSI Design", Oxford.
6. Kaushik Roy and Sharat C. Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley, Student Edition.

Sr. No.	**Examination**	**Modules**
1	**Test 1**	**1,2**
2	**Test 2**	**3,4**
3	**End Semester**	**01-07**

Course Code: MC-BT003 Course: Environmental Science (AY 2018-19)

Course Objectives:

1. To sensitize to the ever-increasing environment problems.
2. To acquire knowledge about environmental pollution.
3. To acquire knowledge with respect to renewable energy and its positive impact on environment.
4. To be aware of the national and international concern for environment for protecting the environment.

Course Outcomes: Students will demonstrate the ability to

1. Propose specifications to comply with norms of environment engineering
2. Describe laws and regulations pertaining to health, safety and environment
3. Apply evaluation tool such as GRIHA to help design, build, operate, and maintain a resource efficient environment management system

Course Contents:

Module	Details	Hours
1	**Introduction to Environmental Engineering**: Biotic and Abiotic Environment, Adverse effects of environment, Types of environmental pollution - Water pollution, Air pollution, Solid waste management, Control Strategies of different environmental problems	06
2	**National Legislation for Environment**: Constitutional provisions for safeguarding the environment, The Environmental (Protection) Act, The Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, The Wild life (Protection) Act, Forest Act, Biodiversity Act	06
3	**Introduction to Ecology**: Definition, Structure and function of an ecosystem-Ecological succession-primary and secondary succession. Ecological pyramid of number, pyramid of energy and pyramid of biomass	06
4	**Introduction to Renewable Energy.** Solar, Wind, Geothermal, Ocean (Tidal), Biomass – Basics, Conservation of natural resources. Environmental and economic impact of each type of renewable energy.	06
5	**Hazard Assessment, Prevention, and Control:** Stress and Safety, Safety and Health Training, Mechanical Hazards and Machine Safeguarding, Fire Hazards and Life Safety, Ethics and Safety, Hazard Analysis/Prevention and Safety Management, Environmental Safety and ISO 14000 (Environmental Management).	06
6	**Introduction to National Rating System** GRIHA (Green Rating For Integrated Habitat Assessment): An evaluation tool to help design, build, operate, and maintain a resource-efficient built environment. Case studies of GRIHA registered buildings	06

7	**International Concerns: Conventions and Treaties**-RAMSAR Convention, CITES, Convention on Biological Diversity, Convention to Combat Desertification, Convention on Climate Chang.	06

Recommended Books:

1. GRIHA Manual Volume 1 - Ministry of New and Renewable Energy, Government of India, New Delhi.
2. ISO 14001:2004(E) - Environmental management systems Requirements with guidance for use.
3. Jagdish Krishnawamy, R J Ranjit Daniels," Environmental Studies", Wiley India Private Ltd. New Delhi. 4. An Indita Basak, Environmental S

Sr. No.	Examination	Modules
1	Test 1	1,2
2	Test 2	3,4
3	End Semester	01-07

Value Added Courses

1. PLC **(VL-BTE03)**

Course Objective:

1. Discuss the purpose, functions, and operations of a PLC
2. Explain basic components of the PLC and how they function

Course Outcome: Students will be able to

1. Generate and print out a ladder logic report using PLC software
2. Create a PLC project using PLC
3. Configure the I/O for a PLC project using PLC

Course content: Introductions to the purpose, functions, and operations of the PLC, Identification of various components of the PLC, Introduction to PLC ladder logic and basic programming concepts, Establishing communications with the PLC, Definitions of conditional inputs and outputs, Electrical continuity versus logical continuity, PLC timer and counter concepts and programming applications, Programming applications using sequencers.

2. Soft Computing II ETAP and WAMS (VL-BTE06)

Course Objective:

1. Introduce ETAP software
2. Discuss the synchro phasor measurement techniques in a Wide Area Control through the basic building blocks of GPS satellite synchronized clocks, the architecture of the Phasor Measurement Units (PMUs), and The communications equipment.

Course Outcome: Students will be able to

1. Use ETAP as an analysis platform for the designing, simulating, operating and automation of generation and distribution of power systems.
2. Understand the synchro phasor measurement techniques in a Wide Area Control

Course content: Build power systems and simulate the power, current and voltage flow, Single Line diagram creation and analysis, run and Analyze AC power circuits, Run load flow analysis on one line diagram, run Short Circuit analysis.

Introduction to Synchro Phasor & WAMS Technologies, Synchro Phasor needs and benefits for Operations, Planning and Control Vision for Synchro Phasor & Online Stability Solutions Fundamental building blocks for WAMS and Synchro Phasor Platform Architecture, PMU standard and communications