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**Credits (Theory)** 21

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**Credits (Practicals/Sessionals)** 6

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**Credits (Practicals/Sessionals)** 8

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**Credits (Practicals/Sessionals)** 8

**TOTAL SEMESTER CREDITS** 28

**TOTAL CUMULATIVE CREDITS** 111
Module-I (18 hours)
Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge’s method, Second order partial differential equation The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II (12 hours)
Complex Analysis:
Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping, Complex integration: Line integral in the complex plane, Cauchy’s integral theorem, Cauchy’s integral formula, Derivatives of analytic functions

Module –III (10 hours)
Power Series, Taylor’s series, Laurent’s series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:

Reference books:
Module-I: (12 hours)

Module-II: (12 hours)

Module-III: (12 hours)
Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved) Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

Text Books:

Reference Books:
4. Gupta, “Managerial Economics”, TMH
5. Lal and Srivastav, “Cost Accounting”, TMH
Module I:
The study of Organizational Behaviour: Definition and Meaning, Why Study OB Learning – Nature of Learning, How Learning occurs, Learning and OB.
Foundations of Individual Behaviour: Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.

Module II:

Module-III:

Text Books:

Reference Books:
1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma” Organizational Behaviour”, TATA McGraw-Hill.
BSMS1213 Material Science and Engineering

MODULE-I (11 Hours)
Introduction, Classification of Engineering Materials, Engineering properties of materials, Selection of Materials
Mechanical Properties of Materials: Tensile strength, Stress–strain behaviour, Ductile and brittle material, Impact test, Toughness, Hardness test, Fatigue and fatigue test, Creep and Creep test, Fracture

MODULE-II (13 Hours)
Electrical and Electronic materials: Electrical conductivity, Thermal conductivity, Free electron theory, Energy band concept of conductor, insulator & semiconductor.
Superconductor materials: Principles of superconductivity, zero resistivity, Critical magnetic field and critical current density, Type I & II superconductors, Applications of superconductors
Dielectric Materials: Microscopic displacement of atoms and molecules in an external DC electric field, Polarization and dielectric constant, Dielectric susceptibility, polarization mechanisms, Temperature and frequency dependence of dielectric constant, Dielectric breakdown, Ferroelectric materials, Piezoelectrics, pyroelectrics and ferroelectrics, Dielectric materials as electrical insulators

MODULE-III (11 Hours)
Optical materials: optical properties – scattering, refraction, reflection, transmission & absorption, Laser – principles and applications, Optical fibres – principles and applications
Polymeric materials: Types of polymers, Mechanism of polymerization, Mechanical behaviour of polymers, Fracture in polymers, Rubber types and applications, Thermo-setting and thermostatics, Conducting polymers
Ceramics: Types, structure, properties and application of ceramic materials
Other materials: Brief description of other materials such as Corrosion resistant materials, Nano phase materials, Shape memory alloy, SMART materials

Text Books:
1. Material Science for Engineers, James F. Shackelford & Madanapalli K Muralidhara, Pearson Education

Reference Books
1. Materials Science by M.S. Vijaya , G.Rangarajan, Tata MacGraw Hill
2. Materials Science by V. Rajendra, A. Marikani, Tata MacGraw Hill
3. Materias Science for Electrical and Electronic Engineers, I.P.Jones, Oxford University Press
4. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
Module-I       (10 Hours)
1. **Introduction to the quantum theory of solids**: Formation of energy bands, The k-space diagram (two and three dimensional representation), conductors, semiconductors and insulators.

2. **Electrons and Holes in semiconductors**: Silicon crystal structure, Donors and acceptors in the band model, electron effective mass, Density of states, Thermal equilibrium, Fermi-Dirac distribution function for electrons and holes, Fermi energy. Equilibrium distribution of electrons & holes: derivation of \( n \) and \( p \) from \( D(E) \) and \( f(E) \), Fermi level and carrier concentrations, The \( np \) product and the intrinsic carrier concentration. General theory of \( n \) and \( p \), Carrier concentrations at extremely high and low temperatures: complete ionization, partial ionization and freeze-out. Energy-band diagram and Fermi-level, Variation of \( E_F \) with doping concentration and temperature.

3. **Motion and Recombination of Electrons and Holes**: Carrier drift: Electron and hole mobilities, Mechanism of carrier scattering, Drift current and conductivity.

Module II       (11 Hours)
4. **Motion and Recombination of Electrons and Holes (continued)**: Carrier diffusion: diffusion current, Total current density, relation between the energy diagram and potential, electric field. Einstein relationship between diffusion coefficient and mobility. Electron-hole recombination, Thermal generation.

5. **PN Junction**: Building blocks of the pn junction theory: Energy band diagram and depletion layer of a pn junction, Built-in potential; Depletion layer model: Field and potential in the depletion layer, depletion-layer width; Reverse-biased PN junction; Capacitance-voltage characteristics; Junction breakdown: peak electric field. Tunneling breakdown and avalanche breakdown; Carrier injection under forward bias-Quasi-equilibrium boundary condition; current continuity equation; Excess carriers in forward-biased pn junction; PN diode I-V characteristic, Charge storage.


Module III       (12 Hours)

8. **MOS Capacitor**: The MOS structure, Energy band diagrams, Flat-band condition and flat-band voltage, Surface accumulation, surface depletion, Threshold condition and threshold voltage, MOS C-V characteristics, \( Q_{inv} \) in MOSFET.

9. **MOS Transistor**: Introduction to the MOSFET, Complementary MOS (CMOS) technology, V-I Characteristics, Surface mobilities and high-mobility FETs, JFET, MOSFET \( V_t \), Body effect and steep retrograde doping, pinch-off voltage,

**Text Books**:

**Reference Books**:
MODULE-I (14 Hrs)
1. NETWORK TOPOLOGY: Graph of a network, Concept of tree, Incidence matrix, Tie-set matrix, Cut-set matrix, Formulation and solution of network equilibrium equations on loop and node basis.
2. NETWORK THEOREMS & COUPLED CIRCUITS: Substitution theorem, Reciprocity theorem, Maximum power transfer theorem, Tellegen’s theorem, Millman’s theorem, Compensation theorem, Coupled Circuits, Dot Convention for representing coupled circuits, Coefficient of coupling, Band Width and Q-factor for series and parallel resonant circuits.

MODULE-II (13 Hrs)
3. LAPLACE TRANSFORM & ITS APPLICATION: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Application of Laplace transform: Circuit Analysis (Steady State and Transient).
4. TWO PORT NETWORK FUNCTIONS & RESPONSES: z, y, ABCD and h-parameters, Reciprocity and Symmetry, Interrelation of two-port parameters, Interconnection of two-port networks, Network Functions, Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.

MODULE-III (13 Hrs)
5. FOURIER SERIES & ITS APPLICATION: Fourier series, Fourier analysis and evaluation of coefficients, Steady state response of network to periodic signals, Fourier transform and convergence, Fourier transform of some functions, Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response.

Text Book:

Reference Book(s):
8. Network Theory, Smarajit Ghosh, PHI.
PCEE4204  Electrical and Electronics Measurement

MODULE- I  (14 Hrs)


MODULE- II  (14 Hrs)


4. AMMETER and VOLTMETER: Derivation for Deflecting Torque of; PMMC, MI (attraction and repulsion types), Electro Dynamometer and Induction type Ammeters and Voltmeters.

5. POTentiometer: Construction, Theory and Principle of operation of DC Potentiometers (Crompton, Vernier, Constant Resistance, & Deflectional Potentiometer), and AC Potentiometers (Drysdale-Tinsley & Gall-Tinsley Potentiometer).

6. MEASUREMENT OF POWER, ENERGY, FREQUENCY and POWER FACTOR: Measurement of single phase and three phase power by wattmeter, Construction, Theory and Principle of operation of (a) Electro-Dynamometer and Induction type Wattmeters, (b) Single Phase and Polyphase Induction type Watt-hour meters, (c) Frequency Meters, and (d) Power Factor Meters.

MODULE- III  (14 Hrs)

7. CURRENT TRANSFORMER and POTENTIAL TRANSFORMER: Construction, Theory, Characteristics and Testing of CTs and PTs.

8. ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS: Amplified DC Meters, AC Voltmeters using Rectifiers, True RMS Voltmeter, Considerations for choosing an Analog Voltmeter, Digital Voltmeters (Block Diagrams only), Q-meter.


Text Book(s):

Reference Book(s):
PCEC4201 Analog Electronics Circuit

MODULE – I (12 Hours)
1. **MOS Field-Effect Transistor**: Principle and Physical Operation of FETs and MOSFETs. P-Channel and N-Channel MOSFET, Complimentary MOS, V-I Characteristics of E- MOSFETS and D-MOSFETS, MOSFETS as an Amplifier and a Switch (4 Hours)
2. **Biasing of BJTs**: Load lines (AC and DC), Operating Points, Fixed Bias and Self Bias, DC Bias with Voltage Feedback, Bias Stabilization, Design Operation (4 Hours)
3. **Biasing of FETs and MOSFETs**: Fixed Bias Configuration and Self Bias Configuration, Voltage Divider Bias and Design (4 Hours)

MODULE – II (17 Hours)
4. **Small Signal Analysis of BJTs**: Small-Signal Equivalent-Circuit Model, Graphical Determination of h-parameters Small Signal Analysis of CE, CC, CB Amplifier with and without $R_E$. Effect of $R_S$ and $R_L$ on CE Amplifier, Emitter Follower, Analysis of Cascade, Darlington Connection and Current Mirror Circuits using BJTs. (6 Hours)
5. **Small Signal Analysis of FETs**: Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifier with and without $R_S$. Effect of $R_{SIG}$ and $R_L$ on CS Amplifier, Analysis of Source Follower and Cascaded System using FETs. (6 Hours)
6. **High Frequency Response of FETs and BJTs**: Low and High Frequency Response of BJTs and FETs, The Unit gain – frequency ($f_t$), Frequency Response of CS Amplifier, Frequency Response of CE Amplifier, Multistage Frequency Effects, Miller Effect Capacitance, Square Wave Testing. (5 Hours)

MODULE – III (12 hours)
9. **Power Amplifier**: Classifications, Class-A and Class-B Amplifier Circuits, Transfer Characteristics, Power Dissipation and Conversion Efficiency of Power Amplifiers. (3 Hours)

**Text Books:**
1. Electronic Devices and Circuits theory, 9th/10th Edition, R.L. Boylestad and L.Nashelsky (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14), Pearson Education, New Delhi.

**Reference Books:**
BEES7211 **Network and Devices Lab**

Select any 8 experiments from the list of 10 experiments

1. Verification of Network Theorems (Superposition, Thevenin, Norton, Maximum Power Transfer).
2. Study of DC and AC Transients.
3. Determination of circuit parameters: Open Circuit and Short Circuit parameters.
5. Frequency response of Low pass and High Pass Filters.
6. Frequency response of Band pass and Band Elimination Filters.
7. Determination of self inductance, mutual inductance and coupling coefficient of a single phase two winding transformer representing a coupled circuit.
8. Study of resonance in R-L-C series circuit.
10. Spectral analysis of a non-sinusoidal waveform.

PCEC7201 **Analog Electronics Circuit Lab**

*List of Experiments*

(At least 10 out of 13 experiments should be done)

6. Frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response.
8. Study of Darlington connection and current mirror circuits.
10. Application of Op-Amp as differentiator, integrator, square wave generator.
11. Square wave testing of an amplifier.

PCEE7204 Electrical and Electronics Measurement Lab

Select any 8 experiments from the list of 10 experiments

5. Testing of Energy meters (Single phase type).
8. Measurement of Power in a single phase circuit by using CTs and PTs.
10. Study of Spectrum Analyzers.
4th Semester

PCEC4205 Electromagnetic Fields and Waves

MODULE – I (11 Hours)
2. **Maxwell’s Equations in Integral Form**: Line Integral, Surface Integral, Faradays Law, Ampere’s Circuital Law, Gauss’s Law for Electric Field, Gauss’s Law for Magnetic Field.
3. **Maxwell’s Equations in Differential Form**: Faradays Law, Ampere’s Circuital Law, Curl and Stoke’s Theorem, Gauss’s Law for Electric Field, Gauss’s Law for Magnetic Field, Divergence and Divergence Theorem.

MODULE – II (11 Hours)

MODULE – III (10 Hours)

**Text Book(s):**

**Reference Book(s):**
BEEC2214 Energy Conversion Devices

MODULE- I (14 Hrs)
1. GENERAL PRINCIPLES OF DC MACHINES: Constructional Features, Methods of Excitation, Expression for EMF Induced and Torque Developed in the Armature.
2. DC GENERATORS: No Load Characteristics for Separately Excited DC Generator and DC Shunt Generator, Conditions for Self Excitation, Critical Resistance and Critical Speed, Losses and Efficiency.
3. DC MOTORS: Speed~Armature Current, Torque~Armature Current and Speed~Torque Characteristic for (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, and (iv) DC Compound Motor, Speed control and Starting of DC shunt and DC series motors, Comparison Between Different types of DC Motors and their Application.

MODULE- II (13 Hrs)
4. TRANSFORMERS: Constructional Features, EMF Equation, Turns Ratio, Determination of Parameters From Tests (Open Circuit Test and Short Circuit Test), Equivalent Circuit, Losses and Efficiency, Introduction to Three Phase Transformers: Three Single Phase Transformers Connected as a Bank of Three Phase Transformer.

MODULE- III (13 Hrs)
6. THREE PHASE INDUCTION MOTORS: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip~Torque Characteristics, Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of Induction Motors
7. SINGLE PHASE INDUCTION MOTORS and COMMUTATOR MOTORS: Revolving Field Theory, Split Phase (capacitor start and run) and Shaded Pole Starting of Single Phase Induction Motors, Speed~Current, Torque~Current and Speed~Torque Characteristic for Single Phase AC Series Motor.

Text Book :

Reference Book(s):
2. The Performance and Design of DC Machines – A E Clayton
Module I  
(08 hrs)  
Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II  
(16 hrs)  
Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.
Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.
Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.
Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.
Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III  
(08 hrs)  
Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.
Template: template classes, template functions.
Namespaces: user defined namespaces, namespaces provided by library.

Text Books:
1. Object Oriented Programming with C++ · E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ · Ashoke N. Kamthane, Pearson Education

Reference Books:
1. Big C++ · Wiley India
2. C++: The Complete Reference· Schildt, McGraw-Hill Education (India)
4. Object Oriented Programming with C++ · Rajiv Sahay, Oxford
5. Mastering C++ · Venugopal, McGraw-Hill Education (India)
PCEC4202 Digital Electronics Circuit

MODULE – I (11 Hours)

1. Number System: Introduction to Binary Numbers, Data Representation, Binary, Octal, Hexadecimal and Decimal Number System and their Conversion. (2 Hours)

2. Boolean Algebra and Logic Gates: Basic Logic Operation and Identities, Algebraic Laws, NOR and NAND Gates, Useful Boolean Identities, Algebraic Reduction, Complete Logic Sets, Arithmetic Operation using 1’s and 2’s Compliments, Signed Binary and Floating Point Number Representation. (4 Hours)


MODULE – II (15 Hours)


5. CMOS Logic Circuits: Voltages as Logic Variables, Logic Delay Times: Output Switching Times, Propagation Delay, Fan-In and Fan-out, Extension to other Logic Gate.
   C-MOS Electronics, MOSFETS, The NOT Function in C-MOS: Complimentary Pairs and the C-MOS Invertors, Logic Formation Using MOSFETS: the NAND and NOR Gate, C-MOS Logic Connection, Complex Logic Gates in C-MOS: 3-input Logic Gates, A general 4-input Logic Gate, Logic Cascades. (6 Hours)


MODULE – III (16 hours)

7. Logic Components: Concept of Digital Components, An Equality Detector, Line Decoder, Multiplexers and De-multiplexers, Binary Adders, Subtraction and Multiplication. (5 Hours)

8. Memory Elements and Arrays: General Properties, Latches, Clock and Synchronization, Master-Slave and Edge-triggered Flip-flops, Registers, RAM and ROMs, C-MOS Memories. (6 Hours)


Text Books:


Reference Books:

Select any 8 experiments from the list of 10 experiments

1. Determination of critical resistance and critical speed from no load test of a DC shunt generator.
2. Plotting of external and internal characteristics of a DC shunt generator.
3. Starting of DC shunt motors by 3-point/ 4-point starter.
4. Speed control of DC shunt motor by armature control and flux control method.
5. Determination of Efficiency by Open Circuit and Short Circuit test on single phase transformer.
6. Polarity test and Parallel operation of two single phase transformers.
7. Open circuit and Short circuit test of an alternator.
8. Load test of three phase induction motors.
10. Starting of single phase induction motors
PCEC7202 **Digital Electronics Circuit Lab**

**List of Experiments:**

(Atleast 10 experiments should be done, Experiment No. 1 and 2 are compulsory and out of the balance 8 experiments atleast 3 experiments has to be implemented through both Verilog/VHDL and hardware implementation as per choice of the student totaling to 6 and the rest 2 can be either through Verilog/VHDL or hardware implementation.)

1. Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates, use of Universal NAND Gate.
2. Gate-level minimization: Two level and multi level implementation of Boolean functions.
3. Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segment display.
4. Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number of Gates.
5. Design with multiplexers and de-multiplexers.
7. Shift Registers: Design and investigate the operation of all types of shift registers with parallel load.
9. Memory Unit: Investigate the behaviour of RAM unit and its storage capacity – 16 X 4 RAM: testing, simulating and memory expansion.
12. Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce a 8-bit product.
13. Verilog/VHDL simulation and implementation of Experiments listed at Sl. No. 3 to 12.

BECS7212 **C++ & Object Oriented Programming Lab**

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using static polymorphism.(1 class)
4. Programs on dynamic polymorphism.(1 class)
5. Programs on operator overloading.(1 class)
6. Programs on dynamic memory management using new, delete operators.(1 class)
7. Programs on copy constructor and usage of assignment operator.(1 class)
8. Programs on exception handling .(1 class)
This course will focus on communication in professional (work-related) situations of the kind that BPUT graduates may expect to encounter on entering the professional domain.

Some typical forms of work-related communication, oral or written, are listed below. Practice activities for all four skills can be designed around these or similar situations.

1. Gaining entry into an organization
i. Preparing job-applications and CVs
ii. Facing an interview
iii. Participating in group discussion (as part of the recruitment process)

2. In-house communication
   a. Superior/ Senior ➔ subordinate / junior (individual ➔ individual / group)
      i. Welcoming new entrants to the organization, introducing the workplace culture etc.
      ii. Briefing subordinates / juniors : explaining duties and responsibilities etc.
      iii. Instructing/ directing subordinates/ juniors
      iv. Expressing / recording appreciation, praising / rewarding a subordinate or junior
      v. Reprimanding / correcting / disciplining a subordinate/junior (for a lapse) ; asking for an explanation etc.
   b. Subordinate / Junior ➔ Superior / Senior
      i. Responding to the above
      ii. Reporting problems / difficulties / deficiencies
      iii. Offering suggestions