

# **COURSE STRUCTURE & SYLLABUS OF BACHELOR OF TECHNOLOGY (B.TECH)**

*In*

**Electrical**

**Course Structure**

**Second Year**

**Third Semester**

<b>Paper Code</b>	<b>Subject</b>
BSE1	Mathematics-III
BSE2	Thermodynamics
BSE3	Signals & Networks
BSE4	Digital Electronics
BSE5	Electrical Machine

**Syllabus**

## **BSE1 : MATHEMATICS III**

### **1 PARTIAL DIFFERENTIATION AND PARTIAL DIFFERENTIAL EQUATION**

Introduction, Limit , Partial derivatives , Partial derivatives of Higher orders, Which variable is to be treated as constant, Homogeneous function, Euler's Theorem on Homogeneous Functions, Introduction, Total Differential Coefficient, Important Deductions, Typical cases, Geometrical Interpretation of  $\frac{dz}{dx}$ ,  $\frac{dz}{dy}$ , Tangent plane to a surface, Error determination, Jacobians, Properties of Jacobians, Jacobians of

Implicit Functions, Partial Derivatives of Implicit Functions by Jacobian, Taylor's series, Conditions for F(x,y) to be of two variables maximum or minimum, Lagrange's method of undermined Multipliers.

### **2 PARTIAL DIFFERENTIAL EQUATIONS**

Partial Differential Equations, Order, Method of Forming Partial Differential Equations, Solution of Equation by direct Integration, Lagrange's Linear equation, Working Rule, Method of Multipliers, Partial Differential Equations non- Linear in p,q , Linear Homogeneous Partial Diff. Eqn., Rules for finding the complimentary function, Rules for finding the particular Integral, Introduction, Method of Separation of Variables, Equation of Vibrating Strain, Solution of Wave Equation, One Dimensional Heat Flow, Two dimensional Heat Flow.

### **3 FOURIER SERIES**

Periodic Functions, Fourier Series, Dirichlet's Conditions, Advantages of Fourier Series, Useful Integrals, Determination of Fourier constants (Euler's Formulae), Functions defined in two or more sub spaces, Even Functions, Half Range's series, Change of Interval, Parseval's Formula, Fourier series in Complex Form, Practical Harmonic Analysis.

## 4 LAPLACE TRANSFORMATION

Introduction, Laplace Transform, Important Formulae, Properties of Laplace Transforms, Laplace Transform of the Derivative of  $f(t)$ , Laplace Transform of Derivative of order  $n$ , Laplace Transform of Integral of  $f(t)$ , Laplace Transform of  $t.f(t)$  (Multiplication by  $t$ ), Laplace Transform of  $\frac{1}{t}f(t)$  (Division by  $t$ ), Unit step function, second shifting theorem, Theorem, Impulse Function, Periodic Functions, Convolution Theorem, Laplace Transform of Bessel function, Evaluation of Integral, Formulae of Laplace Transform, properties of Laplace Transform, Inverse of Laplace Transform, Important formulae, Multiplication by  $s$ , Division of  $s$  (Multiplication by  $1/s$ ), First shifting properties, second shifting properties, Inverse Laplace Transform of Derivatives, Inverse Laplace Transform of Integrals, Partial Fraction Method, Inverse Laplace Transform, Solution of Differential Equations, Solution of simultaneous equations, Inversion Formulae for the Laplace Transform.

## 5 NUMERICAL TECHNIQUES

Solution of Ordinary Differential Equations, Taylor's Series Method, Picard's method of successive approximations, Euler's method, Euler's Modified formula, Runge's Formula, Runge's Formula (Third order), Runge's Kutta Formula (Fourth order), Higher order Differential Equations.

## 6 NUMERICAL METHODS FOR SOLUTION OF PARTIAL DIFFERENTIAL EQUATION

General Linear partial differential equations, Finite-Difference Approximation to Derivatives, Solution of Partial Differential equation (Laplace's method), Jacobi's Iteration Formula, Gauss-Seidal method, Successive over-Relaxation or S.O.R. method, Poisson Equation, Heat equation (parabolic equations), Wave equation (Hyperbolic Equation).

## BSE2 : THERMODYNAMICS

### 1. Combustion of Fuel

Introduction, Mass fraction and Mole Fraction, Symbols for Elements and Compounds, Combustion Equations of Gaseous Fuels, Theoretical or Minimum Mass of Air Required for Complete Combustion, Theoretical or Minimum Volume of Air required for Complete Combustion, Excess Air Supplied, Air Fuel ratio, Analysis of products of combustion, Combustion Equations, Volumetric analysis of products, Conversion of volumetric analysis to gravimetric analysis, Volume Fraction, Conversion of volumetric Analysis into Mass Analysis or Gravimetric Analysis, Conversion of Mass Analysis into Volumetric Analysis, Mass of Carbon in Fuel Gases, The analysis of Fuel Gas, The Orsat Apparatus.

### 2. Entropy

Introduction, Entropy as a property, The Second Law, Analysis for Entropy, Clausius Inequality, Change of entropy in an irreversible process, Change of Entropy for Ideal Gas and Pure Substance, Change of Entropy of a perfect gas during Various Thermodynamics Processes, Change of Entropy during Constant Process (or Isobaric Process), Change of Entropy during Constant Temperature Process (or Isothermal process), Change of Entropy during Reversible Adiabatic Process (or Isentropic Process), Change of Entropy during Polytropic Process ( $pv^n = \text{Constant}$ ).

### 3. Air Compressor

Introduction, Uses of Compressed air for industries, Types of Air Compressors, Capacity Control of Compressor, Types of compressor valves, Work done by Reciprocating Air Compressor with Clearance Volume, Effect of Clearance on volumetric efficiency, Condition for maximum efficiency in two stage compression with intercooling.

### 4. IC Engine

Introduction, Classification of I.C. Engines, Fuel Supply System for S.I. and C.I. Engine, Ignition Systems of Petrol Engines, Fuel Injection system for Diesel Engines, Cooling Systems for I.C. Engines, Lubrication System for I.C.

Engines, Governing of internal combustion engines, Main Components of I.C. Engines, Reciprocating Internal Combustion Engines, Four-Stroke cycle, Two-stroke cycle.

**5. IC Engine Testing & Performance**

Indicated Power, Measurement of friction power, Indicated mean Effective Pressure, Measurement of fuel consumption, Energy balance of an I.C. Engine, Determination of mechanical, Thermal and Relative efficiency.

**6. Steam Process**

Introduction, Thermodynamics Processes of Vapour, Enthalpy – Entropy or H-S Chart or Mollier Diagram, Measurement of dryness-fraction of steam, Bucket or Barrel Calorimeter, BOILER, Introduction, Classification of Boilers, Boiler Mountings and Accessories, Equivalent Evaporation, Boiler Efficiency, Heat Losses in a Boiler, Heat Balance Sheet, Boiler Draught.

**7. Vapour Power Cycle**

Introduction, The Carnot cycle, The ideal Rankine Cycle, Factors affecting the performance of Rankine cycle.

**8. Air Standard Cycle**

Introduction, Otto Cycle, Diesel Cycle, Dual Combustion Cycle, Comparison of Otto, Diesel Dual Cycle, Air and Fuel-vapour mixtures Concept of air fuel Cycle.

**BSE3 : SIGNALS & NETWORKS**

**1. SIGNALS, SYSTEMS AND WAVEFORMS**

Signals; Characteristics of Signals; Step, Ramp, and Impulse Functions (Signals); Systems (Types of Networks) --- Linear and NonLinear Network (Systems), Time Invariant and Time Variant Networks, Casual and Non Casual Networks, Passive and Active Networks, Lumped and Distributed Networks.

**2. LAPLACE TRANSFORMS**

Introduction, Definition of Laplace Transform, Properties of Laplace Transform, Inverse Laplace Transform, Inverse Laplace Transform Using Partial Fraction Expansion, Inverse Laplace Transform Using Convolution Integral.

**3. APPLICATIONS OF LAPLACE TRANSFORMS**

Introduction, Laplace Transformation For Solving Differential Equations, Application of Laplace Transform for Network Analysis, Definition of System Function, Impulse and Step Response of Networks.

**4. NETWORK FUNCTIONS**

Driving Point Functions, Transfer Functions, Poles and Zeros, Necessary Conditions.

**5. TWO PORT NETWORKS**

Introduction, Open Circuit Impedance Parameters or Z-Parameters, Short Circuit Admittance Parameters or Y- Parameters, Hybrid Parameters, Transmission or ABCD Parameters, Interrelationships between the Parameters, Interconnection of Two Port Networks, Input Impedance Intermis of Two Port Parameters, Output Impedance Intermis of Two Port Parameters.

**6. NETWORK TOPOLOGY**

Graph of the Network; Graph Theory for Network Analysis ---Network Equilibrium Equations On Loop or KVL Basis, Network Equilibrium Equations On Node or KCL Basis; Network Equilibrium Equations in Matrix Form --- Mesh or Loop or KVL Equilibrium Equations, Node or KCL Equilibrium Equations.

**7. DRIVING POINT SYNTHESIS**

Synthesis of Networks with Two Kinds of Elements; LC – Driving Pont Immitance Functions --- Synthesis of L-C networks; RC Driving Point Immitance Functions ---Synthesis of RC functions; RL Driving Point Immitance Functions --- Note about RL and RC Networks; RLC Network Synthesis.

## **BSE4: DIGITAL ELECTRONICS**

### **1. NUMBER SYSTEMS AND CODES:**

Binary Number System, Octal Number System, Hexadecimal Number System, Bits and Bytes , 1's and 2's Complements, Decimal –to- Binary Conversion, Decimal-to- Octal Conversion, Decimal –to- Hexadecimal Conversion, Binary –octal and Octal – Binary Conversions , Hexadecimal – Binary and Binary –Hexadecimal Conversion, Hexadecimal –Octal and Octal –Hexadecimal Conversion. BCD Code, Excess -3 Code , Gray code , Alphanumeric Codes ,Parity Bits, Hamming Code, Floating Point Numbers.

### **2. BINARY ARITHMETIC:**

Basic Rules of Binary , Addition of Larger Bit Binary Numbers, Subtraction of Larger Bit Binary Numbers, Addition Using 2's Complement Method, Subtraction Using 2's Complement Method, Binary Multiplicity –repeated Left Shift and Add Algorithm , Binary Division – Repeated Right Shift and Subtract Algorithm.

### **3. LOGIC GATES AND LOGIC FAMILIES:**

Positive and Negative Logic, Truth Tables, Logic Gates, Fan out of Logic Gates, Logic Families, TTL Logic Family, CMOS Logic Family, ECL Logic Family, NMOS AND PMOS Logic Families.

### **4. BOOLEAN ALGEBRA AND MINIMISATION TECHNIQUES:**

Boolean Algebra vs. Ordinary Algebra , Boolean Expressions- Variables and Literals, Boolean Expressions – Equivalent and Complement, Theorems of Boolean Algebra, Minimisation Techniques ,Sum –of – products Boolean Expressions, Quine- Mccluskey Tabular Method, Karnaugh Map Method, Karnaugh Maps for Boolean Expressions : With More Than Four Variables.

### **5. COMBINATIONAL LOGIC CIRCUITS:**

Combinational Circuits, Implementing Combinational Logic, Arithmetic Circuits –Basic Building Blocks, Adder- Subtractor, BCD Adder, Carry Propagation- Look Ahead Carry Generator, Arithmetic Logic Unit (ALU), Multipliers, Magnitude Comparator, Parity Generator and Checker, De- multiplexers and Decoders, Encoders, Read Only Memory (ROM), Programmable Logic Array (PLA)

### **6. FLIP FLOPS AND RELATED DEVICES:**

R-S Flip Flop , Level Triggered and Edge Triggered Flip Flops, J.K Flip Flop, Master-slave Flip Flops, T-flip Flop, D-flip Flop, Synchronous and Asynchronous Inputs.

### **7. COUNTERS AND REGISTERS:**

Ripple Counter vs. Synchronous Counter, Modulus (or Mod-Number) of a Counter, Propagation Delay in Ripple Counters, Binary Ripple Counters- Operational Principle, Binary Ripple Counters with Modulus Less Than ( $2^n$ ), Synchronous (or Parallel ) Counters, Up/Down Counters, Decade and BCD Counters , Presettable Counters, Shift Register, Serial-in Serial –out Shift Register, Serial –in Parallel-out Shift Register, Parallel – in , Serial –out Shift Register, Parallel-in , Parallel –out Shift Register, Shift Register Counters- Ring Counter, Shift Counter.

### **8. SEMI- CONDUCTOR MEMORY:**

RAM Architecture, Static RAM (SRAM), Dynamic RAM (DRAM),

## **BSE5 : ELECTRICAL MACHINES**

### **1 INTRODUCTION**

Basic concept of Electrical Engineering; Resistance  
Inductance  
Capacitance  
Resistance connected in series and Parallel  
Capacitance connected in series and parallel  
Concept of AC/DC currents and AC/DC Voltages,  
EMF

Potential difference, Work, Power and Energy.

## **2 DC NETWORKS**

Kirchhoff's Laws,  
Node voltage and Mesh current Methods  
Delta – Star and Star - Delta Conversion  
Superposition principle  
Thevenin's and Norton's Theorems

## **3 TRANSFORMER**

Construction and principle of X'Mers  
EMF equation  
Ideal X'Mer  
Shell type & Core type X'Mer  
Phasor Diagrams  
Equivalent Circuits,  
Regulation and Efficiency of X'Mer,  
Capacity of X'Mer, and Losses,  
Introduction to Auto X'Mer

## **4 DC MACHINES**

Construction and Principle of DC generation and DC Motor,  
Back emf of DC Motor,  
Types of DC Motor,  
Reversal of Direction of Rotation of DC Motor,  
Starting of DC Motor,  
Characteristics of DC Motor,  
Uses of DC Motor, Losses in DC Machine.

## **5 ALTERNATOR**

Construction and Working principle of Alternator,  
Application of Alternators.

## **6 SYNCHRONOUS MOTORS**

Principle of Operation,  
Application of Synchronous Motors  
Comparison between Synchronous Motor and Induction Motors

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