

## BTAM-500 MATHEMATICS-III

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

### Detailed Contents

1. Fourier Series Periodic functions, Euler's formula. Even and odd functions, Change of Interval, half range expansions, Fourier series of different wave forms.
2. Laplace Transforms: Definition, Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Transform of multiplication and division by  $t$ , convolution theorem, Laplace transform of unit step function. Applications to solution of ordinary linear differential equations with constant coefficients.
3. Special Functions: Frobenius method for power series solution of differential equations, Bessel's equation, Bessel functions of the first and second kind, Legendre's equation, Legendre polynomial.
4. Partial Differential Equations: Formation of partial differential equations, Equations solvable by direct integration, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Solution by method of separation of variables, Applications: Wave equation and Heat conduction equation in one dimension. Solution of two dimensional Laplace equation (Cartesian co- ordinates).
5. Functions of Complex Variable: definition of Limit, continuity, derivative of complex functions, and analytic function. Necessary and sufficient conditions for analytic function (without proof), Cauchy-Riemann equation (Cartesian and polar co-ordinates), harmonic functions, orthogonal system, determination of conjugate functions. Miller's Thomsomson method, Applications to fluid flow problems. Brief introduction to basic transformations, Bilinear transformations, complex integration: Line integrals in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for analytic function and its derivatives. Taylor's and Laurent's expansions, singular points, poles, residue, Cauchy's Residue theorem, evaluation of real integrals by contour integration ( $\int \cos x, \sin x$ )

### Books

1. Kreyszing Erwin, Advanced Engineering Mathematics, Wiley Eastern
2. B.S Grewal, Higher Engineering Mathematics, Khanna Publishers
3. N.K Jain, Numerical Solutions of Differential Equations, Prentice Hall
4. Sharma and Gupta, Differential Equations, Krishna Prakashan Media
5. N.P Bali , Text book of Eng Mathematics, Laxmi Publishers

## BTME 501 MACHINE DESIGN-I

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

### Detailed Contents

1. Meaning of design with special reference to machine design, definition and understanding of various types of design, design process, design and creativity, general design considerations, concept of tearing, bearing, shearing, crushing, bending and fracture.
2. Designation of materials according to Indian standards code, basic criteria of selection of material, mechanical properties of materials.
3. Concept of concurrent engineering in design, introduction to 'Design for X' manufacturing considerations in machine design, stress concentration, factor of safety under different loading conditions, design for static loading, design for variable loading for both limited and unlimited life, concept of fatigue and endurance strength.
4. Design of fasteners:  
Design of rivets for boiler joints, lozenge joints, eccentrically loaded joints.  
Design of spigot and socket cotter joint, gib and cotter joint and knuckle joint.  
Design of welded joints for various loading conditions in torsion, shear or direct loads, eccentrically loaded joints
5. Design of shaft and axles:  
Design of solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for rigidity, Design of axle.
6. Design of keys and couplings:  
Design of keys, design of splines, design of sleeve and solid muff coupling, clamp or compression coupling, rigid and flexible flange coupling, design of universal joint.
7. Design of levers and links:  
Design of levers (foot lever, hand lever, cranked lever, bell crank lever, safety valve lever and shoe brake lever), design of link.
8. Design of pipe joints:  
Stresses in pipe joints, design of pipe joints with oval flange, square flange, design of seals and gaskets.

### Books

1. Joseph E. Shigley, Charles Russell Mischke, Richard Gordon Budynas, Mechanical Engineering Design, McGraw-Hill
2. Robert C. Juvinall Fundamentals of machine component design, Wiley
3. V.K Jadon, Analysis and design of machine elements, I.K. International
4. V.B Bhandari, Design of Machine elements, Tata Mc. Hill
5. S.S Jolly, Design of machine elements-I, Dhanpat Rai and Co.

### Following is a sample list of problems which may be used for Tutorials

1. Select a daily use product and design the conceptual design by applying the design process talking the controlling parameters
2. Make a list of mechanical components and know their materials and suggest some alternative materials for the each one of them

3. Design a wall bracket, which is being used in real life by actual measurement of load

a) Welded joints

b) Riveted and bolted joints

And justify your findings

4. Find a flange coupling in the college laboratory and justify its design by actual measurements

5. Design a shaft used in some practical application, by actual working and loading conditions

6. Select a braking system lever (both hand and foot lever) and justify the design parameters

7. Justify the design of single plate clutch of an engine assembly

**Note: 1. Design data book compiled by PSG college of Engg. & Tech., Coimbatore is allowed in Examination.**

**Note: 2 Guide lines regarding paper setting:**

Part A- 10 questions of 2 marks each. All compulsory.

Part B- There will be 6 questions of 10 marks each. Candidate will be required to attempt any four questions.

## **BTME 502 COMPUTER AIDED DESIGN AND MANUFACTURING**

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

Detailed Contents

### 1. Fundamentals of CAD;

Design process with and without computer; CAD/CAM system and its evaluation criteria, brief treatment of input and output devices, Display devices; Functions of a graphics package and Graphics standard GKS, IGES and STEP; Modeling and viewing; Application areas of CAD.

### 2. Geometric Transformations:

Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation: Concatenation of transformation matrices. Application of geometric transformations.

### 3. Geometric Modeling:

Wireframe model: solid modeling: Boundary Representation (B-rep), Constructive Solid Geometry (CSG), Parametric Modeling Technique ; Mass , volumetric properties calculations; surface modeling, concepts of hidden-line removal and shading: Mechanical Assembly Kinematics analysis and simulation.

### 4. Representation of curves and surfaces:

Non-parametric and parametric representation of curves. Parametric representation of Hermite Cubic, Beizer and B-spline curves; Surface and its analysis. Representation of Analytical and synthetic surfaces.

5. Overview of FEM, Advantages and applications, recent advance in FEM, FEA software Basic principles and general procedure of FEM.

### 6. NC/CNC Machine Tools;

NC machine tools- basic components, coordinate systems; features of NC machine tools. Computerized Numerical Control (CNC): Tooling for NC machines - tool presetting equipment, flexible tooling, tool length compensation, tool path graphics; NC motion control system; Manual part programming, fixed/floating zero. Block format and codes: Computer assisted part programming. DNC and Adaptive Control: Direct numerical control: Adaptive control in machining system; Combined DNC/CNC system.

### 7. Group Technology (GT):

Part families; part classification and coding system: Group technology machine cells: Advantages of GT.

## 8. Computer Aided Process Planning:

Introduction and benefits of CAPP. Types of CAPP systems, machinability, data selection systems in CAPP.

## 9. Computer Integrated Manufacturing Systems:

Basic Concepts of CIM: CIM Definition, The meaning of Manufacturing, Types of Manufacturing systems; Need, Elements, Evolution of CIM; Benefits of CIM; Flexible Manufacturing Systems: Physical Components of an FMS. Types of Flexibility, Layout Considerations; FMS benefits.

### **Books:**

1. Mikell P. Groover, Emory W. Zimmers, CAD/CAM, PHI
2. D.D. Bedworth, M.R Henderson & P.M. Wolfe, Computer Integrated Design and Manufacturing, Tata McGraw Hill
3. Zeid Ibrahim, CAD/CAM - theory and Practice, Tata McGraw Hill
4. P. N Rao, CAD/CAM, Tata McGraw Hill
5. C. Elanchezhian, G. Shanmuga Sundar, Computer aided manufacturing (CAM), Firewall Media

## **BTME 503 MECHANICAL MEASUREMENTS AND METROLOGY**

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

### **1. General Concepts**

Need and classification of measurements and instruments; basic and auxiliary functional elements of a measurement system; Mechanical versus electrical / electronic instruments; primary, secondary and working standards.

### **2. Static and Dynamic Characteristics of Instruments**

Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone. Zero, first and second order systems and their response to step, ramp and sinusoidal input signals.

### **3. Errors in Measurement**

Sources of errors, systematic and random errors; statistical analysis of test-data, probable error and probability tables, rejection of test data, error propagation; Design and planning of experiments and report writing.

### **4. Metrology**

Line, end and wavelength standards; linear measurements - vernier scale and micrometer, vernier height gauge and depth gauge; comparators - their types, relative merits and limitations; Angular measurements - sine bar, clinometer, angle gauge; concept and measurement of straightness and flatness by interferometry; surface roughness - specifications and measurement, Measurement of major diameter, minor diameter, effective diameter, pitch, angle and form of threads for internal and external threads; measurement of tooth thickness, pitch and checking of profile for spur gears.

### **5. Functional Elements**

Introduction to sensors and transducers, types of sensors, review of electro-mechanical sensors and transducers - variable resistance, inductance and capacitive pick ups, photo cells and piezo-electric transducers and application of these elements for measurement of position / displacement, speed / velocity / acceleration, force and liquid level. Resistance strain gauges, gauge factor, bonded and unbonded gauges, surface preparation and bonding technique signal conditioning and bridge circuits, temperature compensation, application of strain gauges for direct, bending and torsional loads. Introduction to amplifying, transmitting and recording devices.

## 6. Pressure and Flow Measurement

Bourdon tube, diaphragm and bellows, vacuum measurement - McLeod gauge, thermal conductivity gauge and ionisation gauge; Dead weight gauge tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: flow visualisation techniques.

## 7. Temperature Measurement

Thermal expansion methods - bimetallic thermometers, liquid-in-glass thermometer and filled-in-system thermometers; thermo-electric sensors - common thermo couples, reference junction considerations, special materials and configurations; metal resistance thermometers and thermistors; optical and total radiation pyrometers; calibration standards.

## 8. Speed, Force, Torque and Shaft Power Measurement

Mechanical tachometers, vibration reed tachometer and stroboscope; proving ring, hydraulic and pneumatic load cells, torque on rotating shafts; Absorption, transmission and driving dynamometers.

### **Books**

1. E.O Doebelin, Measurement System: Application and Design, McGraw Hill
2. J.P Holman, Experimental Methods for Engineers, McGraw Hill
3. D.S Kumar, Mechanical Measurement and Control, Metropolitan Book Co.
4. R.K Jain, Engineering Metrology, Khanna Publishers
5. B.C Kuo, Automatic Control systems, Prentice Hall

## **BTME 504 INDUSTRIAL AUTOMATION AND ROBOTICS**

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

### Detailed Contents

1. Introduction:
  - Concept and scope of automation:
  - Socio economic impacts of automation
  - Types of Automation, Low Cost Automation
2. Fluid Power:
  - Fluid power control elements
  - Standard graphical symbols
  - Fluid power generators
  - Hydraulic and pneumatic Cylinders - construction, design and mounting;
  - Hydraulic and pneumatic Valves for pressure, flow and direction control:
3. Basic hydraulic and pneumatic circuits:
  - Direct and Indirect Control of Single/Double Acting Cylinders
  - Designing of logic circuits for a given time displacement diagram & sequence of operations,
  - Hydraulic & Pneumatic Circuits using Time Delay Valve & Quick Exhaust Valve
  - Memory Circuit & Speed Control of a Cylinder
  - Troubleshooting and “Causes & Effects of Malfunctions”
  - Basics of Control Chain
  - Circuit Layouts
  - Designation of specific Elements in a Circuit
4. Fluidics:
  - Boolean algebra
  - Truth Tables
  - Logic Gates
  - Coanda effect
5. Electrical and Electronic Controls
  - Basics of Programmable logic controllers (PLC)
  - Architecture & Components of PLC
  - Ladder Logic Diagrams
6. Transfer Devices and feeders:
  - Classification, Constructional details and Applications of Transfer devices
  - Vibratory bowl feeders
  - Reciprocating tube
  - Centrifugal hopper feeders
7. Robotics
  - Introduction,



Classification based on geometry, control and path movement,  
Robot Specifications, Robot Performance Parameters  
Robot Programming  
Machine Vision, Teach pendants  
Industrial Applications of Robots

**Books**

1. Anthony Esposito, Fluid Power with applications, Pearson
2. S. R Majumdar, Pneumatic Control, McGraw Hill
3. S. R Deb, Robotic Technology and Flexible Automation, Tata Mc Hill
4. Saeed B. Niku Introduction to Robotics, Wiley India
5. Ashitava Ghosal, Robotics, Oxford

## **BTME 505 AUTOMOBILE ENGINEERING**

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

### **1. Introduction**

Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit.

### **2. Power Unit**

Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system, silencers, types of pistons and rings

### **3. Fuel Supply System**

Air cleaner and fuel pumps; Air fuel requirements and carburation; constructional details of Carter carburetors and fuel injection systems; MPFi (Petrol), Diesel fuel system - cleaning, injection pump, injector and nozzles, Common Rail fuel supply system

### **4. Lubrication and Cooling Systems**

Necessity of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; different systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan.

### **5. Chassis and Suspension**

Loads on the frame, considerations of strength and stiffness, engine mounting, independent suspension systems (Mac Pherson, Trailing Links, Wishbone), shock absorbers and stabilizers; wheels and tyres, tyre wear types, constructional details of plies

### **6. Transmission system**

Basic requirements and standard transmission systems; constructional features of automobile clutch, gear box, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission

## 7. Steering System

Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel alignment; power steering, Ball re-circulating mechanism

## 8. Braking System

General braking requirements; Mechanical, hydraulic, vacuum power and servo brakes; Weight transfer during braking and stopping distances

## 9. Electric System

Classification, Introduction to Conventional and transistorized ignition systems; Charging, capacity ratings and battery testing; starter motor and drive arrangements: voltage and current regulation

## 10. Maintenance

Preventive maintenance, trouble shooting and rectification in different systems; engine tuning and servicing, major tools used for maintenance of automobiles

### Books

1. W.H Crouse, Automotive mechanics, McGraw Hill
2. J. Heitner, Automotive Mechanics, East West Press
3. Kirpal Singh, Automobile Engineering Vol. I and II, Standard Publishers
4. J. Webster, Auto Mechanics, Glencoe Publishing Co.
5. P.S Gill, Automobile Engineering, S.K Kataria

## **BTME506 COMPUTER AIDED DESIGN AND MANUFACTURING LAB**

**Internal Marks: 30**

**External Marks: 20**

**Total Marks: 50**

### **1. Introduction to modeling (using any CAD software):**

1. 2D drawing using sketcher – 2 Drawings 2 Hrs
2. 3D modeling using 3D features (Modeling of Crane Hook, Bench Vice, Screw Jack components) 4 Hrs
3. Assembling and drafting (any 2 above mentioned assemblies) with proper mating conditions and interference checking. 4 Hrs
4. Surface modeling – (Computer mouse, Plastic bottles with spraying Nozzle) 4 Hrs

### **2. Computer Aided Manufacturing:**

1. Manual part programming on CNC Lathe and CNC Milling – (4 programs, 2 for each) 4 hrs
2. Computer Aided Part programming for CNC Lathe and CNC Milling to generate tool path, NC code, and Optimization of tool path (to reduce machining time) using any CAM software. 4Hrs

## **BTME 507 MECHANICAL MEASUREMENTS AND METROLOGY LAB**

**Internal Marks: 30**

**External Marks: 20**

**Total Marks: 50**

1. Measurement of an angle with the help of sine bar
2. Measurement of surface roughness of a machined Plate, Rod and Pipe
3. Measurement of gear elements using profile projector
4. Measurement of effective diameter of external threads using Three wire method
5. Measurement of thread element by Tool makers microscope
6. Calibration of a pressure guage with the help of a dead weight guage tester
7. Use of stroboscope for measurement of speed of shaft
8. Use of pitot tube to plot velocity profile of a fluid through a circular duct
9. Preparation of a thermocouple, its calibration and application for temperature measurement

## **BTME 508 INDUSTRIAL AUTOMATION AND ROBOTICS LAB**

**Internal Marks: 15**

**External Marks: 10**

**Total Marks: 25**

1. Design and assembly of hydraulic / pneumatic circuit.
2. Demonstration and working of power steering mechanism
3. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves
4. Use of direction control valve and pressure control valves clamping devices for jig and fixture
5. Study of robotic arm and its configuration
6. Study the robotic end effectors
7. Study of different types of hydraulic and pneumatic valves

## **BTME 509 AUTOMOBILE ENGINEERING LAB**

**Internal Marks: 15**

**External Marks: 10**

**Total Marks: 25**

1. Valve refacing and valve seat grinding and checking for leakage of valves
2. Trouble shooting in cooling system of an automotive vehicle
3. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
5. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
6. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
7. Replacing of ring and studying the method of replacing piston after