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

In
MECHANICAL

Course Structure

Fourth Year

Seventh Semester

Paper Code	Name of the Subject
BEME1	CAD/ CAM (Application) & Automation
BEME2	Meteorology & Quality Control
BEME3	I.C. Engines & Automobile Engineering
BEME4	Finite Elements Methods in Engineering
BEME5	Elective-I
BEME2P	Meteorology & Quality Control Practical
BEME4P	I.C. Engines & Automobile Engineering Practical

BEME1: CAD/CAM (APPLICATION) & AUTOMATION

CAD/CAM System

Introduction To CAD / CAM, Product Cycle and CAD / CAM, Advantages of CAD / CAM, Hardware in CAD, Types of Input Devices, CPU and Output Devices, Software for CAD / CAM, Functions of a Graphics Software, Selection of CAD / CAM Systems

Computer Graphics

Geometric Transformations, Homogeneous Coordinates, Inverse Transformations, Concatenation or Composite Transformations, Coordinate Transformations, Three Dimensional Transformations, Solved Examples, Standardisation in Graphics Software, CAD / CAM Data Exchange, Shape Based Format, Product Data Based Format, Exercises.

Geometrical Modeling

Introduction, Model Structure Organisation, Database Creation, Wire Frame Modeling, Wire Frame Representation, Real Objects and Wire Frame Models, Surface Modeling, Kinds of Surfaces, Solid Modeling, Representation Schemes for Solid Models, Applications of Solid Modeling, Parametric Solid Modeling, Solved Examples, Exercises.

NC – CNC – DNC Machine Tools

Numerical Control of Machine Tools, Elements of NC Manufacturing System, Coordinate System and Machine Motions, Types of NC Systems, Position and Motion Control in an NC System, Structure, Drives and other Devices, Steps in NC Manufacturing, Applications of NC Machine Tool, Advantages and Disadvantages of NC Technology, Limitations of Conventional NC, Computer Numerical Control (CNC) Technology, CNC controllers, Features and Advantages of CNC, Adaptive Control, Advantages of Adaptive Control, Direct Numerical Control (DNC), Types of DNC, Advantages and Disadvantages of DNC, New Trends in CNC, DNC.

Part Programming

Manual Part Programming, Principles of an NC Program, Word Address Format (WAF), Machining Formulas, Solved Examples (2 Axes-Drilling and Milling), Tool Length and Cutter Diameter Compensation, Canned Cycles for Milling and Drilling, Solved Examples (21/2 Axes – Drilling and Milling), Subprogram or Subroutines, DO Loop, Macros, Solved Examples, CNC Lathes, Diameter Versus Radius Programming, Solved Examples, Canned Cycles on Lathes, Solved Examples, Computer Assisted Part Programming, Languages in Computer Assisted Programming, Structure of APT, Repetitive Programming using APT, Solved Examples, CAD / CAM Systems for Part Programming, Exercises.

Automation

Concepts in Manufacturing Systems, Definition of Automation, Types of Automation, Advantages and Limitations of Automation, Strategies in Automation, Strategies in Automation, Group Technology, Merits and Demerits of Group Technology, Concept of a Machine Cell, Flexible Manufacturing System (FMS), Elements of FMS, Workpiece Handling, Workpiece Transport using Automated Guided Vehicle System (AGVS), Applications of FMS, Planning and Implementation of FMS, Merits and Demerits in FMS, Computer Integrated Manufacturing (CIM).

BEME2: METEOROLOGY & QUALITY CONTROL

1) **Measurements:** International standards of length-Line and end measurement, Need of measurement, possible errors in measurement, slip gauges.

2) Tolerances and gauging: unilateral and bilateral tolerances, Limits, Fits, Types of Fits, IS specifications of limits. Importance of limits, System in mass production, limit gauges used for plain and taper works.

3) Magnification: Principles and characteristics of measuring instruments, Mechanical, Optical, electrical, Pneumatic method of magnification, different types of Verniers, Micrometers, Dial gauges, Mechanical and pneumatic, Types of comparators. Use of comparators in inspection.

4) Measurement of angles, tapers and radius: Bevel Protractor, Spirit level, Clinometers, angle Decker, standard balls and rollers for angle measurement, angle slip gauges, radius measurement of circular portion, measurement of concave and convex surface radius.

5) Interferometry: Principle of Interferometry and application in checking of flatness, angle and height.

6) Straightness and Flatness: Straight edge, use of level beam comparator, autocollimator testing of flatness of surface plate(Theoretical treatment only)

7) Surface finish: Types of textures obtained during machine operation, range of C.L.A. value in different operations in numerical assessment of surface finish(B.I.S. Specifications of C.L.A. value)-sample length of different machining operations. Direction of lay, texture,symbols , instruments used in surface finish assessment. (03)

8) Measurement of External Threads: Different errors in screw threads, measurement of forms of thread with profile projector, pitch measurement, measurement of thread diameter with standard wire, screw thread micrometer.

9) Measurement of Spur Gears: Run out checking, Pitch measurement, profile checking, backlash checking, tooth thickness measurement, alignment checking, errors in gears, checking of composite errors.

10)Quality control :-

A) Concept of Quality and quality control, elements of quality and its growth, purpose, setup, policy and objective,factors controlling and quality of design and conformance, balance between cost and quality and value of quality. Specification of quality ,planning through trial lots and for essential information.

B) Introduction to topic such as in process quality,quality circles,quality management,total quality control,ISO 9000 and equivalent Indian standards.

11) Statistical Quality Control-Importance of statistical method in quality control, measuring of statistical control variables and attributes. Measurement/inspection, different types of control charts(X Bars, R, P. charts) and their constructions and their application.

12) Acceptance Sampling- Sampling inspection and percentage inspection, basic concept of sampling inspection, operating characteristic curves, conflicting interests of consumer and producer, producer and consumers risks, AWQL, LTPD,ADGL, single and double sampling plans.

13) Recent trends in quality Control-

1) CAQC
2) Six Sigma
3) Zero defect
4) T.Q.M.
5) T.Q.C.
6) Non-contact inspection
7) Q.F.D.
8) C.M.M.
9) QUIZEN
10)D.O.P.(Case study)

BEME3: I.C. ENGINES & AUTOMOBILE ENGINEERING

Unit – 1

1. Historical Developments and modern trends in I.C. Engines
2. Engine Components
3. Engine classification
4. Fuel-air cycle analysis
5. Comparison of P-V Diagram of air-standard cycles
6. Fuel-air cycle and actual cycle
7. Effect of variables on performance

Unit – 2

1. Carburetion, Mixture requirements, Carburetor types
2. Construction and Working of fuel pump and fuel injector, Types of fuel injectors
3. Fuel distribution systems
4. M.P.F.I. system for modern automobile engines

Unit – 3

1. **Ignition system:**
   Battery and coil ignition system, Magneto ignition system, Electronic ignition system, Advantage over mechanical contact breaker point system

2. **Engine Cooling system:**
   Air Cooling, Water cooling, Thermostatic Radiators

3. **Lubrication system:**
   Dry sump Lubrication, Wet sump lubrication – Fully pressurized, oil filters

4. **Governing system:**
   Quality governing, Quantity governing, Hit & Miss governing

Unit – 4:

1. **Testing & Performance of I.C. Engine:** Determination of brake power, indicated power, friction power. Determination of brake thermal efficiency, mechanical efficiency, volumetric efficiency. Energy Balance. Performance characteristics. Supercharging & Turbo charging methods and limitations. (Only descriptive treatment)

Unit – 5:

1. **Combustion in S.I. Engines:**
    a. Stages of Combustion. Concept of combustion quality
    b. Effect of engine variable on ignition lag and flame propagation. Abnormal Combustion: Theories, effects and controlling measures, Combustion chambers for S.I. engines
2. **Combustion in C.I. Engines:**
    a. Stages of Combustion
    b. Diesel knock and its control
    c. Combustion chambers for C.I. engines

Unit – 6

1. Standards for emission of pollutants from motor vehicles as per CMV rules
2. PUC norms requirements for automotive applications
3. Hybrid vehicles

BEME4: FINITE ELEMENTS METHODS IN ENGINEERING

1. **INTRODUCTION**
   Introduction. Historical Background. Design Considerations. Need Of Finite Element Method. The Process Of Finite Element Method, Field And Boundary Conditions, Steps Involved In Fem, The Standard Discrete System , Transformation Of Co-Ordinates.

2. **FINITE ELEMENTS OF ELASTIC CONTINUUM DISPLACEMENT APPROACH**
   Introduction, Direct Formulation Of Finite Element Characteristic, Generalized Nature Of Displacements, Strains, And Stresses, Generalization To The Whole Region--Internal Nodal Force Concept Abandoned, Displacement Approach As A Minimization Of Total Potential Energy, Convergence Criteria, Discretization Error And Convergence Rate, Displacement Functions With Discontinuity Between Elements--Non-Conforming Elements And The Patch Test, Bound On Strain Energy In A Displacement Formulation, Direct Minimization.

3. **GENERALIZATION OF THE FINITE ELEMENT CONCEPTS WEIGHTED RESIDUAL AND VARIATIONAL APPROACHES**
   Introduction, Weighted Residual Methods, Approximation To Integral Formulations: The Weighted Residual Method, Virtual Work As The 'Weak Form' Of Equilibrium Equations For Analysis Of Solids Or Fluids, Variational Principles, Establishment Of Natural Variational Principles For Linear, Self-Adjoint Differential Equations, Maximum, Minimum, Or A Saddle Point, Constrained Variation Principles, Lagrange Multipliers And Adjoin Functions.

4. **STRAIN PLANE STRESS AND PLANE**
   Introduction, Element Characteristics, Some Practical Applications, Special Treatment Of Plane Strain With An Incompressible Material.

5. **AXI-SYMMETRIC STRESS ANALYSIS**
   Introduction, Element Characteristics, Some Illustrative Examples.

6. **THREE – DIMENSIONAL STRESS ANALYSIS**
   Introduction, Tetrahedral Element Characteristics.

7. **ELEMENT SHAPE FUNCTIONS SOME GENERAL FAMILIES OF C_0 CONTINUITY**
   Introduction, Two – Dimensional Elements, Completeness Of Polynomials, Rectangular Elements – Lagrange Family, Rectangular Elements – 'Serendipity' Family, Triangular Element Family, One-Dimensional Elopements, Three-Dimensional Elements, Other Simple Three-Dimensional Elements.

8. **CURVED, ISOPARAMETRIC ELEMENTS AND NUMERICAL INTEGRATION**

Introduction, Parametric Curvilinear Co-Ordinates, Geometrical Conformability Of Elements, Variation Of The Unknown Function With In Distorted, Curvilinear, Elements, Continuity Requirements, Transformations, Element Matrices, Area And Volume Co-Ordinates, Convergence Of Elements In Curvilinear Co-Ordinates, Numerical Integration.

9. SOME APPLICATIONS OF ISOPARAMETRIC ELEMENTS IN TWO- AND THREE-DIMENSIONAL STRESS ANALYSIS

Introduction, A Computational Advantage Of Numerically Integrated Finite Elements.

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