



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3110006

BASIC MECHANICAL ENGINEERING

1ST YEAR

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: Understanding of basic principles of Mechanical Engineering is required in various field of engineering.

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits C | Examination Marks | | | | Total Marks |
|-----------------|---|---|------------------|-------------------|--------|-----------------|--------|----------------|
| L | T | P | | Theory Marks | | Practical Marks | | |
| | | | | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

Content:

| Sr # | Topic | Teaching Hrs. | Module Weightage |
|------|---|---------------|------------------|
| 1 | Introduction: Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth law and First law | 4 | 25% |
| 2 | Energy: Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydro, Solar, Wind, and Bio-fuels, Environmental issues like Global warming and Ozone depletion | 3 | |
| 3 | Properties of gases: Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between c_p and c_v , Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Polytropic process | 5 | |
| 4 | Properties of Steam: Steam formation, Types of steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of steam tables, steam calorimeters | 6 | 30% |
| 5 | Heat Engines: Heat engine cycle and Heat engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles | 5 | |
| 6 | Steam Boilers: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, Functioning of different mountings and accessories | - | |
| 7 | Internal Combustion Engines: Introduction, Classification, Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies | 4 | 20% |
| 8 | Pumps: Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming | 3 | |
| 9 | Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistaging | 3 | |
| 10 | Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, Vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners | 4 | 25% |
| 11 | Couplings, Clutches and Brakes: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and | - | |



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| | | | |
|----|---|---|--|
| | Centrifugal), and Brakes (Block; Shoe; Band and Disc) | | |
| 12 | Transmission of Motion and Power: Shaft and axle, Different arrangement and applications of Belt drive; Chain drive; Friction drive and Gear drive | - | |
| 13 | Engineering Materials: Types, properties and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer | 4 | |

Note: Topic No. 6, 11 and 12 of the above syllabus are to be covered in Practical Hours.

Suggested Specification table with Marks (Theory):

| Distribution of Theory Marks | | | | | |
|------------------------------|---------|---------|---------|---------|---------|
| R Level | U Level | A Level | N Level | E Level | C Level |
| 20 | 40 | 40 | - | - | - |

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
2. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
3. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
4. Elements of Mechanical Engineering by Sadhu Singh, S. Chand Publication
5. Introduction to Engineering Materials by B.K. Agrawal, McGraw Hill Publication, New Delhi

Course Outcome:

| Sr. No. | CO statement | Marks % weightage |
|---------|--|-------------------|
| CO-1 | Discuss the various sources of energy and basic terminology of Mechanical engineering | 14 |
| CO-2 | Make calculations for commonly used working fluids i.e. ideal gases and steam | 22 |
| CO-3 | Analyze various heat engine cycles and understand construction and working of IC engines | 20 |
| CO-4 | Discuss working and applications of steam boilers and various energy conversion systems | 28 |
| CO-5 | Discuss various power transmission elements | 08 |
| CO-6 | Discuss properties of various engineering materials and their applications | 08 |

List of Experiments:

1. To understand construction and working of various types of boilers.
2. To understand construction and working of different boiler mountings and accessories.
3. To understand construction features of two/four stoke petrol/diesel engines
4. To determine brake thermal efficiency of an I. C. Engine.
5. To understand construction and working of different types of air compressors.
6. To demonstrate vapor compression refrigeration cycle of domestic refrigerator OR window air conditioner OR split air conditioner.
7. To understand construction, working and application of clutches, coupling and brakes



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8. To understand different arrangement and application of various power transmission drives

Major Equipment: Models of Cochran, Lancashire and Babcock and Wilcox boilers, models of various mountings and accessories, Models of various types of IC engines, Single cylinder two stroke /four stroke petrol/ diesel engine, models of pumps, compressors, Domestic refrigerator/window air conditioner/split air conditioner, models of various types of brakes, coupling, clutches, drives

List of Open Source Software/learning website: <http://nptel.iitm.ac.in>, <http://vlab.co.in/>