

**SAMPLE PAPERS**  
**DIPLOMA FIRST SEMESTER EXAMINATION 2025 (JUT)**  
**MECHANICAL SCIENCE & ENGINEERING**  
*DIPLOMA WALLAH*

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**Instructions:**

1. **Question No. 1 is compulsory.** It contains 7 MCQs of 2 marks each.
  2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
  3. All questions (Q.2 to Q.7) carry 14 marks each (typically divided into 7+7).
  4. Use neat sketches wherever necessary.
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**SECTION – A (Compulsory)**

**Q.1 Choose the correct option for the following: (7 × 2 = 14 Marks)**

- i. Which material property is defined as the ability of a metal to be drawn into thin wires?
- a) Malleability
  - b) Ductility
  - c) Plasticity
  - d) Elasticity
- ii. The primary objective of the "Normalizing" process in heat treatment is to:
- a) Soften the metal
  - b) Refine grain structure and remove internal stresses
  - c) Increase surface hardness only
  - d) Improve magnetic properties
- iii. Which of the following is an example of a Permanent Fastener?
- a) Bolted joint
  - b) Riveted joint
  - c) Screwed joint
  - d) Cotter joint
- iv. In a belt drive, the ratio of the diameters of the driving and driven pulleys is known as:

- a) Mechanical advantage
- b) Velocity ratio
- c) Slip ratio
- d) Transmission efficiency

v. Which type of gear is used to connect two intersecting shafts?

- a) Spur Gear
- b) Helical Gear
- b) Bevel Gear
- d) Worm Gear

vi. The internal diameter of an engine cylinder is technically termed as:

- a) Stroke
- b) Clearance
- c) Bore
- d) Displacement

vii. Which part of the IC engine converts the reciprocating motion of the piston into rotary motion?

- a) Connecting rod
- b) Crankshaft
- c) Camshaft
- d) Gudgeon pin



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**SECTION – B (Answer any FOUR questions)**

Q.2 A. Explain the construction and working principle of a Four-Stroke Spark Ignition (SI) Engine with a neat labelled sketch. [7 Marks]

B. Describe the aim of Heat Treatment. Briefly explain the procedure for Annealing and Hardening. [7 Marks]

Q.3

A. Define Hardenability. Explain the working principle of Carburizing as a surface hardening process. [7 Marks]

B. Provide a detailed comparison between SI Engines and CI Engines (Minimum 5 points). [7 Marks]

Q.4

A. What is a shaft coupling? Explain the construction and working of a Flange Coupling with a neat sketch. [7 Marks]

B. Explain why V-belt drives are preferred over Flat belt drives in industrial applications. [7 Marks]

Q.5

A. Classify bearings based on contact type. Describe the construction and working of Ball Bearings. [7 Marks]

B. Differentiate between a Simple Gear Train and a Compound Gear Train with simple sketches. [7 Marks]

Q.6

A. Define the following mechanical properties: Toughness, Brittleness, Malleability, and Hardness. [7 Marks]

B. A four-stroke engine has a compression ratio of 8. If the clearance volume is  $50 \text{ cm}^3$ , calculate the Swept Volume and Total Volume. [7 Marks]

Q.7 Write short notes on any FOUR of the following: ( $4 \times 3.5 = 14$  Marks)

A. TDC and BDC

B. Slip and Creep in belts

C. Lap Joint vs. Butt Joint

D. Applications of Stainless Steel

E. Splines and their advantages



**✔ SOLUTIONS – PAPER 1****MCQ Answer Key:**

i (b), ii (b), iii (b), iv (b), v (c), vi (c), vii (b).

**Short Answer Solutions:**

- **TDC/BDC:** Top Dead Centre (TDC) is the topmost position of the piston in the cylinder; Bottom Dead Centre (BDC) is the lowest position<sup>1</sup>.
- **Slip & Creep:** Slip is the actual difference between pulley and belt speeds due to insufficient friction; Creep is the change in belt length due to elastic tension as it passes over pulleys<sup>2</sup>.
- **Lap vs Butt Joint:** In a Lap joint, plates overlap; in a Butt joint, plates are placed end-to-end and joined via a cover plate<sup>3</sup>.

**Model Long Answer Highlights:**

- **4-Stroke SI Engine:** Consists of Suction, Compression, Power, and Exhaust strokes. Uses a Spark Plug to ignite the fuel-air mixture<sup>4</sup>.
- **Annealing:** Heating steel to a specific temp, holding it, and cooling slowly in the furnace to soften it and improve ductility<sup>5</sup>.

