

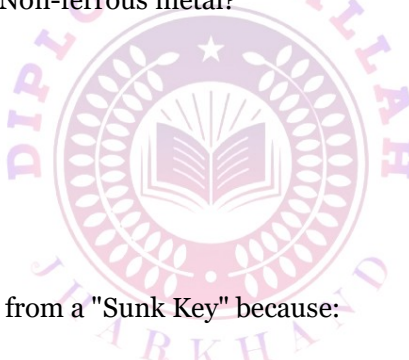
SAMPLE PAPERS
DIPLOMA FIRST SEMESTER EXAMINATION 2025 (JUT)
MECHANICAL SCIENCE & ENGINEERING
DIPLOMA WALLAH

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

- i. Which of the following is a Non-ferrous metal?
- a) Grey Cast Iron
 - b) Stainless Steel
 - c) Aluminum
 - d) Wrought Iron
- ii. A "Saddle Key" is different from a "Sunk Key" because:
- a) It is stronger
 - b) It requires no keyway on the shaft
 - c) It is used for heavy loads
 - d) It is circular in shape
- iii. Which type of drive is known as a "Positive Drive" (No Slip)?
- a) V-belt drive
 - b) Flat belt drive
 - c) Gear drive
 - d) Crossed belt drive
- iv. What is the standard unit for Engine Torque?
- a) Kilowatts (kW)
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- b) Newton-meter (N-m)
- c) RPM
- d) Pascal (Pa)

v. The distance the piston travels from TDC to BDC is called:

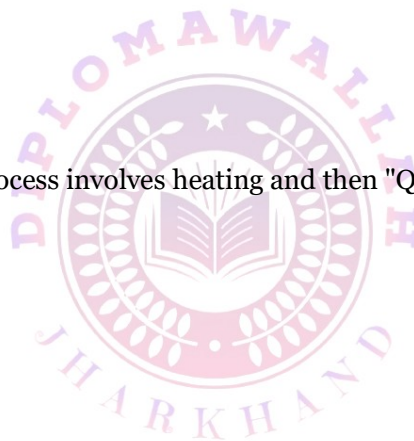
- a) Clearance
- b) Stroke
- c) Bore
- d) Lead

vi. In a gear train, if the driven gear has more teeth than the driver gear, the speed will:

- a) Increase
- b) Decrease
- c) Remain same
- d) Become zero

vii. Which heat treatment process involves heating and then "Quenching" (sudden cooling) in water or oil?

- a) Annealing
- b) Normalizing
- c) Hardening
- d) Tempering



SECTION – B (Answer any FOUR questions)

Q.2

A. Explain the construction and working of a Four-Stroke SI Engine using a neat P-V Diagram. [7 Marks]

B. Describe the properties and applications of Non-metallic Materials like Ceramics and Polymers. [7 Marks]

Q.3

A. Explain the Velocity Ratio for a compound gear train. Derive a simple formula for it. [7 Marks]

B. What are Splines? State their primary advantage over standard keys. [7 Marks]

Q.4

A. List the properties and two major applications of Stainless Steel and Bronze. [7 Marks]

B. Explain the working of a Thrust Bearing with a neat sketch. [7 Marks]

Q.5

A. Discuss the advantages and disadvantages of Screwed Joints. [7 Marks]

B. Compare SI Engines vs. CI Engines on the basis of fuel used, ignition method, and compression ratio. [7 Marks]

Q.6

A. Explain the Procedure of Hardening and the resulting changes in the properties of the material. [7 Marks]

B. Define Indicated Power (IP), Brake Power (BP), and Friction Power (FP). State the relationship between them. [7 Marks]

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

A. Rack and Pinion

B. Types of Sunk Keys (with sketch)

C. Specific Fuel Consumption (SFC)

D. Clearance Volume vs. Swept Volume

E. Aim of Heat Treatment



SOLUTIONS – PAPER 3**MCQ Answer Key:**

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

Short Answer Solutions:

- **SFC:** Specific Fuel Consumption is the amount of fuel consumed by an engine per unit of power produced per hour⁸.
- **Rack and Pinion:** Used to convert rotary motion into linear motion or vice versa⁹.

Model Long Answer Highlights:

- **P-V Diagram:** Illustrates the four processes: 1-2 (Adiabatic Compression), 2-3 (Heat addition at constant volume), 3-4 (Adiabatic Expansion/Power), 4-1 (Heat rejection at constant volume)¹⁰.
- **IP, BP, FP:** $IP = BP + FP$. Indicated Power is the total power developed inside the cylinder; Brake Power is the actual power available at the output shaft¹¹.

