

MECHANICAL SCIENCE & ENGINEERING

BRANCH:- MECHANICAL / METALLURGY

SEMESTER – FIRST

These important questions have been prepared using your previous exam papers (PYQs), verified concepts, and additional reference from trusted online academic sources. For deeper understanding, please refer to your class notes as well.

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1 HIGH & LONG IMPORTANT QUESTIONS =

High-Scoring Question
Explain the construction and working principle of a Four-Stroke Spark Ignition (SI) Engine with a neat P-V diagram and a simple labeled sketch of the engine mechanism.
Explain the aim of heat treatment. Describe the procedure and the resulting changes in properties for Annealing, Normalizing, and Hardening .
Define Hardenability . Explain the working principles of Carburizing and Nitriding (or Induction Hardening) as surface hardening processes, stating where they are practically applied.
Compare and contrast the following with a minimum of five points each: a) Two-Stroke vs. Four-Stroke Engines. b) SI Engine vs. CI Engine .
Couplings and Keys: What is a shaft coupling? Explain the construction and working of a Flange Coupling with a neat sketch. Also, describe the construction and application of a Woodruff Key .
Drives Comparison & Velocity Ratio: Explain why V-belt drives are preferred over Flat belt drives in many industrial applications. List the types of flat belt drives (Open,

High-Scoring Question

Crossed, etc.) and calculate the **Velocity Ratio** for an open belt drive, considering the effect of slip.

Bearings: Classify bearings based on the contact type. Describe the construction and working of **Ball Bearings** and **Roller Bearings**, highlighting their respective advantages.

2 IMPORTANT & SHORT QUESTIONS

- **UNIT-1 (Materials):**
 - Define the following mechanical properties: **Toughness, Brittleness, Malleability, and Hardness.**
 - Classify **Cast Iron** based on its structure and mention a specific application for **Alloy Cast Iron.**
 - List the properties and two major applications of **Stainless Steel** and **Bronze (Copper Alloy).**
- **UNIT-2 (Shafts, Keys, Bearings):**
 - Differentiate between **Sliding Contact Bearings** and **Rolling Contact Bearings** with one example each.
 - Draw a neat sketch of a **Sunk Key** and a **Saddle Key.**
 - What are **Splines**? State their primary advantage over keys.
- **UNIT-3 (Drives):**
 - List the **advantages and disadvantages of using Gear Drives** over belt or chain drives.
 - With a simple sketch, differentiate between a **Simple Gear Train** and a **Compound Gear Train.**
 - What are **Slip** and **Creep** in a belt drive?
- **UNIT-4 (Fasteners):**
 - Differentiate between **Lap Joint** and **Butt Joint** in riveting with simple sketches.
 - List the advantages and disadvantages of a **Screwed Joint.**
- **UNIT-5 (Engine Terminology):**
 - Explain the following terms with the help of a labeled sketch of a cylinder: **TDC, BDC, Stroke, and Clearance Volume.**

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- Define **Mean Effective Pressure (MEP)** and explain its significance in engine performance.
- Define **Brake Thermal Efficiency** and **Indicated Thermal Efficiency**.

3 “AA BHI SAKTA HAI” QUESTIONS (Low Probability but Smart Picks)

- **UNIT-1:** Explain the properties and applications of any two **Non-metallic Materials** (e.g., Ceramics and Polymers).
- **UNIT-2:** Briefly explain the construction and use of a **Thrust Bearing**.
- **UNIT-3:** Sketch and explain the working of a **Rack and Pinion** gear arrangement.
- **UNIT-4:** Write down the names of any three types of **Screw Fastenings** (e.g., Bolt, Stud, Screw).
- **UNIT-5:** Define the terms **Engine Torque** and **Specific Fuel Consumption (SFC)**.

12 Numerical Probability Analysis

Unit	Topic	Likelihood	Typical Calculation Type
Unit 3	Velocity Ratio/Speed Ratio	HIGH	Calculation of velocity ratio for simple/compound gear trains or belt drives, given diameters or number of teeth.
Unit 5	Engine Parameters	MEDIUM-HIGH	Calculation of Compression Ratio (CR) , Indicated Power (IP) , Brake Power (BP) , or Mechanical Efficiency
Unit 5	Power and Efficiency	MEDIUM	Simple problems involving the relation: $IP = BP + FP$

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