GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Internal Combustion Engine - 3171923

Chapter 1: Introduction to SI and CI Engines

Repeated Questions:

1. Comparison & Classification:

- **Q.** Compare SI and CI engines. **(SUMMER 2025, 3 Marks; WINTER 2023, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2022, 3 Marks; SUMMER 2023, 3 Marks - classification in detail)**
- **Q.** Give classification of I.C. Engine in detail. **(SUMMER 2023, 3 Marks; WINTER 2025, 4 Marks)**
- **Q.** Enlist and explain applications of SI and CI engines. **(WINTER 2023, 4 Marks)**

2. Fuels:

- **Q.** Compare properties of conventional fuels (Petrol/Diesel) with alternate/unconventional fuels. **(SUMMER 2025, 7 Marks; SUMMER 2024, 4 Marks; SUMMER 2022, 7 Marks)**

Other Important Questions:

1. SI vs. CI – Further Comparisons:

- **Q.** Compare SI and CI engines based on initial and maintenance costs. **(WINTER 2023, 3 Marks)**
- **Q.** Compare Petrol and Diesel engine on the basis of: Fuel Ignition, Thermal efficiency, Fuel supply. **(WINTER 2022, 3 Marks)**
- **Q.** Compare petrol and diesel engines based on the following points: 1) Operating cost 2) Compression ratio 3) Fuel Ignition. **(WINTER 2025, 3 Marks)**
- **Q.** Explain the thermodynamic differences between SI and CI engines. **(SUMMER 2026, 3 Marks)**
- **Q.** Compare the performance characteristics and applications of SI and CI engines. **(SUMMER 2026, 4 Marks)**

2. Engine Basics & Fuel Qualities:

- **Q.** Explain compression ratio and clearance volume. **(SUMMER 2023, 4 Marks)**
- **Q.** Explain working of a four-stroke petrol engine. **(SUMMER 2023, 7 Marks)**
- **Q.** Discuss important qualities of IC engine fuels. **(WINTER 2023, 7 Marks)**
- **Q.** What are the desirable properties of IC engine fuels? **(WINTER 2022, 4 Marks)**

3. Ideal Cycle (Numerical):

- **Q.** In an ideal constant volume cycle the pressure and temperature at the beginning of compression are 97 kN/m² and 40°C respectively. The volume ratio of compression is 7:1. The heat supplied during the cycle is 1200 kJ/kg of working fluid. Determine the maximum temperature attained in the cycle, thermal efficiency of cycle and work done during the cycle per kg of working fluid. **(SUMMER 2026, 7 Marks)**

Chapter 2: Fuel Supply Systems (Carburetion and Injection)

Repeated Questions:

1. Carburetion:

- **Q.** With a neat sketch, describe the working of a simple carburetor. [Diagram/sketch required – refer to the original question papers] **(SUMMER 2025, 4 Marks; SUMMER 2022, 4 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks OR)**
- **Q.** Derive the air-fuel ratio through approximate analysis of a simple carburetor. **(SUMMER 2025, 7 Marks OR; SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks)**
- **Q.** Define Stoichiometric, Rich, and Lean mixture. **(SUMMER 2025, 3 Marks; SUMMER 2022, 3 Marks; WINTER 2025, 3 Marks)**
- **Q.** Explain mixture requirements for different loads and speeds in an SI engine. **(WINTER 2023, 4 Marks; SUMMER 2023, 4 Marks - factors affecting carburation)**

2. Fuel Injection Systems:

- **Q.** Explain the working of an MPFI (Multi-Point Fuel Injection) system. State its advantages. **(SUMMER 2025, 7 Marks; SUMMER 2023, 4 Marks - brief; SUMMER 2022, 7 Marks; SUMMER 2026, 7 Marks)**
- **Q.** What are the requirements of a good fuel injection system for a CI engine? **(SUMMER 2022, 4 Marks; SUMMER 2025, 4 Marks)**
- **Q.** List types of nozzles used in CI engines. Explain any one. **(WINTER 2023, 3 Marks; WINTER 2022, 3 Marks - classification of CI chambers implies nozzles)**
- **Q.** Explain the construction and working of a Bosch fuel injection pump. **(WINTER 2022, 7 Marks; WINTER 2024, 4 Marks - sketch)**

3. Fuel Supply Systems:

- **Q.** Explain the fuel supply system in a petrol engine. OR diesel engine. **(SUMMER 2023, 7 Marks; WINTER 2025, 7 Marks OR)**

Other Important Questions:

1. Carburetor – Theory:

- **Q.** Explain ignition limit and stoichiometric mixture. **(SUMMER 2023, 3 Marks)**
- **Q.** What are the drawbacks of a simple carburetor? **(WINTER 2022, 4 Marks)**
- **Q.** Explain the functions of parts of a simple carburetor: Venturi, Float chamber, Choke valve. **(SUMMER 2024, 3 Marks)**
- **Q.** Explain the compensating or double jet with a neat sketch. **(SUMMER 2024, 4 Marks)**
- **Q.** Draw neat sketches of Solex carburetor and Carter Carburetor. **(WINTER 2024, 4 Marks)**
- **Q.** How does a carburetor adjust the air-fuel mixture? **(WINTER 2024, 3 Marks)**
- **Q.** Explain the carburetion process and enlist the ideal requirements of a good carburetor. **(WINTER 2025, 4 Marks)**
- **Q.** Explain the orifice-chamber method for air consumption measurement. **(SUMMER 2024, 4 Marks)**

2. CI Engine Injection:

- **Q.** Explain the working of a Common Rail fuel injection system. **(WINTER 2022, 7 Marks OR)**
- **Q.** Explain the functions of fuel pumps and injectors. **(SUMMER 2026, 3 Marks)**
- **Q.** Discuss spray formation of diesel injection and factors affecting it. **(SUMMER 2026, 4 Marks)**
- **Q.** Explain various types of injection systems used in CI engines with a diagram. [Diagram required – refer to the original question paper of S26] **(SUMMER 2026, 7 Marks)**
- **Q.** Compare different types of nozzles used in CI engines. **(SUMMER 2026, 7 Marks OR)**

Chapter 3: Combustion in SI and CI Engines

Repeated Questions:

1. Stages of Combustion:

- **Q.** Explain the stages of combustion in an SI engine. (Often with a P-θ diagram) **(SUMMER 2025, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2023, 4 Marks - brief; SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks OR; WINTER 2025, 7 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Explain the stages of combustion in a CI engine. (Often with a P-θ diagram) **(SUMMER 2025, 7 Marks OR; SUMMER 2024, 7 Marks; SUMMER 2023, 4 Marks - brief; SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks; WINTER 2025, 7 Marks OR; SUMMER 2026, 3 Marks OR)**

2. Knocking:

- **Q.** Explain knocking/detonation in an SI engine. What are its causes, effects, and control? **(SUMMER 2025, 3 Marks; SUMMER 2025, 4 Marks; SUMMER 2023, 3 Marks; SUMMER 2022, 4 Marks; WINTER 2022, 7 Marks - comparison; WINTER 2025, 3 Marks; WINTER 2025, 3 Marks OR; SUMMER 2026, 4 Marks)**
- **Q.** Explain knocking/detonation in a CI engine. What are its causes, effects, and control? **(SUMMER 2025, 3 Marks; SUMMER 2025, 4 Marks OR; WINTER 2024, 3 Marks; SUMMER 2023 - implied in C.I. combustion; SUMMER 2022, 4 Marks OR; WINTER 2022, 7 Marks - comparison; SUMMER 2026, 4 Marks OR)**
- **Q.** Compare knocking in SI and CI engines. **(WINTER 2022, 7 Marks; SUMMER 2024, 3 Marks)**

3. Combustion Chambers:

- **Q.** List different SI engine combustion chambers and explain any one with a sketch. **(WINTER 2023, 4 Marks OR; SUMMER 2023, 7 Marks; WINTER 2022, 7 Marks - types)**

Other Important Questions:

1. Ignition & Abnormal Combustion:

- **Q.** What is the importance of ignition lag in SI engine combustion? **(WINTER 2022, 3 Marks)**
- **Q.** Define: Ignition lag, HUCR, Performance number. **(SUMMER 2024, 3 Marks)**
- **Q.** Explain the following terms: Run-on surface ignition, Run-away surface ignition, wild ping, Rumble, Pre-ignition. **(WINTER 2024, 7 Marks)**
- **Q.** Explain the concept of detonation in CI engines. **(WINTER 2024, 3 Marks)**
- **Q.** Explain factors affecting engine knocking. **(WINTER 2023, 7 Marks OR)**

2. Combustion Chambers & Swirl:

- **Q.** Compare different combustion chamber designs for SI engines. **(WINTER 2024, 7 Marks)**
- **Q.** Classify different types of combustion chambers in a CI engine. **(WINTER 2022, 3 Marks OR)**
- **Q.** Explain the Lanova air-cell combustion chamber. **(SUMMER 2024, 4 Marks)**
- **Q.** Explain basic requirements of a good combustion chamber. **(WINTER 2024, 4 Marks)**
- **Q.** Explain induction swirl and compression swirl. **(SUMMER 2023, 3 Marks OR)**
- **Q.** Evaluate why “Turbulence” is required in an SI engine and “Swirl” is required in a diesel engine. **(SUMMER 2023, 7 Marks OR)**

Chapter 4: Engine Systems (Lubrication, Cooling, Supercharging)

Repeated Questions:

1. Cooling Systems:

- **Q.** Compare Air Cooling and Water Cooling systems. **(SUMMER 2025, 4 Marks OR; SUMMER 2024, 4 Marks; SUMMER 2022, 4 Marks OR)**
- **Q.** Explain the Pressurized Water Cooling system with a neat sketch. **(SUMMER 2025, 7 Marks OR; WINTER 2023, 7 Marks; SUMMER 2022, 7 Marks OR)**
- **Q.** Explain the necessity of engine cooling. **(WINTER 2023, 3 Marks; WINTER 2025, 4 Marks OR)**

2. Lubrication Systems:

- **Q.** Explain a Pressure Feed (Full Pressure) Lubrication system with a neat sketch. **(SUMMER 2025, 7 Marks; SUMMER 2022, 7 Marks)**
- **Q.** Explain the Splash Lubrication system with a neat sketch. **(WINTER 2023, 7 Marks OR; WINTER 2022, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** Compare wet sump and dry sump lubrication systems. **(SUMMER 2025, 4 Marks OR; WINTER 2022, 4 Marks; SUMMER 2022, 4 Marks OR; WINTER 2025, 4 Marks)**
- **Q.** Explain the S.A.E. rating of lubricants. **(WINTER 2024, 3 Marks OR; WINTER 2022, 3 Marks)**

3. Supercharging & Stratified Charge:

- **Q.** Compare Supercharging and Turbocharging. **(SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2022, 4 Marks OR)**
- **Q.** What is supercharging? Explain its objectives and thermodynamic cycle. **(WINTER 2024, 7 Marks; WINTER 2023, 3 Marks; SUMMER 2022, 3 Marks)**
- **Q.** Explain the working principle of a stratified charge engine. **(WINTER 2023, 3 Marks OR; SUMMER 2024, 4 Marks; WINTER 2025, 3 Marks)**

Other Important Questions:

1. Cooling – Theory:

- **Q.** Give the classification of the engine cooling system. **(WINTER 2022, 3 Marks)**
- **Q.** Explain the engine air cooling system with a neat sketch. **(WINTER 2024, 4 Marks OR)**

2. Lubrication – Theory:

- **Q.** List desirable properties of engine lubricants. **(WINTER 2024, 3 Marks)**
- **Q.** Explain types of lubricants and their properties. **(WINTER 2023, 4 Marks)**
- **Q.** State the function of the lubrication system. **(WINTER 2022, 3 Marks OR)**
- **Q.** Enlist the functions of the lubrication system. **(SUMMER 2024, 3 Marks)**

3. Turbocharging & Supercharging Effects:

- **Q.** Explain turbocharger. **(SUMMER 2022, 3 Marks OR)**
- **Q.** What is meant by pulse turbocharging? **(WINTER 2024, 7 Marks OR)**
- **Q.** Explain the effects of supercharging. **(WINTER 2025, 4 Marks)**

Chapter 5: Engine Testing, Performance, and Emissions

Repeated Questions:

1. Engine Testing & Heat Balance:

- **Q.** Explain the Air Box method to calculate air consumption. **(SUMMER 2025, 3 Marks; WINTER 2023, 4 Marks; SUMMER 2022, 3 Marks; SUMMER 2026, 4 Marks)**
- **Q.** Explain Willan's Line method to find friction power. **(SUMMER 2025, 4 Marks OR; WINTER 2023, 3 Marks; SUMMER 2022, 4 Marks OR; WINTER 2025, 4 Marks OR)**
- **Q.** Explain the Morse Test and perform calculations to find Indicated Power, Mechanical Efficiency, etc. [Very important numerical topic – questions appear in almost every paper] **(SUMMER 2025, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2023, 7 Marks; WINTER 2022, 7 Marks; SUMMER 2022, 7 Marks; SUMMER 2026, 7 Marks; SUMMER 2026, 4 Marks OR)**
- **Q.** Draw a Heat Balance Sheet (on kW and percentage basis) based on given observations. [Another crucial numerical topic] **(SUMMER 2025, 7 Marks OR; SUMMER 2024, 7 Marks OR; WINTER 2022, 7 Marks; WINTER 2025, 4 Marks OR)**

2. Emissions & Norms:

- **Q.** Explain emissions from SI and CI engines. **(SUMMER 2025, 4 Marks; WINTER 2023, 4 Marks; SUMMER 2022, 3 Marks; WINTER 2025, 3 Marks OR; SUMMER 2026, 7 Marks)**
- **Q.** Discuss the role of catalytic converters in controlling emissions. **(WINTER 2023, 7 Marks; WINTER 2022, 4 Marks - comparison with thermal reactor)**
- **Q.** Briefly explain Bharat Stage / EURO-III and EURO-IV norms. **(SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2025, 4 Marks)**

3. Wankel Engine:

- **Q.** Explain the working principle of a Wankel engine. **(WINTER 2024, 3 Marks; WINTER 2023, 7 Marks OR; SUMMER 2024, 7 Marks; WINTER 2025, 3 Marks OR; SUMMER 2026, 3 Marks)**

Other Important Questions:

1. Emissions & Control:

- **Q.** What are the primary pollutants from an SI engine? **(WINTER 2023, 7 Marks OR)**
- **Q.** Explain diesel smoke and its control. **(WINTER 2023, 3 Marks OR)**
- **Q.** Explain EGR (Exhaust Gas Recirculation). **(SUMMER 2023, 4 Marks)**
- **Q.** Explain effect on exhaust emission: A/F ratio, S/V ratio, Engine speed. **(WINTER 2023, 4 Marks)**
- **Q.** Explain CRDI (Common Rail Direct Injection) system. **(SUMMER 2022, 7 Marks OR)**
- **Q.** Explain the sustainability and ethical concerns in engine emission control. **(SUMMER 2026, 3 Marks)**
- **Q.** Discuss the impact of emission legislation on engine design. **(SUMMER 2026, 3 Marks OR)**
- **Q.** Explain the effect of engine maintenance on exhaust emissions. Also compare diesel and gasoline emissions. **(SUMMER 2026, 7 Marks OR)**

2. Engine Maintenance, Governing & Other Engines:

- **Q.** Explain trouble shooting and overhauling of engines. **(WINTER 2023, 4 Marks OR)**
- **Q.** Carry out mass analysis of carbon for complete/incomplete combustion. **(SUMMER 2023, 7 Marks OR)**
- **Q.** Define the governing of I.C. engine & also name the types of same. **(WINTER 2025, 3 Marks)**
- **Q.** Explain the working principle of a Sterling engine. **(SUMMER 2026, 3 Marks OR)**

3. Engine Performance (Numerical):

- **Q.** The following data are collected from a 4-stroke single cylinder engine at full load: Bore = 200 mm, stroke = 280 mm, speed = 300 RPM, indicated mean effective pressure = 5.6 bar, torque on

the drum = 250 Nm, fuel consumed = 4.2 kg/hr, CV = 41000 kJ/kg. Determine mechanical efficiency, indicated thermal efficiency and brake thermal efficiency. **(WINTER 2025, 7 Marks)**

- **Q.** A single cylinder 2 stroke engine running at 2000 RPM develops torque 10 Nm. The indicated power of the engine is 2.3 kW. Find the loss due to F.P. as a percentage of brake power. **(WINTER 2025, 7 Marks OR)**
- **Q.** A six cylinder, four-stroke gasoline engine having a bore and stroke of 100 mm has a compression ratio 8. The relative efficiency is 54% when the indicated specific fuel consumption is 300 gm/kWh. Determine: (i) the calorific value of the fuel and (ii) corresponding fuel consumption, given that imep is 8.5 bar and speed is 2550 rpm. **(SUMMER 2026, 7 Marks OR)**

Chapter 6 & 7: Alternative Fuels and Unconventional Engines (and Fuel-Related Issues)

Repeated Questions:

1. Alternative Fuels:

- **Q.** Explain the suitability of Biofuels (Methanol, Ethanol, etc.) as alternative fuels. **(WINTER 2024, 4 Marks; SUMMER 2023, 6 Marks - syllabus; SUMMER 2026, 4 Marks)**
- **Q.** Explain the advantages of using hydrogen as a fuel. **(WINTER 2022, 4 Marks; SUMMER 2026, 4 Marks OR)**
- **Q.** Write a short note on alternative fuels. **(WINTER 2023, 7 Marks OR; WINTER 2025, 7 Marks)**

Other Important Questions:

1. Biofuels & Fuel-Related Issues:

- **Q.** Explain the advantages of biofuels. **(WINTER 2025, 7 Marks OR)**
- **Q.** Explain the following terms: Ice formation, Vapour lock, Back-firing. **(SUMMER 2024, 7 Marks)**

****