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B. Tech 5th Semester Examination

Internal Combustion Engines (O.S.)

ME-5004

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five question with at least one question from each section. Section E is compulsory. Use of non-programmable calculators is allowed.

SECTION - A

1. (a) Compare of Otto, Diesel and Dual combustion cycle for the same compression ratio and maximum pressure with the help of P-V and T-S diagram.

   (b) Define scavenging and explain various methods of scavenging. **(10+10=20)**

2. In an IC engine operating on the dual cycle (limited pressure Cycle), the temperature of the working fluid (air) at the beginning of compression is 27°C. The ratio of the maximum and minimum pressures of the cycle is 70 and the compression ratio is 15. The amounts of heat added at constant volume and constant pressure are equal. Compute the air standard thermal efficiency of the cycle. State three main reasons why the actual thermal efficiency is different from the theoretical value. **(20)**

SECTION - B

3. (a) Describe with suitable sketches the following systems in reference to a carburetor.

i. Main metering system

ii. Idling system

iii. Power enrichment or economizer system

iv. Acceleration pump system

v. Choke

(b) What are the essential requirements of a Diesel fuel injection system? **(12+8=20)**

4. (a) Differentiate between air injection and airless injection systems.

(b) Compare the merits and demerits of Battery ignition and Magneto ignition systems. **(10+10=20)**

SECTION - C

5. (a) Explain the auto ignition theory of detonation in a spark ignition engine. Considering this theory describe the influence of (i) engine speed (ii) cylinder size (iii) inlet pressure on the detonation tendency of an SI engine?

(b) What are the functions of a lubrication system in an IC engine? Explain the pressure lubrication system in details. **(10+10=20)**

6. (a) What do you mean by delay period in CI engines? Explain the effect of the following operating variables on this.

i. Compression ratio

ii. Ignition advance

iii. Intake pressure

iv. Inlet temperature

v. Fuel/air ratio

(b) What are different types of radiators used in cooling the engines? Explain any one in detail. **(10+10=20)**

SECTION - D

7. (a) Explain clearly what do you understand by super charging of an IC engine? How is it achieved? What is the effect of supercharging on the following parameters?

i. Power Output

ii. Mechanical efficiency

iii. Fuel consumption

(b) Discuss the emissions from SI and CI engines. On what factors do these emissions depend? **(10+10=20)**

8. A four cylinder, four stroke diesel engine develops 83.5 kW at 1800 r.p.m with specific fuel consumption of 0.231 kg/kWh and air fuel ratio of 23:1. The analysis of fuel is 87% carbon and 13% hydrogen with calorific value of the fuel is 43500 kJ/Kg. The jacket cooling water flows at 0.246 Kg/s and its temperature rise is 50 K. The exhaust temperature is 589 K. Draw up energy balance for the engine. Take R = 0.302 KJ/Kg K and C_p = 1.09 kJ/Kg K for the dry exhaust gases and C_p = 1.86 kJ/Kg K for superheated steam. The temperature in the test house 290.8 K and exhaust gas pressure is 1.013 bar. **(20)**

SECTION - E

9. (a) Name the factors responsible for the formation of NO_x in SI engine combustion.

(b) Does the flame front exist in a CI engine? Explain

(c) What do you mean by SAE rating for lubricants?

(d) Differentiate between Cetane number and Diesel index w.r.t. to diesel-fuel.

(e) Sketch the valve timing diagram for a four stroke petrol engine.

(f) Explain the term 'Highest Useful Compression Ratio' used in SI engines.

(g) Differentiate between indicated thermal efficiency and brake thermal efficiency w.r.t to IC engines.

(h) Compare Hydrogen and CNG as alternative fuels for IC engines.

(i) Discuss mixture requirement for various operating conditions of a simple carburetor.

(j) Differentiate between 4-stroke petrol engine and 4-stroke Diesel engine. **(2×10=20)**