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(2066)

16136(J)

B. Tech 6th Semester Examination

Internal Combustion Engines (NS)

ME-325 June-16

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 five questions in all, selecting one question each from Sections A, B, C & D, and all sub-parts of question no. 9 of Section E.

SECTION - A

1. (a) List the important reciprocating engine parts and their materials. (6)

   (b) A six cylinder four stroke petrol engine has a swept volume of 290 cm^2 per cylinder, a compression ratio of 10 and operates at a speed of 3300 rpm. If the engine is required to develop an output of 75kW at this speed, calculate the cycle efficiency, the necessary rate of head addition, the mean effective pressure, and the maximum temperature of the cycle. Assume that the engine operates on the Otto cycle and that the pressure and temperature before isentropic compression are 1 bar and 145°C respectively. Take C_v= 0.718, γ=1.4. If the above engine is a compression ignition engine operating on the Diesel cycle and receiving heat at the same rate, calculate efficiency, the maximum temperature of the cycle, the power output and the mean effective pressure. (14)

2. (a) Explain with graph the three possible theoretical scavenging processes. (6)

   (b) What is the difference between the valve timing of a crankcase-scavenged and supercharge two stroke engines? (6)

   (c) Obtain the engine dimensions of a two cylinder, two stroke I.C. engine from the following data: Engine speed: 3900 rpm, volumetric efficiency: 0.76, Mechanical efficiency =, 0.74, Fuel consumption: 7.3 kg/hr, Specific gravity: 0.73, Enthalpy of combustion of fuel: 10,500kcal.kg, Air fuel ratio: 18:1, Piston speed: 595 m/min, Indicated mean effective pressure: 5 atm. Find also the brake power output and thermal efficiency. Assume standard pressure and temperature. (8)

SECTION - B

3. (a) Describe with a neat sketch any petrol injection system and also write the advantages and disadvantages of petrol injection system. (8)

   (b) The venturi of a simple carburettor has throat diameter of 18 mm and coefficient of air flow is 0.85. The fuel orifice has a diameter of 1.23 mm and coefficient of fuel flow is 0.66. The petrol surface is 5 mm below the throat. Find (a) the air fuel ratio for a pressure drop of 0.07 bar when the nozzle lip is neglected; (b) the air fuel ratio when the nozzle lip is taken account; (c) the minimum velocity of air or critical air velocity required to start the fuel flow when nozzle lip is provided. Take density of air & fuel as 1.2 and 750 kg/m^3 respectively. (12)

4. (a) Differentiate battery and magneto ignition system in tabular form and also draw neat sketches for both the ignition systems. (10)

   (b) Determine the diameter of a fuel orifice for a 4-stroke engine developing 13kW per cylinder at 1800 rpm, using 0.272 kg/kWh fuel of 32° API. The duration of injection is 30° of crank travel. The fuel injection pressure is 120 bar and the combustion chamber pressure is 30 bar. take velocity coefficient 0.9, ρ = 0.8654. (10)

SECTION - C

5. (a) The spark plug is fired at 18° before TDC in an engine running at 1800 rpm. It takes 8° of engine rotation to start combustion and get into flame propagation mode. Flame termination occurs at 12° after TDC. Bore diameter is 8.4 cm and the spark plug is offset 8mm from the centre line of the cylinder. The flame front can be approximated as a sphere moving out from the spark plug. Calculate the effective flame front speed during flame. (5)

   (b) Explain the phenomenon of knock in CI engines and compare it with SI engine knock in tabular form. (10)

   (c) How are SI and CI engine fuels rated? (5)

6. (a) Compare the quantity of cooling water required for a 100 kW petrol and diesel in which the water is raised in temperature by 33°C in passing through the jackets. In petrol engine the percentage of energy going to coolant is 28% and in diesel 26%. The efficiency of petrol engine is 26% and of diesel engine 31% (8)

   (b) Clearly explain the various wet sump lubrication system. Compare wet sump and dry sump lubrication system. (12)

SECTION - D

7. (a) Describe the Morse test. What is the assumption made in this test? What precautions should be taken in performing this test? What is the accuracy of this test? (10)

   (b) A four stroke gas engine has a cylinder diameter of 27 cm and piston stroke of 45 cm. The effective diameter of the brake is 1.62 m. The observations made in a test of the engine were as follows:

   Duration of test: 38 min 30 sec, Total number of revolutions: 8080, Total number of explosions: 3230, Net load on the brake: 903 N, Mean effective pressure: 5.64

bar, Gas used: 7.7 m^3, Pressure of gas at meter: 135 mm of H_2O above atm pressure, Temperature of gas: 27°C, Height of barometer: 750 mm Hg, Calorific value of gas: 18420 kJ/m^3 at NTP, Mass of jacket cooling water: 183 kg, Rise in temperature of cooling water: 47°C, Draw up a heat balance sheet and calculate the indicated and brake thermal efficiency. (10)

8. (a) Compare diesel and gasoline engine emissions. (5)

   (b) Write the merits and demerits of biogas and CNG. (5)

   (c) How knock emissions are caused and what are their effects on environment? (5)

   (d) With a sketch explain LPG fuel feed system. (5)

SECTION - E
(Compulsory Question)

9. Write short answers of the following:

   (a) List of parameters by which performance of an engine is evaluated.

   (b) Distinguish between power and specific output.

   (c) Discuss the various applications of IC engines.

   (d) What is the use of air standard cycle analysis?

   (e) Why is flame speed important? What is the most important single factor affecting flame speed?

   (f) Why a very rich mixture is required for idling?

   (g) Why the air injection system is not used now days and also write the requirements of an ideal injection.

   (h) What do you understand by the energy requirements of the ignition system?

   (i) How lubricating oils are classified?

   (j) Define trapping efficiency and delivery ratio. (2×10=20)