TE-ME-SEM-VI (Rev)

17/12/14

ICE

QP Code :15224

(3 Hours) [Total Marks : 100

- **Question No 1 is compulsory.**
- **Answer any four out of remaining six questions.**
- **Assumptions made should be clearly stated .**
- **Assume suitable data wherever required, but justify the same.**

Q-1 Answer any **four** of the following : [20]

(a) Distinguish between CI and SI engines
(b) What is detonation in SI Engine?How it can be controlled?
(c) What do you understand by supercharging ?What are its limitations?
(d) Write a note on SAE grading of Lubricants.
(e) Define bsfc and brake thermal efficiency. If bsfc of the engine is 0.23kg/kWh find the brake thermal efficiency of the engine. The calorific value of the fuel is 42000 kJ/kg.

Q-2 a) Explain with a sketch the working of common rail fuel injection system of a diesel engine [6]

b) A simple jet carburetor is required to supply 6 kg of air per minute and 0.45 kg of fuel of density 740 kg/m^3. The air is initially at 1.013 bar and 27^0 C. Calculate the throat diameter of the choke for a flow velocity of 92 m/s.Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 75% of that at the choke, calculate the fuel orifice diameter assuming $C_d = 0.60$. [10]

c) Define octane number and cetane number and their significance. [4]

Q-3 a) Explain in detail the various stages of combustion in a S.I. engine [10]

b) A six-cylinder, four stroke diesel engine operates on A/F ratio = 20. The diameter and stroke of the cylinder are 100 mm and 140 mm respectively. The volumetric efficiency is 80%. The condition of air at the beginning of the compression is 1bar,27^o C. Determine : (i)Maximum amount of fuel that can be injected in each cylinder per second. (ii)The diameter of the fuel orifice assuming that only one orifice is used, if the speed of the engine is 1500 rpm, injection pressure is 150 bar, air pressure during fuel injection is 40 bar and fuel injection is carried out for 20 degree crank angle. Assume coefficient of discharge for the orifice = 0.6 and Sp Gravity of fuel = 0.85 [10]

Q-4 a) What is the function of a lubrication system in IC engine. Explain with a sketch the working of full pressure wet sump lubrication system. [10]

b) A 4-stroke diesel engine is designed to operate with the following characteristics at sea level, where the mean conditions are 1.013 bar and 10°C : [10]
B.P. = 250 kW ; volumetric efficiency = 78 per cent (at sea level free air conditions); specific fuel consumption = 0.245 kg/kWh. Air-fuel ratio = 17:1; speed = 1500r.p.m. Determine the required engine capacity and the brake mean effective pressure. The engine is run at an altitude of 2700 m where the atmospheric pressure is 0.72 bar by fitting a supercharger directly and mechanically coupled to the engine. The power consumed by the supercharger is 8 per cent of total power produced by the engine and the temperature of air leaving the supercharger is 32°C. The air-fuel ratio and the thermal efficiency remain the same for the supercharged engine as when running unsupercharged at sea level, as does the volumetric efficiency. Determine the increase of air pressure required at the supercharger to maintain the same net output of 250 kW.

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Q-5 a) Why cooling is required in I.C engines. Distinguish between air and water cooling. Explain with a sketch the operation of thermostatic cooling system. [10]

b) Following observations were made during a trial on single cylinder 2 stroke engine. : [10]

Cylinder Diameter = 220 mm ; Stroke Length = 270 mm ; Brake diameter = 1.5m Speed = 450 RPM; Brake Load = 460 N ;indicated mean effective pr = 3 bar Percentage of Hydrogen by mass in the fuel = 15;Fuel used = 5.4 kg/hr ; Calorific value of fuel = 43900 kJ/kg ; Cooling Water circulated = 440 kg/hr ; Air fuel ratio = 31:1; Exhaust gas temperature = 355 ° C ; Ambient temperature = 20 ° C Rise in cooling water temperature = 36.1 ° C; C_p of dry exhaust gases = 1kJ/kgK Sp.Heat of dry steam = 1.88 kJ/kg K.

Calculate : i) Mechanical efficiency ii) Brake thermal efficiency and iii) Draw up heat balance sheet on percentage basis

Q-6 a) What are the important considerations in the design of combustion chamber of CI engine. What are the advantages of an induced swirl and its limitations. Explain in brief the methods of generating the induced swirl. [10]

b) A four stroke petrol engine with 80 mm bore, 100 mm stroke is tested at full throttle at constant speed. The net brake power of the engine is 12.5 kW with all the cylinders firing. The fuel supply is fixed at 0.068 kg/min and the four cylinders are successively short circuited without change of speed, the brake torque being correspondingly adjusted. The brake power with cylinders 1,2,3 and 4 being cut off sequentially is 9 kW,9.15 kW, 9.2 kW and 9.1 kW respectively. The calorific value of the fuel is 44100 kJ/kg and the clearance volume of one cylinder is $70x10^3$ mm^3 . Determine indicated power, indicated thermal efficiency and air standard efficiency of the engine. [10]

Q-7 Write short notes on any **four** of the following : [20]

i. Torque measurement
ii. Wankel Engine
iii. Stratified charge engine
iv. Magneto ignition System
v. Alternate fuels for IC engine
vi. Scavenging of petrol engine.
