MECH/CBGS/V/ICE | 03-12-2016

IC Engine

Q. P. Code : 600700

(3 Hours) **[Total Marks : 80]**

Note: i. Q.No.1 is **compulsory.**
ii. Attempt any **Three** question from Q.No.2 to Q.No.6
iii. Make suitable assumptions if required
iv. Use of Steam Table is permitted.

Q.No.1 Solve Any **Four** **(5×4)**

a) Indicate whether the following statements are right or wrong and, correct the wrong statements:
i. The thermal efficiency of a diesel cycle will increase with increase in cut off ratio.
ii. Higher the Octane numbers of a fuel, longer the ignition delay.
iii. Camshafts of four strokes I.C. Engines rotate at twice the speed off crankshaft.
iv. Increasing the compression ratio of a C. I. Engine will increase the knocking tendency.
v. Carbon deposits in I. C. Engine cylinder results in decrease of effective compression ratio.

b) What will be the effect on the efficiency of an Otto cycle having compression ratio of 8, if C_v increases by 1.6% C_v, specific heat?

c) What is the difference between physical delay and chemical delay? State the factors on which delay period depends.

d) Compute the bmep in bar, mean piston speed in m/s and torque in Nm for a two stroke, four cylinder C.I. Engine having following specifications bore dia.150 mm, brake power 265 kW at 2400 rpm, L/d ratio of 0.90. Also identify whether this engine is a square, over square or under square engine.

e) List out and define various engine efficiencies with their tentative values for the modern engines.

Q.No.2 **a)** During an engine trial on a six cylinder four stroke diesel engine,cylinder bore 180 mm, the stroke 200 mm, the following observations were recorded : speed 1500 rpm, BP = 245 Kw , mep = 8 bar ,fuel consumption :70 kg/hr, heating valve of fuel 44 MJ/kg , Hydrogen content of the fuel 12%, air consumption 28 kg/min., mass of cooling water 85 kg/min., cooling water temperature rise 42 ^{0}C, cooling oil circulated through the engine = 50 kg/min, temperature rise of cooling oil = 24^{0}C ,specific heat of cooling oil 2.1 kJ/KgK, room temperature 30 ^{0}C, exhaust gas temperature 400 ^{0}C, Cp of the dry exhaust gas 1.045 kJ/kgK, partial pressure of the steam in a exhaust gases 0.035 bar. Estimate the mechanical efficiency and Draw of the heat balance sheet. **(15)**

b) What are the sources of HC formation in petrol engine? Explain the different factors which affect the HC formation. **(05)**

Q.No.3 **a)** Why C.I engines exhibit more favorable fuel consumption at part load and idling, compared to the carbureted S.I engines? **(05)**

[TURN OVER]

b) Describe the phenomenon of knocking in S.I. engines with the help of P-Θ and P-V plots. **(05)**

c) Willan's line test is conducted on a constant speed diesel engine operating at 1500 rpm and developing 50 kW power output at full load. Willan's line may be considered as a straight line up to 60% load, with the slope of the line being 8° (eight degrees). The fuel consumption for this engine is 2.46 kg/h at 10% load. Calorific Value (C.V.) of fuel used is 42 MJ/kg. Calculate (i) Frictional power (ii) Fuel consumption in kg/h at 60% load. (iii) Brake thermal efficiency at 60% load. (iv) Mechanical efficiency at 40% toad. (v) Brake torque at 40% load. **(10)**

Q.No.4 a) Write short note on the following : **(Any Two)** **(5×2)**
i) Air cooling ii) Wankel Engine iii) Dissociation

b) A 4- stroke cycle C.I. engine develops 11 KW per cylinder while running at 1800 r.p.m. and using fuel oil of 32 ^{0} API. Fuel injection occupies 32 ^{0}C of crank travel and takes place through a fuel injection orifice 0.47 mm diameter with a flow coefficent of 0.9. Fuel is injected at a pressure of 118.2 bar in to combustion chamber where the pressure is 31.38 bar. Estimate the quantity of fuel injected in kg/Kwh. **(10)**

Specific gravity of fuel oil is given by: 141.5 /(131.5 + ^{0} API)

Q.No.5 a) Write short note on the following : **(Any Two)** **(2×5)**
i) Stratified Charge Engine.
ii) Alternative Fuels for I.C. Engine.
iii) Electronic Fuel-Injection systems

b) Determine the size of fuel orifice to give A:F = 12:1. The diameter of venturi throat is 3.5 cm and the vacuum at the venturi is 6.9 cm of Hg. The pressure and temperature of atmospheric air are 1.013 bar and 25 ^{0}C. The nozzle lip = 5 mm. Take Cd_a= 0.9, Cd_f = 0.7, density of fuel 760 Kg/m^3. **(10)**

Consider the compressibility of air.

Q.No.6 a) The average indicated power in a C.I. engine is 15 kw/m^3 of free air inducted per minute. It is a four stroke engine having swept volume 3.4 liter. The speed of the engine is 3300 rpm and has a volumetric efficiency 80% referred to free air conditions of 1.013 bar and 22^{0}C. It is proposed to provide with a blower, driven mechanically from the engine. The blower has a pressure ratio1.8 and adiabatic efficiency 75%. It can be assumed that at the end of suction, in the supercharged condition, the cylinder contain a volume of air equal to the swept volume at the pressure and temperature of delivery from the blower. Calculate the net increase in break power. Take Mechanical efficiency of engine and blower as 80%. **(12)**

b) Explain briefly various methods to control Emission. **(8)**
