15/11/19

TE/Sem V/CBCGS/AUTO/ND-19

Time : 3 Hrs **Marks : 80**

Note: 1 Q.No.1 is **compulsory.**
2. Attempt any **Three** question from Q.No.2 to Q.No.6
3. Make suitable assumptions if required

Q.No.1 Solve Any **Four** **(5*4)**

a) Define the following terms.
i) Stroke ii) C.R. iii) TDC iv) Clearance Volume v) Displacement Volume.

b) List the types of combustion chamber for S. I. Engine and illustrate any one.

c) Classify the diesel injection system and illustrate any one.

d) State advantages and Disadvantages of HCCI Engine

e) List five reasons why there are HC emissions in the exhaust of an automobile.

Q.No.2 a) State the reasons for efficiency of actual cycle is much lower than the air standard cycle efficiency? List the major losses and differences in actual engine cycle and air standard cycle. **(10)**

b) A single cylinder engine operating at 2000 rpm develops a torque of 8 N-m. The indicated power of the engine is 2.0 kW. Determine loss due to friction as the percentage of brake power. **(05)**

c) Why does the optimum ignition timing change with engine-operating conditions? State the advantages of electronic ignition **(05)**

Q.No.3 a) Illustrate the phenomenon of knocking in S.I. engines with the help of P-Θ and P - V plots. State harmful effect of knocking. **(10)**

b) Evaluate the air-fuel ratio of a 4-stroke, single cylinder, air cooled engine with fuel consumption time for 10 cc as 20.0 sec. and air consumption time for 0.1 m^3 as 16.3 sec. The load is 16 kg at speed of 3000 rpm. Also evaluate brake specific fuel consumption in g/kWh and brake thermal efficiency. Assume the density of air as 1.175 kg/m^3 and specific gravity of fuel to be 0.7. The lower heating value of fuel is 44 MJ/kg and the dynamometer constant is 5000. **(10)**

Q.No.4 a) Describe the Engine Pollution, list the methods to control pollution and state the EURO and BHARAT norms. (10)

b) A four-cylinder, four-stroke diesel engine develops a power of 180 kW at 1500 rpm. The *b.s.f.c.* is 0.2 kg/kWh. At the beginning of injection pressure is 30 bar and the maximum cylinder pressure is 50 bar. The injection is expected to be at 200 bar and maximum pressure at the injector is set to be about 500 bar. Determine the total orifice area required per injector if the injection takes place over 15^0 crank angles. (10)

Use following assumptions:

C_d for injector = 0.7 , *S.G.* for fuel = 0.875 , Atmospheric pressure = 1 bar, Effective pressure difference = Average pressure difference over the injection period.

Q.No.5 a) List Exhaust Gas Oxygen sensors and state their importance in ECM (06)

b) An air compressor is being run by the entire output of a supercharged 4-stroke cycle diesel engine. Air enters the compressor at 25°C and is passed on to a Cooler where 1210 kJ per mm is rejected. The air leaves the cooler at 65°C and 1.75 bar. Part of this air-flow is used to supercharge the engine which has a volumetric efficiency of 72% based on induction manifold condition of 65°C and 1.75 bar. The engine, which has six cylinders of 100 mm. bore and 110 mm stroke runs at 2000 rpm and delivers an output torque of 150 Nm. The mechanical efficiency of engine is 80%. Evaluate:— (14)

(i) The indicated mean effective pressure of the engine;

(ii) The air consumption rate of the engine;

(iii) The air-flow into compressor in kg per min.

Q.No.6 a) State the necessity of engine cooling and disadvantages of overcooling (05)

b) The following readings were recorded during a trial on a single cylinder, 2-stroke Diesel Engine. (15)

Power supplied by electric motor for motoring at rated speed = 1.5 kW; Rated speed = 500 rpm; Net load on brake = 225 N; Diameter of brake wheel = 100 cm; Rate of cooling water through engine jacket = 13.65 kg/min; Rise in temperature of cooling water = 10°C; Fuel consumption = 2 kg/h; C.V. of fuel used = 43000 kJ/kg; A:F ratio = 32:1; C_{ps} (gases) = 1.006 kJ/kg°C; Exhaust gas temperature = 345°C; Ambient temperature = 25°C and Ambient pressure = 1bar; Take L = D = 30 mm Determine:

(i) Mechanical Efficiency (ii) Thermal efficiency

(iii) Brake specific fuel consumption (iv) Brake mean effective pressure

Draw the heat balance sheet on percentage basis.

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