BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING) THIRD YEAR FIRST SEMESTER-2019

INTERNAL COMBUSTION ENGINE Time -- Three hours Full Marks – 100

Answer any 5(Five) questions
All questions carry equal marks. Answers to the different parts of a particular question are to be given sequentially.

Q.1.a) In an engine working on diesel cycle inlet pressure and temperature are 1 bar and 25^0C respectively. Pressure at the end of adiabatic compression is 32 bar. The ratio of expansion i.e. after constant pressure heat addition is 5. Calculate the heat addition, heat rejection and the efficiency of the cycle. Assume γ=1.4, C_p=1.004 kJ/kg K and C_v=0.717kJ/kg K. 10

b) Derive the expression of efficiency of an air-standard Diesel cycle showing the P-v and T-s diagrams for the cycle. 10

Q.2.a) Derive the expression for air-fuel ratio of a simple float type carburetor. 12

b) Sketch the variation of fuel-air ratio required from a simple float type carburetor with respect to the percentage opening of the Throttle valve. Why high fuel-air ratio is required for High Power mode of working of the carburetor. 8

Q.3.a) Draw the valve timing diagram for a high speed vertical SI engine. Explain why the exhaust valve opens before the BDC. 10

b) A simple float type carburetor is required to supply 4.5 kg of air and 0.4 kg of fuel per minute. The fuel density is 780 kg/m^3. The air is initially at 1 bar and 295 K. Calculate the throat diameter of the choke for a flow velocity of 120 m/s of air. If the pressure drop across the fuel metering orifice is 90% of that at the throat of the carburetor, calculate orifice diameter assuming γ = 1.41. 10

Q.4.a) With neat sketches explain the different types of fuel injection system in a CI engine. 10

b) A six cylinder, four-stroke diesel engine develops 125 kW at 3000 rpm. Its brake specific fuel consumption is 200 gm/kW h. Calculate the quantity of fuel to be injected per cycle per cylinder. The density of the fuel may be taken as 850 kg/m^3. 10

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Q.5.a) What are the fundamental requirements of the fuel injection systems in a C.I. engine. 5

b) What are the functions of the Battery Ignition system in a SI engine. 5

c) Calculate the diameter of the fuel orifice of a four-stroke engine which develops 25 kW per cylinder at 2500 rpm. The brake specific fuel consumption is 0.3 kg/kW h fuel. The fuel is injected at a pressure of 150 bar over a crank travel of 25^0. The pressure in the combustion chamber is 40 bar. Coefficient of velocity is 0.875 and density of fuel is 850 Kg/m^3. 10

Q.6.a) What are the differences in combustion in a S.I. engine and in a C.I. engine. 4

b) Explain the phenomena of 'Abnormal Combustion' in a S.I. Engine and also in a C.I. Engine. 8

c) In a tabular form show that the factors which tend to reduce 'detonation' in a S.I. Engine, actually increase the chance of 'knocking' in a C.I. Engine. 8

Q.7.a) A 4-cyclinder, 4-stroke SI-engine has the following particulars from Morse Test: bore=8 cm; stroke=10 cm; oil consumption=0.15 kg/min; The power measurements are as follows: With all cylinders firing 16.5 kW: with 1^{st} cylinder cut off=11.5 kW; with 2^{nd} cylinder cut off=11.6 kW; with 3^{rd} cylinder cut off=11.7 kW; with 4^{th} cylinder cut off=11.5 kW. Determine a) the indicated power of the engine b) the mechanical efficiency c) indicated thermal efficiency if the calorific value of the fuel used is 43,000 kJ/kg. 15

b) Compare between SI engine and CI engine. 5

Q. 8. Write short notes on: 10 x 2 = 20

a) Crank case scavenged two-stroke engine.

b) Effect of different variables on flame speed in a S.I. Engine.

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