Ref. No. : Ex/ME/T/313/2019

B.E. MECHANICAL ENGINEERING THIRD YEAR FIRST SEMESTER EXAM-2019

Internal Combustion Engine

Time: Three hours **Full Marks: 100**

Answer all groups. Assume unfurnished data, if any, suitably.

GROUP-A
Answer any two questions

1(a)	Why the Volumetric Efficiency is higher in a four-stroke engine compared to that in a two-stroke engine?	(4)
(b)	What is 'scavenging'? Why is it required?	(2+2)
(c)	Why the upper limit of compression ratio of a SI engine is not made higher than 12?	(2)
(d)	Sketch the valve timing diagram of a SI engine, indicating all the details.	(10)
2(a)	Why a high fuel-air ratio is needed during the Idling range of working of a carburetor?	(8)
(b)	Describe briefly the idling arrangement of a carburetor.	(4)
(c)	What are the functions of the Battery Ignition System of a SI engine?	(4)
(d)	State the different types of nozzles used in the fuel injection system of a CI engine.	(4)
3(a)	With a neat sketch derive the expression of fuel-air ratio of a simple float type carburetor.	(10)
(b)	State the reasons for hydrocarbon emission in a SI engine.	(5)
(c)	What are the differences of 'Knocking' in a SI engine and in a CI engine?	(5)

GROUP-B
Answer any three questions

4	A four-cylinder, four-stroke SI engine running at 40rev/s has a carburetor venturi with a 3 cm throat. Assuming the bore and stroke of the engine to be both equal to 10 cm, volumetric efficiency of 75%, the density of air to be 1.15 Kg/m^3 and coefficient of air flow to be 0.75, calculate the suction at the throat. Neglect the compressibility of air.	(10)
5	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 875 kg/m^3.	(10)
6	In an engine working on Diesel cycle, inlet pressure and temperature are 1 bar and 17^0C respectively. Pressure at the end of adiabatic compression is 35 bar. The ratio	(10)

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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=0.717 kJ/kg K.

7 A four-stroke, four-cylinder diesel engine running at 2000 rpm develops 60 kW. Brake thermal efficiency is 30% and calorific value of fuel (CV) is 42 MJ/kg. Engine has a bore of 120 mm and stroke of 100 mm. Take ρ_a=1.15 kg/m^3, air-fuel ratio=15:1 and η_m=0.8. Calculate (i) fuel consumption (kg/s); (ii) air consumption (m^3/s); (iii) indicated thermal efficiency; (iv) volumetric efficiency; and (v) brake mean effective pressure. (10)

GROUP-C

8 A four cylinder gasoline engine working on four stroke develops a brake power of 20.9 kW. A Morse Test was conducted on this engine and the brake power (kW) obtained when each cylinder was made inoperative by short circuiting the spark plug are 14.9, 14.3, 14.8 and 14.5 respectively. The test was conducted at constant speed. Find the indicated power, mechanical efficiency and bmep when all the cylinders are firing. The bore of the engine is 75 mm and the stroke is 90 mm. The engine is running at 3000 rpm. (20)

GROUP-D

9. A spark plug is fired at 18° bTDC in an engine running at 1800 rpm. The combustion delay is 8° of crank rotation. The flame termination occurs at 12° aTDC. The bore diameter is 8.4 cm and the spark plug offset is 8 mm. The flame front can be approximated as a sphere moving out of the spark plug. Calculate the effective flame front speed during flame propagation. (10)