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B. E. (Sixth Semester) Examination, April-May 2021

(New Scheme)

(Mechanical Engg. Branch)

INTERNAL COMBUSTION ENGINES

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Attempt all the questions. Each question has four parts. Part (a) is compulsory. Answer any two from part (b), (c) & (d). Draw diagrams and graphs wherever necessary.

Unit-I

1. (a) State difference between external and internal combustion engine.   2

   (b) Compare S.I. and C.I. engine at the following points : 7

      (i)   Basic cycle

      (ii) Fuel

(iii) Introduction of fuel

(iv) Efficiency

(v) Ignition

(vi) Compression ratio

(vii) Speed

(c) Draw the valve timing diagram for a 4 stroke S. I. engine. Explain why valves are not opened and closed at dead centers.   7

(d) A petrol engine having on compression rati of 6 uses a fuel with calorific value 42 MJ/kg. the air fuel ratio is 15 : 1 pressure and temperature at the start of suction storke is 1 bar and 57°C. Determine the maximum pressure in the cylinder if the index of compression is 1·3 and specific heat at constant volume is given by

$$C_v = (0·678 + 0·00013T) \text{ kJ/kgK}$$

Compare the value with that obtained when $C_v = 0·717$ kJ/kgK.   7

Unit-II

2 (a) What is Octane number?   2

(b) Describe with suitable sketches the combustion phenomenon in SI engines with pressure-crank angle diagram. Explain the phenomenon of detonation or knocking in SI engines.   7

(c) Explain the stages of combustion in CI engine with the help of pressure-crank angle $(p - \theta)$ diagram.   7

(d) What is Volatility of liquid fuels? Discuss the effect of volatility on crank case dilution, carburetor icing, vapour lock.   7

Unit-III

3. (a) Define carburetion.   2

(b) With neat sketch explain the working principle of a simple carburator.   7

(c) A simple carburetor has venturi throat diameter of 22 mm and the coefficient of air flow is 0·82. The fuel orifice has a diameter 1·2 mm and the coefficient of fuel flow is 0·70. The petrol surface is 4 mm below the throat.

Find :

(i) Air fuel ratio when nozzle lip is neglected.

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(ii) Air fuel ratio far pressure drop of 0·075 bar. when nozzle lip is considered.

(iii) The minimum velocity of air [critical air velocity] required to start the fuel flow when the nozzle lip is provided.

Density of air 1·2 kg/m^3 and density of fuel 750 kg/m^3.   7

(d) A simple jet carburetor is required to supply 5 kg of air minute. The air is initially at 1·013 bar and 27 C. Calcualte the throat diameter of the choke for a flow velocity of 90 m/s. Velocity coefficient is 0·8 $\gamma = 1·4$.   7

Unit-IV

4. (a) What is firing order?   2

(b) Compare Battery ignition and magneto ignition.   7

(c) Explain Air cooled system and Water cooled system in IC Engines with diagrams.   7

(d) What is the purpose of lubrication in IC Engines. Explain splash lubrication system.   7

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5. (a) What is Brake Power?   2

(b) What are method to measure friction force power of IC Engine? Explain Willan's line method.   7

(c) A single cylinder 4 stroke cycle oil engine works on diesel cycle. The following readings are taken when the engine in running at full load :

Area of Indicator = 3 cm^2, Length of diameter = 4 cm, Spring constant = 10 bar/cm^2, Speed of the engine = 400 rpm, Load on the brake = 380 N spring reading = 50 N, Diameter of the brake drum 120 cm. Fuel consumption 2·8 kg/hr, Calorific value of the fuel 42000 kJ/kg, Diameter of the cylinder 16 cm, Stroke of the piston 20 cm.

Find Friction power, Mechanical efficiency, Brake thermal efficiency, SFC.   7

(d) The following observations were made during a test on an IC engine at ½ load.

Brake Power = 31·5 kW, Fuel used = 10·5 kg/ hr, Calorific value of the fuel = 43000 kJ/kg. Jacket circulating water = 540 kg/hr. Rise in temp. of cooling water = 56 C, Exhaust gas temp. leaving the engine

475 C, The exhaust gases are passed through the exhaust gas calorimeter for determining the heat carried away by the exhaust gases, Water circulated through exhaust gas calorimeter = 545 kg/hr, Rise in temp. of the water passing through the exhuast gas calorimeter = 36 C, Temp. of the exhaust gases leaving the exhaust gas Calorimeter = 82 C, Ambient Temp. = 17 C, Specific heat of exhaust gases = 1·0 kJ/kg.-K, Specific heat of water = 4·2 kJ/kg-K.

Prepare heat balance sheet on kJ/sec. and on percentage basis.   7