(3 Hours) [Total 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) Why the actual cycle efficiency is much lower than Air Standard Cycle efficiency.

b) Define Octane Number, Cetane Number and HUCR.

c) Describe how I.P. of a multi cylinder engine is measured? Mention the assumption made.

d) What are the A/F ratio requirements of S.I. Engine under various operating conditions.

e) State the advantages and disadvantages of battery ignition system. What is a function of condenser.

Q.No.2 a) What are the criteria for a good combustion chamber? Explain with a neat sketch pre combustion chamber used in C.I. Engine. (10)

b) The percentage analysis of gaseous fuel by volume is given as follows: (10)

CO_2 = 8 %,CO =22 %, O_2 = 4 %, H_2 = 30 %,and N_2 =36 %.Determine the minimum volume of air required for complete combustion of 1 m^3 of gas, Calculate the percentage composition by the volume of the dry product of combustion .If 1.4 m^3 of air is supplied per m^3 of gas, what will be the percentage by volume of CO_2 in the dry product of combustion.

Q.No.3 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. Take h_{fg}= 3060 kJ/kg (12)

b) Explain the phenomenon of diesel knock .Compare it with the phenomenon of detonation in SI engines. (08)

TURN OVER

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Q.No.4 **a)** The average indicated power in a C.I. engine is 15 kW/m³ 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°C. It is proposed to provide with a blower , driven mechanically from the engine . The blower has a pressure ratio 1.8 & 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 & temperature of delivery from the blower. Calculate the net increase in break power. Take Mechanical efficiency = 80%   **(12)**

b) Describe Turbocharging. State the different methods for Turbocharging?   **(08)**

Q.No.5 **a)** State pollutants emitted by petrol engine and effects of following factors on exhaust emission i) air fuel ratio ii) Surface to volume ratio.   **(08)**

b) The venturi of a simple carburetor has a throat diameter, 24mm & the coefficient of discharge 0.81. The fuel orifice is of 1.10 mm diameter & the coefficient of discharge 0.67.The petrol surface is 4 mm below the throat. **calculate,**   **(12)**

  i) A/F for pressure drop of 0.82 bar, when nozzle lip is neglected.

  ii) A/F when lip is taken account.

  iii) The minimum velocity to start the flow when lip is provided. Density of air   1.2 Kg/m³ & density of fuel 750 Kg/m³.

Q.No.6 **a)** A four stroke C.l. engine develops 25 kW per cylinder, at 2500 rpm. The specific fuel consumption is 0.30 kg/kW-k for a fuel with 30° API. The fuel is injected at a pressure of 150 bar over a crank travel of 25°. The pressure in the combustion chamber is 40 bar. Coefficient of velocity is 0.875 and specific gravity is given by S.G=(141.5/131.5+°API) Calculate the diameter of the fuel injector orifice.   **(10)**

b) State the necessity of engine cooling and also state disadvantages of overcooling   **(05)**

c) Briefly explain VCR engine   **(05)**

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