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SF-8355

B. E. - III (Sem. - VI) (Mechanical) Examination

May/June – 2011

Internal Combustion Engines

(New Syllabus)

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. - 3 (SEM. - 6) (MECHANICAL)

Name of the Subject :

☛ INTERNAL COMBUSTION ENGINES (NEW SYLLABUS)

☛ Subject Code No. : 8 3 5 5 ☛ Section No. (1, 2,.....) : Nil

Seat No. :

Student's Signature

(2) Attempt all questions.

(3) Use of Calculator is permitted.

(4) Figure to right indicate full marks.

(5) Assume suitable data if required.

Q – 1 **Attempt any Six.** **12**

1. Classify I C Engine
2. Classify the Cooling System and explain air cooling system.
3. Draw only Valve timing diagram for 4-stroke Petrol Engine.
4. Draw only Valve timing diagram for 2-stroke Diesel Engine.
5. Define Scavenging.
6. Desirable properties of Good I.C.Engine Fuel.
7. Differentiate between octane and Cetane Number.

Q – 2 **Attempt the Following Questions [Any Three]** **18**

1. Prove that the Air standard Efficiency of an otto cycle is $\eta = 1 - 1/(r^{\gamma-1})$. Where r = compression ratio.
2. Prove that the Air standard Efficiency of a Diesel Cycle is $\eta = 1 - 1/(r^{\gamma-1})[1/\gamma\ [\rho^{\gamma} - 1/\rho - 1]]$. Where r = compression ratio and ρ = cut off ratio.
3. Explain with neat sketch Combustion stages in S. I .Engine. Also define Auto ignition Temperature.
4. Explain with neat sketch Detonation in C. I. Engine. Also mention the Factor affecting the detonation.

Q - 3 **Answer the Followings.[Any Three]** **20**

1. A Petrol engine using a compression ratio 7 and A/F ratio of 15:1 has the pressure and temperature at the end of suction stroke 1 bar and 57°C respectively. The fuel used has a calorific value of 44000 kJ/kg. compression follows the law $PV^{1.33} = C$ and specific heat at constant volume is given by the relation $Cv = 0.718 + 2.1 \times 10^{-4} T$, where T is in degree Kelvin. Determine the maximum Pressure and Temperature in the cylinder. Also compare this value with that of constant specific heat, Cv = 0.718.

2. In SI engine works on Otto cycle with compression ratio 6. The initial Pressure and Temperature of the cycle are 1 bar and 37° C. The maximum pressure in the cycle is 30 bar. For unit mass flow calculate (1) Pressure volume and Temperature at various sailent Point in the cycle and (2) Ratio of heat supplied to heat rejected and efficiency. Assume $\gamma = 1.4$ and R = 8.314 kJ/kg mol K.

3. The volumetric analysis of a sample of Producer gas supplied to an engine is : H_2 = 20%, CH_4 = 3%, CO = 22%, CO_2 = 8%, N_2 = 47%. Find : i) The volume of air required for complete combustion of 1 m3 of gas. Ii) If 50% excess air is supplied, find the percentage contraction in volume after the products of combustion have been cooled.

4. In a laboratory test on a petrol engine the following results were obtained. Volumetric analysis of dry exhaust gas : CO = 12.8%, O_2 = 2.2%, N_2 = 85% Mass analysis of fuel : C = 84% and H_2 = 16% Assuming the air contains 23% of Oxygen by weight, Calculate the theoretical mass of air required for complete combustion and actual air supply per kg of air.

Q – 4 **Answer the following Questions.** **12**

1. Explain the parts of simple carburettor.
2. Give only names of Carburettor used in Automobiles.
3. Classify the Carburettor.
4. Define Ignition lag.
5. Define Physical Delay.
6. Define Auto ignition Temperature.
7. Define Adiabatic Flame Temperature.

Q – 5 **Answer the following Questions. [Any Three]** **18**

1. Define Supercharging and give its advantages. Also explain the methods of Supercharging and explain any of them.

2. Explain alternative fuels for I. C. Engine and explain any one of Fuel in details. Also Define Octane and Cetane No.

3. Explain the Methods of obtaining Friction Power and explain any one of them in details.

4. Prove that e Air fuel Ratio for Simple Carburettor if air is assumed to be incompressible is equal to

$$\text{A.F. Ratio} = \frac{C_{da}\, Aa\, \sqrt{2\rho_a.(\Delta p)}}{C_{df}\, A_f\, \sqrt{2\rho_f\, [(\Delta p) - h\, g\, \rho_f]}}$$

Q – 6 Answer the following Questions. [Any Three] **20**

1. A simple carburettor has the venture of throat diameter of 8 cm and the coefficient of discharge is 0.94. The fuel orifice has the diameter of 0.5 cm and its coefficient of discharge of 0.7. find the air-fuel ratio if pressure drop amounts to 0.14 bar when (a) nozzle lip is neglected (b) nozzle lip is taken in to account and it is equal to 0.5 cm. Assume density of fuel as 780 kg/m^3, approach factor as 1 and density of air as 1.293 kg/m^3.

2. The throat diameter of a carburettor is 8 cm and nozzle diameter is 5.5 cm. The Cda = 0.85 and Cdf = 0.70. the nozzle lip is 6 mm. The pressure difference, causing the flow is 0.1 bar. Find (1) A/F ratio supplied by the carburettor neglecting nozzle lip (2) A/F ratio supplied by the carburettor considering nozzle lip (3) minimum velocity of air required to start the fuel flow. Neglect air compressibility. Take ρa = 1.2 kg/m3and ρf = 750 kg/m3.

3. The following observations were made during the test on an oil engine. B.P. of the engine = 31.5 kW. Fuel used = 10.5 kg/hr, CV of Fuel = 43000 kJ/kg, Jacket circulating water = 540 kg/hr. Rise in temperature of cooling water = 56°C. Exhaust gases are passed through the exhaust gas calorimeter for finding the heat carried away by the exhaust gases. Water circulated through the exhaust gas calorimeter = 545 kg/hr. Rise in temperature of water passing through calorimeter = 36°C. Temperature of exhaust gas leaving exhaust gas calorimeter = 82°C. A/F ratio is 19:1. Ambient temperature = 17 °C. Cp for exhaust gases = 1 kJ/kg K. Cp of water = 4.186 kJ/kg K. Draw up the heat balanced sheet on minute and Percentage basis.

4. A six cylinder, SI engine operates on four stroke cycle. The base of each cylinder is 80 mm and stroke is 100 mm. The clearance volume per cylinder is 70 cc. At a speed of 4000 rpm the fuel consumption is 20 kg/hr and torque developed is 150 N.m. Calculate (1) Brake Power (2) BMEP (3) Brake thermal Efficiency if calorific value of the fuel is 43 000 kJ/kg and (4) Relative Efficiency on brake power basis. Assume engine works on otto cycle with r = 1.4 for air.