Course : Internal Combustion Engines (ME 312)

Program : T. Y. Mechanical   Date :

Year: 2012- 13   Term : VI

Duration: 3 hrs   Max. Marks: 50

Instructions:

1) All questions. are compulsory .

2) Assume suitable data, if necessary.

3) Figures to the right indicate full marks for the questions

4) Use of Non programmable calculator, Steam Table is permitted.

Q.1 Solve any **THREE**

a)

  i) State the inputs required to ECU in electronically controlled diesel fuel injection system. State the specific action taken based on these inputs. **3**

  ii) State the features of electronic common rail injection system? **2**

b)

  i) Which cooling system (Air cooled or Water cooled) do you prefer for i) High specific out put engine ii) Higher volumetric efficiency.? Justify your comment **2**

  ii) State the limitations of conventional ignition system at low speed and high speed. Justify your comment **2**

  iii) State the purpose and advantage of thermostat in forced circulation cooling system **1**

c)

  i) With the help of P-V and T-S diagram, Compare Otto, Diesel and Dual cycle for the same compression ratio and heat input **3**

  ii) State the importance of Dual cycle over Diesel cycle for higher compression ratio of Diesel engine **2**

d)

A 4 cylinder 4 stroke petrol engine has a bore of 60 mm and a stroke of 90 mm. It is tested at 2400 r.p.m. against brake which has a torque arm of 0.37 m. The net brake load is 160 N and the fuel consumption is 8.986 lit / hr. The specific gravity of petrol used is 0.74 and it has a lower calorific value of 44100 kJ/kg . When each cylinder is cut out in turn and speed return to 2800 r.p.m.,the brake readings were 110 N,107N,104N, and110 N respectively. Calculate for this speed

i) Mechanical efficiency ii) Brake specific fuel consumption iii) Brake thermal efficiency iv) Brake mean effective pressure v) Indicated mean effective pressure **5**

Q.2 Solve any **FOUR**

a)

What is meant by ignition lag in case of S.I. engine combustion phenomenon ? What is its importance ? Explain the effects of compression ratio , speed and air-fuel ratio on ignition lag. **5**

Q.2 b) i) Discuss the general principals of S.I. engine combustion chamber design (any six). Give one example of combustion chamber in which it is fulfilled. **3**

ii) Explain the effects of following factors on detonation in case of S.I. engine 1) Spark timing 2) Fuel-air ratio **2**

c)

i) " Factors which increase detonation in S.I. engines, tend to reduce knock in C.I. engines" Discuss the validity of above statement in the light of the differences in the nature of the two phenomenon **3**

ii) How C.I. engine combustion chamber are classified ? What type of swirl is used in these chambers ? How combustion induced swirl is created ? **2**

d)

i) Explain and show how following performance characteristics/ phenomenon are related to ASTM distillation curve 1) Evaporation loss 2) Carburetor icing 3) Acceleration and power **3**

ii) Discuss the importance of following properties of S.I. and C.I. engine fuels. 1) Fire point 2) Cloud point 3) Viscosity 4) Sulpher content **2**

e)

During a trial on single cylinder.4 stroke oil engine the following observations were recorded . Bore = 250 mm, Stroke = 600 mm, r.p.m. = 350, Area of indicator diagram = 4.5 cm^2, Length of diagram = 7.1 cm, Spring constant = 8.5 bar/cm, Load on hydraulic dynamometer = 980 N, Dynamometer constant = 11800, Fuel used = 11.1 kg/hr., Calorific value of fuel = 42000 kJ/kg, Cooling water circulated = 18.3 kg/min.,Rise in temperature of cooling water = 25^{0}C, fuel contains 85% carbon and 15% hydrogen, The volume analysis of exhaust gases is Carbon dioxide = 8%,Oxygen = 11% and Nitrogen = 81%,Temperature of exhaust gases = 400^{0}C, Specific heat of exhaust gases = 1kJ/kgK,Ambient temperature = 25^{0}C,Partial pressure of steam in exhaust gases = 0.035 bar,Specific heat of superheated steam = 2.1 kJ/kg K. Draw up heat balance sheet on minute basis and percentage basis. **5**

Q.3 Solve any **THREE**

a) i) State factors responsible for CO and NOx emission from S.I. engine exhaust. State the modification required in engine design and operating variables to reduce these emission **3**

ii) State purpose, working principle and drawbacks with EGR method **2**

b)

i) Explain with neat sketch evaporation loss control device for fuel supply system of S.I. engine **3**

ii) Show and discuss variations of HC,CO and NOx concentration in the exhaust of a conventional S.I. engine with equivalence ratio. **2**

c) i) Discuss the factors affecting the diesel smoke **3**

ii) What is thermal reactor? Draw a neat sketch of thermal reactor package. **2**

d) During a test on a Diesel engine the following observations were made: The power developed by the engine is used for driving a D.C. generator. The output of the generator was 210 A at 200 V, the efficiency of the generator being 82%. The quantity of fuel supplied to the engine was 11.2 kg/hr, Calorific value of fuel being 42600 kJ/kg . The air fuel ratio was 18:1. The exhaust gases were passed through a exhaust gas calorimeter for which observations were as follows. Water circulated through exhaust gas calorimeter = 580 lit. / hr, Temperature rise of water through calorimeter = 36^{0}C, Temperature of exhaust gases at exit of calorimeter = 98^{0}C, Ambient temperature = 20^{0}C. Find i) Heat equivalent to B.P. ii) Percentage heat carried away by exhaust gases **5**