BTS (C) 064 (D)

B.Tech. Degree III Semester Examination November 2002

ME 303 THERMAL ENGINEERING I

(1999 Admissions onwards)

Time: 3 Hours Maximum Marks: 100

I. (a) (i) Explain with diagram about Carnot theorem.
(ii) Differentiate about Perfect gas and Ideal gas. (10)

(b) A gasoline engine delivers 150KW, the fuel used is C_8H_{18} (l) and its enters the engine at 25°C. 15% theoretical air used and it enters at 45°C. The products of combustion leave the engine at 750K and that heat transfer from the engine is 205KW. Determine the fuel consumption per hour, if complete combustion is achieved. (10)

OR

II. (a) Explain about enthalpy formation and chemical reaction in the case of combustion. (10)

(b) (i) An insulated cylinder contains 25Kg of nitrogen its volume capacity is $5m^3$. Paddle work is done on the gas by stirring it till the pressure in the vessel gets increased from 5 bar to 10 bar. Determine (i) change in entropy (ii) change in internal energy, where Cp = 1.04 KJ/KgK. Cv = 0.7432 KJ/KgK. (6)

(ii) What are the main difference between SI engines and CI engines? (4)

III. (a) (i) Explain the working of 4 stroke and 2 stroke engine. }
(ii) Explain the specific heat heat variation on an IC engine. } (10)

(b) A 4 stroke cycle gas engine takes $0.016m^3$ of charge at a pressure of 1.5 bar and at temperature of 27°C. The pressure at the end of compression is 17 bar and at the end of constant volume ignition the pressure is 34 bar. Determine (i) Air standard efficiency (ii) Mean effective pressure of that cycle. (iii) Temperature at the end of compression and expansion. (10)

OR

(Turn over)

IV. (a) (i) Write the comparison of Knock in SI and CI engines. }
(ii) What are the different types of combustion chambers } for CI engines. } (10)

(b) A 6 cylinder 4 stroke petrol engine has a volume compression of 5 : 1. Clearance volume in each cylinder is 110cc. The engine consume 10Kg of fuel per hour whose calorific value is 42000KJ/Kg. The engine runs at 2400 rpm and the efficiency rate is 0.65. Determine mean effective pressure. (10)

V. (a) (i) What are the classification of compressor? }
(ii) What are the functions of inter cooler and after cooler } of the compressor? } (10)

(b) Derive the expression, the work done for operating a single acting single stage reciprocating compressor taking clearence into consideration. (10)

OR

VI. (a) Explain the working of turbo blower and turbo compressor. (10)

(b) A rotary wane compressor compresses 3.2m^3 of air/min from 1 bar to 1.8 bar and runs at 400rpm. Determine the power required to operate the compressor.
(i) When the ports are so located that there is no internal compression and (ii) when the ports are so located that there is 60% increase in pressure due to compression before the back flow occurs. (10)

VII. (a) Derive the equation of Heat transfer through a pipe. (10)

(b) The wall of furnace is made of 30cm thick firebrick, 10cm thick insulated brick and 125 cm thick ordinary brick. Thermal conductivities of brick being 4, 0.6 and $3KJ\ h^{-1}m^{-1}c^{-1}$ respectively. The inner and outer surface temperature furnace are respectively 900°C and 50°C. Neglecting thickness of mortar joints, determine (i) heat flow rate in KJ/hr m^2 of surface area. (ii) Temperature of the interfaces. (10)

OR

Contd.....3.

VIII. (a) What are the concept of grey body, white body and black body? (10)

(b) Two parallel plates 0.5 by 1.0m are spaced 0.5m apart. One plate is maintained at a temperature of 1000°C and the other at 500°C. The emissivities of the plates are 0.2 and 0.5 respectively. The plates are located in a very large room. The walls of which are maintained at 27°C. The plate exchange heat with each other with the room, but only the plate surface facing each other are to be considered in the analysis. Find the net heat transfer to each plate and to the room. (10)

IX. (a) Explain the combined effect of conductive and convective heat transfer and write the field of these combined effect. (10)

(b) Hot air at 50°C is flowing through a CI pipe of 20cm diameter, the pipe is covered with two layers of a insulate material having thickness 5cm, 6cm respectively. The thermal conductivity of these materials are 1 and $2KJm^{-1}h^{-1}c^{-1}$ respectively. Inside and outside convective heat transfer coefficient are $200KJ/m^2/hr/^{\circ}C$ and $60KJ/m^2/hr/^{\circ}C$. The atmospheric air temperature is 15°C. Determine overall heat transfer coefficient and heat load through 25m length of the pipe line. (10)

OR

X. (a) Explain the effectiveness and NTU of heat transfer in heat exchanger. (10)

(b) Hot oil of specific heat 2.09 KJ/Kg°K flows through a counter flow heat exchanger at the rate of 2000Kg/hr. It enters at 193°C and leaves at 65°C. Cold oil of specific heat 1.67 KJ/Kg°K exits at 149°C at the rate of 3600Kg/hr. What is the area required to handle the load if the overall heat transfer coefficient is 0.7KW/m^2 °K? What would be the % change in area if the flow is parallel? (10)

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