Total No of Questions: [8] ***SEAT NO. :***

[Total No. of Pages : 2]

S.E. 2012 (Mechanical / Automobile / Mechanical Sandwich)

Thermodynamics (Code: 202043)

(Semester - I)

Time: 2 Hours ***Max. Marks : 50***

Instructions to the candidates:

1) ***Solve any 4 questions (Q 1 or 2, Q 3 or 4, Q 5 or 6, Q 7 or 8).***
2) ***All the four questions should be solved in one answer book and attach extra supplements if required.***
3) ***Draw neat and labeled diagrams wherever necessary.***
4) ***Use of Steam Tables, Mollier Charts, scientific calculator is allowed.***
5) ***Assume suitable data where ever necessary***
6) ***Figures to the right side indicate full marks.***

Q1)	a)	State and explain Steady Flow Energy Equation and write the equation when applied to following devices (any Six), a. Throttling device. b. Boiler. c. Condenser. d. Nozzles e. Diffusers. f. Turbines g. Compressor	[6]
	b)	30 kg of copper block, Cp = 0.386 kJ/kg K at 95 ^{0}C is dropped in 30 litres of water at 24 ^{0}C. Assume perfect heat transfer and no heat lost to the surrounding. Find the final equilibrium temperature reached for water and copper block and entropy generation.	[6]
		OR	
Q2)	a)	Derive the general equation for change in entropy for any thermodynamic process. Further apply the same for Constant Volume process.	[6]
	b)	A cylinder containing air undergoes a thermodynamic cycle through following two processes. **Process 1:** During compression 82 kJ of work is done on the system (air) by piston and 45 kJ heat is rejected. **Process 2:** During expansion 100 kJ of work is done by the system (air). Using the first law of thermodynamics for cycle estimate a. The heat transfer during process 2 and b. Direction of this heat transfer.	[6]
Q3)	a)	Explain Air standard Otto Cycle on P-V and T-s Diagram. State the formula for Compression ratio in terms of stroke and clearance volume, Expansion ratio, Net work done, Air standard Efficiency.	[6]
	b)	Steam at 1.5 MPa and 0.7 dry is throttled to 0.1 MPa. Find the condition of the steam after throttling. Show the process on Mollier chart.	[6]
		OR	
Q4)	a)	State different methods to determine the dryness fraction of steam. Explain working of any one Calorimeter with neat sketch for estimating the dryness fraction.	[6]
	b)	A gas turbine power plant operates between pressure ratio of 9.77. Operating temperature limits are 295 K and 1085 K. Determine Turbine work, Compressor work and Thermal efficiency.	[6]

Q 5)	a)	Explain with neat sketch working and operation of Fusible plug-.	[6]
	b)	The following results were obtained from boiler trial: a. Feed water per hour = 700 kg at 27 ^{0}C. b. Steam pressure = 8 bar of dryness 0.97. c. Coal consumption = 100 kg/hr. d. C. V. Of Coal = 25000 kJ/kg. e. Unburnt coal collected = 0.6 kg/hr. f. Flue gas formed per kg of fuel = 17.3 kg at 327 ^{0}C (Cp of flue gas = 1.025 kJ/kg K). g. Room Temperature = 16 ^{0}C. Draw the heat balance sheet on kJ/min basis and boiler efficiency.	[7]
		OR	
Q6)	a)	Explain function and location of different boiler mountings and accessories (three each) with the help of line sketch or block diagram.	[6]
	b)	Determine the A: F ratio for an oil fired steam with following data, a. Chimney height = 40 m. b. Draught = 25 mm of water column. c. Mean Chimney gas temperature = 367 ^{0}C. d. Ambient outside temperature = 20 ^{0}C. Also calculate draught in terms of hot gas column and velocity of the flue gases.	[7]
Q7)	a)	Determine the method to determine air required per kg of fuel for complete combustion of fuel when fuel contains constituents C, H, S, O. Write the equations of combustion for all the constituents. Per kg O_2 required by each constituent, theoretical mass of air required.	[6]
	b)	The ultimate analysis of solid fuels is as follows: C=78 %, O_2= 3 %, H_2=3 %, S=1 %, Moisture=5 %, ash=10 %. Calculate the mass of actual air supplied also individual and total mass of products of combustion per kg of fuel if 30 % of excess is supplied of combustion.	[7]
		OR	
Q 8)	a)	Explain flue Gas analysis by using Orsat apparatus.	[6]
	b)	Following results are obtained when sample of gas is tested by a gas calorimeter Gas burnt in calorimeter = 0.08 m3. Pressure of gas supply = 5.2 cm of water. Barometer = 75.5 cm of Hg. , Temperature of gas = 13 0C. Weight of water heated by the gas = 28 kg. Temperature of water at inlet = 10 0C. Temperature of water at outlet = 23.5 0C. Steam condensed = 0.06 kg. Find HCV per m3 of gas at 15 0C and barometric pressure of 76 cm of Hg.	[7]