[Total No. of Printed Pages:2] **CODE NO:- U- 500**

FACULTY OF ENGINEERING

SE(M/P) Examination - *DEC – 2014*

Thermodynamics -I(Revised)

[Time: THREE *Hours*] **[Max. Marks: 80]**

"Please check whether you have got the right question paper."

N.B *1) Question no 1 and 6 are compulsory.*
2) Solve any two questions from remaining questions of each section.
3) Assume suitable data if required.

SECTION A

Q.1 Solve any five 10

a) What are assumptions in steady flow process?
b) What is PMM-II? Explain.
c) Give the Kelvin-Plank and claussius statements of second law of thermodynamics.
d) What is refrigerator? How does it differ from heat pump?
e) Represent carnot cycle on P-V and T-S diagrams.
f) State carnot theorem.
g) An engine works between the temperature limits of 1500^0C and 100^0C. What can be the maximum thermal efficiency of engine?
h) Explain available energy.
i) Explain clearly what is meant by entropy of gas.
j) A certain quantity of air is heated in a reversible isothermal process from 1 bar and 40^0C to 10 bar, calculate change in entropy per kg of air.

Q.2 a) Write the simplified steady flow energy equation for unit mass flow for: 06

i. Condenser.
ii. Centrifugal pump.

b) A centrifugal pump delivers 3000kg of water per minute from initial pressure of 1 bar to a final pressure of 4.2 bar. The suction is2.2m below and delivery is 8.5m above the central line of pump. If suction and delivery pipes are of 200mm and 100mm diameter respectively find the power required to run the pump. 09

Q.3 A reversible heat engine receives heat from two thermal reservoirs maintained at constant temperatures of 750^0K and 500^0K. The engine develops 100KW and rejects 3600KJ/min of heat to heat sink at 250^0K. Determine the heat supplied by each thermal reservoir and thermal efficiency of engine. 15

Q.4 a) Prove that for an irreversible process $\int ds > \int \frac{dQ}{T}$ 07

b) $0.05m^3$ of gas contained in a cylinder at 1 bar and 290^0C is compressed isothermally and reversibly until? The pressure is 5 bar. Calculate change in entropy and heat transfer. 08

Q.5 a) State and explain the principle of increase of entropy and show that entropy of universe is increasing. 07

b) State and prove Carnot istheorem. 08

SECTION B

Q.6 Solve any five 10

a) List the assumptions made in the analysis of air standard cycles.
b) Define swept volume and compression ratio.
c) Represented dual cycle in P-V and T-S diagrams.
d) In an Otto cycle, the temperature at the beginning and end of compression are 43^0c and 323^0C respectively. Determine the air standard efficiency.
e) Define pure substance .Is iced water pure substance?
f) Distinguish between saturated liquid and saturated vapour.
g) What is critical point? Explain.
h) Define dryness fraction of steam. Name the various methods of finding the dryness fraction of steam.
i) List out merits and demerits of liquid fuels over solid fuels.
j) What are advantages of gaseous fuels?

Q.7 The compression ratio of an ideal air standard diesel cycle is 15. The heat transfer is 1470 KJ/Kg of air. Find the pressure and temperature at the end of each process and determine the cycle efficiency. 15

Q.8 One Kg of steam at 5 bar and 0.9 dry is expanded polytropically to 1 bar according to law $PV^{1.1}=c$. determine 15

a) Final condition of steam.
b) Work done
c) Change in internal energy
d) Heat transferred.

Q.9 The percentage composition by mass of coal as found by analysis is given as: 15

C90, $H_2$3.3, O_2 3.0, N_2 0.8, S 0.9 and ash 2.0. Calculate the minimum mass of air required for the complete combustion of 1 kg of this fuel. If 50% excess air is supplied, find the total mass of dry flue gases per kg of fuel and percentage composition of dry flue gases by volume.

Q.10
a) Derive the expression for air standard efficiency of diesel cycle. 07
b) Draw a neat sketch of separating and throttling combined colorimeter and explain its working. 08