Total No. of Printed Pages:2

SUBJECT CODE NO:- K-242
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(MECH/PROD) Examination Oct/Nov 2016
Thermodynamics-I
(Revised)

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

Please check whether you have got the right question paper.

N.B
i) Q.No.1 and Q.No.6 are compulsory.
ii) Solve any two questions from remaining questions from each section.
iii) Use of stem table/mollier diagram allowed.
iv) Assume suitable data, if required.

Section A

Q.1 Solve any five. 10
a) Explain control volume.
b) Modify SFEE for adiabatic horizontal nozzle.
c) State Carnot theorem.
d) Explain available energy.
e) Differentiate between heat pump & refrigerator.
f) State the assumptions of SFEE.
g) Draw adiabatic process of P-V4 T-S diagram.
h) Define flow work.

Q.2 a) Explain PMM-I & PMM-II. 06
b) A centrifugal pump delivers 50kg of water per second. The inlet & outlet pressure are - $0.1MP_a$ & $0.42MP_a$ respectively. The suction is 2.2m below the centre of the pump & delivery is 8.5m above the centre of pump. The suction & delivery pipe diameter are 25cm & 15cm respectively. Determine the capacity of electric motor to run the pump. 09

Q.3 Two Carnot engines are working in series between source & sink. The first engine receives heat from reservoir at a temperature of 1000 K & rejects heat to another reservoir at temperature T_2. The second engine receives the heat energy rejected by first engine & rejects heat to sink at temp of 300 K. Find temperature 'T_2' if (i) power output of both is same (II) both engines have same efficiency. 15

Q.4 a) A mass m of a fluid at a temperature T_1 is mixed with an equal mass of the same fluid at a temperature T_2. Prove that the resultant change of entropy of the universe is $\frac{2mC_p\, l_n\,(T_1+T_2)}{2\sqrt{T_1.T_2}}$ 08
b) Explain the principle of increase in entropy of the universe. 07

Q.5 Write short notes on (any three) 15
a) Limitation of 1st law of thermodynamics.
b) Carnot cycle
c) Heat engine
d) Kelvin plank & Clausis statement

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Section B

Q.6 Solve any five 10

a) Draw Brayton cycle on P-V & T-S diagram.
b) How much heat is liberated by complete combustion of 5kg of fuel having calorific value 30,000kj/kg?
c) State assumptions of power cycles.
d) Explain i) Wet steam ii) Dry steam
e) Draw Ericson's cycle on P-V & T-S diagram.
f) What is specific heat?
g) Enlist the devices used to measure dryness fraction of seam.
h) What is compression ratio?

Q.7 A four stroke, 4 cylinder petrol engine of 250mm bore & 375mm stroke works on Otto cycle. The clearance volume is$0.01052\ m^3$. The initial pressure & temperatures are 1 bar & 27°C. If the maximum pressure is 25 bar. Find 15

i)Pressure & temperature at all points
ii) Thermal efficiency
iii) Mean effective pressure

Q.8 a) A pressure cooker contains 2kg of dry & saturated steam at 5bar. Find the quantity of heat that must be rejected so as to reduce quality upto 60% dry. Also find pressure & temp at new state. 08

b) With neat sketch, explain working of separating calorimeter. 07

Q.9 a) Explain flue gas analysis by using orsat apparatus. 05

b) The dry exhaust gas from an oil engine has the following composition by volume. 10
CO_2=8.85%, CO=1.2%, O_2=6.8% & N_2=83.15%
The fuel has % composition by mass as C=84%, H_2=16% determine.
a) Mass of carbon per kg of dry flue gases.
b) The Air-fuel ration by mass.

Q.10 Write short note on (any three) 15

a) Otto cycle
b) Concept of air standard cycle
c) Phase change diagram of pure substance
d) T-S diagram

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