College of Engineering, Pune

Second Year B.Tech (Mech) Academic Year: 2011-12

Sub: Thermal and Fluid Engineering

Date 19th Nov 2011 **Timing: 3 hrs**

Max. Marks: 50

Instructions: 1. All questions are compulsory, 2. Calculator is allowed
3.Assume suitable data if necessary

1 a) Explain various forms of work with diagrams(any five) (5)

b) Write down the steady flow energy equation and simplify it for a nozzle (3)

C) State Second law of thermodynamics as applicable to a refrigerator (2)

2 a) Derive an equation for work done per kg of air delivered by a reciprocating compressor assuming without clearance. Also assume the air compression process to be polytropic. (3)

b) Differentiate two stroke and four stroke IC engines based on the following points; Pollution, thermal efficiency, Valves, flywheel. (3)

c) Liquid-in-glass thermometer and the bimetallic thermometer (4)

3 a) Explain with the help of a block diagram the working of a closed cycle gas turbine power plant. Represent the same on p-v and T-s plots. (5)

b) Derive an expression for the thermal efficiency of the closed cycle gas turbine power plant. . (5)

OR

In an open cycle gas turbine, air enters the compressor at 1.02 bar and 300K. The pressure of air after compression is 400 kPa. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The Air: Fuel ratio is 80: 1. Find thermal efficiency of the cycle and I.P. of the turbine. Assume the flow rate of air 150/kg/min. You can assume the cp as 1000J/kgK and adiabatic index as 1.4 for air and gases. The calorific value of the fuel is 41720 kJ/kg ,

4 a) State the assumptions made while deriving the Bernoulli's equation. Write down the Euler's equation for a fluid flow and further reduce it to a Bernoulli's equation. State the notations used. (5)

b) Draw a neat proportionate sketch of a venturimeter. Derive the equation for fluid discharge through the circular pipe using venturimeter with usual notations. (5)

OR

(PTO)

A venturimeter is to be introduced in a 20 cm diameter pipe. The flow rate is 0.2 m^3/sec, The pressure of water in the upstream pipe is 6m of water column. Find the minimum diameter of pipe at the throat section of the venturimeter so that pressure head is zero.

Q.5 a) Define **dryness fraction of steam.** (3)

Write the equation for finding the followings:

(i) Enthalpy and entropy of a wet steam

(ii) Enthalpy and entropy of a superheated steam

b) State Fourier's law of heat conduction. (3)

A furnace wall 32 cm thick has inner surface temperature of 640°C and outer surface temperature of 240°C. Calculate percentage increase in wall thickness if heat transfer through the wall is to be reduced by 40%. Assume thermal conductivity of wall remains constant.

c) Write short note on any two (4)

i) variation of thermal conductivity of metals wr to temperature

ii) Centrifugal pump

iii) construction and working of Pelton wheel

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