Printed Pages: 6 **ME-403**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 140407	**Roll No.**

B.TECH.

Theory Examination (Semester-IV) 2015-16

APPLIED THERMODYNAMICS

Time : 3 Hours ***Max. Marks : 100***

Note: 1. Use of steam table is permisible.

2. Assume, any missing data suitably.

Section-A

Q1. Attempt all question. **(2×10=20)**

a) Define the discharge coefficient and critical velocity of nozzle.

b) Why compounding is necessary in steam turbines?

c) Define adiabatic flame temperature and isothermal compressibility.

d) Why modified Rankine cycle is not used in steam turbines?

e) What are main requirements of a good steam boilers?

f) Make comparison between artificial over natural draught?

g) Define the stage efficiency and speed ratio of the steam turbine.

h) What is bleeding?

i) State the difference between Boiler mountings and accessories.

j) Define the term dryness fraction.

Section-B

Q2. Attempt any five. **(5×10=50)**

a) Dry saturated steam at a pressure of 6 bar flow's through nozzles at the rate of 4.5 Kg / sec and discharges at a pressure of 1.6 bar. The loss due to friction occurs only in the diverging portion of the nozzle and its magnitude is 12 % of the total isentropic enthalpy drop. Assume

the isentropic index of expansion n = 1.135.Determine the cross sectional area at the throat and exit of the nozzles

b) What does the Clausius - Clapeyron equation signify? Derive the relation and discuss its application.

c) A boiler house has natural draught chimney of 20 mm height. Flue gases are at temperature of 380°C and ambient temperature is 27°C. Determine the draught in mm of water column for maximum discharge through chimney and also the air supplied per Kg of fuel.

d) What is purpose of governing of steam turbines? Explain the various methods used for governing of steam turbines, in brief.

e) What is basic difference between closed cycle and open cycle gas turbines? With the help of neat sketch, describe the working of a simple constant pressure open cycle gas turbine, in brief.

f) Draw the velocity diagram of a velocity compound impulse turbine. Show the calculations for finding out the tangential force, axial thrust blade efficiency and stage efficiency for both the impulse and reaction turbine.

g) A gas turbine works on Brayton cycle, gas is enters the turbine at a pressure of 600kN/m^2 and a temperature 1200K. The gas expands in the turbine isentropically (Υ = 1.4) to the atmospheric pressure 100kN/m^2. Calculate

(i) Air standard efficiency of the cycle.

(ii) The temperature of the exhaust gas, if

(iii) Temperature of air at the exit end of compressor. Assume that the compression process isentropic atmospheric temperature is 300K.

h) System at 15 bar and 300°C is throttled till its pressure becomes 10 bar and then expanded isentropically passing through a turbine until pressure falls to 1 bar. The exhaust steam from the turbine is used for process work

(i) Find the condition of the steam leaving the turbine and work done per kg. of steam passing through the turbine.

(ii) If the steam is directly passed through the turbine them find the work done per kg of steam.

Section-C

Attempt any two. **(2×15=30)**

Q3. Discuss the effect of inlet pressure and temperature of steam on Rankine cycle. Write the advantages of reheating of the steam and at what pressure (in terms of initial pressure) reheating is generally done to obtain best results. Why generally one open feed water is used in Rankine cycle and what is it called?

Q4. (i) Explain the terms 'State Point locus' and 'Reheat Factor'. For six stage 1 turbine find Out the reheat factor with the help of H - S plot and prove that

(Internal efficiency = Stage efficiency x Reheat factor olThe turbine.)

(ii) For a constant pressure closed cycle gas turbine, derive the mathematical Expression of optimum pressure ratio for maximum cycle thermal efficiency.

Q5. An inventor claims to have developed an efficient hot engine which would have a heat source at 1000°C and rejects heat

to a sink at 50°Cand gives an efficiency of 90%.Justify whether his claim is possible. Draw schematic and T-S diagrams of an open cycle gas turbine plant which has been provided with perfect intercooling, reheating and regeneration arrangements.