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Code No: 115ER **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, May - 2018

THERMAL ENGINEERING - II

(Common to AME, ME)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Define Stoichiometric quantity of air. [2]
b) Explain the concept of Mean temperature of heat addition. [3]
c) How boilers are classified on different accounts with examples for each category. [2]
d) What is the effect of friction on the flow through a steam nozzle? [3]
e) What is the High level Jet condenser? [2]
f) Write the expression for blade efficiency for a single stage reaction turbine for getting the maximum blade efficiency. [3]
g) What are the different methods to improve the efficiency of gas turbines? [2]
h) What are the basic requirements of a combustion chamber used in Gas Turbine Plant? [3]
i) List out the factors which are to be considered for the comparison of different types of rockets? [2]
j) Define thrust Augmentation. [3]

PART - B

(50 Marks)

2.a) Discuss the advantages of reheating the steam in high pressure steam plants.
b) In a single regenerative heater system, the steam is supplied to the turbine at a rate of 68000 kg/hr and 15420 kg of steam is blowed per hour at 10 bar and the remaining is passed to the condenser. Determine the enthalpy of steam at entry of regenerative heater and entry condition at the entry of the condenser. [5+5]

OR

3.a) Write short note on adiabatic flame temperature.
b) In a Rankine cycle, the steam at inlet to turbine is saturated at pressure of 30 bar and exhaust pressure is 0.25 bar. Determine (i) The pump work (ii) Turbine work (iii) Rankine efficiency (iv) Condenser heat flow (v) dryness at the end of expansion. Assume flow rate of 10 kg/s. [5+5]

4.a) Derive an expression for maximum discharge rate of gases through the chimney for a given height of the chimney.

b) Calculate the height of a chimney required to produce a draught equivalent to 1.7cm of water if the flue gas temperature is 270^0C and ambient temperature is 22^0C and minimum amount of air per kg of fuel is 17kg. [5+5]

OR

5. Dry saturated steam at a pressure of 8bar enters a convergent divergent nozzle and leaves it at a pressure of 1.5 bar. If the flow is isentropic and the corresponding expansion index is 1.135. Find the ratio of cross sectional area at exit and throat for maximum discharge. [10]

6. The air entering a steam condenser with steam is estimated at 6kg per hour. The temperature at inlet to air cooler section is 30°C and at the outlet 26°C. The vacuum in the shell is essentially constant throughout and is 721mm of Hg, while the barometer reads 758 mm of Hg. Calculate the volume of air entering the cooling section per hour, the mass of moisture contained in the air and the mass of steam condensed per hour in the cooling section. [10]

OR

7.a) A surface condenser is designed to handle 10000 kg of steam per hour. The steam enters at 0.08 bar abs. and 0.9 dryness and the condensate leaves at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow per hour, If the cooling water temperature rise is limited to 10^0C.

b) Define the term Degree of Reaction used in Reaction Turbines. Prove that moving and fixed blades should have the same shape for 50% reaction. [5+5]

8.a) Derive the thermal efficiency of an ideal gas turbine power plant.

b) A gas turbine plant receives air at 1 bar and 290K and compresses it to 5bar. If the temperature of air after compression is 1000K. Find the thermal efficiency of the turbine. Take γ=1.4 for air. [5+5]

OR

9. A gas turbine unit receives air at 100kPa and 300K and compresses it adiabatically to 620kPa with efficiency of the compressor 88%. The fuel has a heating value of 44,180kJ/kg and the fuel/air ratio is 0.017kg fuel/kg air. The turbine internal efficiency is 90%. Calculate the compressor work, turbine work and thermal efficiency. [10]

10.a) Derive the expressions for thermal efficiency of thrust and thrust power.

b) Explain the principle and working of liquid propellent rocket engine with neat sketch. [5+5]

OR

11. a) State the fundamental differences between the jet propulsion and rocket propulsion.

b) List out the requirements of an ideal rocket propellant and give the applications of rockets. [5+5]

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