Code No: NR310303 **NR**

III B.Tech I Semester Supplementary Examinations, November 2005
THERMAL ENGINEERING - II
(Mechanical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. In a boiler, the following observations were made:
   Pressure of steam = 10 bar
   Steam condensed = 540 kg/hr
   Fuel used = 65 kg/hr
   Moisture in fuel = 2% by Mass
   Mase of dry flue gases = 9kg/kg of fuel
   LCV of fuel = 32,000 KJ/kg
   Temperature of the flue gases = 325 ^{0}C
   Temperature of boiler house = 28 ^{0}C
   Feed water temperature = 50 ^{0}C
   Mean specific heat of flue gases = 1 KJ/kg K
   Dryness factor of steam = 0.95
   Prepare a heat balance sheet for the boiler. [16]

2. (a) Explain various types of nozzles.
   (b) Dry saturated steam enters a steam nozzle at pressure of 12 Bar and is discharged at a pressure of 1.5 Bar and dryness fraction 0.95. What will be the final velocity of steam? Neglect initial velocity. If 12% of heat drop is lost in friction. find the percentage reduction in the final velocity. [6+10]

3. (a) What are the requirements of a good surface condenser?
   (b) What are the merits and demerits of a surface condenser over jet condenser? [6+10]

4. (a) Define the following as related to steam turbines.
      i. Speed ratio
      ii. blade velocity coefficient
      iii. Diagram efficiency
      iv. stage efficiency
   (b) Derive the expression for maximum blade efficiency in a single stage impulse turbine. [8+8]

5. (a) what is the Parson's Reaction turbine?
   (b) A 50% reaction turbine (with symmetrical velocity triangles) running at 400 rpm has the exit angle of the blades as 20^o and the velocity of steam relative to the blades at the exit is 1.35 times the mean blade speed. The steam flow rate is 8.33 kg/s and at a particular stage the specific volume is 1.381 m3/kg. Calculate for this stage:

i. The suitable blade height, assuming the rotor mean diameter as 12 times the blade height, and

ii. The diagram work. [6+10]

6. (a) The following data is refers to a closed cycle gas turbine plant
Atmospheric Air temperature 27^0C
Maximum temperature of the cycle 823^0C
Pressure at compressor inlet 1 bar
Pressure ratio 4
Compressor efficiency 80%
Turbine efficiency 85%
Heating value of fuel 41,800 kJ/Kg
Turbine efficiency 80%
Heater loss 10% of Heating value

Find.

i. Work ratio

ii. Turbine work

iii. Compressor work

iv. Heat supplied Assume the working substance is Air ,regard as simple gas with Cp = 1 KJ/Kg ^{0}K and $^\gamma = 1.4$

(b) What is "regeneration " in gas turbines. [12+4]

7. (a) Explain the working difference between propeller jet, turbo-jet and turbo prop.

(b) A turbo-jet unit flying at a speed of 729 Km/hr at an altitude where air temperature and pressure are 22 K and 0.877 bar. The maximum temperature of the plant is limited to 860^0o C. Find the specific thrust produced if the exhaust gases from the turbine are expanded to atmospheric pressure in a convergent nozzle. Using the following data:
The pressure ratio of the compressor is 4:1
Efficiency of ram compression is 0.90
η_c = 0.80, η_t =0.85, η_n =0.93
Transmission efficiency is 0.98
Neglecting the pressure losses and mass of the fuel find the specific thrust produced by the unit. [6+10]

8. (a) Describe nuclear rocket engine with a neat sketch.

(b) What are the other kinds of rocket propulsion? Mention some of them. [8+8]

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