Code: 13A03502 **R13**

B.Tech III Year I Semester (R13) Supplementary Examinations June 2017

THERMAL ENGINEERING – II

(Mechanical Engineering)

(Use of Steam tables and Mollier charts is permitted in the examination hall)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define the term dryness fraction of steam.

(b) What is latent heat of steam?

(c) How are the steam boilers classified?

(d) Explain about fusible plug in steam boilers.

(e) Explain the term “Over expanding” in a nozzle.

(f) What is compounding in steam turbines?

(g) What is regenerative steam condenser?

(h) Describe gas turbine verses reciprocating I.C. engine.

(i) What is meant by thrust?

(j) Explain briefly about pulse jet.

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 Steam is supplied from a boiler to a steam engine at a pressure of 1.1 MN/m^2 and at a temperature of 250°C. It is expanded isentropically to a release pressure of 0.28 MN/m^2. Its pressure then falls at constant volume to 35 kN/m^2 at which pressure it is exhausted to a condenser. Determine: (i) Rankine efficiency. (ii) Specific steam consumption in kg/k Wh. (iii) The Carnot efficiency for same temperature limits.

OR

3 A steam power station uses the following cycle: Steam at boiler outlet 150 bar 55°C, reheat at 40 bar to 550°C, condenser at 0.1 bar. Using the Mollier chart assuming ideal process find: (i) Quality at turbine exhaust. (ii) Cycle efficiency. (iii) Steam rate.

UNIT - II

4 Describe the working of a Lancashire boiler with the aid of a neat sketch. Show the path of flue gases to stack and the relative position of economizer and super heater. How does this boiler differ from a Cornish boiler?

OR

5 Describe the working of a locomotive boiler with the aid of a neat sketch. Show the position of various mountings. Explain the method of obtaining draught in the absence of a chimney of appreciable height in these boilers. How is the draught maintained when the locomotive engine is stationary?

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UNIT - III

6 Air expands under reversible adiabatic conditions in a nozzle form 4 bar and 725℃ to a final pressure of 1 bar. Determine: (i) Type of nozzle required. (ii) Critical velocity. (iii) Air flow rate if the minimum nozzle diameter is 1.25 cm.

OR

7 A steam engine using 4500 kg of steam per hour exhaust into a jet condenser where the vacuum is 68.5 cm of Hg(barometer reading being 760 mm of Hg). Cooling water with initial temperature of 25℃ is injected into the condenser at an hourly rate of 350 m^3. Air enters the condenser along with steam at the rate of 1 kg for every 3,000 kg of steam. The injection water has also air dissolved in it which is 6% of the volume of water at atmospheric pressure. The temperature of condensate is 35℃. Assuming the volumetric efficiency of air extraction pump to be 85%, determine its capacity to remove water and air from the condenser. Take atmospheric conditions of 0.98 bar and 27℃.

UNIT - IV

8 A single stage impulse turbine rotor has a diameter of 1.2 m running at 3000 rpm. The nozzle angle is 18°, blade speed ratio is 0.42. The ratio of relative velocity at out let to inlet is 0.9. The out let angle of blade is 3° smaller than the inlet. The steam flow ratio is 5 kg/sec. Draw the velocity diagram and find: (i) Velocity of whirl. (ii) Blade angle. (iii) Axial thrust (d) Power developed.

OR

9 A reaction turbine having identical blading delivers dry saturated steam at 3 bar. The velocity of steam is 100 m/s. The mean blade height is 4 cm and the exit angle of the moving blade 20°. At the mean radius the axial flow velocity equals ¾ blade speed. For steam flow rate of 10,000 kg/hour. Calculate: (i) The rotor speed rev/min. (ii) The power output of stag. (iii) The diagram efficiency. (iv) The percentage increase in relative velocity in the moving blades due to expansion in these blades. (v) The enthalpy drop of the steam in stage.

UNIT - V

10 The following description pertains to a certain gas turbine unit: Inlet condition to compressor = 1 kgf/cm^2 and 300 K, efficiency of compressor = 80%, pressure ratio = 4, turbine inlet temperature = 850 K, turbine expansion efficiency = 85%. Heat value of fuel used = 10,500 k.cal/kg, for an air flow ratio of 80 kgs/min, determine: (i) Air fuel ratio of the turbine plant. (ii) Net horse power of the installation. (iii) Overall efficiency of the plant (iv) Back work ratio. It may be assumed that for air C_p = 0.238 and C_v = 0.17 and for gases C_p = 0.25 and C_v = 0.185.

OR

11 (a) Give the differences between jet thrust and propeller thrust.

(b) What are the propulsive devices in aircrafts and missiles?

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