Code No: 136EB **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, March - 2024
THERMAL ENGINEERING – II
(Mechanical Engineering)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Explain the concept of mean temperature of heat addition. [2]
b) How boilers are classified on different accounts? Write examples for each category? [3]
c) What is the effect of friction on the flow through a steam nozzle? [2]
d) Explain undercooling in the context of flow through nozzles. [3]
e) What is the difference between impulse and reaction blading? [2]
f) Write the expression for blade efficiency for a single stage reaction turbine for getting the maximum blade efficiency. [3]
g) What is the High level Jet condenser? [2]
h) What are the different methods to improve the efficiency of gas turbines? [3]
i) List out the factors which are to be considered for the comparison of different types of rockets. [2]
j) What is thrust Augmentation? [3]

PART – B

(50 Marks)

2.a) Describe the construction and working principle of Cochran boiler with a neat sketch.
b) One kg of steam having a pressure of 9.2 bar and dryness fraction 0.85 is expanded to a pressure at 0.45 bar. If the expansion is hyperbolic, determine the quantity of heat which passes through the cylinder walls in to the steam. [5+5]

OR

3.a) Compare the merits and demerits of water tube and fire tube boilers.
b) Sketch a boiler used in thermal power plant and locate all the parts in it. [5+5]

4. A convergent-divergent nozzle receives wet steam of 2% wet at a pressure of 26 bar with an approach velocity of 100 m/s and expands it to a back pressure of 0.3 bar. Nozzle efficiency is 85% and all the frictional losses take place in the divergent portion only. Determine: (a) The critical throat pressure (b) The discharge of steam (c) The area of cross section of the nozzle at its exit. [10]

OR

5.a) Starting from fundamentals derive an expression for exit velocity of steam in a steam nozzle.
b) The dry and saturated steam at a pressure of 5 bar is expanded isentropic in a nozzle to a pressure of 0.2 bar. Find the velocity of steam leaving the nozzle. [5+5]

6. In an impulse turbine the nozzles are inclined at 18^0 to the wheel tangent. Steam leaves the nozzles at 800 m/s with a flow rate of 10 kg/s. The blade speed is 280 m/s. The relative velocity of steam as it flows over the blades is reduced by 10% due to friction. Determine: (a) The suitable inlet and outlet angles for the blades to ensure the axial thrust to be zero (b) Work done (c) Power developed (d) Diagram efficiency. [10]

OR

7. A simple impulse turbine has one ring of moving blades running at 120 m/s, absolute velocity of steam at exit is 75 m/s at an angle 800 with the tangent of wheel, friction coefficient is 0.85, rate of steam flowing 2.5 Kg/s. Assuming the moving blades to be a symmetrical, find the a) Blade angles, b) Nozzle angle, c) absolute velocity of steam at entrance, and d) power developed. [10]

8.a) Explain the working of an evaporative condenser with a sketch.
b) Explain with a neat sketch the working principle of constant volume gas turbine. [5+5]

OR

9.a) Sketch and describe the operation of central flow surface condenser.
b) Explain the working principle of both open and closed gas turbine with neat sketch. [5+5]

10.a) Write the working principle of RAM jet engine with a neat diagram.
b) Explain the principle and working of liquid propellant rocket engine with neat sketch. [5+5]

OR

11.a) Enumerate the construction and working principle of rockets and list their applications.
b) A jet plane having 2 jets works on turbo-jet system. It flies at a speed of 800km/hr at an altitude where density of air is 0.15 kg/m^3. The propulsive efficiency is 55%. The drag on the plane is 6500N. Calculate i) Absolute velocity of jet ii) quantity of compressed air and iii) diameter of jet. [5+5]

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