

R16

Code No: 136EB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, July - 2023

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) Draw the different processes of Rankine cycle on a T-S diagram. Mention the different operations of Rankine cycle. [2]
- b) What are the functions of a boiler chimney? [3]
- c) Explain what is meant by critical pressure ratio of a nozzle. [2]
- d) Define nozzle velocity coefficient and how it is related to nozzle efficiency. [3]
- e) What do you mean by Parson's reaction turbine? Draw velocity triangles for such turbine. [2]
- f) What is the condition for maximum blade efficiency of a 50% reaction turbine and its value? [3]
- g) Discuss the factors which affect the vacuum efficiency of a condenser. [2]
- h) What are the sources of air leakages into a condenser? Briefly state the effects of air leakage on the performance of a condenser? [3]
- i) What is meant by thrust augmentation? Explain. When it is necessary? [2]
- j) Explain thrust power and propulsion efficiency of a rocket engine. [3]

PART – B

(50 Marks)

2. Classify the boilers based on the temperature and pressure limits. Draw the line diagram of vorex boiler and mention its pressure limits. [10]

OR

3. Draw the Schematic layout of Rankine cycle and derive the thermal efficiency of it. [10]

4. In a convergent-divergent nozzle, the steam enters at 15 bar and 300⁰ C and leaves at a pressure of 2 bar. The inlet velocity to the nozzle is 150 m/s. Find the required throat and exit areas for a mass flow rate of 1 kg/s. Assume nozzle efficiency to be 90 percent and $c_{ps} = 2.4 \text{ kJ/kg.K}$. [10]

OR

5. A convergent-divergent nozzle is required to discharge 5 kg of steam per second. The nozzle is supplied with steam at 10bar and 200⁰C and the discharge takes place against a back pressure of 0.34 bar. Estimate the throat and exit areas. Assume isentropic flow and take the index $n=1.3$. If the nozzle efficiency is assumed to be 85%, determine the exit area? [10]

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- 6.a) What is the need of compounding impulse turbines? Explain any one method in detail.
b) What is the fundamental difference between the operation of impulse and reaction turbines? Explain the same with neat sketches. [5+5]

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7. **OR**
A reaction turbine runs at 3000 rpm and the steam consumption is 20000 kg/hr. The pressure of steam at a certain pair is 2 bar, its dryness fraction is 0.93 and the power developed by the pair is 50 kW. The discharge blade angle is 20° for both the fixed and moving blades and the axial velocity of flow is 0.72 times the blade velocity. Find the drum diameter and the blade height. Take the tip leakage steam as 8%. Neglect blade thickness? [10]

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8. Explain the working of an evaporative condenser with the help of neat sketch. [10]

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9. Describe with the help of neat sketch the working of a simple constant pressure open cycle gas turbine and derive its thermal efficiency. [10]

10. Explain the Ram-Jet engine with the help of neat sketch. [10]

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- 11.a) Describe the working of a solid propellant rocket with a sketch.
b) Write about monopropellant and bipropellant rockets and mention few examples of propellants. [5+5]

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