R20 Regulation *Subject code:3P5CC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech V Semester Supplementary Examinations, May 2025

THERMAL ENGINEERING-II

(ME)

Maximum Marks: 70 Date: 23.06.2025 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X2M=20 Marks)		Marks	CO	BTL
1	Mention various processes in a Reheat Cycle?	2M	1	L1
2	Mention various factors considered for the selection of Boilers?	2M	1	L1
3	Write various types of Steam nozzles?	2M	2	L1
4	What is the stagnation pressure of steam nozzle?	2M	2	L1
5	Draw the combined velocity triangle diagram of an Impulse turbine?	2M	3	L1
6	Draw the pressure velocity profile of Reaction turbine?	2M	3	L1
7	Define isentropic efficiency of a compressor and turbine?	2M	4	L1
8	Draw the T-S diagram of Reheating process in gas turbine?	2M	4	L1
9	What is the working principle of Jet propulsion?	2M	5	L1
10	Define the torque .	2M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	a) A simple Rankin cycle works between pressures 28 bar and 0.006 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption? b) Explain with a neat sketch working of Benson Boiler.	5M 5M	1	L2
	OR			
12	a) Explain the working principle of Babcock and Wilcox boiler. b) Explain with neat sketch any three of the following mounting: i) Water level indicator ii) Pressure gauge iii) Feed check value iv) Blow of cock v) High steam and low water safety value vi) Junction or stop value	5M 5M	1	L2
13	a) Derive Critical pressure ratio of nozzle and determine the maximum mass rate of flow through steam nozzle? b) Superheat steam enters a steam nozzle at a pressure of 20 bar and discharged at a pressure of 2 bar. If the dryness fraction of discharge steam is 0.86, what will be the final velocity of steam? Neglect initial velocity of steam. If 15 % of heat drop is lost reaction, Examine the percentage reduction in the final velocity.	5M 5M	2	L2
	OR			

NOTE: STEAM TABLES ALLOWED.

14	a) Dry saturated steam enters a steam nozzle at a pressure of 15 bar and discharged at a pressure of 2 bar. If the dryness fraction of discharge steam is 0.96, what will be the final velocity of steam? Neglect initial velocity of steam. If 10% of heat drop is lost infraction, examine the percentage reduction in the final velocity. b) Derive an expression for maximum discharge through convergent divergent nozzle for steam	5M 5M	2	L2
15	a) The velocity of steam exiting the nozzle of the impulse stage of turbine is 400 m/s. The blades operate close to the maximum bladingefficiency. The nozzle angle is 20°. Considering equiangular blades and neglecting blade friction, calculate for a steam flow of 0.6 kg/s, the diagram power and the diagram efficiency. b)A single stage impulse turbine rotor has a diameter of 1.2 m running at 3000 rpm. The nozzle angle is 18^0. Blade speed ratio is 0.42. The ratio of the relative velocity at outlet to relative velocity at inlet in0.9. The outlet angle of the blade is 3°smaller than the inlet angle. The steam flow rate is 5 kg/s. Draw the velocity diagram and find the following : (i) Velocity of whirl (ii) Axial thrust on the bearing (iii) Blade angles	5M 5M	3	L2
	OR			
16	a) Calculate the vacuum efficiency from the following data: Vacuum at steam inlet to condenser=70 mm of Hg Barometer reading=760 mm of Hg Hot well temperature t=30^{0C} b) What are the comparisons between jet condenser and surface condenser?	5M 5M	3	L2
17	a) A gas turbine plant consists of two stage compressors with perfect intercooler and a single stage turbine. If the plant works between the temperature limits of 300 K and 1000K and 2 bar and 14 bar. Find the net power of the plant per kg of air. Take C_P= 1kJ/kg K b) What are the comparisons between jet condenser and surface condenser	5M 5M	4	L2
	OR			
18	Explain working principle the down flow surface condenser with neat sketch.	10M	4	L2
19	a) In a gas turbine plant, the air is compressed in a single stage compressor from 1 bar to 9 bar and from an initial temperature of 300 K. The same air is then heated to a temperature of 800 K and then expanded in the turbine. The air is then reheated to a temperature of 800 K and expanded in the second turbine. Find the maximum power that can be obtained from the installation, if the mass of air circulated per second is 2 kg. Take C_P=1 kJ/ kg K b) Describe the working of ramjet engine with a neat sketch.	5M 5M	5	L2
	OR			
20	a)The effective jet exit velocity of a rocket is 2500 m/s, the forward flight velocity is 1250 m/s, and the propellant consumption if 65 kg/s. Calculate: i) The thrust; ii) The thrust power and iii) The propulsive effect.	10M	5	L2