Code No: R1922033 **R19** SET - 1

II B. Tech II Semester Regular Examinations, August/September - 2021
APPLIED THERMODYNAMICS
(Mechanical Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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1	a)	Explain with the help of diagram a Rankine cycle. Derive an expression for its thermal efficiency.	[8M]
	b)	A steam power plant works between 35bar and 0.03 bar. If the steam supplied is dry saturated and the cycle of operation is Rankine, find (i) Cycle efficiency (ii) Specific steam consumption	[7M]
		Or	
2		In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 25 bar and the exhaust pressure is 0.3 bar. Determine (i)The pump work (ii) Turbine work (iii) Rankine efficiency (iv) Condenser heat flow (v) dryness fraction of expansion Assume flow rate of 10 kg/s	[15M]
3	a)	What is meant by draught. List out the differences between the natural draught and artificial draught.	[8M]
	b)	Explain the working principle of Locomotive boiler with the neat sketch	[7M]
		Or	
4	a)	List out the differences between the water tube boilers and fire tube boilers	[8M]
	b)	Explain the working principle of Babcock and Wilcox boiler with the neat sketch.	[7M]
5		In a De Laval turbine steam issues from the nozzle with a velocity of 1000m/s. The nozzle angle is 15^0, the mean blade velocity is 300 m/s, and the inlet and outlet angles of blades are equal. The mass of the steam flowing through the turbine per hour is 500 kg. Calculate (i) Blade angles (ii) Relative velocity of the steam entering the blades (iii)Power developed (iv) Blade efficiency Take Blade velocity coefficient as 0.8	[15M]
		Or	
6		Dry saturated steam at a pressure of 10 bar enters a convergent-divergent nozzle and leaves at a pressure of 1 bar. If the flow is adiabatic and frictionless, determine: (i)The exit velocity of steam (ii) Ratio of cross section at exit and that at throat Assume the index of adiabatic expansion to be 1.135	[15M]
7		At a stage in a reaction turbine the pressure of steam is 0.34 bar and the dryness 0.95.For a flow rate of 36000 kg/h, the stage develops 950 kW. The turbine runs at 3600 r.p.m and the velocity of flow is 0.72 times the blade velocity. The outlet angle of both stator and rotor blades is 20^0.Determine at this stage. Mean rotor diameter (ii) Height of the blades	[15M]
		Or	
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8 a) Explain briefly Parallel flow jet condenser with the neat sketch [8M]

b) The air leakage into the condenser operating in conjunction with a steam turbine is estimated at 0.681 kg per minute. The vacuum near the outlet to the air pump is 710 mm when the barometer reads760 mm and the temperature at this point is 18^0C. [7M]
Find : (i) The minimum capacity of air-pump in m^3/min
(ii) The mass of vapour extracted with the air/min

9 a) Explain the working of the roots blower with the neat sketch [8M]

b) Explain the working of centrifugal compressor with the help of neat sketch [7M]

Or

10 An axial flow compressor with an overall isentropic efficiency of 82% draws air at 15^0C and compresses it in the pressure ratio of 5:1.The mean blade speed and flow velocity are constant throughout the compressor. Assuming 50% reaction blading and taking blade velocity as 175 m/s and work input factor as 0.8,calculate Flow velocity (ii) Number of stages [15M]
Take $\alpha_1 = 12^0$ and $\beta_1 = 42^0$