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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Third Semester

Mechanical Engineering

ME 2202/ME 33/10122 ME 303/ME 1201/080190005 – ENGINEERING THERMODYNAMICS

(Regulation 2008/2010)

(Common to PTME 2202 Engineering Thermodynamics for B.E. (Part – Time) Third Semester Mechanical Engineering – Regulation 2009)

Time: Three hours

Maximum: 100 marks

(Use of approved thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables permitted in the Examination)

Answer ALL questions.

PART A — $(10 \times 2 = 20 \text{ marks})$

- 1. What is microscopic approach in thermodynamics?
- 2. Define extensive property.
- 3. State Clausius statement of II law of thermodynamics.
- 4. Draw a schematic of an heat pump.
- 5. Define a pure substance.
- 6. How is Triple point represented in the P-v diagram?
- 7. Define Avagadro's law.
- 8. What is a real gas? Give example.
- 9. Why do wet clothes dry in the sun faster?
- 10. Define Degree of saturation.

PART B — $(5 \times 16 = 80 \text{ marks})$

11. (a) Derive the steady flow energy equation and reduce it for a turbine, pump nozzle and a heat exchanger.

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(b) Briefly explain the following:

(i) Point and path function.
(ii) Property, state, process and path
(iii) Quasi-static process.
(4)
(4)

12.	(a)	receiv heat	ves heat at 870°K and rejects to a reservoir at T. B re rejected by the first engine and in turn rejects to a s	eceives	•
		-		(0)	
		•		(C)	
		(ii) Menti	ion the Clausius inequality for open, closed and is		
	·	syster	ms. \bigcirc	(4)	
	(b)	(i) 3kg of	f air at 500kPa 90°C expands adiabatically in a closed s	zzetom	
	(~)	until that o	its volume is doubled and its temperature becomes eq of the surroundings at 100kPa and 10°C. Find maximum	ual to	
	•	(ii) Briefl	y discuss about the concept of entropy.	(4)	
13.	(a)	bar and 480 and cycle	0°C. The minimum pressure is 0.07 bar. Find the work of efficiency using steam tables with and without considerables.	output	•
	_	·	Or		
	(b)	what the st	temperature will the steam become saturated vapour? We team quality at 80°C. Also find what is the heat trans	hat is	-
	-	(ii) When	will you call a vapour superheated? Give example. Also	when (4)	
14.	(a)			s its (12)	
		(ii) Write	down two Tds relations. Or	(4)	
	(b)	(i) Derive	e any two Maxwell's relation.	(10)	
	•	·	_	(0)	
15.	(a)	ratio	of (former) 1:2(later) on dry basis. Determine the	in the	
		(ii) Briefly	y discuss about evaporative cooling process. Or	(6)	
	(b)	(i) Define			•
		(ii) Explai		(8)	
			,	and (4)	
	13.	(b) 13. (a) (b) 14. (a) (b) 15. (a)	heat 300°I (1) (2) (ii) Ment syste (b) (i) 3kg o until that o chang (ii) Briefl 13. (a) Steam at 4 bar and 48 and cycle pump work (b) (i) Steam what the si per kg (ii) When will y 14. (a) (i) Deriv signif (ii) Write (b) (i) Deriv (ii) Draw salien 15. (a) (i) Air at ratio condit (ii) Briefl (b) (i) Define (ii) Expla (iii) Repre	receives heat at 870°K and rejects to a reservoir at T. B reheat rejected by the first engine and in turn rejects to a s 300°K. Find the temperature T for (1) Equal work outputs of both engines (2) Same Efficiencies (ii) Mention the Clausius inequality for open, closed and is systems. Or (b) (i) 3kg of air at 500kPa, 90°C expands adiabatically in a closed s until its volume is doubled and its temperature becomes equivalent the surroundings at 100kPa and 10°C. Find maximum change in availability and the irreversibility. (ii) Briefly discuss about the concept of entropy. 13. (a) Steam at 480°C, 90 bar is supplied to a Rankine cycle. It is reheated bar and 480°C. The minimum pressure is 0.07 bar. Find the work of and cycle efficiency using steam tables with and without consist pump work. Or (b) (i) Steam initially at 0.3 MPa, 250°C is cooled at constant volum what temperature will the steam become saturated vapour? We the steam quality at 80°C. Also find what is the heat transper kg of steam in cooling from 250°C to 80°C. (ii) When will you call a vapour superheated? Give example. Also will you call a liquid as compressed liquid? Give example. 14. (a) (i) Derive the Clausius- Clapeyron equation and discussing inficance. (ii) Write down two Tds relations. Or (b) (i) Derive any two Maxwell's relation. (ii) Draw a neat schematic of a compressibility chart and indicated salient features. 15. (a) (i) Air at 20°C, 40% R.H is mixed with air at 40°C, 40% R.H is ratio of (former) 1 :2(later) on dry basis. Determine the condition of air. (ii) Briefly discuss about evaporative cooling process. Or (b) (i) Define the terms — Relative humidity and Specific hum the condition of air. (iii) Explain the adiabatic saturation process with a schematic.	receives heat at 870°K and rejects to a reservoir at T. B receives heat rejected by the first engine and in turn rejects to a sink at 300°K. Find the temperature T for (1) Equal work outputs of both engines (6) (2) Same Efficiencies (6) (ii) Mention the Clausius inequality for open, closed and isolated systems. Or (b) (i) 3kg of air at 500kPa, 90°C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surroundings at 100kPa and 10°C. Find maximum work, change in availability and the irreversibility. (ii) Briefly discuss about the concept of entropy. (4) 13. (a) Steam at 480°C. 790 bar is supplied to a Rankine cycle. It is reheated to 12 bar and 480°C. The minimum pressure is 0.07 bar. Find the work output and cycle efficiency using steam tables with and without considering pump work. Or (b) (i) Steam initially at 0.3 MPa, 250°C is cooled at constant volume. At what temperature will the steam become saturated vapour? What is the steam quality at 80°C. Also find what is the heat transferred per kg of steam in cooling from 250°C to 80°C. (ii) When will you call a vapour superheated? Give example. Also when will you call a liquid as compressed liquid? Give example. (4) 14. (a) (i) Derive the Clausius Clapeyron equation and discuss its significance. (12) (iii) Write down two Tds relations. (4) Or (b) (i) Derive any two Maxwell's relation. (ii) Draw a neat schematic of a compressibility chart and indicate its salient features. (6) 15. (a) (i) Air at 20°C, 40% R.H is mixed with air at 40°C, 40% R.H in the ratio of (former) 1 :2(later) on dry basis. Determine the final condition of air. (iii) Briefly discuss about evaporative cooling process. (6) Or (b) (i) Define the terms — Relative humidity and Specific humidity. (2 + 2) (iii) Represent — heating and humidification, cooling and