P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

December 2022

SEME2011 Engineering Thermodynamics

30.11.2022, Wednesday **Time: 10:00 a.m. To 12:30 p.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1	Fill in the Blanks (Any Five)	**[05]**	**CO**	**BTL**
(i)	Which of the following is the extensive property of a thermodynamic system? a) Pressure b) Volume c) Temperature d) Density		**1**	**1**
(ii)	The maximum entropy means there is a) Minimum availability for conversion into work. b) Minimum unavailability for conversion into work. c) Maximum availability for conversion into work		**2**	**1**
(iii)	The compressibility chart gives best results in _____ for all gases. a) Critical point b) Vicinity of critical point c) Any point d) all of the above.		**3**	**1**
(iv)	Kelvin-Planck's law deals with a) conservation of energy b) conservation of heat c) conservation of mass d) conversion of heat into work		**2**	**2**
(v)	The difference of reversible maximum work and the actual work called a) irreversibility b) unavailability c) reversibility d) availability		**3**	**2**
(vi)	___ is conserved but ___ is not conserved. a) exergy, energy b) energy, exergy c) both exergy and energy are conserved d) neither exergy nor energy is conserved		**3**	**2**
(vii)	Which of the following thermodynamic law gives the concept of enthalpy? a) First law of thermodynamics b) Second law of thermodynamics c) Third law of thermodynamics d) Fourth law of thermodynamics		**1**	**1**
Q - 2 (a)	Write the limitation of first law of thermodynamics. Explain the second law of thermodynamics by Clausius statement and Kelvin-Plank statement	**[05]**	**1**	**2**

Q - 2 (b)	Differentiate between the followings 1)Point function and path function , 2) Microscopic approach and macroscopic approach, 3) Pure substance and working substance	**[05]**	**1**	**3**
	OR			
Q - 2 (a)	What do you mean by Reversible Work?	**[05]**	**2**	**3**
Q - 2 (b)	To a closed system 150 kJ of work is supplied. If the initial volume is 0.6 m3 and pressure off the system changes as p=8-4V, where p is in bar and V is in m3, determine the final volume and pressure of the system.	**[05]**	**2**	
Q - 3 (a)	Write down the general energy equation for steady flow system and simplify when applied for the following systems: centrifugal water pump Reciprocating air Compressor Steam nozzle Steam turbine Gas turbine	**[05]**	**2**	**4**
Q - 3 (b)	Explain Reversible and Irreversible process with example	**[05]**	**3**	**4**
	OR			
Q - 3 (a)	Describe the working of a Carnot cycle.	**[05]**	**3**	**3**
Q - 3 (b)	A heat pump operates between two identical bodies which are at temperature T1 and cools one of the bodies to a temperature T2 (T2<T1). Prove that for this operation the minimum work required by the heat pump is given by W=Cp [T12 /T22 +T2-2T1] Where Cp is the specific heat which is same for both bodies.	**[05]**	**2**	**4**
Q - 4	Attempt any one.	**[05]**		
(I)	State and explain the gouy-stodola theorem.		**3**	**3**
(ii)	Give the Exergy balance for steady flow system.		**2**	**3**
	SECTION – II			
Q - 1	Fill in the Blanks (Any Five)	**[05]**		
(i)	For a high compression ration whose efficiency is higher diesel or Petrol engine?		**1**	**5**
(ii)	Relation between C.O.P of Heat pump and C.O.P of refrigerator a) C.O.P (H.P) + C.O.P (ref) = 1 b) C.O.P (H.P) - C.O.P (ref) = 1 c) C.O.P (ref) - C.O.P (H.P) = 1 d) none of above		**1**	**1**
(iii)	The efficiency of Brayton cycle depends on a) Compression ratio b) Pressure ratio c) a & b d) no one		**1**	**1**

(iv)	In which of one the steam is taken back for heating again in boiler? a) Regeneration b) reheating c) preheating d) intercooling		1	2
(v)	Efficiency of Diesel cycle does not depend on a) Compression ration b) Pressure ratio c) Cut off ratio d) no one		1	2
(vi)	What is cut off ratio for diesel cycle? a) V1/v2 b) v2/v1 c) v3/v2 d) v1/v4		1	1
(vii)	Mollier diagram is the graph of? a) S Vs H b) P Vs V c) H Vs S d) T Vs S		1	1
Q - 2 (a)	Analyze reheating in Rankine cycle with necessary diagrams and how efficiency is improved?	[05]	4	4
Q - 2 (b)	In Air Standard Diesel cycle , the compression ratio is 16, and at the beginning of isentropic compression, the temperature is 15^0C and the pressure is 0.1 Mpa. Heat is added until the temperature at the constant pressure process is 1480^0C. calculate a) cut-off ratio, b) heat supplied per kg of air and c) cycle efficiency.	[05]	4	5
	OR			
Q - 2 (a)	Understand the use of Otto cycle efficiency and evaluate the efficiency equation	[05]	4	5
Q - 2 (b)	Analyze intercooling in Brayton cycle with necessary diagrams and how efficiency is improved?	[05]	4	4
Q - 3 (a)	Evaluate Vander Wall's equation and explain Dalton's law of partial pressure.	[05]	5	5
Q - 3 (b)	Apply the concept of Diesel cycle and derive the efficiency equation.	[05]	4	3
	OR			
Q - 3 (a)	Create the VCR cycle with example of Refrigerator/Window Air Conditioner.	[05]	4	6
Q - 3 (b)	Evaluate the difference between VCR cycle VS VAR cycle.	[05]	4	5
Q - 4	Attempt any one/two.	[05]		
(i)	Analyze the law of corresponding states and establish the relationship between reduced properties.		5	5
(ii)	Apply the Dalton's law of partial pressure with an example.		5	3

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CO : Course Outcome Number BTL : Blooms Taxonomy Level

Level of Bloom's Revised Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create