Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New) • EXAMINATION – WINTER 2016

Subject Code:2132502 Date:06/01/2017

Subject Name:Engineering Thermodynamics & Heat transfer

Time:10:30 AM to 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 Short Questions 14

1 Second law of thermodynamics establishes the concept of
(a) Entropy (b) Enthalpy (c) Energy (d) Work

2 Zeroth law of thermodynamics gives idea about
(a) Pressure (b) temperature (c) conductivity (d) none of the above

3 The polytropic index is unity for _ _ _ _ _ process.
(a) Isobaric (b) isochoric (c) isothermal (d) Adiabatic

4 The entropy of universe tends to be
(a) Minimum (b) Remains same (c)Maximum (d) None of the above

5 The characteristic gas equation $pv = mRT$ is valid for
(a) Real gas (b) Perfect gas (c) mono-atomic gas (d) mixture of gases

6 Work done for free expansion is
(a) Zero (b)Maximum (c)Minimum (d) None of the above

7 Heat transfer takes place according to _ _ _ _ law of thermodynamics.
(a) Zeroth (b) First (c) Second (d) Third

8 The heat transfer medium is not required in case of
(a) conduction (b) convection (c)radiation (d) None of the above

9 Heat transfer in liquid and gases is mainly due to
(a) conduction (b) convection (c)radiation (d) None of the above

10 Fins are provided on surface in order to increase
(a) heat transfer area (b)heat transfer coefficient
(c) temperature gradient (d) None of the above

11 The Stefan-Boltzmann law is used in analysis of _ _ _ _
(a) conduction (b) convection (c)radiation (d) None of the above

12 The free convection heat transfer is significantly affected by
(a) Reynolds Number (b) Prandtl Number
(c) Stanton Number (d) Grashoff Number

13 The automobile radiator is a heat exchanger of the type
(a) Parallel flow (b) cross flow (c) counter flow (d) None of the above

14 Free convection in a liquid bath is caused by
(a) Density difference (b) Molecular energy interaction
(c) flow of electrons (d) None of the above

Q.2 (a) What are different types of Thermodynamic Systems? Explain any two with suitable example. **03**

(b) The air at 1.02 *bar* and 22°*C*, initially occupying a cylinder volume of 0.015 m^3, is compressed reversibly and adiabatically by a piston to a pressure of 6.8 *bar*. Calculate: (i) final temperature (ii) final volume **04**

(c) Define the following terms: (i) System (ii) Property (iii) State (iv) Process (v) Boundary (vi) Cycle (vii) Pure Substance **07**

OR

	(c)	Establish the inequality of Clausius.	**07**
Q.3	**(a)**	Define (i) entropy, (ii) exergy and (iii) thermal energy reservoir.	**03**
	(b)	A Carnot cycle operates between source and sink temperatures of 250°*C* and – 15°*C*. if the system receives 90 *kJ* from the source, find: (i) Efficiency of the system (ii) The net work transfer	**04**
	(c)	State Kelvin-Plant statement of second law of thermodynamics. Verify that violation of Kelvin Plank statement leads to violation of Clausius statement.	**07**
		OR	
Q.3	**(a)**	What is the difference between critical point and triple point?	**03**
	(b)	Differentiate between PMM1 and PMM2.	**04**
	(c)	What do you understand by the dead state? What is meant by availability?	**07**
Q.4	**(a)**	Derive SFEE equation of the nozzle with necessary assumptions.	**03**
	(b)	What do you meant by thermodynamic equilibrium? Explain its types.	**04**
	(c)	By dimensional analysis show that for forced convection heat transfer $Nu = f(Re, Pr)$	**07**
		OR	
Q.4	**(a)**	What are the three modes of heat transfer? Explain any two of them briefly.	**03**
	(b)	The inner surface of a plane wall is at 60°*C* and the outer surface is at 35°*C*. Calculate the rate of heat transfer per m^2 of surface area of the wall, which is 220 *mm* thick. The $k_{wall} = 0.51\ W/m\ °C$	**04**
	(c)	Derive the general heat conduction equation for Cartesian coordinate system.	**07**
Q.5	**(a)**	In a counter flow heat exchanger, 2.78 *kg/sec* of an oil ($Cp = 2.095\ kJ/kg\ K$) is cooled from 80°*C* to 50°*C* by 2.22 *kg/sec* of water entering at 25°*C*. Determine the heat exchange area. Take $U = 300\ W/m^2\ K$ and *Cp of water* $= 4.18\ kJ/kg\ K$	**03**
	(b)	Differentiate between fin efficiency and fin effectiveness.	**04**
	(c)	Derive equation of logarithmic mean temperature difference for parallel flow Heat-exchanger.	**07**
		OR	
Q.5	**(a)**	What is dimensionless numbers? Explain physical significance of Reynolds number.	**03**
	(b)	Explain the following terms of Radiation with usual notations: (a)Emissivity (b) Shape factor	**04**
	(c)	Explain term Boiling also explain various regimes of boiling.	**07**

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