Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New) EXAMINATION – SUMMER 2016

Subject Code:2132502 **Date:09/06/2016**

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.**

Q.1 Short Questions 14

1 Workdone in a free expansion process is
(a) Zero (b) Minimum (c) Maximum (d) Positive

2 Characteristic gas constant of a gas equal to
(a) Cp / Cv (b) Cp + Cv (c) Cp – Cv (d) Cp x C

3 Second law of thermodynamics defines
(a) heat (b) Work (c) Entropy (d) Enthalpy

4 Properties of substances like pressure, temperature and density, in thermodynamic coordinates are
(a) Path function (b) Point function
(c) Real function (d) Cyclic function

5 The value of n = 1 in the polytropic process indicates it to be
(a) reversible process (b) isothermal process
(c) adiabatic process (d) irreversible process

6 In an isothermal process, the internal energy of gas molecules
(a) Increases (b) decreases
(c) remains constant (d) shows unpredictable behavior.

7 Entropy change depends on
(a) heat transfer (b) mass transfer
(c) change of temperature (d) thermodynamic state

8 Carnot cycle efficiency depends upon
(a) properties of the substance (b) condition of engine
(c) working condition (d) temperature range of operation

9 Heat transfer takes place as per
(a) Zeroth law (b) first law
(c) second law (d) Kirchoff's law

10 Emissivity of a white polished body in comparison to a black body is
(a) higher (b) lower
(c) same (d) depends upon the shape of body

11 A non dimensional number generally associated with natural convection heat transfer is
(a) Grashoff number (b) Nusselt number
(c) Weber number (d) Prandtl number

12 LMTD in case of counter flow heat exchanger as compared to parallel flow heat exchanger is
(a) higher (b) lower
(c) same (d) depends on the area of heat exchanger

13 A perfect black body is one which
(a) is black in color (b) reflects all heat (c) transmits all heat radiations
(d) absorbs heat radiations of all wave lengths falling on it

14 Fourier's law of heat conduction is valid for
(a) one dimensional cases (b) two dimensional cases (c) three dimensional cases (d) regular surfaces having non-uniform temperature gradients

Q.2	**(a)**	Differentiate between open system, closed system and an isolated system.	**03**
	(b)	Differentiate between PMM1 and PMM2.	**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	
	(c)	Air flows steadily at the rate of 0.5 *kg/s* through as air compressor, entering at 7 *m/s* velocity, 100 *kPa* pressure, 0.95 m^3/kg volume and leaving at *5 m/s*, 700 *kPa* and 0.19 m^3/kg. The internal energy of the air leaving is 90 *kJ/kg* greater than that of air entering. Cooling water in the compressor jackets absorbs heat from the air at rate of 58 *kW*. Compute (a) rate of shaft work input to air in *kW* (b) Find ratio of inlet pipe diameter to outlet pipe diameter.	**07**
Q.3	**(a)**	Define the following terms: (a) Exergy (b) Dead state of a system (c) Entropy	**03**
	(b)	Explain the process of steam formation using *h-s* chart with usual notations.	**04**
	(c)	What is irreversibility? State various types of irreversibilities and explain them.	**07**
		OR	
Q.3	**(a)**	Define the following terms: (a) Triple point (b) Thermal energy reservoir (c) critical point	**03**
	(b)	Prove that all reversible engines working between the two constant temperature reservoirs have the same efficiency.	**04**
	(c)	Define property. What is meant by intensive and extensive property? State difference between Microscopic approach and Macroscopic approach.	**07**
Q.4	**(a)**	What are the three modes of heat transfer? Explain them briefly.	**03**
	(b)	Explain the following laws: (a)Fourier's Law of heat conduction (b) Newton's Law of cooling	**04**
	(c)	By dimensional analysis show that for forced convection heat transfer $Nu = f(Re, Pr)$, where Nu = Nusselt number, Re = Reynolds number, Pr = Prandtl number.	**07**
		OR	
Q.4	**(a)**	Differentiate between free convection and forced convection.	**03**
	(b)	Differentiate between fin efficiency and fin effectiveness.	**04**
	(c)	Derive an expression for three dimensional time dependent heat conduction with internal heat generation and constant thermal conductivity in Cartesian coordinate system. Reduce it as Fourier equation.	**07**
Q.5	**(a)**	Explain Wein's displacement law of radiation.	**03**
	(b)	Explain the following terms of Radiation with usual notations: (a)Emissivity (b) Shape factor	**04**
	(c)	Derive equation for log mean temperature difference (LMTD) for parallel flow heat exchanger.	**07**
		OR	
Q.5	**(a)**	Explain Kirchoff's law.	**03**
	(b)	An oil cooler for a lubricating system has to cool 1000 *kg/h* of oil (Cp = 2.09 *kJ/kg K*) from 80 ^{0}C to 40 ^{0}C by using a cooling water flow of 1000 *kg/h* available at 30 ^{0}C. Give your choice for a parallel flow or counter flow heat exchanger with suitable reasons. Estimate the surface area of heat exchanger, if overall heat transfer coefficient is 24W/m^2 K (Cp of water = 4.18 *kJ/kg K*)	**04**
	(c)	Define condensation process. Explain drop wise and film wise condensation.	**07**

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