Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (New) EXAMINATION – WINTER 2015

Subject Code:2132502 **Date :02/01/2016**

Subject Name: Engineering Thermodynamics & Heat Transfer

Time: 2:30pm to 5:00pm **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		**Define the following terms.**	**14**
	1	Black body	
	2	Quasi-static process	
	3	Availability	
	4	Perfect gas	
	5	Reversible Process	
	6	Enthalpy	
	7	Entropy	
	8	Point function	
	9	Extensive property	
	10	Pure substance	
	11	Macroscopic approach	
	12	System	
	13	Emissivity	
	14	Conduction	
Q.2	**(a)**	In an IC engine, during the compression stroke the heat rejected to the cooling water is 50 kJ/kg and the work input is 100 kJ/kg. Calculate the change in internal energy of working fluid stating whether it is a gain or loss.	**03**
	(b)	What are different types of Thermodynamic Systems? Explain with suitable example.	**04**
	(c)	What is irreversibility? State various types of irreversibility and explain them.	**07**
		OR	
	(c)	Establish the inequality of Clausius.	**07**
Q.3	**(a)**	Find the COP and heat transfer rate in the condenser of a refrigerator in *kJ/h* which has a refrigeration capacity of 12000 *kJ/h* when power input is 0.75 *kW*	**03**
	(b)	What do you mean by PMM1 and PMM2 ?	**04**
	(c)	Explain the concept of decrease in available energy when heat is transferred through a finite temperature difference with the aid of T-S diagram.	**07**
		OR	
Q.3	**(a)**	Explain the concept of Energy ,Exergy and dead state of system.	**03**
	(b)	Explain the process of steam formation using *h-s* chart.	**04**
	(c)	State the Steady Flow Energy Equation and explain how this equation can be applied for (i) Nozzle, (ii) Boiler, and (iii) Steam Turbine.	**07**
Q.4	**(a)**	What is the difference between critical point and triple point?	**03**
	(b)	What is the difference between fin efficiency and fin effectiveness ?	**04**
	(c)	Derive the general heat conduction equation for Cartesian coordinate	**07**

system.

OR

Q.4	**(a)**	Explain zeroth law of thermodynamics.	**03**
	(b)	Explain the mechanism of convection heat transfer. Also explain natural and forced convection.	**04**
	(c)	By dimensional analysis show that for forced convection $Nu = f\,(Re, Pr)$, where Nusselt No (Nu) = hl/K, Reynolds No (Re) = $\rho V l/\mu$, Prandtl No (Pr) = $\mu C_p/K$	**07**
Q.5	**(a)**	State silent features of shape factor.	**03**
	(b)	Assuming the sun to be a black body emitting radiation with maximum intensity at $\lambda = 0.49\ \mu m$, calculate the following: (i) The surface temperature of the sun, and (ii) The heat flux at the surface of the sun.	**04**
	(c)	Explain term Boiling also explain various regimes of boiling.	**07**

OR

Q.5	**(a)**	Explain Wein's displacement law of Radiation.	**03**
	(b)	In a counter-flow double pipe heat exchanger, water is heated from 25 °C to 65 °C by an oil with a specific heat of 1.45 *kJ/kg K* and mass flow rate of 0.9 *kg/s*. The oil is cooled from 230 °C to 160 °C. If the overall heat transfer coefficient is 420 $W/m^2\ °C$, calculate the following: (i) The rate of heat transfer (ii) LMTD of heat exchanger.	**04**
	(c)	Derive the equation for logarithmic mean temperature difference (LMTD) for parallel flow heat exchanger.	**07**

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