Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I (NEW) EXAMINATION – SUMMER 2017

Subject Code:2711101 **Date:09/05/2017**

Subject Name: Advanced Thermodynamics & Heat Transfer

Time: 02:30 P.M. to 05:00 P.M. **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	6 kg of air at 550 K and 4 bar is enclosed in a closed system. (i) Determine the availability of the system if the surrounding pressure and temperature are 1 bar and 290 K respectively. (ii) If the air is cooled at constant pressure to the atmospheric temperature, determine the availability and effectiveness.	**07**
	(b)	An iron cube at a temperature of 400°C is dropped into an insulated bath containing 10 kg water at 25°C. The water finally reaches a temperature of 50°C at steady state. Given that the specific heat of water is equal to 4186 J/kg K. Find the entropy changes for the iron cube and the water. Is the process reversible ? If so why ?	**07**
Q.2	**(a)**	Explain the following terms : (i) Exergy (ii) Irreversibility (iii) Entropy balance	**07**
	(b)	What do you understand by the entropy principle? And what are the important characteristics of entropy?	**07**
		OR	
	(b)	Explain Gouy–Stodola theorem with its application.	**07**
Q.3	**(a)**	Explain second law efficiency of a process.	**07**
	(b)	Derive the general heat conduction equation for Cylindrical Co-ordinates.	**07**
		OR	
Q.3	**(a)**	Explain lumped parameter analysis and derive it's governing equation.	**07**
	(b)	What are Heisler charts? Explain the significance of Heisler charts in solving transient conduction problems.	**07**
Q.4	**(a)**	What is natural convection? How does it differ from forced convection? What force causes natural convection currents?	**07**
	(b)	Derive the integral momentum equation for the boundary layer over a flat plate.	**07**
		OR	
Q.4	**(a)**	Draw the boiling curve and identify the burnout point on the curve. Explain how burnout is caused. Why is the burnout point avoided in the design of boilers?	**07**
	(b)	Explain the following term in relation with natural convection heat transfer including its physical significance: 1. Buoyancy force 2. Volumetric expansion coefficient 3. Grashof number	**07**
Q.5	**(a)**	What is black body? What are its properties? Explain the concept of total and spectral emissive power of black body.	**07**
	(b)	Explain Heat pipe	**07**
		OR	
Q.5	**(a)**	Explain the following :(1) Emissivity (2) Lambert's cosine law (3) Wein's displacement law of radiation	**07**
	(b)	What is shape factor? Discuss the salient features of the shape factor for analysis of radiant heat exchange between surfaces.	**07**

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