Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1721004 **Date: 02-01-2014**

Subject Name: Radiation Heating and Cooling System

Time: 10.30 am – 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 **(a)** Explain following laws in details applied in radiation heat transfer. **07**
(i) Wein's Displacement law (ii) Stefan-Boltzmann law

(b) Explain the term 'Control Volume'. Also describe the important characteristics of control volume. **07**

Q.2 **(a)** Explain with figure Heat Transfer Modes within an enclosed space fitted with Radiant Cooling System. **07**

(b) The air flow through a circular duct at 25 m/s at an elevation of 50 m. Calculate the change in total specific energy of the air if its velocity reduced to 3 m/s and brought to an elevation of 12 m. The air is cooled by 20^0 C. **07**

OR

(b) Distinguish between Configuration Factor and Interchange Factor by giving suitable examples. **07**

Q.3 **(a)** Explain Radiosity (J) and Irradiation (G). Also explain the concept of space and surface resistance with the help of electrical network approach. **07**

(b) Explain concept of 'Relative Temperature Relationship' for forced air cooling system and radiant cooling system. **07**

OR

Q.3 **(a)** Explain with necessary figure Gagge Two-node Model for thermal comfort. **07**

(b) Define and explain the following terms. **07**
(i) Operative Temperature (ii) Mean Radiant Temperature

Q.4 **(a)** Write short note on following thermal comfort tools used for radiant systems analysis: (i) DOE-2 (ii) ASHRAE Research Project-781 **07**

(b) Describe in details the evaluation features of radiant panels. **07**

OR

Q.4 **(a)** A thin plate receives radiation on one side from a surface at 650^0 C and radiates on the other face to a surface at 150^0 C. Determine the temperature of the plate. Take F=1. Neglect convection heat flow. **07**

(b) Explain the significance of the following expression with usual annotations for different emissive concept: $a_\lambda(\theta, \phi, T) = \frac{E_\lambda(\theta, \phi, T)}{E_{b\lambda}(\phi, T)}$ **07**

Q.5 **(a)** Explain following with necessary neat sketch: **07**
(i) Solid angle (ii) Blackbody radiation

(b) Explain the operation of a bimetallic thermostat for temperature control with necessary figures. **07**

OR

Q.5 **(a)** Discuss the benefits of a typical Radiant Cooling and Heating System according to Feustel and Stetiu (1993). **07**

(b) Write short note on "Impact of Control Choice" on energy consumption for the radiant system. **07**

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