Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1721004   **Date: 05-06-2013**
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)** Write short answers for following questions.   **06**
   (i) Define Operative Temperature in terms of MRT and DBT.
   (ii) Which are the common factors affect on operating cost of Radiant heating system?
   (iii) Define concept of Multimodal Heat Transfer.
   (iv) State the use of Blackbody Fraction. Define it mathematically with usual annotations.
   (v) What assumption is made to form Binary Star Model of thermal circuit? Also represent the model by neat figure.
   (vi) Draw the figure which demonstrates multimodal heat transfer in Radiantly heated room.

(b) Explain with figure Heat Transfer Modes within an enclosed space fitted with   **08**
Radiant Cooling System.

Q.2 **(a)** Write brief answers for followings.   **06**
   (i) Give definition of Radiation Intensity (I) with necessary figure.
   (ii) Derive $_{max}T=2.898\times10^{-3}$ mK with the help of Planck's law.
   (iii) Enlist the characteristics chosen by Gagge for the standard environment.

(b) A room contains five people and 2 numbers of light fixtures of 300 W each.   **08**
The ventilation system provides 1.2 kg/s of air at 16^0 C. Heat is transferred
from the surroundings to room at a rate of 120 W. Calculate the specific
enthalpy of the air in the room.

OR

(b) The air flow through a circular duct at 25 m/s at an elevation of 50 m.   **08**
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.

Q.3 **(a)** Distinguish between Configuration Factor and Interchange Factor by giving   **07**
suitable examples.

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

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) Wien's law of displacement   (ii)   Mean Radiant Temperature

Q.4 **(a)** Write short note on following thermal comfort tools used for radiant systems **07**
analysis.
(i) Energy Plus   (ii)   ASHRAE Research Project-781
(b) Describe in details the evaluation features of radiant panels.   **07**

OR

Q.4 **(a)** Explain the operation of a bimetallic thermostat for temperature control with **07**
necessary figures.
(b) Describe the method to calculate the MRT in terms of radiant intensity **07**
balance at a particular point in the room.

Q.5 **(a)** Discuss the benefits of a typical Radiant Cooling and Heating System **07**
according to Feustel and Stetiu (1993).
(b) A thin plate receives radiation on one side from a surface at 650^0 C and **07**
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.

OR

Q.5 **(a)** Describe the important features of radiant panel evaluation. **07**
(b) Write short note on "Impact of control Choice" on energy consumption for **07**
the radiant system.

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