Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER- II(Old course) • EXAMINATION (Remedial) - WINTER- 2015

Subject Code: 1721004

Date: 14/12/2015

Subject Name: Radiation Heating and Cooling System Time: 2:30 pm to 5:00 pm Instructions:

Total Marks: 70

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Explain the heat transfer phenomenon at a radiant cooling system panel 07 considering heat transfer balance on its active surface.
 - (b) Define Wein's displacement law. Also calculate the wavelength (in nanometers) 07 for the peak intensity of the light coming from a surface at temperature of 150° C.
- **Q.2** (a) Derive the relationship $E_b = \pi \cdot I_b$ between Emissive power and Intensity for a 07 given hemispherical surface.
 - (b) Consider a hemispherical shell of 1 m in diameter, at 500 K, a circular disc of 0.1 07 m in diameter, concentric, in the base plane and at 300 K, and the circular corona at the base that completes the closure of the hemisphere, also at 500 K. Assume that there is only heat transfer by radiation (no convection and no conduction through the contacts). Find the heat transfer received by the disc assuming that all surfaces are blackbodies.

OR

- (b) Find the view factor from a small area (dA_1) normal and centered with respect to a **07** circular disc of radius R at a distance H apart, from the view factor definition.
- Q.3 (a) Define 'Thermal Comfort' as per ASHRAE Standard 55 (1992). Also Explain 07 briefly the Gagge Model of thermal comfort.
 - (b) A black body of 0.25 m² area has an effective temperature of 900 K. Calculate (i) 07 Total rate of energy emission (ii) Intensity of normal radiation (iii) Intensity of radiation along a direction 45° to the normal.

OR

Q.3 (a) Write short note on following thermal comfort tools used for radiant systems 07 analysis.

(i) Energy Plus (ii) ASHRAE Research Project-781

- (b) A room contains six people and 3 numbers of light fixtures of 300 W each. The 07 ventilation system provides 1.8 kg/s of air at 15^o C. Heat is transferred from the surroundings to room at a rate of 110 W. Calculate the specific enthalpy of the air in the room.
- Q.4 (a) Describe briefly Spherical Harmonics and Monte Carlo method techniques for 07 solving the Radiative Transfer Equations (RTE).
 - (b) Enumerate the different types of temperature controls used for radiant systems. 07Explain working of any one with figure.

OR

Q.4 (a) Explain Radiosity (J) and Irradiation (G). Also explain the concept of space and surface resistance with the help of electrical network approach.

- (b) Define the Mean Radiant Temperature (MRT). Also Calculate the MRT for the **07** room of size: 6 m length, 4 m width and 3 m height if all the inside surfaces are at a temperature of 30° C. Assume it is a homogenous steady state area weighted average of the uncontrolled surface temperatures.
- Q.5 (a) Explain working of the Radiant Heating and Cooling Hybrid System with neat 07 sketch.
 - (b) Write short notes on (i) Motorized Mixing Valves (ii) Line Voltage Thermostat. 07OR
- Q.5 (a) Describe performance capabilities of radiant heating systems in comparison to 07 convection heating systems.
 - (b) Describe emissivity, absorptivity and transmissivity characteristics of building 07 material surfaces in a radiant environment.
