UNIT 4

PART A

1. Define Radiation heat transfer.

2. What is Stefan\'s Bolts Mann law?

3. What is Intensity of radiation?

4. Define Shape factor.

5. What is Radiation Shield?

6. Define Quantum theory.

7. Define Emissive power of a black surface.

8. Define concept of Black body.

9. Define Planck\'s distribution law.

10. Define Wien\'s distribution law.

11. Define Emissivity of a surface.

12. What is meant by Kirchhoff\'s law?

13. Define Irradiation.

14. Define Radiosity.

15. Distinguish between Absorptivity & Transmittivity of radiation.

16. What are the gases, which radiate heat?

17. What is mean beam length in Gas Radiation?

18. What is the equation for radiation between two gray bodies?

19. Distinguish between Reflectivity & Transmittivity.

20. Differentiate Opaque body & perfectly transparent surface.

21. Write down the Wien\'s formula.

22. Write down the heat transfer equation for Radiant exchange between infinite parallel gray planes.

UNIT IV (Part B Questions)

23. Liquid Helium at 4.2 K is stored in a dewar flask of inner diameter = 0.48 m and outer diameter = 0.5 m. The dewar flask can be treated as a spherical vessel. The outer surface of the inner vessel and the inner surface of the outer vessel are well polished and the emissivity of these surfaces is 0.05. The space between the two vessels is thoroughly evacuated. The inner surface of the dewar flask is at 4.2 K while the outer surface is at 300 K. Estimate the rate of heat transfer between the surfaces. (16)

24. A thin aluminium sheet with an emissivity of 0.1 on both sides is placed between two very large parallel plates that are maintained at uniform temperatures T1 = 800 K and T2 = 500 K and have emissivities $\xi 1 = 0.2$ and $\xi 2 = 0.7$ respectively. De termine the net rate of radiation heat transfer between the two plates per unit surface area of the plates and compare the result to that without shield. (16)

25. (i) Discuss how the radiation from gases differ from that of solids. (6)

(ii) Two very large parallel plates with emissivities 0.5 exchange heat. Determine the percentage reduction in the heat transfer rate if a polished aluminium radiation shield of $\xi = 0.04$ is placed in between the plates. (10)

26. (i) Define emissivity, absorptivity and reflectivity. (6)

(ii) Describe the phenomenon of radiation from real surfaces. (10)

27 (i) What are the radiation view factors and why they are used? (4)

(ii) Determine the view factor (F14) for the figure shown below. (12)

28. (i) State and prove the following laws: (1) Kirchoff's law of radiation (2) Stefan - Boltzmann law. (8)

(ii) Show- from energy-balance consideration that the radiation heat transfer from a plane composite surface area A4 and made up of plane surface areas A2 and A3 to a plane surface area Al is given by: A4F41=A3F31+A2F21 & F14=F12+F13. (8)

29. (i) Using the definition of radiosity and irradiation prove that the radiation heat exchange between two grey bodies is given by the relation. (8)

(ii) A surface at 100 K with emissivity of 0.10 is protected from a radiation flux of 1250 W/m2 by a shield with emissivity of 0.05. Determine the percentage cut off and the shield temperature. Assume shape factor as 1. (8)

30. Explain briefly the following:

(i) Specular and Diffuse reflection (5)

(ii) Reflectivity and Transmissivity (5)

(iii) Reciprocity rule and Summation rule (6)

31. (i) Two parallel, infinite grey surfaces are maintained at temperature of 127^0C and 227^0C respectively. If the temperature of the hot surface is increased to 327°C, by what factor is the net radiation exchange per unit area increased? Assume the emissivities of cold and hot surface to be 0.9 and 0.7 respectively. (8)

(ii) Two equal and parallel discs of diameter 25 cm are separated by a distance of 50 cm. If the discs are maintained at 600°C and 250°C. Calculate the radiation heat exchange between them. (8)

32. Two large parallel planes with emissivities 0.35 and 0.85 exchange heat by radiation. The planes are respectively 1073K and 773K. A radiation shield having the emissivity of 0.04 is

placed between them. Find the percentage reduction in radiation heat exchange and temperature of the shield. (16)