Conduction and Radiation

Swayam Prabha Course Code: M63

PROFESSOR'S NAME	Prof. C. Balaji
DEPARTMENT	Department of Mechanical Engineering
INSTITUTE	Indian Institute Of Technology Kharagpur
COURSE OUTLINE	Radiation: Introduction, radiation from a black body, radiation properties of non-black opaque surfaces, shape factors for uniform diffuse radiation, radiation exchange in gray diffuse enclosures, fundamentals of gas radiation, the engineering treatment of gas radiation in enclosures, multimode heat transfer. Conduction: Introduction – energy equation in heat conduction and common types of boundary conditions, extended surface heat transfer – variable area fins, multidimensional steady conduction – 2D Cartesian, cylindrical, superposition principle, transient conduction – 1D Cartesian, cylindrical, spherical, integral method, conduction with change of phase, numerical solution of conduction problems.

COURSE DETAILS

S. No	Module ID/ Lecture ID	Lecture Title/Topic
1.	L1	Importance of Thermal Radiation
2.	L2	Blackbody Definition
3.	L3	Solid Angle, Spectral Radiation Intensity
4.	L4	Radiation Pressure and Radiation Energy Density
5.	L5	Relationship between "I" and "T" and Candidate Blackbody Distribution Functions
6.	L6	Candidate Blackbody Distribution Functions contd...
7.	L7	Planck's Blackbody Radiation Distribution Function

8.	**L8**	Planck's Distribution and Wien's Displacement Law
9.	**L9**	Universal Blackbody Function
10.	**L10**	Emissivity
11.	**L11**	Emissivity contd...
12.	**L12**	Emissivity contd....
13.	**L13**	Kirchoff Law, Absorptivity
14.	**L14**	Kirchoff Law, Absorptivity contd...
15.	**L15**	Problems on Emissivity, Absorptivity
16.	**L16**	Reflectivity
17.	**L17**	Transmissivity
18.	**L18**	Problems on Reflectivity and Transmissivity
19.	**L19**	Radiation Heat Transfer between Surfaces
20.	**L20**	View Factor
21.	**L21**	View Factor contd...
22.	**L22**	View Factor contd....
23.	**L23**	Enclosure Analysis
24.	**L24**	Enclosure Analysis contd...
25.	**L25**	Enclosure Analysis- Gray Surface
26.	**L26**	Enclosure Analysis- Non Gray Surfaces
27.	**L27**	Radiation in Participating Media
28.	**L28**	Solution to the RTE
29.	**L29**	Concept of Mean Beam Length
30.	**L30**	Enclosure Analysis in the Presence of Absorbing/ Emitting Gas
31.	**L31**	Emissivities and Absorptivities of Gas Mixtures
32.	**L32**	Conduction- Introduction
33.	**L33**	Conduction- Energy Equation
34.	**L34**	Conduction- 1D, Steady State

35.	**L35**	Conduction- 1D, Heat Generation
36.	**L36**	Fin Heat Transfer- I
37.	**L37**	Fin Heat Transfer- II
38.	**L38**	Conduction- Cylindrical and Spherical Geometries
39.	**L39**	Transient Conduction
40.	**L40**	Transient Conduction contd...
41.	**L41**	Two Dimensional Steady State Conduction
42.	**L42**	Analytical Solution for Laplace Equation
43.	**L43**	Numerical Methods in Conduction
44.	**L44**	Numerical Methods in Conduction contd...
45.	**L45**	Conduction with Change of Phase
46.	**L46**	Conduction with Change of Phase contd...

List of reference material/ books:

Conduction:

1. Conduction Heat Transfer, D. Poulikakos, Prentice Hall, 1994.

2. Heat Conduction, S. Kakac and Y. Yener, Taylor and Francis, 1994.

3. Analytical methods in Conduction Heat Transfer, G.E.Myers, McGraw Hill, 1971.

4. Conduction Heat Transfer, V.S. Arpaci, Addison Wesley, 1996 (Abridged edition Ginn press 1998)

5. Heat Transfer, A.J.Chapman, Macmillan, 1984.

Radiation:

1. Thermal Radiation Heat Transfer, R. Siegel and J.R.Howell, Taylor & Francis, 2002.

2. Radiation Heat Transfer, E.M.Sparrow and R.D.Cess, Wadsworth, 1966.

3. Radiative Transfer, H.C.Hottel and A.F.Saroffim, McGraw hill, 1967.

4. Radiative Heat Transfer, M.F.Modest, McGraw Hill, 2003.

Name and contact details of two referees for the course: