**Approval: 9th Senate Meeting**

**Course Name:** Thermal Radiation

**Course Number:** ME 613

**Credits:** 3-0-0-3

**Prerequisites:** Fundamentals of heat transfer

**Intended for:** UG/PG

**Distribution:** Elective

**Semester:** Even

Course Objective:

This course will provide comprehensive knowledge of thermal radiation. The course covers the radiation properties of materials, radiation in participative and non-participative medium. The extensive emphasis will be given on the radiation in participative media and non-gray behaviors of gases and surfaces. The course also covers radiation phenomena in semi-transparent medium and collimated beam radiation. Along with the P1, zonal and finite volume method of the radiative transfer equation, the students will also be introduced with statistical monte carlo method for collimated beam radiation. This course is theoretical in nature and to make understand of radiation physics practice on some opensource code will be encouraged.

***Modules:***

Module 1: Fundamentals of Thermal Radiative Heat Transfer (3)

Introduction, The nature of thermal radiation, Basic laws of thermal radiation Introduction to radiation characteristics of opaque surfaces, gases, solid, liquid and particles.

Module 2: Radiation properties of real surfaces (2)

Definitions of radiation phenomena at surfaces, Radiative properties of metals, non-conductors, semi-transparent sheets

Module 3: Radiation Exchange between surfaces (10)

Introduction to view factors and methods to calculate the view factors. Radiative exchange between Grey, Diffuse Surfaces, Partially-Specular Grey Surfaces.

Module 4: Gas Radiation (20)

The equation of radiative transfer in participative media, Boundary conditions for the equation of transfer, divergence of radiative heat flux, overall energy conservation, radiative properties of molecular gases, line radiation, spectral models for radiative transfer calculations, Narrow band models, Wide band models. radiative properties of particulate media Rayleigh scattering. P1, Zonal and Finite volume method for radiative transfer equation.

Module 5: Radiation properties of semi-transparent media and Collimated beam radiation. (4)

Radiation phenomena in semi-transparent solids and liquids. Monte carlo method for the collimated beam radiation.

Module 6: Design and Performance study of solar conversion devices by using open source or

standard softwares (3)

***References and text books:***


1. M. F. Modest, “Radiative Heat Transfer”, 3rd ed, 2013, Academic Press.
2. J. R. Howell, R. Siegel, M.P. Menguc, “Thermal Radiation Heat Transfer” 5th ed, 2011, CRC Press.