

# NUCLEAR ENGINEERING AND SAFETY

## MODULE I INTRODUCTION

Binding energy – fission process – radio activity – alpha, beta and gamma rays radioactive decay – decay schemes – effects of radiation – neutron interaction – cross section – reaction rate – neutron moderation – multiplication – scattering – collision – fast fission – resonance escape – thermal utilization – criticality.

## MODULE II REACTOR (CONTROL AND TYPES)

Control requirements in design considerations – means of control – control and shut down rods – their operation and operational problems – control rod worth – control instrumentation and monitoring – online central data processing system.

Boiling water reactors – radioactivity of steam system – direct cycle and dual cycle power plants – pressurized water reactors and pressurized heavy water reactors – fast breeder reactors and their role in power generation in the Indian context – conversion and breeding – doubling time – liquid metal coolants – nuclear power plants in India.

## MODULE III SAFETY OF NUCLEAR REACTORS

Safety design principles – engineered safety features – site related factors – safety related systems – heat transport systems – reactor control and protection system – fire protection system – quality assurance in plant components – operational safety – safety regulation process – public awareness and emergency preparedness. Accident Case studies- Three Mile island and Chernobyl accident.

## MODULE IV RADIATION CONTROL

Radiation shielding – radiation dose – dose measurements – units of exposure – exposure limits – barriers for control of radioactivity release – control of radiation exposure to plant personnel – health physics surveillance – waste management and disposal practices – environmental releases.

## BOOKS

1. "Loss prevention in the process Industries" Frank P. Lees Butterworth-Hein-UK, 1990.
2. Loffness, R.L., "Nuclear Power Plant" Van Nostrand Publications, 1979.
3. M.M.E.L.Wakil, "Nuclear Energy Conversion", International Text Book Co.
4. M.M.E.L.Wakil, "Nuclear Power Engineering", International Text Book Co.
5. R.L.Murray, "Introduction to Nuclear Engineering", Prentice Hall.

## REFERENCES

6. Sri Ram K, "Basic Nuclear Engineering" Wiley Eastern Ltd., New Delhi, 1990.
7. Sterman U.S. "Thermal and Nuclear Power Stations", MIR Publications, Moscow, 1986.