

PPH324: NUCLEAR REACTOR PHYSICS

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Course Objectives: To impart primary but wide theoretical knowledge about nuclear reactor and related topics.

Review of Physics of Nucleus: Characteristics of atomic nucleus, Binding energy, Nuclear fission.

Nuclear Reaction: Neutron sources, Types of Nuclear Reaction, Macroscopic & Microscopic Cross-section, Interaction of neutrons with nuclei, Absorption & Scattering Cross-sections.

Neutron Moderation: Inelastic scattering, Elastic collisions, moderating ratio, Slowing down Density, Resonance escape, Moderatos.

Fission Process and Diffusion Theory: Prompt neutrons, Fast fission, Fission energy, Thermal utilization, Fission products, Chain reaction, Multiplication factor, Leakage of neutrons, Critical size, Diffusion and slowing down theory, Homogenous and heterogeneous reactors.

Materials for Nuclear Reactors: Fuel materials, Moderator and Reflectors, Cladding materials, Coolants and control Rods.

Type of Power Reactors: Boiling water reactors, Pressurized water reactors, Pressurized heavy water reactors, Light water cooled graphite moderated reactors, Gas cooled reactors, Advanced gas cooled reactors, High temperature gas cooled reactors and liquid metal cooled reactors and Fast breeder reactors.

Fuel and Waste Management: Fuel management schemes, Fuel composition, Fuel cycle cost and waste management.

Laboratory Assignments: Visits to fission reactor sites and related case studies for generation of nuclear energy.

Course Learning Outcomes (CLO):

Students will have understanding of:

1. detailed primary aspects of nuclear reactors.
2. the related safety aspects.
3. how to manage the nuclear fuel and waste?

Recommended Books:

1. *Glasstons, Sammuel and Sesonke, Alexander, Nuclear reactor Engineer, CBS Publishers & Distributors, (1986).*
2. *Lamarshs, J.R., Introduction to Nuclear Reactor Theory, Addison-Wesley Publishing Co., (1966).*