18MTE65	NUCLEAR MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To study about materials required for nuclear applications.

UNIT I	INTRODUCTION	9	+	0

Structure of a nuclear power plant, requirements of reactor materials, fuel materials, plutonium uraniumand thorium and their alloys & compounds,

UNIT II	CORE MATERIALS	9	+	0

core materials: beryllium, graphite, control and shielding
materials, magnesium & its alloys, aluminium & its alloys, zirconium & its alloys, austenitic stainless steel; materials for reactor vessel and other components, pearlitic steels, ferritic, chromium stainless steels, copper alloys, titanium and its alloys, coolants used in reactors: radiation embrittlement, corrosion of reactor materials, mechanical properties of materials.

UNIT III	REACTOR INSTRUMENTATION	9	+	0

Reactor Instrumentation — general considerations — Reactor Nuclear Instrumentation systems — an overview — pressurized water nuclear instrumentation, boiling water reactor nuclear instrumentation, Encore detectors, self powered detectors, detectors based on beta decay, detectors based on secondary electrons from gamma decay.

UNIT IV	NUCLEAR TECHNIQUES FOR MATERIAL ANALYSIS	9	+	0

Nuclear techniques for materials analysis — basic principles of materials analysis, basic requirements for the technique, nuclear techniques for elemental analysis, main nuclear processes useful for materials analysis, the quantitative estimate, Rutherford back scattering (RBS) and elastic recoil detection analysis(ERDA). Nuclear reaction analysis — principle of the technique and required instrumentation, nuclear reactions suitable for nuclear reaction analysis, neutron activation analysis. PIXE and XRF techniques.

UNIT V	NUCLEAR WASTE MANAGEMENT	9	+	0

Nuclear Waste Management: Introduces scientific and engineering aspects of the management of spent fuel, reprocessed high-level waste, low-level wastes, and decommissioning wastes. Characteristics and classification of nuclear wastes and waste forms. Fundamental processes and governing equations of radionuclide transport in the environment. Discussion of performance assessment for repositories. Design principles and evaluation methods for geologic waste disposal systems.

Total (L+T) = 45 Hours

Course Outcomes:

Upon completion of this course, the students will be able to:		
CO1	:	Know about the structure of a nuclear power plant
CO2	:	Identify the reactor core materials
CO3	:	Classify various reactor vessel materials
CO4	:	Identify corrosion of reactor materials and mechanical properties of materials.

Text Books:

1.	V.Gerasimov& A. Monakhov, Nuclear Engineering Materials, Mir Publishers, Moskow, 1983.
2.	D.S.Clark& W.R Varney, Physical Metallurgy for engineers, East West Press, New Delhi, 1987

Reference Books:

1.	C.M.Srivatsava&C.Srinivasan, Science of engineering Materials, 1997, New Age International.