

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: **Centre of Excellence in Disaster Mitigation & Management**

1. Subject Code: **DMN-611** Course Title: **Nuclear Physics for Disaster Mitigation**

2. Contact Hours: L: **3** T: **1** P: **0**

3. Examination Duration (Hrs): Theory: **3** Practical: **0**

4. Relative Weight: **CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0**

5. Credits: **4** 6. Semester: **Autumn/ Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **Nil**

9. Objective of Course: To familiarize the students with the basics of nuclear physics and related instrumentation useful in dealing with nuclear disasters.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Radioactivity: Sources of radioactivity, decay schemes, fossil, cosmogenic and artificial radioactivity. Interaction of radiation with matter: Heavy charged particles, electrons, positrons, photons and neutrons, Counting statistics, Error analysis. Radiation exposure, dose units and their conversion, safe levels and risk factors for various radiations, dosimeters.	10
2.	Nuclear reactions: Kinematics of nuclear reactions, cross sections, centre of mass and laboratory frames. Radiation detectors and spectroscopy: Modes of detector operation, gas-filled detectors, Geiger counters, scintillation detectors, gamma spectroscopy, pulse processing and analysis, applications in security.	8
3.	Fission and Fusion: Nuclear fission, fission products, neutrons emitted in fission, fission cross sections, energy distribution in fission, General consideration on fusion reactions, ITER project.	4
4.	Nuclear reactors: Neutron diffusion and moderation, heat generation and heat flow in reactors, heat removal from nuclear reactors, energy production, different types of nuclear reactors (Slab reactor, thermal reactor, reflected reactor), reactor licensing, Radioactive waste disposal, fission product poisoning, radiation shielding, safety and the environment. Nuclear energy in India and around the world.	12

5.	Nuclear disasters: Potential consequences (ecology, economic, human, legal), Post-disaster actions, Causes for disasters, Types of radiation accidents, Statistics of radiation accidents, Three-mile island, Chernobyl, Fukushima.	8
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	G. F. Knoll, "Radiation detection and Measurement", 4 th Ed. John Wiley and Sons.	2010
2.	Gad Shani, "Radiation Dosimetry", 2 nd Ed., CRC Press	2000
3.	Nicholas Tsoulfanidis, "Measurement and Detection of Radiation", 2 nd Ed. Taylor and Francis.	1995
4.	John R. Lamarsh, Anthony J. Baratta, "Introduction To Nuclear Engineering", Prentice Hall.	2001
5.	Irving Kaplan, "Nuclear Physics", 2 nd Ed., Adison-Wiley Company.	2002
6.	<u>James Mahaffey</u> , "Atomic Accidents: A History of Nuclear Meltdowns and Disasters: From the Ozark Mountains to Fukushima", Open Road Media.	2014