MPE 506: Applications of Radiation and Radioisotopes in Health and Agriculture

Teaching hours: Each Unit – 12 h

Objective:

Familiarizing the students withmedical and agricultural applications of radiations, radioisotopes and radiation technology.

Outcomes:

- Students will be aware of origin and sources of radiation and radioactivity.
- They will learn about nuclear reactors and also about nuclear waste and their impact on terrestrial and marine environments.
- Basic understanding, general knowledge and applications of nuclear radiation in health sector will be familiarized. Also learn about various radiation based equipment used in diagnosis and therapy.
- Students will acquire basic knowledge and understanding of application of nuclear radiation and its technology in agriculture.

Unit I: Environmental Radioactivity

Sources of environmental radioactivity – Natural, artificially produced and technologically enhanced radioactivity. The nuclear fuel cycle, nuclear power reactors, types of reactors, low level and high level radioactive waste, reactor accidents. Nuclear explosions: Short-term and worldwide effects. Impact on marine and terrestrial environments, Behaviour of radioactive contaminants in terrestrial environment.

Unit II: Medical Applications

Sterilization of medical products.New drug testing - radioactive tagging; drug delivery and efficiency, Medical Imaging – X-rays, CT, MRI, SPECT& PET scanning. Therapeutic applications - cancers, heart disease, gastrointestinal, endocrine, neurological disorders and other abnormalities within the body, external radiation therapy, internal radionuclide therapy - Brachytherapy, Boron Neutron Capture Therapy (BNCT). Gamma Knife Radiosurgery (Cyber Knife).Nuclear medicine - radio nuclide production and radiopharmaceuticals, tracers in biological substances, radioisotopes tagging for diagnostic or therapeutic purposes.

Unit III: Agricultural applications

Radiotracers - fertilizers uptake, retention and utilization, nutrients and water requirement estimation, mineral and elemental uptake and distribution by plants and crops. Nuclear moisture density gauge – Soil moisture monitoring. Soil sterilization using ionising radiation.Insect pest management – Pesticide residue monitoring in food, soil, ground water and environment. Crop improvement – sterile insect technique (SIT), radiation induce mutations to develop plants resistant to diseases, new crop breeding of improved variety (groundnut and black gram). Food processing and preservation – reducing post-harvest loss,

food preservation, extension of shelf life, irradiation from packaged food, postponing ripening of fruits.Animal diseases and their vectors.Animal production and health.

Reference Books:

1. Hall Eric J. Radiobiology for the radiologist, Lippincott Williams &Wikins, Philadelfia, 1994.
2. Eisenbud M. Environmental Radioactivity, Academic Press Inc. (London) Ltd., 24-28 Oval Road, London NW1 7DX, 1987.
3. Bushong, Stewart C. Radiological Science for technologists – physics, biology and protection, Mosby, St. Louis, 1997.
4. Edward L. Alphen, “Radiation Biophysics” Academic Press, Second Edition.

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