

## **OBM552 MEDICAL PHYSICS**

### DETAILED SYLLABUS

#### **OBJECTIVES:**

- To study the complete non-ionizing radiations including light and its effect in human body.
- To understand the principles of ultrasound radiation and its applications in medicine.
- To learn about radioactive nuclides and also the interactions of radiation with matters and how isotopes are produced.
- To study the harmful effects of radiation and radiation protection regulations.

#### **UNIT I NON-IONIZING RADIATION AND ITS MEDICAL APPLICATIONS**

Introduction to EM waves - Tissue as a leaky dielectric - Relaxation processes: Debye model, Cole– Cole model- Overview of non-ionizing radiation effects-Low Frequency Effects- Higher frequency effects. Physics of light-Measurement of light and its unit- limits of vision and color vision an overview - Applications of ultraviolet in medicine, Thermography.

#### **UNIT II ULTRASOUND IN MEDICINE**

Ultrasound fundamentals – Generation of ultrasound (Ultrasound Transducer) - Interaction of Ultrasound with matter: Cavitation, Reflection, Transmission- Scanning systems – Artefacts Ultrasound- Doppler-Double Doppler shift-Clinical Applications- Ultrasonography.

#### **UNIT III PRINCIPLES OF RADIOACTIVE NUCLIDES AND DECAY**

Introduction to Radioisotopes - Radioactive decay : Spontaneous Fission, Isomeric Transition, Alpha Decay, Beta Decay, Positron Decay, Electron Capture- Radioactive decay equations – Half life- Mean Life- Effective half-life - Natural and Artificial radioactivity, - Production of radionuclide – Cyclotron produced Radionuclide - Reactor produced Radionuclide: fission and electron Capture reaction, Target and Its Processing Equation for Production of Radionuclide - Radionuclide Generator Technetium generator.

#### **UNIT IV INTERACTION OF RADIATION WITH MATTER**

Interaction of charged particles with matter –Specific ionization, Linear energy transfer, range, Bremsstrahlung, Annihilation - Interaction of X and Gamma radiation with matter: Photoelectric effect, Compton Scattering, Pair production- Attenuation of Gamma Radiation - Interaction of

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*Notes*

*Syllabus*

*Question Papers*

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neutron with matter and their clinical significance- Radionuclide used in Medicine and Technology.

### **UNIT V RADIATION EFFECTS AND REGULATIONS**

Classification of Radiation Damage, Stochastic and Deterministic Effects, Acute Effects of Total Body Irradiation, Long-Term Effects of Radiation, Risk Versus Benefit in Diagnostic Radiology and Nuclear Medicine, Risk of Pregnant Women, Nuclear Regulatory Commission, ALARA Program, Medical Uses of Radioactive Materials, Survey for Contamination and Exposure Rate, Dose Calibrators and Survey Meters, Bioassay, Radioactive Waste Disposal.

### **OUTCOMES:**

At the end of the course, the student should be able to:

- Analyze the low frequency and high frequency effects of non-ionizing radiation and physics of light.
- Define various clinical applications based on ultrasound wave.
- Explain the process of radioactive nuclide production using different techniques
- Analyze radiation mechanics involved with various physiological systems
- Outline the detrimental effects of radiation and regulations for radiation safety.

### **TEXT BOOKS:**

1. B H Brown, R H Smallwood, D C Barber, P V Lawford and D R Hose, Medical Physics and Biomedical Engineering, 2nd Edition, IOP Publishers.2001. (Unit I & II)
2. Gopal B. Saha, Physics and Radiobiology of Nuclear Medicine, 4th Edition, Springer, 2013. (Unit III & IV)
- 3.R. Hendee and Russell Ritenour "Medical Imaging Physics", Fourth Edition William, WileyLiss, 2002. (Unit V)

### **REFERENCES:**

1. S. Webb "The Physics of Medical Imaging", Taylor and Francis, 1988
2. HyltonB.Meire and Pat Farrant "Basic Ultrasound" John Wiley & Sons, 1995
3. John R Cameran, James G Skofronick "Medical Physics" John-Wiley & Sons. 1978

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4. W.J.Meredith and J.B. Massey “ Fundamental Physics of Radiology” Third edition  
,Varghese Publishinghouse. 1992