

B. Sc. III Year		BPH-E504		Semester-V	
DSE 1		Medical Physics			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	3 Hrs	30	70	100	04

NOTE: The question paper shall consist of TWO sections (Sec.-A, Sec.-B). Sec.-A shall contain 10 short answer type questions of Five mark each and student shall be required to attempt any Five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

PHYSICS OF THE BODY-I

Mechanics of the body: Skeleton, forces, and body stability. Muscles and the dynamics of body movement Physics of body crashing; Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Pressure system of the body: Physics of breathing, Physics of the cardiovascular system. **(10 Lectures)**

PHYSICS OF THE BODY-II

Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound Optical system of the body: Physics of the eye. Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer. **(10 Lectures)**

Lectures)

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I

X-RAYS: Electromagnetic spectrum – production of x-rays – x-ray spectra- Brehmsstrahlung- Characteristic x-ray – X-ray tubes – Coolidge tube – x-ray tube design– tube cooling stationary mode – Rotating anode x-ray tube – Tube rating – quality and intensity of x-ray. X-ray generator circuits – half wave and full wave rectification – filament circuit – kilo voltage circuit – high frequency generator – exposure timer – HT cables. **(7 Lectures)**

RADIATION PHYSICS: Radiation units - exposure - absorbed dose – units: rad, gray - relative biological effectiveness - effective dose - inverse square law - interaction of radiation with matter - linear attenuation coefficient. Radiation Detectors -Thimble chamber- condenser chambers – Geiger counter – Scintillation counter – ionization chamber – Dosimeters – survey methods – area monitors – TLD and semiconductor detectors. **(7 Lectures)**

MEDICAL IMAGING PHYSICS: X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR) – NMR imaging – MRI Radiological imaging – Radiography – Filters – grids – cassette – X-ray film – film processing – fluoroscopy – computed tomography scanner – principle function – display – generations – mammography. Ultrasound imaging – magnetic resonance imaging – thyroid uptake system – Gamma camera (Only Principle, function and display). **(9 Lectures)**

RADIATION THERAPY PHYSICS: Radiotherapy – kilo voltage machines – deep therapy machines – Telecobalt machines – Medical linear accelerator. Basics of Teletherapy units – deep x-ray, Telecobalt units, medical linear accelerator – Radiation protection – external beam characteristics – phantom – dose maximum and build up – bolus – percentage depth dose – tissue – air ratio – back scatter factor. **(6 Lectures)**

RADIATION AND RADIATION PROTECTION: Principles of radiation protection-protective materials-radiation effects – somatic, genetic stochastic & deterministic effect, Personal monitoring devices – TLD film badge – pocket dosimeter. Radiation dosimetry, Natural radioactivity, Biological effects of radiation, Radiation monitors. **(6 Lectures)**

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II

Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography
Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment.

(5 Lectures)

References:

- Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978)
- Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
- Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
- Physics of Radiation Therapy : F M Khan - Williams and Wilkins, Third edition (2003)
- Physics of the human body, Irving P. Herman, Springer (2007).
- The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
- The Physics of Radiology-H E Johns and Cunningham.

(i) Course learning outcome:

This course will enable the student to

- Focus on the application of Physics to clinical medicine.
- Gain a broad and fundamental understanding of Physics while developing particular expertise in medical applications.
- Learn about the human body, its anatomy, physiology and biophysics, exploring its performance as a physical machine. Other topics include the Physics of the senses.
- He / She will study diagnostic and therapeutic applications like the ECG, radiation Physics, X-ray technology, ultrasound and magnetic resonance imaging.
- Gain knowledge with reference to working of various diagnostic tools , medical imaging techniques, how ionizing radiation interacts with matter, how it affects living organisms and how it is used as a therapeutic technique and radiation safety practices
- Imparts functional knowledge regarding need for radiological protection and the sources of and approximate level of radiation exposure for treatment purposes.
- In the laboratory course, the student will be exposed to the workings of various medical devices. He / she gets familiarized with various detectors used in medical imaging, medical diagnostics. The hands-on experience will be very useful for the students when he / she enter the job market.

(ii) Broad contents of the course:

- Physics of the Body-I
- Physics of the Body –II
- Physics of Diagnostic and Therapeutic Systems-I
- Radiation Physics
- Medical Imaging Physics
- Radiation Oncology Physics
- Radiation and Radiation Protection
- Physics of Diagnostic and Therapeutic Systems-II

(iii) Skills to be learned

Essential physics of Medical Imaging, Radiological Physics, Therapeutic Systems and Radiation Therapy is acquired.