



AGHOREKAMINI PRAKASHCHANDRA MAHAVIDYALAYA



ADD ON COURSE ON

Fundamentals of Medical Physics

ORGANIZED BY

DEPARTMENT OF PHYSICS

IN ASSOCIATION WITH

**IQAC, AGHOREKAMINI PRAKASHCHANDRA  
MAHAVIDYALAYA**

**COURSE TITLE:** Fundamentals of Medical Physics

**COURSE DURATION:** 36 HOURS (FROM 16.11.2021- 07.12.2021)

**COURSE OFFERED BY:** Dept. of **Physics**,  
A.K.P.C Mahavidyalaya  
Bengai, Hooghly

**PARTICIPATING TEACHERS:**

1. DR. SATYAKI KAR (Assistant Professor)
2. DR. SHAMPA MONDAL (Associate Professor)
3. DR. RAJIB KUMAR MANDAL (Assistant Professor)
4. SURAJIT GUIN (SACT)

**COURSE COORDINATOR:** Surajit Guin

(9734707361)

## SYLLABUS:

1. PHYSICS OF HUMANBODY: STANDARD ANATOMICAL POSITION, PLANES. FAMILIARITY WITH TERMS LIKE- SUPERIOR, INFERIOR, ANTERIOR, POSTERIOR, MEDIAL, LATERAL, PROXIMAL AND DISTAL. MECHANICS OF THE BODY: SKELETON, FORCES, AND BODY STABILITY. MUSCLES AND DYNAMICS OF BODY MOVEMENT. PHYSICS OF LOCOMOTOR SYSTEMS: JOINTS AND MOVEMENTS, STABILITY AND EQUILIBRIUM. ENERGY HOUSEHOLD OF THE BODY: ENERGY BALANCE IN THE BODY, ENERGY CONSUMPTION OF THE BODY, HEAT LOSSES OF THE BODY, THERMAL REGULATION. PRESSURE SYSTEM OF BODY: PHYSICS OF BREATHING, PHYSICS OF CARDIOVASCULAR SYSTEM.

2. 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 & TYPES: 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. SINGLE AND THREE PHASE ELECTRIC SUPPLY. POWER RATINGS. TYPES OF X-RAY GENERATOR, HIGH FREQUENCY GENERATOR, EXPOSURE TIMERS AND SWITCHES, HT CABLES.

3. RADIATION PHYSICS: RADIATION UNITS EXPOSURE, ABSORBED DOSE, UNITS: RAD, GRAY, RELATIVE BIOLOGICAL EFFECTIVENESS, EFFECTIVE DOSE- REM & SIEVERT, INVERSE SQUARE LAW. INTERACTION OF RADIATION WITH MATTER COMPTON & PHOTOELECTRIC EFFECT, LINEAR ATTENUATION COEFFICIENT. RADIATION DETECTORS: IONIZATION, CHAMBER. GEIGER MULLER COUNTER, SCINTILLATION COUNTERS AND SOLID STATE DETECTORS, TFT.

4. MEDICAL IMAGING PHYSICS: EVOLUTION OF MEDICAL IMAGING, X-RAY DIAGNOSTICS AND IMAGING, PHYSICS OF NUCLEAR MAGNETIC RESONANCE (NMR), NMR IMAGING, MRI RADIOLOGICAL IMAGING, ULTRASOUND IMAGING, PHYSICS OF DOPPLER WITH APPLICATIONS AND MODES, VASCULAR DOPPLER. RADIOGRAPHY: FILTERS, GRIDS, CASSETTE, X-RAY FILM, FILM PROCESSING, FLUOROSCOPY. COMPUTED TOMOGRAPHY SCANNER- PRINCIPLE AND FUNCTION, DISPLAY,

GENERATIONS, MAMMOGRAPHY. THYROID UPTAKE SYSTEM AND GAMMA CAMERA.

5. RADIATION ONCOLOGY PHYSICS: EXTERNAL BEAM THERAPY (BASIC IDEA): TELECOBALT, CONFORMAL RADIATION THERAPY (CRT), 3DCRT, IMRT, IMAGE GUIDED RADIOTHERAPY, EPID, RAPID ARC, PROTON THERAPY, GAMMA KNIFE, CYBER KNIFE. CONTACT BEAM THERAPY (BASIC IDEA): BRACHYTHERAPY- LDR AND HDR, INTRA OPERATIVE BRACHYTHERAPY. RADIOTHERAPY, KILO VOLTAGE MACHINES, DEEP THERAPY MACHINES, TELECOBALT MACHINES, MEDICAL LINEAR ACCELERATOR. BASICS OF TELETHERAPY UNITS, DEEP X-RAY, TELECOBALT UNITS, RADIATION PROTECTION, EXTERNAL BEAM CHARACTERISTICS, DOSE MAXIMUM AND BUILD UP – BOLUS, PERCENTAGE DEPTH DOSE, TISSUE MAXIMUM RATIO AND TISSUE PHANTOM RATIO, PLANNED TARGET VOLUME AND GROSS TUMOUR VOLUME.

6. RADIATION AND RADIATION PROTECTION: PRINCIPLES OF RADIATION PROTECTION, PROTECTIVE MATERIALS RADIATION EFFECTS, SOMATIC, GENETIC STOCHASTIC AND DETERMINISTIC EFFECT. PERSONAL MONITORING DEVICES: TLD FILM BADGE, POCKET DOSIMETER, OSL DOSIMETER. RADIATION DOSIMETER. NATURAL RADIOACTIVITY, BIOLOGICAL EFFECTS OF RADIATION, RADIATION MONITORS. STEPS TO REDUCE RADIATION TO PATIENT, STAFF AND PUBLIC. DOSE LIMITS FOR OCCUPATIONAL WORKERS AND PUBLIC. AERB: EXISTENCE AND PURPOSE.

## MODULES:

### UNIT- 1

Basic Anatomical Terminology. (Time: 4 Hours)

### UNIT- 2

Production and Applications of X-Ray (Time: 6 Hours)

### UNIT- 3

Radiations, detectors and Counters (Time: 7 Hours)

## UNIT- 4

Physics of imaging: NMR imaging, Doppler imaging Ultrasound imaging etc.

(Time: 7 Hours)

## UNIT- 5

Applications of radiation therapy in oncology. (Time: 5 Hours)

## UNIT- 6

Radiation from radioactive substances and protections. (Time: 7 Hours)

## PROGRAMME OUTCOME:

1. STUDENTS WILL LEARN ABOUT ANATOMICAL TERMINOLOGY OF HUMAN BODY.
2. STUDENTS WILL BE AWARE ABOUT PRODUCTION AND USE OF X-RAY IN MEDICAL SCIENCE.
3. STUDENT AND PATIENT'S OPINION WILL LEARN ABOUT THE IMPORTANCE PHYSICS RULES OF DIFFERENT IMAGING IN MEDICAL SCIENCE
4. STUDENTS AS WELL AS PATIENT'S AWARENESS ON RADITHERAPY IN ONCOLOGY WILL INCREASE.

## COURSE OUTCOME:

CO -1 : STUDENTS WILL LEARN ABOUT THE ANATOMY OF HUMAN BODY.

CO -2 : THEY WILL KNOW ABOUT THE PRODUCTION OF X-RAY

CO 3 : IT WILL BE POSSIBLE TO KNOW WHAT IS THE APPLICATIONS OF X-RAY IN RADIOLOGY.

CO 4 : STUDENTS AS WELL AS CITIZENS WILL BE ABLE TO LEARN ABOUT THE ROLE OF ULTRASOUND, NMR SPECTROSCOPY IN IMAGING.

CO 5 : STUDENTS AND CITIZENS WILL LEARN ABOUT IMPORTANCE OF RADIO PHYSICS IN ONCOLOGY.

CO 6 : THEY WILL LEARN ABOUT THE POSITIVE AND NEGATIVE EFFECTS OF PATIENT'S BODY DUE ON RADIATIONS.

### MODE OF EVALUATION:

After the completion of course, written examination will be taken for 80 Marks and a viva will be conducted for 20 Marks. On the basis of marks obtained for written examination and viva, the results will be prepared. The gradation system for the declaration of results will be as follows:

#### Grading system

|             |           |           |       |               |         |               |       |      |
|-------------|-----------|-----------|-------|---------------|---------|---------------|-------|------|
| Level       | Excellent | Very Good | Good  | Above Average | Average | Below Average | Poor  | Fail |
| Grade       | A+        | A         | B+    | B             | C       | D             | E     | F    |
| Marks range | 90-100    | 80-89     | 70-79 | 60-69         | 50-59   | 40-49         | 33-40 | 0-32 |