



**DHANALAKSHMI SRINIVASAN**  
**INSTITUTE OF TECHNOLOGY**  
(Approved by AICTE, New Delhi & Affiliated to Anna University)  
NH - 45, Trichy - Chennai Trunk Road,  
SAMAYAPURAM, TRICHY - 621 112.  
E.mail: dsit2011@gmail.com Website: www.dsit.ac.in

## COURSE PLAN

<b>Subject code: BM8401</b>	<b>Branch/Year/Sem/Section: B.E BME/II/IV</b>
<b>Subject Name: MEDICAL PHYSICS</b>	<b>Batch:2018-2022</b>
<b>Staff Name: DR.K.BASKARAN</b>	<b>Academic year:2019-2020</b>

### COURSE OBJECTIVE

- To study principles and effects of ionizing and non-ionizing radiation in human body
- To discuss the physics of the senses
- To explore the effects of radiation in matter and how isotopes are produced
- To understand various detectors for detecting the presence of ionizing radiation.

### TEXT BOOK:

T1. Gopal B. Saha, —Physics and Radiobiology of Nuclear Medicine, 4th Edition, Springer, 2013.

T2. 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.

### REFERENCES:

R1. S.Webb — The Physics of Medical Imaging, Taylor and Francis, 1988

R2. J.P.Woodcock, —Ultrasonic, Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002

R3. Hylton B. Meire and Pat Farrant —Basic Ultrasound, John Wiley & Sons, 1995

### WEB RESOURCES

W1. <https://www.sciencedirect.com/topics/engineering/scintillation-detector> (TOPIC-38,39)

W2. [https://en.wikipedia.org/wiki/Gamma-ray\\_spectrometer](https://en.wikipedia.org/wiki/Gamma-ray_spectrometer) (TOPIC -40)

W3. [https://en.wikipedia.org/wiki/Liquid\\_scintillation\\_counting](https://en.wikipedia.org/wiki/Liquid_scintillation_counting) (TOPIC-41,42)

W4. <https://www.radiologyinfo.org/en/info.cfm?pg=thyroiduptake> (TOPIC-43,44)

W5. [https://en.wikipedia.org/wiki/Geiger\\_counter](https://en.wikipedia.org/wiki/Geiger_counter) (TOPIC-45)

### TEACHING METHODOLOGIES:

- BB - BLACK BOARD
- VIDEO - VIDEO TUTORIAL
- PPT - POWER POINT PRESENTATION



# DHANALAKSHMI SRINIVASAN INSTITUTE OF TECHNOLOGY

(Approved by AICTE, New Delhi & Affiliated to Anna University)

NH - 45, Trichy - Chennai Trunk Road,

SAMAYAPURAM, TRICHY - 621 112.

E.mail: dsit2011@gmail.com Website: www.dsit.ac.in

## DEPARTMENT OF BIOMEDICAL ENGINEERING

**BM8401**

**MEDICAL PHYSICS**

**LTPC**

**3 0 0 3**

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

**9**

Introduction and objectives - 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, Ultraviolet

### **UNIT-II PHYSICS OF THE SENSES**

**7**

Introduction and objectives - Cutaneous sensation - The chemical senses - Audition -Vision - Psychophysics

### **UNIT-III PRINCIPLES OF RADIOACTIVE NUCLIDES**

**10**

Radioactive Decay - Spontaneous Emission - Isometric Transition - Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Decay series, Production of radionuclides - Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, Target and Its Processing Equation for Production of Radionuclides, radionuclide Generator-Technetium generator

### **UNIT- IV RADIOACTIVE DECAY AND INTERACTION OF RADIATION WITH MATTER**

**11**

Spontaneous Fission- Isomeric Transition-Alpha Decay-Beta Decay-Positron Decay-Electron Capture- 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 neutron with matter and their clinical significance.

### **UNIT V SCINTILLATION, SEMICONDUCTOR and GAS FILLED DETECTORS**

**8**

Scintillation Detectors - Solid Scintillation Counters - Gamma-Ray Spectrometry-Liquid Scintillation Counters-Characteristics of Counting Systems-Gamma Well Counters-Thyroid Probe-Principles of Gas-Filled Detectors - Ionization Chambers-Geiger-Müller Counters

**TOTAL: 45 PERIODS**

Topic No	Topic Name	Books For reference	Page No	Teaching Methodology	No of periods required	Cumulative periods
<b>UNIT I NON-IONIZING RADIATION AND ITS MEDICAL APPLICATIONS (9)</b>						
1.	Introduction and objectives - Tissue as a leaky dielectric -	T2	248-251	BB	1	1
2.	Relaxation processes, Debye model,	T2	251-253	BB	1	2
3.	Cole–Cole model,	T2	253-255	BB	1	3
4.	Overview of non-ionizing radiation effects	T2	255-257	BB	1	4
5.	Low Frequency Effects	T2	257-262	BB	1	5
6.	Higher frequency effects.	T2	262-264	BB	1	6
7.	Physics of light, Measurement of light and its unit	T2	124-128	BB	1	7
8.	- limits of vision and color vision an overview,	T2	133-137	BB	1	8
9.	Ultraviolet	T2	264-265	BB	1	9
<b>LEARNING OUTCOME:</b>						
<b>At the end of unit , the students will be able to</b>						
<ul style="list-style-type: none"> <li>• Know the fundamentals of Non-ionizing radiation.</li> <li>• Understand the concept of ionizing radiation.</li> <li>• Define the types of models.</li> </ul>						
<b>UNIT II PHYSICS OF THE SENSES (7)</b>						
10.	Introduction and objectives	T2	100	BB	1	10
11.	Importance of sense	T2	101	BB	1	11
12.	Cutaneous sensation	T2	101-104	BB	1	12
13.	The chemical senses	T2	104-107	BB	1	13
14.	Audition	T2	107-124	BB	1	14
15.	Vision	T2	124-137	BB	1	15

16.	Psychophysics	T2	137-139	BB & VIDEO	1	16
<b>LEARNING OUTCOME:</b>						
<b>At the end of unit , the students will be able to</b>						
<ul style="list-style-type: none"> <li>• Understand the concept of importance of senses.</li> <li>• Define cutaneous sensation.</li> <li>• Gain the knowledge about audition &amp; vision.</li> </ul>						
<b>UNIT - III</b>		<b>PRINCIPLES OF RADIOACTIVE NUCLIDES</b>				<b>(10)</b>
17	Radioactive Decay ,Spontaneous Emission ,Isometric Transition	T2	331-335	BB	1	17
18	Gamma ray emission, alpha, beta, Positron decay, electron capture,	T2	336-341	BB & VIDEO	1	18
19	Sources of Radioisotopes Natural and Artificial radioactivity,	T2	350-355	BB	1	19
20	Radionuclide used in Medicine and Technology	T2	356-362	BB	1	20
21	Decay series, Production of radionuclides	T2	365-371	BB	1	21
22	Cyclotron produced Radionuclide- Reactor produced Radio	T2	375-380	BB	1	22
23	nuclide-fission and electron Capture reaction,	T2	380-388	BB	1	23
24	Target and Its Processing Equation for Production of Radionuclides,	T2	390-395	BB	1	24
25	radionuclide Generator	T2	401-407	BB	1	25
26	Technetium generator.	T2	407-415	BB	1	26
<b>LEARNING OUTCOME:</b>						
<b>At the end of unit , the students will be able to</b>						
<ul style="list-style-type: none"> <li>• Understand the concept of radioactive decay.</li> <li>• Gain knowledge about radio-isotopes.</li> <li>• Define generator.</li> </ul>						

<b>UNIT IV RADIOACTIVE DECAY AND INTERACTION OF RADIATION WITH MATTER (11)</b>						
27	Spontaneous Fission- Isomeric Transition-Alpha Decay	T2	502-509	BB	1	27
28	Beta Decay-Positron Decay	T2	510-513	BB & VIDEO	1	28
29	-Electron Capture-Interaction of charged particles with matter	T2	515-520	BB	1	29
30	Specific ionization, Linear energy transfer range	T2	521-523	BB	1	30
31	Bremsstrahlung	T2	525-530	BB	1	31
32	Annihilation, Interaction of X and Gamma radiation with matter	T2	531-540	BB	1	32
33	Photoelectric effect	T2	541-545	BB	1	33
34	Compton Scattering , Pair production	T2	545-550	BB	1	34
35	Attenuation of Gamma Radiation	T2	551-553	BB	1	35
36	Interaction of neutron with matter	T2	554-560	BB	1	36
37	clinical significance.	T2	561-563	BB	1	37

**LEARNING OUTCOME:**

**At the end of unit , the students will be able to**

- Understand the concept of radioactive decay.
- Known about Bremsstrahlung.
- Get the knowledge about photoelectric effect.

<b>UNIT V SCINTILLATION, SEMICONDUCTOR and GAS FILLED DETECTORS (8)</b>						
38	Scintillation Detectors	W1	-	BB	1	
39	Solid Scintillation Counters	W1	-	BB	1	
40	Gamma-Ray Spectrometry	W2	-	BB	1	
41	Liquid Scintillation Counters	W3	-	BB	1	

42	Characteristics of Counting Systems-Gamma Well Counters	W3	-	BB	1	
43	Thyroid Probe-Principles of Gas	W4	-	BB	1	
44	Filled Detectors - Ionization Chambers	W4	-	PPT	1	
45	Geiger-Müller Counters	W5	-	PPT	1	

**LEARNING OUTCOME:**

**At the end of unit , the students will be able to understand detectors and its importance.**

**COURSE OUTCOME**

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

- Explain about non-ionizing radiation, interaction with tissue and its effects.
- Define and compare intensities of sensory stimuli
- Summarizes how ionizing radiation interacts with the human body, how to quantify it and its levels seen in the environment and healthcare
- Explain the fundamentals of radioactivity and radioactive isotopes
- Illustrates the methods of detecting and recording the ionizing radiation and its interaction with matter

**CONTENT BEYOND THE SYLLABUS**

- Ultrasound

**CONTINUES INTERNAL ASSESSMENT DETAILS**

ASSESMENT NUMBER	I	II	MODEL
TOPIC NO.(UNIT)	1-16(1 <sup>st</sup> & 2 <sup>nd</sup> units)	13-37 (3 <sup>rd</sup> & 4 <sup>th</sup> units)	1-45 (units 1-5)

**ASSIGNMENT DETAILS**

ASSIGNMENT NUMBER	I	II	III
TOPIC NUMBER FOR REFERENCE	1-16(1 <sup>st</sup> & 2 <sup>nd</sup> units)	17-37 (3 <sup>rd</sup> & 4 <sup>th</sup> units)	1-45 (units 1-5)
DEAD LINE			

<b>ASSIGNMENT NUMBER</b>	<b>BATCH</b>	<b>DESCRIPTIVE QUESTIONS/TOPIC (Minimum of 8 Pages)</b>
<b>I</b>	60 members	Non-Ionizing Radiation And importance of senses
<b>II</b>	60 members	Radionuclide Generator & Attenuation of Gamma Radiation
<b>III</b>	60 members	Interaction of neutron with matter & Geiger-Müller Counters