MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
(Formerly West Bengal University of Technology)
Syllabus of B. Sc. in Radiology & Imaging Technology
(Effective from 2024-25 Academic Sessions)

Semester-II

Course Name: Basics of Human Physiology

Mode: Offline **Credits: 5 (3T+2P)**
BMMIT 2101 & BMMIT 2191

Aim of the Course: To acquaint students with basic Concepts of human Physiology

Course Objectives:

To impart basic knowledges related to General physiology, Haematology, Nerve-Muscle physiology, Cardiovascular, Digestive , Respiratory physiology and other branches of physiology

To know about general physiology , homeostasis and related knowledges.

To acquaint students with properties and functions of Blood, Haemopoesis ,Blood Groups

To impart knowledge on Cardio vascular system -general organization, functions & importance of CVS , properties of cardiac muscle, Junctional tissues of heart & their functions, Origin & spread of Cardiac Impulse, cardiac pacemaker, Cardiac cycle & E C G - etc.

To acquaint students with properties and functions of Digestive system ,the innervations & blood supply of Digestive system, Movements of Digestive System (Intestine), Digestion & Absorption of Carbohydrate, Proteins & Fats.

The Students will acquire knowledge about Respiratory System –Physiologic anatomy, functions of respiratory system, non respiratory functions of lung, Mechanism of respiration, Lung Volumes & capacities, Transport of Respiratory GasesO2, Transport of Respiratory Gases CO2, Regulation of Respiration etc.

To impart knowledge on Muscle nerve physiology and nervous system , Structure of neuron & types, Structure of skeletal Muscle, sarcomere, Neuromuscular junction& Transmission. Excitation & contraction coupling (Mechanism of muscle contraction). Functions of Nervous system , Neuron – Conduction of Impulses, factors affecting, Synapse- transmission, Receptors, Reflexes etc.

Knowledge of Special senses-and skin- vision, colorblindness,

Mechanism of Hearing, Deafness, structure and function of skin, Body temperature, Regulation of Temperature & fever etc will be the acquired knowledge.

To impart knowledge on Endocrine System , description of various endocrine glands and their functions.

The Students will acquire knowledge about male and female Reproductive systems - Structure & Functions Tests for Ovulation, Oestrogen & Progesterone , Pregnancy test, Parturition. Contraceptives, Lactation etc.

To impart knowledge on Excretory System-structure & functions of kidney, Renal circulation, Mechanism of Urine formation, Artificial Kidney

Students will be skilled on and other related knowledges.

Sl	Graduate attributes	Mapped modules
CO1	**To acquaint students with General Physiology- with an Introduction to physiology, Homeostasis etc**	**M1**
CO2	**Students will know the properties and functions of Blood, Haemopoesis , Haemogram (RBC, WBC, Platelet count, Hb Concentrations), Blood Groups - ABO and RH grouping, Coagulations & Anticoagulants, Anaemias: Causes, effects & treatment, Body Fluid: Compartments, Composition, Immunity.**	**M2**
CO3	**The students will have the concepts of Cardio vascular system - general organization, functions & importance of CVS , properties of cardiac muscle, Junctional tissues of heart & their functions, Origin & spread of Cardiac Impulse, cardiac pacemaker, Cardiac cycle & E C G**	**M3**
CO4	**To acquaint students with Digestive system –innervations & blood supply of Digestive system, Movements of Digestive System (Intestine), Digestion & Absorption of Carbohydrate, Proteins & Fats.**	**M4**
CO5	**The students will have knowledge on Respiratory System – Physiologic anatomy, functions of respiratory system, Mechanism of respiration, Lung Volumes & capacities, Transport of Respiratory GasesO2, Transport of Respiratory Gases CO2, Regulation of Respiration etc.**	**M5**
CO6	**To acquaint students with Muscle nerve physiology and nervous system along with neuron structure & types, Structure of skeletal Muscle, sarcomere, Neuromuscular junction& Transmission.. Functions of Nervous system , Neuron – Conduction of Impulses, etc**	**M6**
CO7	**The Students will acquire knowledge about Special senses-and skin, Vision, functions of different parts, Refractive errors of Eye and correction, Visual Pathway, colour Blindness, Hearing, Mechanism of Hearing, Structure and function of skin, Body temperature, Regulation of Temperature & fever.**	**M7**
CO8	**Students will know about Endocrine System ,description of various endocrine glands and their functions**	**M8**
CO9	**A thorough knowledge will be acquired on Reproductive systems - Structure & Functions of male and femaleReproductive system, Male Reproductive System: spermatogenesis, Testosterone, Female reproductive system -and related topics.**	**M9**
CO10	**To impart knowledge on excretory system-function and physiology**	**M10**

Learning Outcome/ Skills:

To impart basic knowledge about the basic components of prokaryotic and eukaryotic cells, cellular Structure and organization, Basics Techniques of Cell Biology like cell fragmentation, separation, Structure and Function of Cell organelles for secretion, transport, protein synthesis and heredity, cell cycle, apoptosis and cancer.

Module Number	Content	Total Hours	% of questions	Bloom Level (applicable)	Remarks, if any
THEORY					
M1	**General Physiology-** **Introduction to physiology, Homeostasis**	**2**	**04**	**1, 2**	**NA**
M2	**Blood-properties and functions of Blood, Haemopoesis , Haemogram (RBC, WBC, Platelet count, Hb Concentrations), Blood Groups -**	**3**	**10**	**1, 2, 3**	**NA**
M3	Cardio vascular system **- functions & importance of CVS , properties of cardiac muscle, Origin & spread of Cardiac Impulse, cardiac pacemaker, Cardiac cycle & E C G**	**4**	**10**	**1, 2, 3**	**NA**
M4	**Digestive system –** **blood supply of Digestive system, Composition and functions of all Digestive juices, Movements of Digestive System (Intestine), Digestion & Absorption of Carbohydrate, Proteins & Fats**	**5**	**10**	**1, 2, 3**	**NA**
M5	**Respiratory System –** **functions of respiratory system, Mechanism of respiration, Lung Volumes & capacities, Regulation of Respiration**	**4**	**15**	**1, 2, 3**	**NA**
M6	**Muscle nerve physiology and nervous system** **Structure of neuron ,skeletal Muscle, sarcomere, Neuromuscular junction& Transmission. Excitation &**	**10**	**15**	**1,2,3,4**	**NA**

	contraction coupling (Mechanism of muscle contraction). Functions of Nervous system .Functions of various parts of the Brain.Cerebro-Spinal Fluid (CSF)				
M7	**Special senses-and skin Structure and function of Eye, colour Blindness, Hearing: Tests for Hearing (Deafness) Skin - function, Body temperature, Regulation of Temperature & fever**	**4**	**10**	**1,2,3**	**NA**
M8	**Endocrine System ,description of various endocrine glands and their functions**	**3**	**10**	**2,3,4**	**NA**
M9	**- Structure & Functions of Reproductive system, Male and female Reproductive System: Tests for Ovulation, Oestrogen & Progesterone , Pregnancy test, Parturition. Contraceptives, Lactation**	**6**	**10**	**3,4**	**NA**
M10	**Excretory System General Introduction, structure & functions of kidney, Renal circulation,Mechanism of Urine formation, Artificial Kidney**	**4**	**6**	**2,3**	**NA**
Total Theory		**45**	**100**	**1, 2, 3**	**NA**
Practical		**30**			**NA**
	TOTAL	**75**			**NA**

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Detailed Syllabus

Module 1:
General Physiology-
Introduction to physiology, Homeostasis, Transport Across cell membrane
Total Hours: 2

Module 2:

Blood –

Composition, properties and functions of Blood, Haemopoesis , Haemogram (RBC, WBC, Platelet count, Hb Concentrations), Blood Groups - ABO and RH grouping, Coagulations & Anticoagulants, Anaemias: Causes, effects & treatment, Body Fluid: Compartments, Composition, Immunity – Lymphoid tissue

Total Hours: 3

Module 3:
Cardio vascular system - Introduction, general organization, functions & importance of CVS , Structure of heart, properties of cardiac muscle, Junctional tissues of heart & their functions, Origin & spread of Cardiac Impulse, cardiac pacemaker, Cardiac cycle & E C G, Heart Rate & its regulation, Cardiac output, Blood Pressure definition & normal values, Physiological needs & variation, regulation of BP
Total Hours: 4

Module 4:
Digestive system –
General Introduction, organization, innervations & blood supply of Digestive system, Composition and functions of all Digestive juices,Movements of Digestive System (Intestine), Digestion & Absorption of Carbohydrate, Proteins & Fats
Total Hours: 5

Module 5:
Respiratory System –
Physiologic anatomy, functions of respiratory system, non respiratory functions of lung, Mechanism of respiration, Lung Volumes & capacities, Transport of Respiratory GasesO2, Transport of Respiratory Gases CO2, Regulation of Respiration
Total Hours: 4

Module 6:.
Muscle nerve physiology and nervous system
Structure of neuron & types, Structure of skeletal Muscle, sarcomere, Neuromuscular junction& Transmission. Excitation & contraction coupling (Mechanism of muscle contraction). Functions of Nervous system , Neuron – Conduction of Impulses, factors affecting, Synapse- transmission, Receptors, Reflexes Ascending tracts, Descending tracts, Functions of various parts of the Brain.Cerebro-Spinal Fluid (CSF): Composition,
Total Hours: 10

Module 7.
Special senses-and skin
Vision: Structure of Eye, functions of different parts, Refractive errors of Eye and correction, Visual Pathway, Colour vision & tests for colour Blindness, Hearing: Structure and function of ear, Mechanism of Hearing, Tests for Hearing (Deafness)
Skin - Structure and function, Body temperature, Regulation of Temperature & fever

Total Hours: 4

Module 8.
Endocrine System - Short description of various endocrine glands and their functions
Total Hours: 3

Module 9.
Reproductive systems - Structure & Functions of Reproductive system, Male Reproductive System: spermatogenesis, Testosterone, Female reproductive system: Ovulation, Menstrual cycle, Oogenesis, Tests for Ovulation, Oestrogen & Progesterone , Pregnancy test, Parturition. Contraceptives, Lactation: Composition of Milk, advantages of breast Feeding
Total Hours-6

Module 10.
Excretory System
General Introduction, structure & functions of kidney, Renal circulation, Glomerular filtration & tubular reabsorption, Nephron, Juxta Glomerular Apparatus,Mechanism of Urine formation, Micturition, Cystomatrogram.Diuretics, Artificial Kidney
Total Hours-4

PRACTICAL

Credit: 2

Total Hours: 30
(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Study of Microscope and its use, Collection of Blood and study of Haemocytometer
2. Haemoglobinometry
3. White Blood Cell count
4. Red Blood Cell count
5. Determination of Blood Groups
6. Leishman's staining and Differential WBC Count
7. Determination of Bleeding Time, Determination of Clotting Time
8. Pulse & Blood Pressure Recording, Auscultation for Heart Sounds
9. Artificial Respiration –Demonstration, Spirometry-Demonstration Recording of body temperature
10. Examination of sensory system
11. Examination of motor system and Eye
12. Examination of ear

Suggested Readings:

Text book
1. Basics of medical Physiology –D Venkatesh and H.H Sudhakar, 3 rd
2. Principles of Physiology – Devasis Pramanik, 5 th edition.
3. Human Physiology for BDS –Dr A.K. Jain, 5 th edition.
4. Textbook of human Physiology for dental students-Indu khurana 2nd edition.
5. Essentials of medical Physiology for dental students –Sembulingum.

Reference books:
1. Textbook of Medical Physiology, Guyton , 2 nd South Asia Edition.
2. Textbook of Physiology Volume I & II (for MBBS) – Dr. A. K. Jain.
3. Comprehensive textbook of Medical Physiology Volume I & II – Dr. G. K. Pal..

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Course Name: Fundamental Physics and basics of Radiation Physics

Mode: Offline **Credits: 5(3T+2P)**
BMMIT 2102 & BMMIT 2192

Aim of the Course: To acquaint students with basic Concepts of Electricity and Magnetism, about X Ray related activities .

Course Objectives:

To impart basic knowledge about the basic concepts on Units and measurements-Force, work, power and energy-Temperature and heat

To have an overview on Electricity and magnetism-including Electric charges, Coulomb's law, magnetism and principles, Magnetic inductions.

To know about Electromagnetic Induction,Induced electro motive force-Faradays experiments- and related knowledges.

To acquaint students with X-rays-Discovery of x-rays- properties-production- x-ray spectrum etc.

To impart knowledge on X-ray generator circuits- Vacuum tube diodes-semi conductor diodes-transister, Discovery of radioactivity, natural radioactivity- etc.

The Students will acquire knowledge about interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, Radiation detection and measurement etc.

Students will be skilled on Radiation quantities and units, Radiation intensity-exposure, roentgen, its limitations and other related knowledges.

Sl	**Graduate attributes**	**Mapped modules**
CO1	To acquaint students with **Basic concepts** on Units and measurements-Force, work, power and energy-Temperature and heat	**M1**
CO2	students will know the **Electricity and magnetism**: Electric charges, Coulomb's law, magnetism and principles, Magnetic inductions.	**M2**
CO3	The students will have the concepts of **Electromagnetic Induction**-Induced electro motive force-Faradays experiments- laws of electro magnetic induction-	**M3**
CO4	To acquaint students with X-rays-Discovery of x-rays- properties-production- x-ray spectrum etc.	**M4**
CO5	The students will have knowledge on **X-ray generator circuits**- Vacuum tube diodes-semi conductor diodes-transister rectification, half and full wave-self rectification – X-ray generator; filament circuit-kilo voltage circuit-single phase generator-three phase generator-constant potential generator Fuses etc.	**M5**
CO6	**To acquaint students with Radioactivity-Discovery of radioactivity, natural radioactivity-activity units- radium, thorium and uranium series- alpha, beta decay and gamma rays - radioactive disintegration**	**M6**

	exponential decay, half-life period, decay constant, Artificial radioactivity etc	
CO7	**The Students will acquire knowledge about interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, half value layer, linear attenuation coefficient-coherent scattering-photoelectric effect- etc**	**M7**
CO8	**Students will be skilled on Radiation quantities and units: Radiation intensity-exposure, roentgen, its limitations kerma and absorbed dose-electronic equilibrium etc.**	**M8**
CO9	**A thorough knowledge will be acquired on radiation detection and measurements, the principle of radiation detection-and related topics.**	**M9**

Learning Outcome/ Skills:

To impart basic knowledge about the basic components of prokaryotic and eukaryotic cells, cellular Structure and organization, Basics Techniques of Cell Biology like cell fragmentation, separation, Structure and Function of Cell organelles for secretion, transport, protein synthesis and heredity, cell cycle, apoptosis and cancer.

Module Number	Content	Total Hours	% of questions	Bloom Level (applicable)	Remarks, if any
THEORY					
M1	**Basic concepts on various Units and measurements**	**5**	**10**	**1, 2**	**NA**
M2	**Electricity and magnetism- various aspects**	**4**	**10**	**1, 2, 3**	**NA**
M3	**Electromagnetic Induction**	**5**	**10**	**1, 2, 3**	**NA**
M4	**X-rays-Discovery of x-rays and properties-**	**6**	**10**	**1, 2, 3**	**NA**
M5	**X-ray generator circuits**	**5**	**15**	**1, 2, 3**	**NA**
M6	**Radioactivity**	**5**	**15**	**1,2,3**	**NA**
M7	**Interaction of X and gamma rays**	**5**	**10**	**1,2,3**	**NA**
M8	**Radiation quantities and units:**	**4**	**10**	**2,3,4**	**NA**
M9	**Radiation detection and measurements**	**6**	**10**	**3,4**	**NA**

Total Theory		**45**	**100**	**1, 2, 3**	**NA**
Practical		**30**			**NA**
	TOTAL	**75**			**NA**

Detailed Syllabus

Module 1:

Basic concepts:
Units and measurements-Force, work, power and energy-Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization-excitation-Binding energy-electron volt Electromagnetic radiation-Quantum nature of radiation-mass energy equivalence, Fluorescence-electromagnetic spectrum

Total Hours: 5

Module 2:

Electricity and magnetism: Electric charges, Coulomb's law -Unit of charge-Electric potential, unit of potential-Electric induction, capacitance and capacitors, series and parallel connection-electric current, unit, resistance, ohm's law, electric power, Joule's law Magnetism: Magnetic induction-magnetic properties-Hysteresis-magnetic effect of current-Electrical instruments, Galvanometer, voltmeter, ammeter and multimeter.

Total Hours: 4

Module 3:

Electromagnetic Induction: Induced electro motive force-Faradays experiments- laws of electromagnetic induction-Self and mutual induction-Alternating current- Ac generatorPeak and RMS values- AC circuits with resistance-capacitance and inductance- Choke coil- eddy current. Transformer-theory, design, losses- auto transformer- high voltage transformer- electric power transmission

Total Hours: 5

Module 4:

X-rays: Discovery of x-rays- properties-production- x-ray spectrum- bremsstrahlung and characteristic x-rays-X-ray tube; Coolidge tube, tube design, line focus principle-space charge effect, tube cooling- Modern x-ray tubes-stationary anode, rotating anode, grid controlled x-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating-Quality and intensity of x-rays-, factors influencing them.

Total Hours: 6

Module 5: X-ray generator circuits: Vacuum tube diodes-semiconductor diodes-transister rectification, half and full wave-self rectification – X-ray generator; filament circuit-kilo voltage circuit-single phase generator-three phase generator-constant potential generator Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthing

Total Hours: 5

Module 6:.Radioactivity: Discovery of radioactivity, natural radioactivity-activity units- radium, thorium and uranium series- alpha, beta decay and gamma rays - radioactive disintegration exponential decay, half life period, decay constant. Artificial radioactivity –production of radioisotopes-cyclotron-neutron-fission and fusion-chain reaction-atom bomb-nuclear reactor.
Total Hours: 5

Module 7.Interaction of X and gamma rays:
Transmission through matter, law of exponential attenuation, half value layer, linear attenuation coefficient-coherent scattering-photoelectric effect- compton scattering-pair production-photonuclear disintegration-Particle interactions. Interactions of x and gamma rays in the body; fat-soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance
Total Hours: 5

Module 8.
Radiation quantities and units:
Radiation intensity-exposure, roentgen, its limitations kerma and absorbed dose-electronic equilibrium-rad, gray, conversion factor for roentgen to rad-RBE-LET-quality factor-dose equivalent-rem, sievert.
Total Hours: 4

Module 9.
Radiation detection and measurements: Principle of radiation detection-Ionization chamber-proportional counter-GM tubes-scintillation detectors-semiconductor detectorGamma ray spectrometer. Measuring system: free ionization chamber-thimble ion chamber condenser chamber-victoreen electrometer-secondary standard dosimeter-film dosimeter chemical dosimeter-thermo-luminecent dosimeter-Pocket dosimeter. Radiation survey meterzone monitor-contamination monitor, their function use and maintenance
Total Hours-6

PRACTICAL

Credit: 2

Total Hours: 30

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

13. Student should know the procedures adopted in Imaging Radiographs and should bev given an overview of diagnostic Radiology:
14. Cross sectional diagram of X-ray Film.
15. Cross sectional diagram of Intensifying Screen.
16. Characteristic Curve.
17. X-ray Tube

Suggested Readings:

Text book
1.First year Physics for Radiographers - Hay & Hughes.
Reference books
1.Basic radiological physics-K.Thayalan, Jaypee publishers (P) Ltd, New Delhi(2001)
2.Fundamental of X-ray and Radium Physics - Joseph Selman
3.Basic Medical Radiation Physics - Stanton.
4.Chrtistensen's Physics of Diagnostic Radiology - Christesen.