DEPARTMENT OF EMERGING TECHNOLOGY

Scheme & Syllabus of

Integrated B.Sc. (Hons/Hons. with Research) - M.Sc.

Medical Imaging Technology

Programme under National Education Policy 2020

(w.e.f. 2023-24)

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

(Established by State Legislature Act 17 of 1995)

'A^{+}' GRADE NAAC Accredited

SEMESTER-I

Course Code	Course	Nomenclature	Teaching Schedule			Credits	Hrs/ week	Marks		
			L	T	P			Ext.	Int	Total
23MIT101T	Discipline Specific Course (DSC-A1)	Human Anatomy & Physiology - I	3	0	0	3	3	50	25	75
23MIT101P		Human Anatomy & Physiology – I Lab	0	0	2	1	2	15	10	25
23MIT103T	Discipline Specific Course (DSC-B1)	Radiographic Photography	4	0	0	4	4	70	30	100
23MIT105T	Discipline Specific Course (DSC-C1)	Fundamentals of Medical Imaging Technology	4	0	0	4	4	70	30	100
23MIT107T	Minor Course (MIC1)	Introduction to National Healthcare System	2	0	0	2	2	35	15	50
23MIT109T	Multidisciplinary Course (MDC1)	Basic Physics	3	0	0	3	3	50	25	75
23ENG101	Ability Enhancement Course (AECI)	English	2	0	0	2	2	35	15	50
23MIT111T	Skill Enhancement Course (SEC1)	Essentials of Computer Science	2	0	0	2	1	35	15	50
23MIT111P		Essentials of Computer Science Lab	0	0	2	1	2	15	10	25
23EVL101	Value Added Course (VAC1)	Environmental Science	2	0	0	2	2	35	15	50
						24	**26**	**415**	**185**	**600**

SEMESTER-II

Paper code	Course	Nomenclature	Teaching Schedule			Credits	Hrs/ week	Marks		
			L	T	P			Ext.	Int.	Total
23MIT102T	Discipline Specific Course (DSC-A1)	Human Anatomy & Physiology - II	3	0	0	3	3	50	25	75
23MIT102P		Human Anatomy & Physiology – II Lab	0	0	2	1	2	15	10	25
23MIT104 T	Discipline Specific Course (DSC-B1)	Radiographic Techniques-I	3	0	0	3	3	50	25	75
23MIT104 P		Radiographic Techniques-I	0	0	2	1	2	15	10	25
23MIT106T	Discipline Specific Course (DSC-C1)	Conventional Radiological Equipment	4	0	0	4	4	70	30	100
23MIT108T	Minor Course (MIC1)	Medical Terminologies, Ethics and Law	2	0	0	2	2	35	15	50
23MIT110T	Multidisciplinary Course (MDC1)	Radiation Physics - I	3	0	0	3	3	50	25	75
----	Ability Enhancement Course (AECI)	Hindi	2	0	0	2	2	35	15	50
23MIT114T	Skill Enhancement Course (SEC1)	Patient Safety, Professionalism & Values	3	0	0	3	3	50	25	75
----	Value Added Course (VAC1)	Yoga and Meditation	2	0	0	2	2	35	15	50
						24	**26**	**415**	**185**	**600**

Notes: The student opting for exit after first year must complete summer internship of 4 credits (120 hrs.) to get UG Certificate.

SEMESTER-I

Course Code	Course	Nomenclature	Teaching Schedule			Credits	Hrs/ week	Marks		
			L	T	P			Ext.	Int.	Total
23MIT101T	Discipline Specific Course (DSC-A1)	Human Anatomy & Physiology - I	3	0	0	3	3	50	25	75
23MIT101P		Human Anatomy & Physiology – I Lab	0	0	2	1	2	15	10	25
23MIT103T	Discipline Specific Course (DSC-B1)	Radiographic Photography	4	0	0	4	4	70	30	100
23MIT105T	Discipline Specific Course (DSC-C1)	Fundamentals of Medical Imaging Technology	4	0	0	4	4	70	30	100
23MIT107T	Minor Course (MIC1)	Introduction to National Healthcare System	2	0	0	2	2	35	15	50
23MIT109T	Multidisciplinary Course (MDC1)	Basic Physics	3	0	0	3	3	50	25	75
23ENG101	Ability Enhancement Course (AECI)	English	2	0	0	2	2	35	15	50
23MIT111T	Skill Enhancement Course (SEC1)	Essentials of Computer Science	2	0	0	2	1	35	15	50
23MIT111P		Essentials of Computer Science Lab	0	0	2	1	2	15	10	25
23EVL101	Value Added Course (VAC1)	Environmental Science	2	0	0	2	2	35	15	50
						24	**26**	**415**	**185**	**600**

Human Anatomy & Physiology – I

Course Code: 23MIT101T Course Credits: 3 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 3 hours (L) + 0 hours (T) per week.	**Course Assessment: Max. Marks: 75 (Internal: 25; External: 50)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

UNIT-1

Introduction to the Human Body: Outline of the systems of the human body, Anatomical positions, terminology, regions and planes, Structure & functions of the cell and its components, Epithelium, Tissues, Glands, Muscles.

UNIT-2

Musculo-Skeletal System: Axial Skelton-Skull, Vertebral column, Sternum & Ribs. Appendicular Skeleton: Shoulder girdle and Bones of Upper limb pelvic girdle and Bones of lower limb. Factors affecting healing, Joints – Definition, Classification & Movements. Shoulder joint, Elbow joint, Hip joint, Knee joint. Diseases of bones and joints.

UNIT-3

Cardiovascular System: Composition and functions of Blood, Erythropoiesis, Blood groups, Coagulation, Blood disorders, Cardiovascular System: Anatomy &physiology of heart and blood vessels (arteries and veins), cardiac cycle, heart valves, systemic &pulmonary circulation, Blood pressure, Cardiac output, Pulse, ECG, Heart sounds.

UNIT-4

Respiratory System: Anatomy &physiology of all organs of Respiratory System, Physiology of Respiration, Exchange of gases in alveoli, O_2 Transport and CO_2 elimination, Respiratory regulation.

Reference Books:

1. Anne Waugh & Allison Grant, "Ross and Wilson Anatomy and Physiology in Health and Illness", Churchill Living Stone Elsevier, 12th Edition, 2014.
2. Arthur C Guyton, John E Hall, "Textbook of Medical Physiology", Saunders Elsevier, Pennsylvania, 13th Edition, 2015.
3. Jain A K, "Text book of Physiology", Avichal Publishing Company, Sirmour, Himachal Pradesh, 5th Edition, 2012
4. Gerard J. Tortora & Bryan H. Derrickson, "Principles of Anatomy and Physiology" Wiley, 14th Edition, 2014

Human Anatomy & Physiology – I LAB

Course Code: 23MIT101P Course Credits: 1 Type: Compulsory Contact Hours: 2 hours/week Mode: Practical session	**Course Assessment: Max. Marks: 25 (Internal: 10; External: 15)** For the end-semester practical examination, the assessment will be done by an external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department.

List of Experiments

1. Study of human skeleton parts with skeletal models.
2. Study of joints with joints models.
3. Study with charts and models of cardiovascular system.
4. Study with charts and models of respiratory system.
5. Study of Spirometry.
6. Cross sectional anatomy related to Ultrasound, CT, MRI, Imaging Techniques.

Note: At least five experiments are to be performed by the students from the above topics. The course coordinator may also design and set experiments in addition to above topics as per the scope and requirement of the syllabus.

Radiographic Photography

Course Code: 23MIT103 T Course Credits: 4 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 4 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 100 (Internal: 30; External:70)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

The photographic process: Introduction, visible light, images produced by radiation, light sensitive photographic materials. Image Characteristic: Real and mental images, reflected, transmitted and emitted light images photographic emulsions, The photographic latent image Positive process. Film materials in X-Ray departments, history, structure of an X-ray films and single and double emulsion films, types of films, cross over effect. Spectral sensitivity of film material, graininess of film material, speed and Contrast of photographic materials. Sensitometry: Photographic density, characteristic curves, features of the characteristics curve. Variation in the characteristic curve with the development. Comparison of emulsions by their characteristic curves. Information from the characteristic curve.

Unit-2

The storage of film material and radiograph: Storage of unprocessed films. Storing of radiographs: Expiry date, shelf life, storage condition, stock control. Intensifying screens and cassettes, Luminescence, fluorescence and phosphorescence. Construction of an intensifying screen. The Fluorescent materials: Types of intensifying screens, Intensification factor the influence of KV scattered radiation Detail sharpness and speed, size of the Crystal Reciprocity Failure, Quantum Mottle. Cassette Design; Store of Cassettes. type of cassettes, mounting of intensifying screen, Loading & Unloading of Cassettes. Care of intensifying screens, tests to check screen film contact and light leakage.

Unit-3

Film processing: Development, the nature of development – manual or automatic. The PH scale. The constitution of developing solutions both in manual and automatic processing and properties of developing chemicals. The development time, factors in the use of developer, developer activity. Fixing and role of a fixing solution. Constitution of the fixing solutions and properties of the constituents. Fixer used in automatic processors. Factors affecting the use of fixer. Regeneration of fixing solution. Silver recovery from waste fixer or from scrap film and its various methods. Rinsing washing and drying, Objects of rinsing and washing, methods. employed methods of drying films. Preparation of solutions and making stock solution. Processing equipment: Material for processing equipment, processors for manual operation, hangers, control of chemicals temperature by heating and thermostat, heaters as well as cooling methods. Maintenance of automatic processors and common faults. Dark Room: Layout and planning, Dark room construction- nature of floor, walls ceiling and radiation protection. Type of entry, door design, dark room illuminations- white light and safe lighting. Dark Room Equipment and its layout. Location of pass-through boxes or cassette hatches. Systems for day light film handling, Daylight systems using cassettes and without cassettes.

Unit-4

The radiographic image: Components in image quality –density, contrast and detail unsharpness nature in the radiographic image, Various factors contributing towards unsharpness geometric photographic: Motional, mottle, Graininess distortion. The presentation of the radiograph, identification markers and Orientation Documentary preparation. Viewing accessories: Viewing boxes, magnifiers, viewing conditions. Some special imaging processes, xero-radiography its meaning technique and applications. Copying radiograph, its Techniques &application. Subtractions its techniques applied to radiography as well as its applications. Common film faults due to manufacturing well as due to chemical processing. Management of the quality of the Radiographic images and image quality control

Reference Book:

1. Philip W. Ballinger: Atlas of radiographic positioning and Radiological Procedures.
2. RA Swallow, E Naylor: Clark's positioning in Radiography. EJ Roebuck, AS Whitley
3. Sante LR: Roentgenologic technique (Edwards Inc.)
4. Goldman: A Radiographic index
5. Rossand Gailway: A Handbook of Radiography (Lewis)
6. Glenda J. Bryan: Diagnostic Radiography (Mosby)
7. Piles: Medical Radiographic Technique (Thomas)
8. Scorrow: Contrast Radiography (Schering Chemicals)
9. Stephen Chapman &Richard Nakielny: A Guide to Radiological Procedures (Jaypee Brothers)
10. Text Book of Radiology for Residents and Technicians – Sathish.K.Bhargava
11. Hand book of Medical Radiography - C. Rama Mohan

Fundamentals of Medical Imaging Technology

Course Code: 23MIT105T Course Credits: 4 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 4 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 100 (Internal: 30; External:70)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Imaging with Ionizing Radiation: Production of X Rays, X-ray equipment, Clinical applications. **Computerized Tomography**: Function and operation of a CT Scanner, Clinical applications. Single Photon Emission, Computed Tomography (SPECT), Positron Emission Tomography (PET).

Unit-2

Magnetic Resonance Imaging: Physics of MRI/NMR, Instrumentation of MRI, MRI clinical applications

Unit-3

Ultrasound Imaging: Propagation of ultrasound waves in fluids, solids and tissue. Doppler Effect, Ultrasound transducers and instrumentation, Clinical applications.

Unit-4

Thermal imaging& other techniques: Medical thermography - equipment & applications. Fluoroscopy, Endoscopy.

Reference Books:

1. Steve Webb, “The Physics of Medical Imaging”, Taylor & Francis, New York, 2010.
2. William R Hendee, Russell Ritenour E, “Medical Imaging Physics” John Wiley, New York, 2002.
3. Paul Suetens, "Fundamentals of Medical Imaging", Cambridge University Press, 2002

Introduction to National Healthcare System

Course Code: 23MIT107T Course Credits: 2 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 2 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 50 (Internal: 15; External:35)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Introduction to Healthcare Delivery System

a. Healthcare delivery system in India at primary, secondary and tertiary care
b. Community participation in healthcare delivery system
c. Health system in developed countries.
d. Private Sector
e. National Health Mission
f. National Health Policy
g. Issues in Health Care Delivery System in India

Unit-2

National Health Programme: Background objectives, action plan, targets, operations, achievements and constraints in various National Heath Programme. Introduction to AYUSH system of medicine

a. Introduction to Ayurveda.
b. Yoga and Naturopathy
c. Unani
d. Siddha
e. Homeopathy
f. Need for integration of various system of medicine

Unit-3

Health Scenario of India- past, present and future. Demography & Vital Statistics-

a. Demography – its concept
b. Vital events of life & its impact on demography
c. Significance and recording of vital statistics
d. Census & its impact on health policy

Unit-4

Epidemiology

a. Principles of Epidemiology
b. Natural History of disease
c. Methods of Epidemiological studies
d. Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Reference Books:

1. Park's Textbook of Preventive and Social Medicine

Basic Physics

Course Code: 23MIT109T Course Credits: 3 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 3 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 75 (Internal: 25; External:50)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-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.

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. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS values and current and voltage, circuit containing LR, CR and LCR-Power factor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current.

Unit-2

Electromagnetic waves: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.

Sound

a. The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction.
b. Doppler's effect, Ultrasonic wave, production of ultrasonic waves (piezo-electric effect) in ultrasonography.
c. Use of principle of Doppler's effect in Diagnostic Radiology (e.g. Echo, blood flow measurement).

Unit-3

Heat: Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion, Newton's law of cooling, Heat radiation, perfect black body, Stefan law, application in Diagnostic Radiology (Heat dissipation in both stationary and rotating X-ray tubes).

Unit-4

Electronics

a. Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers.

b. Semiconductor diodes: p-n junction-properties forward and reverse bias, characteristics of p-n junction Rectifiers-Half-wave and full wave, ripple factor, Efficiency of HW and FW rectifiers. Filter circuits; Zener diode, regulated power supply.

c. Transistors-Symbols, Transistor connections and characteristics, Transistor as an amplifier, load line analysis, operating point, types of amplifiers-voltage and power amplifiers. Feedback-negative feedback in amplifiers.

Reference Books:

1. Modern Physics – R. Murugeshan, Kiruthiga Sivaprasath – S. Chand & Company.
2. A Text Book of Optics – N. Subrahmanyam, Brijlal, M.N. Avadhanulu – S.Chank & Company
3. Basic Electronics solid state – B.L. Theraja – S. Chand & Company
4. Sound – S.R. Govindarajan, T. Murugaiyan, T. Jayaraman

Essentials of Computer Science

Course Code: 23MIT111T Course Credits: 2 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 2 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 50 (Internal: 15; External:35)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Computer Hardware and Assembly/Disassembly

Introduction to Computer Hardware: Basic components of a computer system: CPU, RAM, ROM, Storage devices, etc. Input devices: Keyboard, Mouse, etc. Output devices: Monitor, Printer, etc.

Processors and Motherboards: Understanding processor architecture. Different types of processors and their core counts and frequencies. Motherboard components and connectors.

Data Cables and Connectors: Types of data cables: SATA, IDE, USB, etc. Internal and external connectors and their uses.

Unit-2

Computer Networking and Software Installations

Introduction to Computer Networking: Networking components and devices: Routers, Switches, Hubs, etc. Network setup and configuration. Management commands for network administration. Installing and configuring Network Interface Cards (NICs). Identifying MAC addresses

Software Installations: Installation of Windows Operating System. Types of software and their installations. Installation and usage of essential software (MS Office, Adobe Acrobat, Google Chrome, VLC Media Player, LibreOffice, Win Rar).

Unit-3

PC Maintenance and Webpage Design

PC Maintenance and Troubleshooting: Power On Self-Test (POST) and Beep code errors. Using Multimeter to check power supply. Identifying and replacing faulty components.

Introduction to MS Office Suite: MS Word: Basic features and functions. MS PowerPoint: Creating slides with hyperlinks, videos, audios, and textual content. MS Excel: Introduction and basic computations.

Internet Usage and Basic Webpage Design: Searching the Internet effectively. Checking Internet connection speed. Understanding E-commerce and its usage. Webpage design using HTML. Adding static content like text, images, tables, audio, and video. Introducing dynamic contents and animations in webpages.

Unit-4

Python Programming

Introduction to Python: History and features of Python. Setting up the Python development environment. **Python Basics:** Variables, data types, and basic operations. Control flow statements: if, else, loops. **Functions and Modules:** Creating and calling functions. Understanding modules and their usage **File Handling:** Reading from and writing to files.

Reference Books:

1. "A+ Guide to IT Hardware and Software" by Jean Andrews
2. "Network+ Guide to Networks" by Jill West, Tamara Dean, and Jean Andrews
3. "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross
4. "Python Crash Course" by Eric Matthes
5. "Web Design with HTML, CSS, JavaScript and jQuery Set" by Jon Duckett

Essentials of Computer Science Lab

Course Code: 23MIT111P Course Credits: 1 Type: Compulsory Contact Hours: 2 hours/week Mode: Practical session	**Course Assessment: Max. Marks: 25 (Internal: 10; External: 15)** For the end-semester practical examination, the assessment will be done by an external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department.

List of Experiments

1: Computer Hardware Assembly

- Hands-on assembling and disassembling a desktop computer
- Installing RAM, ROM, and other hardware peripherals
- Connecting internal and external data cables and connectors

2: Network Setup and Configuration

- Setting up a small local network with routers and switches
- Configuring network interface cards (NICs) with unique IP addresses
- Testing network connectivity and sharing resources between computers

3: Software Installation and Configuration

- Installing Windows Operating System on a virtual machine or a physical computer
- Installing and configuring essential software applications like MS Office, Adobe Acrobat, etc.
- Setting up user accounts and permissions for file sharing

4: MS Office Applications

- Creating a professional document using MS Word with proper formatting and styles
- Designing a multimedia-rich presentation with MS PowerPoint
- Creating a basic spreadsheet with MS Excel for data analysis

5: Webpage Design with HTML

- Creating a static webpage with text, images, and tables using HTML
- Adding multimedia elements like audio and video to the webpage
- Implementing basic animations

6: Python Basics

- Writing Python programs to perform arithmetic operations
- Implementing control flow statements like if, else, and loops
- Creating and calling functions in Python

7: File Handling with Python

- Reading data from a text file and displaying it
- Writing data to a file and updating its content

Note: The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students.

SEMESTER-II

Paper code	Course	Nomenclature	Teaching Schedule			Credits	Hrs/ week	Marks		
			L	T	P			Ext.	Int.	Total
23MIT102T	Discipline Specific Course (DSC-A1)	Human Anatomy & Physiology - II	3	0	0	3	3	50	25	75
23MIT102P		Human Anatomy & Physiology – II Lab	0	0	2	1	2	15	10	25
23MIT104 T	Discipline Specific Course (DSC-B1)	Radiographic Techniques-I	3	0	0	3	3	50	25	75
23MIT104 P		Radiographic Techniques-I	0	0	2	1	2	15	10	25
23MIT106T	Discipline Specific Course (DSC-C1)	Conventional Radiological Equipment	4	0	0	4	4	70	30	100
23MIT108T	Minor Course (MIC1)	Medical Terminologies, Ethics and Law	2	0	0	2	2	35	15	50
23MIT110T	Multidisciplinary Course (MDC1)	Radiation Physics - I	3	0	0	3	3	50	25	75
----	Ability Enhancement Course (AECI)	Hindi	2	0	0	2	2	35	15	50
23MIT114T	Skill Enhancement Course (SEC1)	Patient Safety, Professionalism & Values	3	0	0	3	3	50	25	75
----	Value Added Course (VAC1)	Yoga and Meditation	2	0	0	2	2	35	15	50
						24	**26**	**415**	**185**	**600**

Notes:

i) The student opting for exit after first year must complete summer internship of 4 credits (120 hrs.) to get UG Certificate.

Human Anatomy & Physiology – II

Course Code: 23MIT102T Course Credits: 3 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 3 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 75 (Internal: 25; External: 50)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Digestive System: Digestive system: Organs of the digestive system and their secretions, functions and role in digestion. **Lymphatic System:** Lymphatic System: Lymph vessels, Lymph nodes, Functions Spleen and Thymus gland.

Unit-2

Nervous System: Brain: parts & functions, Spinal Cord: parts & functions, Nerve impulse, Action potential, Reflex action, Cranial & Spinal Nerves. Autonomic nervous system (sympathetic and parasympathetic). **Sensory System** Sense organs: Eye, Physiology of sight, Ear, Physiology of hearing and balance, Structure and functions of skin.

Unit-3

Excretory System: Excretory system: Structure&functions of Nephron, Kidney, Urinary bladder, Urethra, Formation of urine, Composition of urine, Water and electrolyte balance. **Endocrine system:** Structure &Functions of glands - Thyroid, Parathyroid, Pituitary, Adrenal, Pancreas.

Unit-4

Reproductive Systems: Female reproductive system: External genitalia: Location, structures and functions, Vagina, uterus, uterine tubes, ovaries, hormone control, ovulation. Breasts (Mammary glands) Changes in puberty, in pregnancy, during lactation.

Male reproductive system: Scrotum testia epididymus, seminal vesicles, Ejaculatory ducts location, structure & functions. Prostate gland & position. Functions of male reproductive system, puberty. Diseases of female and male reproductive system.

Reference Books:

1. Anne Waugh & Allison Grant, "Ross and Wilson Anatomy and Physiology in Health and Illness", Churchill Living Stone Elsevier, 12th Edition, 2014.
2. Arthur C Guyton, John E Hall, "Textbook of Medical Physiology", Saunders Elsevier, Pennsylvania, 13th Edition, 2015.
3. Jain A K, "Text book of Physiology", Avichal Publishing Company, Sirmour, Himachal Pradesh, 5th Edition, 2012
4. Gerard J. Tortora & Bryan H. Derrickson, "Principles of Anatomy and Physiology" Wiley, 14th Edition, 2014

Human Anatomy & Physiology – II LAB

Course Code: 23MIT102P Course Credits: 1 Type: Compulsory Contact Hours: 2 hours/week Mode: Practical session	**Course Assessment: Max. Marks: 25(Internal: 10; External: 15)** For the end-semester practical examination, the assessment will be done by an external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department.

List of Experiments:

1. Study with charts and models of digestive system.
2. Study with charts and models of nervous system.
3. Study with charts and models of eye, ear, nose, tongue & skin.
4. Study with charts and models of excretory system.
5. Study with charts and models of endocrine system.
6. Study with charts and models of male & female reproductive systems.
7. Cross sectional anatomy related to Ultrasound, CT, MRI, Imaging Techniques

Note: At least five experiments are to be performed by the students from the above topics. The course coordinator may also design and set experiments in addition to above topics as per the scope and requirement of the syllabus.

Radiographic Techniques – I

Course Code: 23MIT104T Course Credits: 3 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 3 hours (L) + 0hours (T) per week	**Course Assessment: Max. Marks: 75 (Internal: 25; External: 50)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Radiography techniques of whole skeleton comprising of Whole upper limb with special reference to hand, wrist joint, forearm, elbow joint and upper arm. Supplementary techniques for carpal tunnel, scaphoid bone fracture, head of radius and supra condylar fracture.

Unit-2

Radiography techniques of whole skeleton comprising of Whole lower limb which includes all the bones with special reference to foot, ankle joint lower leg, knee joint, patella and upper leg. Supplementary techniques for calcaneum bone for flat foot intercondylar notch and head of femur etc., Shoulder girdle and humerus.

Unit-3

Radiography techniques of whole skeleton comprising of Whole vertebral column, cervical thoracic, lumber spine, sacrum and coccyx with special techniques for inter vertebral foramina, cervico-dorsal, dorso lumber, lumbo-sacral joint and S.I. Joints. Pelvic girdle and hip region.

Unit-4

Radiography techniques of whole skeleton comprising of Thorax-Complete chest radiography for both the lungs –apical. lordotic and oblique views Techniques to demonstrate fluid levels/ effusion in the thoracic cavity –decubitus AP and lateral views.

Reference Books:

1. Philip W. Ballinger: Atlas of radiographic positioning and Radiological Procedures.
2. RA Swallow, E Naylor: Clark's positioning in Radiography. EJ Roebuck, AS Whitley
3. Sante LR: Roentgenologic technique (Edwards Inc.)
4. Goldman: A Radiographic index
5. Rossand Gailway: A Handbook of Radiography (Lewis)
6. Glenda J. Bryan: Diagnostic Radiography (Mosby)
7. Piles: Medical Radiographic Technique (Thomas)
8. Scorrow: Contrast Radiography (Schering Chemicals)
9. Stephen Chapman &Richard Nakielny: A Guide to Radiological Procedures (Jaypee Brothers)
10. Text Book of Radiology for Residents and Technicians – Sathish.K.Bhargava

Radiographic Techniques-I LAB

Course Code: 23MIT104P Course Credits: 1 Type: Compulsory Contact Hours: 2 hours/week Mode: Practical session	**Course Assessment: Max. Marks: 25 (Internal: 10; External: 15)** For the end-semester practical examination, the assessment will be done by an external examiner appointed by the Controller of Examination along with the internal examiner, preferably the lab course coordinator, appointed by the Chairperson of the Department.

List of Experiments:

1. Radiography of upper limb.
2. Radiography of lower limb.
3. Radiography of shoulder girdle.
4. Radiography of vertebral column.
5. Radiography of pelvic girdle.
6. Radiography of Thorax.

Note: At least five experiments are to be performed by the students from the above topics. The course coordinator may also design and set experiments in addition to above topics as per the scope and requirement of the syllabus.

Conventional Radiological Equipment

Course Code: 23MIT106T Course Credits: 4 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 4 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 100 (Internal: 30; External: 70)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Production of x-rays: X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x - ray tube; construction, working, methods of cooling the anode, rating chart and cooling chart; rotating anode x - ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x - ray tube; effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x - rays, inherent filter and added filter, their effect on quality of the spectrum.

Unit-2

High tension circuits: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment; mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of tube voltage, kV compensator; high tension selector switch, filament circuit, control of tube current, space charge compensation.

Meters and exposure timers: Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber-based timers, integrated timer.

Interlocking circuits: Relays: description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.

Unit-3

Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.

Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualizing intensified image, basic principles of closed-circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid-controlled x-ray tube.

Unit-4

Care and Maintenance of X-ray equipment: General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.

Reference Books:

1. Sante LR: Roentgenologic technique (Edwards Inc.)
2. Rossand Gailway: A Handbook of Radiography (Lewis)
3. Glenda J. Bryan: Diagnostic Radiography (Mosby)
4. Piles: Medical Radiographic Technique (Thomas)
5. Scorrow: Contrast Radiography (Schering Chemicals)
6. Stephen Chapman &Richard Nakielny: A Guide to Radiological Procedures (Jaypee Brothers)
7. Text Book of Radiology for Residents and Technicians – Sathish.K.Bhargava

Medical Terminologies, Ethics and Law

Course Code: 23 MIT 108 T Course Credits: 2 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 2 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 50 (Internal: 15; External: 35)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Medical Terminologies

a. Derivation of medical terms. Define word roots, prefixes, and suffixes.
b. Conventions for combined morphemes and the formation of plurals. Basic medical terms.
c. Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
d. Interpret basic medical abbreviations/symbols.
e. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system.

Unit-2

Record Keeping

a. Interpret medical orders/reports.
b. Data entry and management on electronic health record system.

Unit-3

Medical Ethics

a. Definition - Goal – Scope. Introduction to Code of conduct
b. Basic principles of medical ethics – Confidentiality
c. Malpractice and negligence - Rational and irrational drug therapy
d. Autonomy and informed consent - Right of patients
e. Care of the terminally ill- Euthanasia
f. Organ transplantation

Unit-4

Medical Law

a. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
b. Professional Indemnity insurance policy
c. Development of standardized protocol to avoid near miss or sentinel events
d. Obtaining an informed consent.

Reference Books:

1. Medical Ethics and Law by Dominic Wilkinson
2. Medical Terminology by G Chen, Stephen Leesburg

Radiation Physics – 1

Course Code: 23MIT110T Course Credits: 3 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 3 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 75 (Internal: 25; External: 50)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Atomic Structure: Wave-particle Duality, Bohr's Model of the Atom, Electron Configurations and Energy Levels, Nucleus and its constituent particle (pp and pn hypothesis), Atomic number, mass number, isotopes, isobars, isotones, isomers and mirror nuclei, Nuclear properties: Charge, Size, Mass, Density, spin, parity, magnetic dipole moment, electric quadrupole moment and binding energy per nucleon (curve).

Unit-2

Radioactivity: Definition and units, Radioactive Decay (Spontaneous and Stimulated), Types of Radioactive Decay (Alpha, Beta & Gamma), Theory of alpha decay, Range of alpha particle, Geiger-Nuttle law and alpha spectra, Beta decay, its continuous energy spectra and Neutrino Hypothesis, Gamma decay and its origin, Half-life, mean life, First-order and Second-order Decay Radioactive Decay Series, Internal conversion and Nuclear isomerism.

Unit-3

Interactions of Radiation with Matter: Particle Radiation, Electromagnetic Radiation, Interactions of Heavy (alpha like) and light (beta) charged Particle with matter, (Scattering, Absorption, Range, Stopping Power), Interaction of X-rays and gamma rays with matter (Photoelectric Effect, Compton Scattering, Pair Production), Interaction of neutrons with matter.

Unit-4

Measurement Techniques: (Ionization and florescence), Radiation Detection and Instrumentation –Construction and Principle of Gas-filled (ionization, proportional and GM), Scintillation, and Semiconductor Detectors, neutron detection, Dosimetry and Dose Measurement.

Reference Books:

1. Physics of Diagnostic radiology - Christiansen
2. Physics and Photography Principles of Medical Radiography – Seeman and Herman
3. Basic Radiological Physics - K.Thayalan
4. Radiographic Imaging - Derrick

Patient Safety, Professionalism &Values

Course Code: 23 MIT 114 T Course Credits: 3 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 3 hours (L) + 0hours (T) per week.	**Course Assessment: Max. Marks: 75 (Internal: 25; External: 50)** For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. All questions carry equal marks.

Unit-1

Quality assurance and management:

a. Concepts of Quality of Care
b. Quality Improvement Approaches
c. Standards and Norms
d. Quality Improvement Tools
e. Introduction to NABH guidelines

Unit-2

Basics of emergency care and life support skills:

a. Vital signs and primary assessment
b. Basic emergency care – first aid and triage
c. Ventilations including use of bag-valve-masks (BVMs)
d. Choking, rescue breathing methods
e. One- and Two-rescuer CPR
f. Using an AED (Automated external defibrillator).
g. Managing an emergency including moving a patient

Unit-3

Infection prevention and control:

a. Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)]
b. Prevention & control of common healthcare associated infections,
c. Components of an effective infection control program, and
d. Guidelines (NABH and JCI) for Hospital Infection Control

Unit-4

Professionalism and values:

a. Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality
b. Personal values- ethical or moral values
c. Attitude and behavior- professional behavior, treating people equally
d. Code of conduct, professional accountability and responsibility, misconduct
e. Differences between professions and importance of team efforts
f. Cultural issues in the healthcare environment

Reference Books:

1. Handbook of Healthcare Quality & Patient Safety by Girdhar J. Gyani & Alexander Thomas.
2. Textbook of Patient Safety & Clinical Risk Management by Liam Donaldson, Walter Ricciardi, Susan Sheridan, Riccardo Tartaglia.
3. Implementing Patient Safety by Suzette Woodward