Course Units Offered by the Department

Bachelor of Science Honours in Radiography

1000 LEVEL – SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
EL 1101	Basic English for Allied Health Sciences 1	3*	None
AH 1101	Information Technology	2*	None
AH 1103	Basic Human Anatomy	3	None
AH 1104	Introduction to Psychology	2	None
AH 1106	Basic Biochemistry	2	None
RA 1101	Human Physiology	2	None
RA 1103	General Physics	2	None
RA 1104	Mathematics - I	2	None
RA 1105	Introduction to Electronics and Instrumentation	2	None

1000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
EL 1202	Basic English for Allied Health Sciences 2	3*	None
AH 1201	General Pathology	3	None
RA 1201	Atomic and Radiation Physics	2	None
RA 1202	Radiobiology and Radiation Protection	2	None
RA 1203	Applied Anatomy – I	2	None
RA 1204	Medical Imaging Equipment	3	None
RA 1205	Plain Radiography – I	2	None
RA 1206	Medical Image Processing – I	3	None

2000 LEVEL - SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
EL 2103	Intermediate English for Allied Health Sciences 1	3*	None
RA 2101	Programming Techniques	3	None

RA 2102	Fluoroscopy – I	2	RA 1204
RA 2103	Computed Tomography – I	3	None
RA 2104	Mathematics - II	2	RA 1104
RA 2106	Care of Patient - I	2	None
RA 2107	Common Systemic Diseases	2	None
RA 2108	Pharmacology for Medical Imaging	1	None
RD 2101	Mammography – I	1	None
RD 2102	Plain Radiography – II	2	RA 1205

2000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
EL 2204	Intermediate English for Allied Health Sciences 2	3*	None
RA 2201	Ethics in Medical Radiation Sciences	1	None
RA 2202	Medical Image Processing - II	3	RA 1206, RA 2101
RA 2204	Magnetic Resonance Imaging – I	2	None
RA 2205	Modern Physics	2	RA1103, RA1201, RA1104
RD 2201	Fluoroscopy - II	2	RA 2102
RD 2202	Plain Radiography – III	3	RA 1205
RD 2203	Computed Tomography – II	2	RA 2103

3000 LEVEL – SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
AH3101	Statistics	3	None
RA 3101	Nuclear Imaging – I	3	None
RD 3102	Dental Radiography	2	None
RD 3103	Plain Radiography – IV	2	RD 2102, RD 2202
RD 3104	Applied Anatomy – II	1	AH 1103, RA 1203
RD 3108	Computed Tomography - III	3	RA 2103, RD 2203
RD 3109	Theatre Radiography - I	1	RA 2102
RD 3110	Fluoroscopy - III	2	RA 2102,RD 2201

3000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
RA 3202	Physics of Ultrasound Imaging	1	None
RA 3203	Research Methodology	2	None
RD 3201	Magnetic Resonance Imaging - II	3	RA 2204
RD 3202	Imaging in Common Systemic Diseases– I	1	AH 1103, AH 1201, RA 1203, RD3104
RD 3205	Mammography - II	2**	RD 2101`
RD 3207	Theatre Radiography - II	2***	RA 2102, RD 3109
RD 3208	Nuclear Imaging - II	2	RA3101
RD 3209	Care of Patient – II	2	RA 2106
RD 3210	Radiation Protection in Radiography	2	RA 1202, RA 2102, RA 3101
RD 3211	Applied Anatomy - III	2	RA 1203

4000 LEVEL – SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
RA 4102	Medical Imaging Informatics	1	RA 1206
RA 4103	Management of Health Care Organizations	1†	None
RA 4104	Productive Workforce and Organization in Health Care	1†	None
RD 4101	Maintenance of Medical Imaging Equipment	2	RA 1204, RA 2102
RD 4104	Radiation Dosimetry and Applications	2	RA 1202, RD 3210
RD 4105	Magnetic Resonance Imaging - III	3	RA 2204, RD 3201
RD 4107	Quality Assurance in Medical Imaging - I	2	RA 1204, RA 2102, RD 2101, RD 3102
RD 4108	Imaging in Common Systemic Diseases - II	2	RD 3211, RD3108
RD 4109	Paediatric Imaging	2	None

4000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
RA 4001	Research Project	6††	AH 3101, RA 3203
RA 4202	Ancillary Imaging Techniques	2	RA 2101
RD 4203	In-service Training	4	RD 2202, RD 3102, RD 3103, RD 3108, RD 3110, RD 3205, RD 3207, RD 3208, RD 4105, RD 4109
RD 4204	Quality Assurance in Medical Imaging - II	2	RA 2103, RA 2204, RD 3201

All the courses are listed above are compulsory for BScHons Radiography degree except RA4103 and RA4104.
* Non-GPA
** Mammography - II: Offered only for female students
*** Theatre Radiography - II: Offered only for male students
† Non-GPA optional course: The student may register and complete one or both optional non-GPA courses.
†† Research project will be started at 4000 Level Semester I and will continue throughout the 4000 level. The evaluation procedure will be concluded, and results will be released at the end of 4000 Level Semester II.

Prerequisites: In order to be eligible to follow the higher-level courses, the student shall complete the lower level courses. Completion of a prerequisite means to have followed all the components of the course and to be eligible to sit for the end semester examination.

Optional courses: The student may register and complete one or both optional non-GPA courses given in the list below. To offer an optional course at least 40% of the total number of students from the respective batch should register for the course.

RA 4103	Management of Health Care Organizations
RA 4104	Productive Workforce and Organization in Health Care

Bachelor of Science Honours in Radiotherapy

1000 LEVEL – SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
EL 1101	Basic English for Allied Health Sciences 1	3*	None
AH 1101	Information Technology	2*	None
AH 1103	Basic Human Anatomy	3	None
AH 1104	Introduction to Psychology	2	None
AH 1106	Basic Biochemistry	2	None
RA 1101	Human Physiology	2	None
RA 1103	General Physics	2	None
RA 1104	Mathematics - I	2	None
RA 1105	Introduction to Electronics and Instrumentation	2	None

1000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
EL 1202	Basic English for Allied Health Sciences 2	3*	None
AH 1201	General Pathology	3	None
RA 1201	Atomic and Radiation Physics	2	None
RA 1202	Radiobiology and Radiation Protection	2	None
RA 1203	Applied Anatomy – I	2	None
RA 1204	Medical Imaging Equipment	3	None
RA 1205	Plain Radiography – I	2	None
RA 1206	Medical Image Processing – I	3	None

2000 LEVEL - SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
EL 2103	Intermediate English for Allied Health Sciences 1	3*	None
RA 2101	Programming Techniques	3	None
RA 2102	Fluoroscopy – I	2	RA 1204

RA 2103	Computed Tomography – I	3	None
RA 2104	Mathematics - II	2	RA 1104
RA 2106	Care of Patient - I	2	None
RA 2107	Common Systemic Diseases	2	None
RA 2108	Pharmacology for Medical Imaging	1	None
RT 2101	Radiotherapy Equipment and Physics - I	2	None
RT 2102	Molecular Oncology	2	None

2000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
EL 2204	Intermediate English for Allied Health Sciences 2	3*	None
RA 2201	Ethics in Medical Radiation Sciences	1	None
RA 2202	Medical Image Processing - II	3	RA 1206, RA 2101
RA 2204	Magnetic Resonance Imaging – I	2	None
RA 2205	Modern Physics	2	RA1103, RA1201, RA1104
RT 2201	Principles of Radiotherapy and Oncology	2	RA 2102
RT 2202	Radiotherapy Methods - I	2	None

3000 LEVEL – SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
AH3101	Statistics	3	None
RA 3101	Nuclear Imaging – I	3	None
RT 3101	Radiotherapy Equipment and Physics - II	2	RT 2101
RT 3102	Applied Anatomy in Radiotherapy	2	RA 1203
RT 3103	Treatment Planning - I	2	None
RT 3104	Clinical Oncology and Radiotherapy - I	2	RT 2201, RT 2202
RT 3105	Radiotherapy Methods - II	2	RT 2202
RT 3106	Clinical Practice of Radiotherapy - I	2	RT 2101, RT 2202

3000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
RA 3202	Physics of Ultrasound Imaging	1	None
RA 3203	Research Methodology	2	None
RT 3201	Radiation Protection and Safety in Radiotherapy	2	RA 1202
RT 3202	Care of Patient - II	2	RA 2106, RT 3104
RT 3203	Treatment Planning - II	2	RT 3103
RT 3204	Clinical Oncology and Radiotherapy - II	2	RT 2201, RT 3105
RT 3205	Quality Assurance in Radiotherapy - I	2	RT 2101
RT 3206	Clinical Practice of Radiotherapy - II	3	RT 3101, RT 3105

4000 LEVEL – SEMESTER I

Course Code	Course Title	No. of Credits	Prerequisites
RA 4102	Medical Imaging Informatics	1	RA 1206
RA 4103	Management of Health Care Organizations	1†	None
RA 4104	Productive Workforce and Organization in Health Care	1†	None
RT 4101	Paediatric Radiotherapy	2	RT 3105
RT 4102	Quality Assurance in Radiotherapy - II	2	RT 3101, RT 3205
RT 4103	Evidence Based Clinical Practice	2	None
RT 4104	Maintenance of Radiotherapy Equipment	2	RT 3101
RT 4105	Radiation Dosimetry and Applications	2	RA 1201
RT 4106	Clinical Practice of Radiotherapy - III	3	RT 3105

4000 LEVEL – SEMESTER II

Course Code	Course Title	No. of Credits	Prerequisites
RA 4001	Research Project	6††	AH 3101, RA 3203
RT 4201	Treatment Planning - III	2	RT 3203
RT 4202	Advanced Radiotherapy Methods	2	RT 3105
RT 4203	In-service Training in Radiotherapy	6	RT 3201, RT 3202, RT 3204,

RT 3206, RT 4101, RT 4102,
RT 4106, RT 4201

All the courses are listed above are compulsory for BScHons Radiotherapy degree except RA4103 and RA4104.
* Non-GPA
† Non-GPA optional course: The student may register and complete one or both optional non-GPA courses.
†† Research project will be started at 4000 Level Semester I and will continue throughout the 4000 level. The evaluation procedure will be concluded, and results will be released at the end of 4000 Level Semester II.

Prerequisites: In order to be eligible to follow the higher-level courses, the student shall complete the lower level courses. Completion of a prerequisite means to have followed all the components of the course and to be eligible to sit for the end semester examination.

Optional courses: The student may register and complete one or both optional non-GPA courses given in the list below. To offer an optional course at least 40% of the total number of students from the respective batch should register for the course.
RA 4103 Management of Health Care Organizations
RA 4104 Productive Workforce and Organization in Health Care

Synopses of Course Contents

1000 Level

EL 1101 Basic English for Allied Health Sciences 1 (3Credits)

The aim of this course is to provide the students with the knowledge of basic grammar and language skills and enable students to read, understand and evaluate basic descriptive texts, and to write accurately at UTEL Band 4 Level of competence in the skill areas of Reading and Writing as they transit into a degree programme which is conducted in the English medium. English for General Purposes (EGP) and Allied Health Science-based English for Specific Purposes (ESP) are introduced in an attempt to improve the knowledge of the undergraduates and the course will provide them with an insight and the required knowledge of English in order to function within the academic milieu of a University.

Key Areas of Focus: Selected reading passages describing people, places, Allied Health Science disciplinary themes, texts with appropriate punctuation exercises, reading comprehension texts, and relevant passages with appropriate and sequenced vocabulary elements. Surveying a textbook, skimming and scanning text and processing information appropriately. Language Development and Writing, Formulating simple descriptions of general and scientific context and developing methods of note-taking, Writing short descriptions of self, immediate environment and current situations, formal and informal letters, email and similar communication. Mechanics of Writing: subject-verb agreement, use of connectives, spelling and punctuation. Introduction to dictionary skills for self-learning purposes, Pronunciation and phonetic symbols, Speech activities related to general and academic contexts.

Course assessment: In-course 40%, End semester 60%

AH 1101 Information Technology (2Credits)

Basic concept of computers, Types of computers, Components of a computer, System analysis and design, Data processing, Web page development & languages, System analysis and design, Data processing, Computer networks, E-mail/Internet concepts.

Course assessment: In-course 30%, End semester 70%

AH 1103 Basic Human Anatomy (3Credits)

The cell, Cell division, Basic tissue types, Functional organization of nervous system, Cardiovascular system, Bone cartilage and joints, Muscular system, Gastrointestinal system, Respiratory system, Lymphatic system, Urinary system, Reproductive system, Structure of special sensory organs.

Course assessment: In-course 30%, End semester 70%

AH 1104 Introduction to Psychology (2Credits)

Introduction to Psychology with an emphasis on health-related issues, Major perspectives in psychology, Psychology applied to nursing and health care in general, Coping with stressful situations.

Course assessment: In-course 40%, End semester 60%

AH 1106 Basic Biochemistry (2Credits)

Structure, Function and metabolism of carbohydrates, Proteins, Lipids and nucleic acids, Regulation and integration of metabolism, Introductory Medical Biochemistry.

Course assessment: In-course 30%, End semester 70%

RA 1101 Human Physiology (2Credits)

Introduction to basic organization of the human body, major body systems along with their functions, integration and regulation, organized around the central theme of homeostasis.

Course assessment: In-course 30%, End semester 70%

RA 1103 General Physics (2Credits)

Units and dimensions, Mechanics, Wave mechanics, Electric and magnetic fields, Solids and fluids, Modern physics.

Course assessment: In-course 30%, End semester 70%

RA 1104 Mathematics - I (2 Credits)

Coordinate systems, Sets and inequalities, Introduction to vectors, Matrices and determinants, Complex numbers, Linear equations, Quadratic equations, Functions and graphs, Trigonometric functions, Limits, Derivatives, Exponential and logarithmic functions, Techniques of integration, Areas and volumes, Partial derivatives.

Course assessment: In-course 30%, End semester 70%

RA 1105 Introduction to Electronics and Instrumentation (2Credits)

Fundamentals of electricity: DC circuits and AC circuits; Analog electronics: diodes, transistors and operational amplifiers; Digital electronics; Instrumentation: errors, digital instruments, sensors and transducers, calibration; Applications: signal acquisition, demodulation and hardware in medical imaging. Course assessment: In-course 30%, End semester 70%

EL 1202 Basic English for Allied Health Sciences 2 (3Credits)

The aim of this course is to enable students to understand simple instructions, statements, notices and questions, and to be able to formulate these themselves. This will place them at UTEL Band 4 Level of competence in the skill areas of Listening and Speaking.

Key Areas of Focus: Instructions and directions, announcements, basic questions and answers, sequence markers and conjunctions/connectives, short speeches and dialogues, professional instructions, creative expression, telephone conversations. Sharing personal information appropriately, using and explaining quantitative and qualitative data at a basic level, making short speeches, asking and answering questions, telephone and other conversations for social and information-gathering purposes. Vocabulary development and expansion, Group discussions, Presentations, Impromptu Speaking on general and general health topics, Speech related to formal and informal settings and identifying contextual references.

Course assessment: In-course 40%, End semester 60%

AH 1201 General Pathology (3Credits)

Introduction to pathological mechanisms common to all tissue-cell pathology, Processes of cell injury, Cellular adaptations to injury, Inflammation and repair, Circulatory disturbances, Immunopathology, Neoplasia and genetic basis of diseases.

Course assessment: In-course 30%, End semester 70%

RA 1201 Atomic and Radiation Physics (2Credits)

Bohr's theory of hydrogen like atoms, Angular momenta, Elementary particles, Nuclear properties, Radioactive decay, Fission, Fusion, X-ray production, X-ray interactions, Intensity of radiation, Attenuation, Particle radiation, Interactions of radiation with matter, Introduction to radiation detectors.

Course assessment: In-course 30%, End semester 70%

RA 1202 Radiobiology and Radiation Protection (2Credits)

Background radiation, Quantities and units in radiation dosimetry, Radiation interactions, biological basis of radiation cell killing, Cellular radio sensitivity, Radiation effects on normal tissues, Radiation carcinogenesis, Genetic effects of radiation, Radiation effects on developing embryo, External and internal hazards of radiation, Basic principles of radiation protection, Radiation protection programme. Course assessment: In-course 30%, End semester 70%

RA 1203 Applied Anatomy - I (2 Credits)

Anatomy of appendicular skeleton, axial skeleton, muscles and joints, Surface anatomy, Anatomy of vascular, nervous and lymphatic systems, Cross sectional anatomy of brain, chest, abdomen, pelvis, upper and lower limbs.

Course assessment: In-course 40%, End semester 60%

RA 1204 Medical Imaging Equipment (3Credits)

X-ray machine, Stationary anode X-ray tube, Rotating anode X-ray tube, X-ray production, Line focus principle, Transformers, X-ray generators, Mobile equipment, Exposure switches and timers, X-ray tube rating charts, X-ray filters, X-ray beam restrictors, Grids, Digital equipment.

Course assessment: In-course 30%, End semester 70%

RA 1205 Plain Radiography - I (2Credits)

Basic principles of radiography, Terminology, Techniques and indications of basic radiographic projections of: upper limb, lower limb, spine, pelvis, skull, chest and abdomen; Evaluation criteria of the radiography images, Application of radiation protection.

Course assessment: In-course 30%, End semester 70%

RA 1206 Medical Image Processing - I (3Credits)

Image Recording Media used in Conventional Radiography, Spectral emission, Latent image formation, Conventional film processing, Sensitometry, Film processor maintenance, Dark room procedures, Image artefacts, Digital Radiography, Digital image processing, Computed Radiography, Medical image informatics, Quality Control for Digital Radiography.

Course assessment: In-course 30%, End semester 70%

2000 Level

EL 2103 Intermediate English for Allied Health Sciences 1 (3Credits)

The second-year courses are developed with the aim of introducing students to English for Academic Purposes (EAP). A higher level of competency is expected at this level as students will be introduced to technical and formal writing.
The aim of this course is to ensure that students are successful at UTEL Level 5 in the Reading and Writing examinations. More specifically, the course aims to familiarize students with academic texts of a descriptive and argumentative nature, including visuals such as graphs and tables, as well as to ensure that they can summarize, take notes, skim and scan effectively, and write narrative/descriptive/informative texts of approximately 500 words.
This module caters to the need of English competency for academic and professional purposes.
Students will also be familiarized with IELTS, and complex technical writing. Students are expected to undertake writing assignments of some complexity, identify the authorial voice in texts and to state and defend one's position on issues in an argument.
Key Areas of Focus: Academic and professional texts from the main field and sub-fields of Allied Health Sciences, reading comprehension passages of general and specific interest to undergraduates, reference and citation style guides. Academic and professional text writing, visuals (tables, charts, graphs) and data commentaries (qualitative and quantitative). Language Development and Writing, Cause-effect relationships, Process writing, Comparisons, Formal Letter writing, Direct-Indirect Speech, Vocabulary expansion, Thesis statements, Idioms and proverbs, Phrasal Verbs, Varieties of English, Exposure to different accents of English, Poster presentations, Debates, Group discussions and puzzles. Developing schemata and description, Transitional devices, Report writing, Conditionals, Preparation of a Curriculum Vitae, Application procedure, Reading and understanding Journal Articles, Précis Writing, IELTS Practice tests, How to face an Interview, How to make a presentation, Presentation of a report.
Course assessment: In-course 40%, End semester 60%

RA 2101 Programming Techniques (3Credits)

Syntax and semantics of programming, Structured data, Storing and accessing data structures, Object oriented programming concepts, Graphical user interface designs, Digital image manipulation in graphical user interface applications.
Course assessment: In-course 30%, End semester 70%

RA 2102 Fluoroscopy - I (2Credits)

Basic principles of fluoroscopy, Fluoroscopy equipment setup and image formation, Digital fluoroscopy with flat- panel detectors, Dynamic flat-panel detectors: Types, Characteristics, Operating principles and advantages, Digital image postprocessing, Gray-scale image manipulation, Last-image hold, Temporal frame averaging, Edge enhancement, Temporal subtraction, Energy subtraction. In built facilities and measures for radiation protection, Image quality.
Course assessment: In-course 30%, End semester 70%

RA 2103 Computed Tomography - I (3Credits)

Principles of CT, Data acquisition concepts, Image reconstruction, Basic instrumentation, Image post processing and visualization tools, Spiral/Helical CT, 3-D CT, Image quality, Image artifacts, SPECT/CT, PET/CT, Hybrid imaging, Cardiac CT, CT angiography, CT fluoroscopy, Breast CT, Virtual endoscopy, Applications of CT in radiation therapy, Radiation dose in CT.

Course assessment: In-course 30%, End semester 70%

RA 2104 Mathematics – II (2Credits)

Lagrange multipliers, Infinite series, Vector analysis, First-Order Differential Equation, Higher-Order Linear Differential Equations with constant coefficients, Partial differential equations: Laplace, Heat and wave equation, Fourier series, Integral transformations: Laplace and Fourier transformations, Special functions:,Legendre, Bessel, Hermite and Laguerre, Monte Carlo methods.

Course assessment: In-course 30%, End semester 70%

RA 2106 Care of Patient - I (2Credits)

Basic human needs, Routine patient care in Radiography/Radiotherapy unit, Effective communication and problem solving, First Aid, Infection control, Medical and surgical asepsis, Vital signs, Care of patients with drainage tubes and catheters, Care of elderly patients, Psychological aspects, Fire and electrical safety in the department.

Course assessment: In-course 30%, End semester 70%

RA 2107 Common Systemic Diseases (2Credits)

Overview of common diseases of man; Cardiovascular diseases, Respiratory diseases, Diseases of the liver and biliary tract, Diseases of gastrointestinal tract, Diseases of locomotor system, Diseases of nervous system and muscle disorders, Renal diseases, Hematological diseases and Diseases of reproductive system.

Course assessment: In-course 30%, End semester 70%

RA 2108 Pharmacology for Medical Imaging (1Credit)

Basic principles of pharmacology, Pharmacokinetic and pharmacodynamic concepts, Contrast media: properties, classification, selection and clinical application, techniques and routes of administration, Proper techniques for venipuncture, Pharmacology ofdrugs used in medical imaging and interventional procedures, Radiopharmaceuticals, Safety and adverse effects of pharmaceuticals used in medical imaging and interventional procedures, Mechanism of action of drugs available on the emergency trolley, Aseptic procedures in drug preparation.

Course assessment: In-course 30%, End semester 70%

RD 2101 Mammography - I (1Credit)

Epidemiology of breast cancer, Breast anatomy and physiology, Physics and equipment, Techniques of mammography, Evaluation of the image and lesions identification, Breast biopsy and localization, Other methods of breast imaging, Radiation protection, Quality assurance.

Course assessment: In-course 30%, End semester 70%

RD 2102 Plain Radiography - II (2Credits)

Positioning techniques of special projections of upper limb, lower limb, spine, pelvis, skull, chest and abdomen,Technical evaluation of the radiographs, Radiation protection, Inward and trauma radiography. Course assessment: In-course 30%, End semester 70%

EL 2204 Intermediate English for Allied Health Sciences 1 (3Credits)

This module the aim of this course is to ensure that students are successful at UTEL Level 5 in the Listening and Speaking examinations. They will, therefore, be able to listen to and grasp the main idea of a short speech, through an understanding of sequence markers and key vocabulary related to these spoken texts. This includes subject-related English for Academic Purposes (EAP). The aim is also to enable students to make short descriptive speeches about themselves, their surroundings and their basic substantive disciplines.

Key Areas of Focus: Short lectures and note-taking, discussions on subject- specific areas, answering listening comprehension exercises, identification of main ideas of verbal/visual texts and provide evidence. Understanding and following complex instructions within the field of AHS. Making impromptu speeches, conducting small- group discussions, role plays and simulations, and delivering short speeches on given topics.

Course assessment: In-course 40%, End semester 60%

RT 2101 Radiotherapy Equipment and Physics – I (2Credits)

Introduction to radiotherapy equipment: low energy X-ray equipment, Cobalt and other isotopic equipment; imaging equipment; simulators; mould room equipment; treatment setup devices; physical characteristics and comparisons, optical systems and comparisons; radiation safety of above equipment.

Course assessment: In-course 30%, End semester 70%

RT 2102 Molecular Oncology (2Credits)

Tumour formation, benign and malignant disease, methods of spread of malignant disease; introduction to genetics, genetic predisposition and high-risk groups; radiation effects on malignant cells, tissues; fractionation and its effects, cell survival curve; chemotherapy and effects; radiobiological models; tissue tolerance dose, tumour lethal dose; therapeutic radiation and radio sensitivity.

Course assessment: In-course 30%, End semester 70%

RA 2201 Ethics in Medical Radiation Sciences (1Credit)

Values, Ethical schools of thought, Ethical principles, Patient Consent, Codes of professional ethics, Diversity, Caring and communication, Student and employee rights and responsibilities, Challenges, Ethical issues in health care.

Course assessment: In-course 30%, End semester 70%

RA 2202 Medical Image Processing - II (3Credits)

Analog vs. digital images, Medical image modalities, DICOM image format, 2D, 3D and higher dimensional representations, Digital image processing, Visual perception, light and electro-magnetic spectrum, image acquisition, sampling and quantization, pixels, Image transformations, Image processing, Image segmentation, Representation and description, Digital image compression, Object recognition, Computer aided detection.

Course assessment: In-course 30%, End semester 70%

RA 2204 Magnetic Resonance Imaging - I (2Credits)

Magnetization, Reference frames, Resonance, Bloch equation, Precision, Excitation and relaxation, Free induction decay, Instrumentation, Spin echo, Inversion recovery, Gradient echo acquisitions, Fourier imaging, k-space, Image resolution, Bioeffects and safety.

Course assessment: In-course 30%, End semester 70%

RA 2205 Modern Physics (2Credits)

Electromagnetic theory: Electromagnetic waves in free space, Maxwell's equations, electromagnetic waves in dielectric and conducting media, Quantum physics: Schrödinger equation, Electron spin and fine structures, Spin orbit coupling, Quantum states, Hydrogen atom energy levels, Hydrogen atom wave functions.

Course assessment: In-course 30%, End semester 70%

RD 2201 Fluoroscopy - II (2Credits)

Introduction to contrast media, Instrumentation and accessories, Techniques of fluoroscopy procedures of: Gastrointestinal system, Urinary system, Cardiovascular system, Reproductive system, Arthrography, Sialography, Radiation protection, Patient care.

Course assessment: In-course 30%, End semester 70%

RD 2202 Plain Radiography - III (3Credits)

Practice of basic techniques of plain radiography: Upper limb, Lower limb, Vertebral column, Chest, Skull, Shoulder, Abdomen and Pelvis.

Course assessment: In-course 30%, End semester 70%

RD 2203 Computed Tomography – II (2Credits)

Screening and patient preparation, Handling of the equipment, Different imaging techniques and protocols related to the central nervous system, musculoskeletal system and anatomical regions of head, neck, thorax and mediastinum, abdomen and pelvis, Paediatric imaging, Patient safety concerns, Image post-processing techniques, Aftercare of the patient.

Course assessment: In-course 30%, End semester 70%

RT 2201 Principles of Radiotherapy and Oncology (2Credits)

Introduction to radiotherapy; treatment modalities, suitability of radiation sources for teletherapy and brachytherapy; oncology and pathology related to anatomical systems, tumour staging; treatment intent, common cancers treated by each treatment modality and safety aspects; introduction to brachytherapy, principles of pre-loaded or after-loaded, interstitial, intracavitary, surface mould and radionuclide therapy; introduction to clinical radiotherapy, factors affecting the choice of treatment, technique, dose, documentation, information and communication.

Course assessment: In-course 30%, End semester 70%

RT 2202 Radiotherapy Methods – I (2Credits)

Isocentric and non-isocentric treatment; common treatment delivery techniques : single, parallel opposed, non-parallel opposed, multiple fields, dose distributions, advantages, disadvantages; patient positioning, immobilization, reproducibility, setup procedures, data verification, registration and recording, data monitoring, treatment verification and documentation; specific radiotherapy techniques for common sites: breast, gynecological, GIT, prostate, bladder, lung, lymphomas, CNS , head and neck with related to cobalt teletherapy; Mould room technology.

Course assessment: In-course 30%, End semester 70%

3000 Level

RA 3101 Nuclear Imaging – I (3Credits)

Radioactivity, Decay equation, Successive decay equation, Radiation detectors, Gamma camera, SPECT, PET, PET/CT, Production of radionuclides, Production of radiopharmaceuticals, Nuclear pharmacy, Radioactive waste disposal, Internal radiation dosimetry, Radioimmunoassay, Radiation protection in nuclear medicine, Quality assurance and Quality control in nuclear imaging.

Course assessment: In-course 30%, End semester 70%

RD 3102 Dental Radiography (2Credits)

Dental radiography equipment: OPG, Intra-oral and cephalostat. IOPA, Occlusal, Bitewing techniques, OPG, Cephalogram, Other extra oral radiographs, Cone beam CT.

Course assessment: In-course 30%, End semester 70%

RD 3103 Plain Radiography – IV (2Credits)

Practice of special techniques of plain radiography: Upper limb, Lower limb, Vertebral column, Chest, Skull, Shoulder, Abdomen and Pelvis, In-ward radiography, Trauma radiography.

Course assessment: In-course 30%, End semester 70%

RD 3104 Applied Anatomy - II (1Credit)

Radiographic anatomy: Plain radiography of skull, spine, abdomen, pelvis, chest,upper limb and lower limb. Mammography. Contrast studies of GIT, urinary, cardiovascular, respiratory, reproductive and hepatobiliary systems.

Course assessment: In-course 30%, End semester 70%

RD 3108 Computed Tomography - III (3Credits)

Screening and patient preparation, Handling of the equipment, Perform different CT examinations related to the central nervous system, musculoskeletal system, anatomical regions of head, neck, thorax and mediastinum, abdomen and pelvis, paediatric CT, International and local guidelines and standards, Maintain professional ethics, Management of safe imaging environment.

Course assessment: In-course 30%, End semester 70%

RD 3109 Theatre Radiography - I (1Credit)

Introduction to theatre and cath lab, Role of the radiographer in the theatre, Equipment and accessories, Sterilization and radiation protection, Theatre procedures: Orthopaedic surgeries, Neuro surgeries, Urological procedures, General surgeries, Cath lab and interventional procedures.

Course assessment: In-course 30%, End semester 70%

RD 3110 Fluoroscopy – III (2Credits)

Practice of fluoroscopy procedures of Gastrointestinal, Urinary, Reproductive, Cardiovascular, Skeletal and hepatobiliary systems.

Course assessment: In-course 30%, End semester 70%

RT 3101 Radiotherapy Equipment and Physics – II (2Credits)

Linear accelerators: photon, electron; Intensity Modulated Radiotherapy (IMRT), Image Guided Radiotherapy (IGRT) units; brachytherapy equipment; treatment planning systems; heavy particle accelerators; systemic therapy equipment; comparison of physical characteristics, optical systems; radiation safety of above units.

Course assessment:In-course 30%, End semester 70%

RT 3102 Applied Anatomy in Radiotherapy (2Credits)

Surface anatomy: brain, head and neck, thorax, abdomen, nerves, blood vessels; surface marking: middle and lower 1/3 of oesophagus, heart, larynx, pharynx, stomach, liver, lungs, kidneys, spleen, prostate, cervix, pituitary gland, bladder

Course assessment: In-course 30%, End semester 70%

RT 3103 Treatment Planning – I (2Credits)

Tumour localization: patient positioning, immobilization, reproducibility; target volume definitions; ICRU protocols; contouring and transferring data; principles of treatment planning, isodose distributions, devices influencing dose distribution.

Course assessment: In-course 30%, End semester 70%

RT 3104 Clinical Oncology and Radiotherapy – I (2Credits)

A focus on cancer and current treatment modalities with emphasis on radiotherapy; cancers of the skin, brain, head and neck, thorax and gastrointestinal tract; anatomy, epidemiology, etiology, natural history, clinical presentation, patterns of spread, lymphatic involvement, work-up, staging, treatment options, radiotherapy techniques, prognosis, side effects and management and sequelae.

Course assessment: In-course 30%, End semester 70%

RT 3105 Radiotherapy Methods – II (2Credits)

Iodine therapy; Three-Dimensional Conformal Radiotherapy (3D CRT); Electron Beam Therapy; IMRT; brachytherapy techniques and procedures.

Course assessment: In-course 30%, End semester 70%

RT 3106 Clinical Practice of Radiotherapy – I (2Credits)

Preparation of treatment unit, patient and treatment; treatment technique, dose delivery; care and professionalism in cobalt-60 teletherapy unit with regard to techniques described in Radiotherapy Methods - I.

Course assessment: In-course 30%, End semester 70%

RA 3202 Physics of Ultrasound Imaging (1Credit)

Ultrasound production, interactions and detection, Instruments, Spatial, contrast and temporal resolutions, Doppler ultrasound, Artifacts, Output measurements, Performance measurements, Bioeffects and safety, Quality assurance.

Course assessment: In-course 30%, End semester 70%

RA 3203 Research Methodology (2Credits)

A research problem, Hypothesis and objectives, Process of the scientific method, Differences in research and evidence-based practice, Sources of scientific information, Primary and secondary scientific information, Types of research and types of research designs, Literature review, Population and sampling, Types of variables, Scales of measurements, Data collection methods, Specificity, Sensitivity, Reliability and validity in relation to a test or measurements, Sources of error in research and methods of minimizing errors, Ethical principles, Components of a research proposal and dissertation.

Course assessment: In-course 30%, End semester 70%

RD 3201 Magnetic Resonance Imaging – II (3Credits)

Sequence design; Gradient echo, Fast imaging in the steady state, Echo planar imaging, MR angiography, Diffusion imaging, Perfusion imaging, Cardiac MRI, Dynamic contrast enhanced MRI, Parallel imaging, Spectroscopic imaging, Susceptibility weighted imaging, Functional MRI, Hyperpolarized gas imaging, MRCP, Artefacts. Techniques of MRI: Central nervous system, Abdomen and pelvis, MRCP, Extremities, Cardiac MRI, MR Angiography, Prostate, Breast, Endocrine system, Paediatric MRI, MR contrast studies, MR spectroscopy, MR imaging parameters and protocol setup.

Course assessment: In-course 30%, End semester 70%

RD 3202 Imaging in Common Systemic Diseases – I (1Credit)

Manifestations of common pathological conditions which may appear on radiographic images of respiratory system, cardiovascular system, gastrointestinal tract, genitourinary tract, central nervous system, musculo - skeletal system, breast and paediatrics.

Course assessment: In-course 30%, End semester 70%

RD 3205 Mammography – II (2Credits)

Practice of mammographic projections and image processing, Biopsy procedures, Evaluation of mammography images, Quality control procedures, Effective communication with the patient and staff. Course assessment: In-course 30%, End semester 70%

RD 3207 Theatre Radiography - II (2Credits)

Principle of C-arm and fluoroscopy unit, Preparation of the equipment and the radiographer himself, Fluoroscopy procedures: Hepatobiliary, Urinary, Cardiovascular systems, Orthopedic surgeries and Neuro surgeries, Radiation protection to the patient and staff.

Course assessment: In-course 30% End-Semester examination - 70%

RD 3208 Nuclear Imaging - II (2Credits)

Radiopharmaceuticals and radiolabelling, Nuclear imaging procedures for thyroid, parathyroid, genito- urinary, cardiovascular, respiratory, skeletal, central nervous , hepato biliary, gastrointestinal systems, Myocardial stress imaging, Infections & tumour imaging, Nuclear imaging procedures in emergency, Therapeutic nuclear medicine, Patient care, Quality control.

Course assessment: In-course 30%, End semester 70%

RD 3209 Care of Patient - II (2Credits)

Medical emergencies in diagnostic imaging, Care of patients during contrast enhanced studies, CT, MRI, Nuclear imaging and mobile radiography, Care of patients with: Impaired hearing and vision, Burns, Cardiac and respiratory problems, Mental disorders, Trauma, Head and spinal cord injuries, Communicable diseases, Care of isolated patients, Cardiopulmonary resuscitation.

Course assessment: In-course 30%, End semester 70%

RD 3210 Radiation Protection in Radiography (2Credits)

Radiation exposure control programme, Radiation detectors, Dose calculations from radiation sources, Methods of dose reduction, Patient dose in diagnostic radiology and nuclear medicine, Designing of diagnostic radiology and nuclear medicine facilities, Safe transport of radiation sources, Safe management of radioactive wastes, Radiation protection through quality assurance.

Course assessment: In-course 30%, End semester 70%

RD 3211 Applied Anatomy – III (2Credits)

Anatomy on: Cross sectional images of CT Brain, Para nasal sinuses, Pituitary, Orbits, Temporal bone, Abdomen & pelvis, Chest, Musculoskeletal. Post-processing techniques of CT: Angiography, Urography, Virtual colonoscopy and bronchoscopy. Anatomy on cross sectional images of MRI: Brain, Spine, Para nasal sinuses, Pituitary, Orbits, Musculoskeletal, Abdomen & pelvis, Breast, MR angiography, MRCP, MR urography.

Course assessment: In-course 30%, End semester 70%

RT 3201 Radiation Protection and Safety in Radiotherapy (2Credits)

Dose from internal exposure; calculation of shielding for gamma and beta rays; safe use of unsealed sources in radiotherapy; accidental exposures, emergency procedures, rules and regulations; construction of radiotherapy bunkers; personal dose monitoring; management of radiation exposed personnel; regulations on source transportation and replacement; regulations on radiographers.

Course assessment: In-course 30%, End semester 70%

RT 3202 Care of Patient – II (2Credits)

Communication, ethics, care of patients before, during and after radiotherapy, skin and mouth care during radiotherapy; monitoring and management of common side effects; care of chemo irradiated patients; practical problems in radiotherapy room, handling equipment, shielding, immobilization devices; emergency treatments; care of elderly patients, paediatric patients, differently abled patients, unconscious patients, patients with communicable/ noncommunicable diseases, patients with tubes.

Course assessment: In-course 30%, End semester 70%

RT 3203 Treatment Planning – II (2Credits)

Parameters used in treatment planning; corrections for tissue inhomogeneities and surface irregularities, tissue compensator, bolus; treatment planning techniques; patient positioning; design of wedge filters; dose calculations for Cobalt-60, linear accelerator; skin dose, electron contamination of photon beams, dose distribution in build-up region, skin sparing effect, effect of absorber skin distance, field size, electron filters, skin sparing at oblique incidence, separation of adjacent fields, guidelines for field matching, dose calculation outside the beam; two dimensional manual planning for breast, maxillary antrum, oesophagus, bladder and prostate, rectum tumours; errors in treatment planning.

Course assessment: In-course 30%, End semester 70%

RT 3204 Clinical Oncology and Radiotherapy – II (2Credits)

Further exploration of cancer and current treatment modalities with emphasis on radiotherapy, cancers of genitourinary, lymphoreticular, musculoskeletal, integumentary, hematopoietic and endocrine systems; anatomy, epidemiology, etiology, natural history, clinical presentation, patterns of spread, lymphatic involvement, work-up, staging, treatment options, radiotherapy techniques, prognosis, side effects, management and sequelae.

Course assessment: In-course 30%, End semester 70%

RT 3205 Quality Assurance in Radiotherapy – I (2Credits)

Basics: managing QA programme, QA instrumentation, QA programme for Cobalt-60 units, linear accelerator units, brachytherapy units, simulator units, mould room; detailed periodic QA programme for Cobalt-60 and linear accelerator units; performance of routine QA procedures.

Course assessment: In-course 30%, End semester 70%

RT 3206 Clinical Practice of Radiotherapy – II (3Credits)

Preparation of treatment unit, patient, treatment; technique, dose delivery; care and professionalism in brachytherapy and iodine therapy units with regard to techniques described in Radiotherapy Methods - II.

Course assessment: In-course 30%, End semester 70%

4000 Level

RA 4102 Medical Imaging Informatics (1Credit)

Introduction to medical imaging informatics, Review of imaging anatomy and physiology, Information systems and architectures, Medical data visualization, Documenting imaging findings.

Course assessment: In-course 30%, End semester 70%

RA4103 Management of Healthcare Organizations (1Credit)

State sector vs. private sector, Preventive sector vs. curative sector, Central health ministry vs. provincial health ministry, Functional structure of a hospital, Organizational structure of hospital & campaign, Administrative procedures, Basics of financial regulations, Purchases & supply management, Inventory & stores management.

Course assessment: In-course 30%, End semester 70%

RA 4104 Productive Workforce and Organization in Health Care (1Credit)

Quality in healthcare organization, Infection-free & safe environment, Effective human resource management, Medical ethics & etiquettes, Medical documentations & it's legal aspects, Leadership skills, Professional conduct, Conflict Management in workplaces, Effective Communication, Public relations, Updates on current health trends, Circulars & guidelines.

Course assessment: In-course 30%, End semester 70%

RD 4101 Maintenance of Medical Imaging Equipment (2Credits)

Health and safety in maintenance work, Management of medical equipment, Basic Electricity and Electronics, Instrumentation. Corrective and preventive maintenance of X-ray generators & high tension cables, Health and safety act and electricity at work regulations, X-ray tube and its components, Fluoroscopy equipment, Mobile radiography equipment, Capacitor discharge and C-Arm equipment, Automatic film processors.

Course assessment: In-course 30%, End semester 70%

RD 4104 Radiation Dosimetry and Applications (2 Credits)

Radiation field quantities, Quantities and units used in radiation protection, X and Gamma-rays interaction with matter, Charged particle interactions with matter, Dose calculations, Measurement of exposure: free air chamber, air wall chamber, Bragg-Gray principle, Bio dosimetry, Personal dosimetry, Radiopharmaceutical dosimetry, Dose measurement in clinical setting.

Course assessment: In-course 30%, End semester 70%

RD 4105 Magnetic Resonance Imaging - III (3Credits)

Screening and patient preparation, Handling of the equipment and selection of MR coils, Perform MRI examinations related to the central nervous system, musculoskeletal system, endocrine system, anatomical regions of head, neck, breast, thorax and mediastinum, abdomen and pelvis, prostate, extremities and joints, paediatric MRI, MR spectroscopy, Patient care, International and local guidelines and standards, Maintain professional ethics, Management of safe imaging environment.

Course assessment: In-course 30%, End semester 70%

RD 4107 Quality Assurance in Medical Imaging - I (2Credits)

Quality system, Quality assurance and quality control, Acceptance testing, Radiographic quality control routine performance: X-ray tube quality control, QA in dental radiography, mammography, fluoroscopy and digital radiography.

Course assessment: In-course 30%, End semester 70%

RD 4108 Imaging in Common Systemic Diseases- II (2Credits)

Manifestations of pathological conditions which may appear on CT brain, para nasal sinuses, orbits, temporal bone, spine, chest, abdomen and pelvis, musculo skeletal system, cardiovascular system and CT angiography, Manifestations of pathological conditions which may appear on MRI brain, pituitary, orbits, spine, musculo skeletal system, chest, abdomen and pelvis, breast, cardiac MRI and MR Angiography, MRCP.

Course assessment: In-course 30%, End semester 70%

RD 4109 Paediatric Imaging (2Credits)

Understanding childhood, Clinical applications, International and national directives and guidelines, Consent, Technical considerations: minimizing heat loss, immobilisation, sedation and anesthesia, administration of contrast media, nill per orally (NPO) status, radiation protection, Effective communication, Radiographic techniques for the chest and upper respiratory tract, central nervous system, musculoskeletal system, cardiovascular system, gastrointestinal system and genitourinary system, Paediatric MRI and nuclear imaging examinations, Imaging of neonates, Imaging of non-accidental trauma.

Course assessment: In-course 30%, End semester 70%

RT 4101 Paediatric Radiotherapy (2Credits)

Introduction to paediatric tumours; late effects of paediatric radiotherapy; radiotherapy for CNS tumours, neuroblastoma, soft tissue sarcomas and Wilms' tumour.

Course assessment: In-course 30%, End semester 70%

RT 4102 Quality Assurance in Radiotherapy – II (2Credits)

Acceptance tests, commissioning tests, dosimetric checks; detailed QA programme for brachytherapy units, brachytherapy sources and simulator units; QA programme for advanced treatment methods; QA programme for recording and verification; performance of QA procedures.

In-course 30%, End semester 70%

RT 4103 Evidence Based Clinical Practice (2Credits)

Introduction to evidence-based practice and epidemiology; evaluating the evidence; applying evidence practice principles to professional practice.

Course assessment: In-course 30%, End semester 70%

RT 4104 Maintenance of Radiotherapy Equipment (2Credits)

Carry out maintenance of low energy and high energy photon equipment, brachytherapy equipment, treatment planning equipment, equipment used in systemic therapy, treatment set up devices and mould room equipment.

ICourse assessment: In-course 30%, End semester 70%

RT 4105 Radiation Dosimetry and Applications (2Credits)

Principles of radiation dosimetry, Application in radiotherapy: calibration of cobalt, linear accelerator, in vivo and in vitro dosimetry.

Course assessment: In-course 30%, End semester 70%

RT 4106 Clinical Practice of Radiotherapy – III (3Credits)

Preparation of treatment unit, patient, treatment; technique, dose delivery; care and professionalism in linear accelerator and CT simulation units with regard to techniques described in Radiotherapy Methods- II.

Course assessment: In-course 30%, End semester 70%

RA 4001 Research Project (6 Credits)

Problem identification and project formulation, Search and retrieve information required, Identification and optimal utilization of available resources, Project execution, Socioeconomic, ethical and safety evaluation, Data collection and analysis, Dissertation writing and presentation.

Course assessment: In-course 70%, End semester 30%

RD 4202 Ancillary Imaging Techniques (2Credits)

Skeletal survey, Bone densitometry: DEXA, Quantitative ultrasound, Quantitative computed tomography, Foreign body imaging, Soft tissue imaging and tomography, Forensic radiological procedures, Macro radiography, Veterinary radiological procedures.

Course assessment: In-course 30%, End semester 70%

RD 4203 In Service Training (4 Credits)

Practice of plain radiography, Fluoroscopy and contrast studies, Digital radiography, Mobile radiography, Dental radiography, Nuclear imaging, CT, MRI, Mammography and Theatre radiography.

Course assessment: In-course 80%, End semester 20%

RD 4204 Quality Assurance in Medical Imaging - II (2 Credits)

Quality assurance tests in CT, Quality assurance tests in MRI.

Course assessment: In-course 30%, End semester 70%

RT 4201 Treatment Planning – III (2 Credits)

Introduction to 3D planning; 3D planning of different clinical cases; IMRT, electron, brachytherapy treatment planning and dose calculation.

Course assessment: In-course 30%, End semester 70%

RT 4202 Advanced Radiotherapy Methods (2Credits)

Stereotactic radiosurgery, stereotactic radiotherapy, Volumetric Modulated Arc Therapy (VMAT), total skin electron treatment, Total Body Irradiation (TBI), IGRT, tomotherapy, advanced brachytherapy methods, motion sensitive approaches to radiotherapy.

Course assessment: In-course 30%, End semester 70%

RT 4203 In-service Training in Radiotherapy (6Credits)

Practice of radionuclide therapy, brachytherapy, 3D planning, electron therapy, IMRT.

Course assessment: In-course 30%, End semester 70%