CURRICULUM FOR
B.Sc. IN RADIOTHERAPY
DEGREE PROGRAMME

Department of Radiography /Radiotherapy

Faculty of Allied Health Sciences

University of Peradeniya

JUSTIFICATION

B.Sc. in Radiotherapy awarded by Department of Radiography/ Radiotherapy, Faculty of Allied Health Sciences, University of Peradeniya is the only degree offered in this discipline in Sri Lanka.

Radiotherapy is a medical specialty employed in hospitals to treat disease, primarily cancer, using high energy radiation and therapeutic radiographers are health care professionals skilled in the art and science of medical radiation treatment delivery.

The need for therapeutic radiographers will continue for the foreseeable future across Sri Lanka and internationally. Especially with the expansion in the number and size of cancer treatment facilities, the success of radiotherapy treatment and the growing incidence of cancer worldwide, there was a necessity to revise the curriculum.

The revised curriculum consists of 120 credits including hospital based training and a research project.

The programme is designed not only to produce competent therapeutic radiographers equipped with knowledge and professional skills to provide safe, effective and compassionate care but also to expand the role and provide a career ladder for therapeutic radiographers. This degree will ensure students have the ability to undertake the accurate delivery of treatment, the provision of a high standard of patient care, good inter-personal skills, and the ability to adapt and respond to the individual needs of the patient.

ADMISSION REQUIREMENTS

The admission of undergraduate student to follow B.Sc. Radiography/ Radiotherapy degree programme offered by the Faculty of Allied Health Sciences (FAHS) is made by the University Grants Commission. Selection for admission is based on the results of the GCE (Advanced Level) examination conducted by the Department of Examinations, Ministry of Education according to the demand for vacancies.

*Examination by- laws will be adapted from the Faculty of Allied Health Sciences existing prospectus.

Level	Course Code	Course Title	Credits
1000 Level - Semester 1			
1000	AH 1101	English and Communication Skills - I	Non credit
	AH 1102	Information Technology	Non credit
	AH 1103	Basic Human Anatomy	2
	AH 1106	Introduction to Psychology	2
	RA 1101	Human Physiology	2
	RA 1102	Basic Biochemistry	1
	RA 1103	General Physics	2
	RA 1104	Mathematics - I	2
	RA 1105	Introduction to Electronics and Instrumentation	2
	1000 Level - Semester 2		
	AH 1201	English and Communication Skills - II	Non credit
	AH 1203	General Pathology	2
	RA 1201	Atomic and Radiation Physics	2
	RA 1202	Radiobiology and Radiation Protection	2
	RA 1203	Applied Anatomy - I	2
	RA 1204	Medical Imaging Equipment	3
	RA 1205	Plain Radiography - I	2
	RA 1206	Medical Image Processing - I	3
		Total No. of Credits for 1000 Level	**29**
2000 Level - Semester 1			
2000	AH 2101	English and Communication Skills - III	Non credit
	RA 2101	Programming Techniques	3
	RA 2102	Fluoroscopy - I	2
	RA 2103	Computed Tomography - I	3
	RA 2104	Mathematics - II	2
	RA 2105	Modern Physics	2
	RA 2106	Care of Patient - I	2
	RT 2101	Radiotherapy Equipment and Physics - I	2
	RT 2102	Molecular Oncology	2
	2000 Level - Semester 2		
	AH 2201	English and Communication Skills - IV	Non credit
	RA 2201	Ethics in Medical Radiation Sciences	1
	RA 2202	Medical Image Processing - II	3
	RA 2203	Common Systemic Diseases	2
	RA 2204	Magnetic Resonance Imaging - I	3
	RT 2201	Principles of Radiotherapy and Oncology	2
	RT 2202	Radiotherapy Methods - I	2
		Total No. of Credits for 2000 Level	**31**

3000 Level - Semester 1			
3000	RA 3101	Nuclear Imaging - I	3
	RT 3101	Radiotherapy Physics and Equipment - II	2
	RT 3102	Applied Anatomy in Radiotherapy	2
	RT 3103	Treatment Planning - I	2
	RT 3104	Clinical Oncology and Radiotherapy - I	2
	RT 3105	Radiotherapy Methods - II	2
	RT 3106	Clinical Practice of Radiotherapy - I	2
	3000 Level - Semester 2		
	RA 3201	Statistics	2
	RT 3201	Radiation Protection and Safety in Radiotherapy	2
	RT 3202	Care of Patient - II	2
	RT 3203	Treatment Planning - II	2
	RT 3204	Clinical Oncology and Radiotherapy - II	2
	RT 3205	Quality Assurance in Radiotherapy - I	2
	RT 3206	Clinical Practice of Radiotherapy - II	3
		Total No. of Credits for 3000 Level	**30**
4000 Level - Semester 1			
4000	RA 4101	Research Methodology	2
	RT 4101	Paediatric Radiotherapy	2
	RT 4102	Quality Assurance in Radiotherapy - II	2
	RT 4103	Evidence Based Clinical Practice	2
	RT 4104	Maintenance of Radiotherapy Equipment	2
	RT 4105	Radiation Dosimetry and Applications	2
	RT 4106	Clinical Practice of Radiotherapy - III	3
	4000 Level - Semester 2		
	RA 4201	Research Project	6
	RA 4202	Medical Data Communication	1
	RT 4201	Treatment Planning - III	2
	RT 4202	Advanced Radiotherapy Methods	2
	RT 4203	In-service Training in Radiotherapy	4
		Total No. of Credits for 4000 Level	**30**
Total No. of Credits for B.Sc. Radiotherapy Degree			**120**

AH - Common module in Allied Health Sciences degree programmes
RA - Common module for Radiography and Radiotherapy degree programmes
RT - Module in Radiotherapy degree programme

LEVEL 1000 – SEMESTER 1

Course Code : AH 1103
Course Title : Basic Human Anatomy
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 25 hrs, Practical/ Demonstrations- 10 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Define various terminology used in anatomy and its sub divisions
2. Explain the organization of human body at different levels, namely cell, tissues and organs forming systems
3. Explain briefly the normal structure of cell tissues, organs, systems and their inter-relationships
4. Identify the structures of human body in diagrams, models and specimens

Course syllabus/ Course Description

The structure and function of the cell, Organization of the body , Embryology, Structure of Cardiovascular system, Lymphatic system, Respiratory System, Digestive System, Genito - Urinary System, Endocrine System, Musculoskeletal System, Nervous System, Sensory Organs.

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Seeley, R., Stephens, T. and Tate, P. (2007) *Anatomy and Physiology*, 8th ed. McCraw-Hill Science
2. Waugh, A. and Grant, A. (2006) *Ross and Wilson Anatomy and Physiology in Health and Illness*, 10th ed. Churchill Livingstone

* Continues Assessment for each course includes practical, assignments, quizzes and mid semester examination where applicable.

* End Semester Examination will be held in the form of a written examination, OSPE, practical examination and viva where applicable.

Course Code : AH 1106 **Course Title** : Introduction to Psychology **Credits** : 02 **Prerequisite** : None	
Compulsory/ Optional : Compulsory	
Time Allocation : Lectures- 30 hrs	
Intended learning outcomes: At the successful completion of the course, the students will be able to**:** 1. Explain the major perspectives in psychology 2. Identify different sources of evidence in psychology 3. Discuss the psychological influences in healthcare 4. Apply and relate the psychological concepts to health care	
Course syllabus/ Course Description 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, Promotion of attachment and bonding between infant and care giver	
Assessment	Percentage Mark
Continuous Assessment	40%
End Semester Examination	60%

Recommended References:

1. Russell, G. (1999) *Essential Psychology for Nurses and Other Health professionals*, 1st ed. Routledge
2. Atkinson, R.L., Atkinson, R.C., Smith, E.E., Bem, D.J. and Nolen-Hoeksema, S. (1999) *Hilgard's Introduction to Psychology*. 13th ed. Cengage Learning
3. Marks, D.F., Murray, M. and Evans, B. (2011) *Health Psychology : Theory, Research and Practice*, 3rd ed. SAGE Publications Ltd

Course Code : RA 1101
Course Title : Human Physiology
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the end of the module, the student should be able to describe**:**

1. The functions of different systems of the body
2. Their integration and control mechanisms to maintain homeostasis

Course syllabus/ Course Description

Organization of the body for function, Homeostasis, Body fluids, Blood, Temperature regulation, Growth and development, Ageing, Cardiovascular system, Lymphatic system, Respiratory system, Digestive system, Endocrine system,Nerve, Muscle, Nervous system, Special senses, Urinary system, Reproductive system, ECG- Fundamental concepts.

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Seeley, R., Stephens, T. and Tate, P. (2007) *Anatomy and Physiology*, 8th ed. McCraw-Hill Science

Course Code : RA 1102
Course Title : Basic Biochemistry
Credits : 01
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 15 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Explain the normal biochemical and physiological processes in the human body
2. Compare the deviations from norms, related to biochemical and nutritional status

Course syllabus/ Course Description

Structure and Function of cell organelles, Structure and Function of carbohydrates, lipids, proteins and nucleic acids, pH and buffers. Enzymes, properties and kinetics, Biological oxidation, Metabolism of carbohydrate, lipids, proteins and nucleic acids, Integration and regulation of metabolic pathways, Calcium metabolism, Cell cycle and Regulation

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Bhagavan, N.V. (2001) *Medical Biochemistry*, 4th ed. Academic Press
2. Harvey, R.A. and Ferrier, D.R. (2010) *Biochemistry (Lippincott's Illustrated Reviews Series*), 5th ed. Lippincott Williams & Wilkins
3. Murray, R., Rodwell, V. and Bender, D., Weil, P.A. and Kennely, P.J. (2009) *Harper's Illustrated Biochemistry*, 28th ed. McGraw-Hill Medical

Course No : RA 1103
Course Title : General Physics
Credits : 02
Prerequisite : None

Compulsory / Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Aims and/ or Objectives and/ or Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Explain the motion and equilibrium of objects using principles of Physics
2. Describe the behavior of static and dynamics of charge particles placed in electric and magnetic fields
3. Identify different types of waves and explain their behavior in different media
4. Discuss the properties of solids and liquids
5. Apply principle of modern Physics to solve problems in radiography

Course syllabus/ Course Description

Units and dimensions, significant figures, Mechanics: Kinematics in one and two dimensions, Newton's Laws of motion, Friction, Energy, work and power, System of Particles, Rotational motion, Wave Mechanics: Longitudinal and transverse waves, superposition of waves, progressive and stationary waves, vibrations of strings and air columns, resonance, speed of sound in a media, Doppler effect, Electric and Magnetic Fields: Coulomb forces on charges, electric field intensity and electric potential, magnetic fields due to current carrying conductors, Magnetic force on current carrying conductors, electromagnetic induction, Solid and Fluids: Inter-atomic and inter-molecular forces, state of matter, Solids: elastic properties, Hook's law, Young's modulus, bulk modulus and modulus of rigidity, Liquids: Cohesion application, viscosity, Stoke's law, terminal velocity, Modern Physics: Atomic nucleus, alpha, beta and gamma radiation, low of radioactive decay, binding energy and its calculations, fission and fusion processes.

Assessment	**Percentage Mark**
Continuous Assessment	50%
End Semester Examination	50%

Recommended References:

1. Serway, R.A. and Beichner, R.J. (2000) *Physics for Scientists and Engineers*, Saunders College pub
2. Resnik, R., Haliday, D. and Walker, J. (2000) *Fundamentals of Physics*, John Wiley & Sons, Inc.
3. Tipler, P.A. (2000) *Physics for Scientists and Engineers*, Worth Pub

Course Code : RA 1104
Course Title : Mathematics - I
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Utilize mathematical concepts to solve the problems in Physics
2. Explain the behaviour of the physical variables using functions and graphs
3. Solve linear and quadratic equations
4. Describe and apply various trigonometric, exponential and logarithmic functions to solve problems in Physics
5. Apply basic rules of derivatives and partial derivatives to solve problems

Course syllabus/ Course Description

Cartesian coordinate system, 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

Assessment	Percentage Mark
Continuous Assessment	50%
End Semester Examination	50%

Recommended References:

1. Arya, J.C., Lardner R.W., and Pearson (1979) *Mathematics for Biological Sciences*, 1st ed.
2. Zill, D.G. (2012) *The First Course in Differential Equations*, 10th ed. Brooks
3. Plumpton, C.(1981) *New Tertiary Mathematics*, Oxford : Pergamon

Course Code : RA 1105
Course Title : Introduction to Electronics and Instrumentation
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 25 hrs, Practical/ Demonstrations - 10 hours

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Analyze simple electrical and electronic circuits
2. Describe the operations of different circuits constructed with operational amplifiers
3. Use modern electronic equipment and measuring devices effectively, with an understanding of the transducers and data conversion systems
4. Explain errors, signal acquisition and demodulation in medical imaging equipment

Course syllabus/ Course Description

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; Process Automation; Antennas; Signal processing.

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Boylestad, R.L. and Nashelsky, L. (2001) *Electronic Devices and circuit theory*, 6th ed. Prentice-Hall of India
2. Malvino, A.P. (1999) *Electronic Principles*, 6th ed. Glencoe/McGraw-Hill
3. Sawhney, A.K. (2002) *A course in Electrical and Electronic Measurements and Instrumentation*, 17th ed. Dhanpat Rai & Co

LEVEL 1000 – SEMESTER 2

Course Code : AH 1203
Course Title : General Pathology
Credits : 02
Prerequisite : AH 1103, RA 1101, RA 1102

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Define the terminology and describe the basic concepts of general pathology for the purpose of reading, learning and working in teams of medical care personal
2. Use and integrate the knowledge of basic pathological process underlying the diseases of tissues for
3. Define the involvement of immune system in pathogenesis of diseases

Course syllabus/ Course Description

Introduction to Pathology, Inflammation and Repair (Acute Inflammation, Chronic Inflammation, Wound healing and complications, Principles of fracture healing and complications),Growth disturbances (Hypertrophy, Atrophy, Hyperplasia, Metaplasia, Dysplasia), Degeneration and necrosis (Cell damage, Apoptosis, Necrosis, Gangrene), Circulatory disturbances (Ischemia and Infarction, Thrombosis, Embolism, Atherosclerosis, Oedema, Congestion and Heart failure), Tissue deposits and Pigments, Immunology, Neoplasia (Types of Neoplasia, Tumour markers and Molecular basis of carcinogenesis), Genetic basis of diseases

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Reid, R., Roberts, M. E., Callander, R. and Ramsden, I. (2011) *Pathology Illustrated*

Course Code : RA 1201
Course Title : Atomic and Radiation Physics
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 25 hrs, Practical/ Demonstrations - 10 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Explain the model of Bohr's theory of Hydrogen like atoms using principles of Physics
2. Describe the behaviour of alpha, beta, gamma, and their interaction with matter
3. Identify different types of radiation interaction with matter
4. Discuss the general properties of electromagnetic waves
5. Solve problems applying principles of Atomic Physics, Nuclear and Radiation Physics

Course syllabus/ Course Description

Bohr's theory of Hydrogen like atoms, Angular momenta, Nuclear properties, , Magnetic resonance, Radioactive decay, Fission, Fusion, Electromagnetic radiation, Properties of electromagnetic waves, Electromagnetic spectrum, Intensity of radiation, X-ray Production, Breaking radiation, Characteristic X-Rays, Interactions of X-Rays, Types of X-Ray interactions, Photo electric effect, Attenuation, Ionizing radiation : alpha, beta, gamma rays, interactions of radiations with matter

Assessment	**Percentage Mark**
Continuous Assessment	40%
End Semester Examination	60%

Recommended References:

1. Ball, J., Moore, A.D. and Turner, S. (2008) *Ball and Moore's Essential Physics for Radiographers*, 4th ed. Wiley-John & Sons
2. Curry, T.S., Dowdey, J.E. and Murry, R.E. (1990) *Christensen's Physics of Diagnostic Radiology*, 4th ed. Lippincott Williams & Wilkins
3. Grahm, D.T. and Cloke, P. (2003) *Principles of Radiological Physic*s, Churchill Livingstone
4. Hay, J.A. and Hiyes, D.J. (1997) *1st year Physics for Radiographers*, 3rd ed. W.B.Saunders Company

Course Code : RA 1202
Course Title : Radiobiology and Radiation Protection
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Relate different types of biological effects following exposure to ionizing radiation with the mechanisms
2. Use radiation for beneficial practices observing / adhering to internationally recognised guidelines to optimize radiation protection of workers, patients and general public

Course syllabus/ Course Description

Background Radiation, Quantities and Units in radiation dosimetry, Radiation Interactions at cellular and tissue levels, Biological basis of radiation cell killing, Biological, physical and chemical factors affecting cellular radiosensitivity, Radiation effects on normal tissues, Radiation carcinogenesis, Genetic effects of radiation, Radiation effects on developing embryo, External and Internal hazards of radiation and methods of evaluation, Basic Principles of Radiation Protection, Elements of a Radiation Protection Programme, National and International regulations and Standards

Assessment	**Percentage Mark**
Continuous Assessment	40%
End Semester Examination	60%

Recommended References:

1. Hall, E.J. and Giaccia, A. (2011) *Radiobiology for the Radiologist*; 7th ed. Lippincott Williams &Wilkins
2. Kogel, A.V. and Joiner, M. (2009) *Basic Clinical Radiobiology*, 4th ed. Macmillan Publishers
3. Martin, A. and Harbison, S.A. (2006) *An Introduction to Radiation Protection,* 5th ed. Hodder Arnold
4. Sherer, M.A.S., Visconti, P.J. and Ritenour, E.R.(2006) *Radiation Protection in Medical Radiography*, 5th ed. Mosby Elsevier

Course Code : RA 1203
Course Title : Applied Anatomy - I
Credits : 02
Prerequisite : AH 1103

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 25 hrs, Practical/ Demonstrations - 10 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Identify the component parts of the different systems of the body
2. Relate their knowledge with the radiological anatomy of the systems

Course syllabus/ Course Description

Anatomy of Appendicular skeleton, Axial skeleton, Muscles, Joints, Surface anatomy, abdomen, Identification of muscles and tendons in appendicular skeleton with cross sectional anatomy, Anatomy of vascular, nervous and lymphatic systems, Cross sectional anatomy of brain, chest, abdomen, pelvis and upper and lower limbs

Assessment	**Percentage Mark**
Continuous Assessment	40%
End Semester Examination	60%

Recommended References:

1. Kumar, S. (2006) *Surface & Imaging Anatomy*, 1st ed. CBS Publishers & Distributors
2. Netter, F.H. (2010) *Atlas of Human Anatomy*, 5th ed. Elsevier Health Sciences

Course Code : RA 1204
Course Title : Medical Imaging Equipment
Credits : 03
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 40 hrs, Practical/ Demonstrations - 10 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Identify the components of X-ray equipment
2. Describe the structure of X-ray equipment and explain their mechanism

Course syllabus/ Course Description

X-ray machine, Stationary anode x-ray tube, Rotating anode X-ray tube, X-ray production, Bremsstrahlung, Characteristic radiation, Transformers, X-ray generators, Exposure switches and timers, X-ray tube rating charts, X-ray interaction with matter, X-ray filters, X-ray beam restrictors, Grids, Grid performances, Grid cut off, Construction and operation of isocentric skull equipment, Tomography, OPG, Intraoral and Cephalostat, Mobile equipment, Digital equipment

Assessment	**Percentage Mark**
Continuous Assessment	40%
End Semester Examination	60%

Recommended References:

1. Carter, P.H., Paterson, A.M. and Thornton, M.L. (1994) *Chesney's Equipment for student Radiographers*, 4th ed. Wiley-Blackwell
2. Bushberg, J.T., Seibert, J.A., Leidholdt, E.M. and Boone, J.M. (2011) *The Essential Physics of Medical Imaging*, 3rd ed. Lippincott Williams & Wilkins
3. B. Podgorsak, E.B. (2010) *Radiation Physics for Medical Physicists*, 2nd ed. Springer

Course Code : RA 1205 **Course Title** : Plain Radiography - I **Credits** : 02 **Prerequisite** : None	
Compulsory/ Optional : Compulsory	
Time Allocation : Lectures- 25hrs, Practical/ Demonstrations - 10 hrs	
Intended learning outcomes: At the successful completion of the course, the students will be able to**:** 1. Correctly position the patient for basic radiographic techniques 2. Evaluate the quality of the various radiographic projections	
Course syllabus/ Course Description Physical principles of radiography, Terminology, Technical evaluation and anatomy of the images of: Upper limb, Lower limb, Spine, Pelvis AP, Single Hip AP, Skull, Chest and Abdomen	
Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Aitchison, F. (2009*) Chapman and Nakielny: A Guide to Radiological Procedures,* 5th ed. Elsevier Health Sciences
2. Ball, J.L. and Price T. (1995) *Chesney's Radiographic Imaging,* 6th ed. Wiley-Blackwell
3. Bryan, G.J. and Davies, E.R. (1987) *Diagnostic Radiography Practical Manual,* 4th ed. Churchill Livingstone
4. Frank, E.D., Long, B.W. and Smith, B.J. (2007) *Merrill's Atlas of Radiographic Positioning and Procedures* (vol. 1,2,3), 11th ed. Mosby
5. Unett, E.M. and Royle, A.J. (1997) *Radiographic Technique and Imaging Evaluation,* Nelson Thornes
6. Whitley, A.S., Sloane, C., Hoadley, G. and Moore, A.D. (2005) *Clark's Positioning in Radiography,* 12th ed. Hodder Arnold

Course Code : RA 1206
Course Title : Medical Image Processing - I
Credits : 03
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs, Practical/ Demonstrations - 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Distinguish image formation in conventional radiography vs. digital radiography
2. Describe manual and automatic film processing in conventional radiography
3. Evaluate sensitometry and its application in film processor quality control

Course syllabus/ Course Description

Image Recording Medium used in Conventional Radiography: Photographic Films, Intensifying screens, Matching spectral emission to spectral sensitivity, Latent image formation,Conventional film processing: manual & automatic, Sensitometry, Film processor maintenance, Dark room procedures: film handling, processing & film Storage conditions, Radiographic image artefacts, Digital Radiography, An Overview, Digital Image Processing Concepts, Computed Radiography: Physics and Technology, Effective Use of Computed Radiography, Flat-Panel Digital Radiography, Picture Archiving and Communication Systems, Medical Image Informatics: An Overview, Quality Control for Digital Radiography

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Ball, J.L. and Price T. (1995) *Chesney's Radiographic Imaging,* 6th ed. Wiley-Blackwell
2. Seeram, E. (2010) *Digital Radiography : An Introduction for Technologists*, 1st ed. Cengage Learning

LEVEL 2000 – SEMESTER 1

Course Code : RA 2101
Course Title : Programming Techniques
Credits : 03
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs, Practical/ Demonstrations - 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Develop GUI based applications
2. Manipulate digital images with computer programs

Course syllabus/ Course Description

Syntax and Semantics of programming, Structured data (lists, stacks, queues, ordered binary trees), Storing and accessing data structures, Object Oriented Programming (OOP) concepts, Graphical User Interface (GUI) designs, Digital image manipulation in GUI applications.

Assessment	**Percentage Mark**
Continuous Assessment	40%
End Semester Examination	60%

Recommended References:

1. Dietel, P.J. and Dietel, H.M. (2011) *Java: How to Program*, 9th ed. Prentice Hall

Course Code : RA 2102
Course Title : Fluoroscopy - I
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 26 hrs, Practical/ Demonstrations - 08 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Identify the components of conventional and digital fluoroscopy equipment
2. Describe conventional and digital fluoroscopy image formation

Course syllabus/ Course Description

Basic Principles of fluoroscopy image formation, Fluoroscopic X-ray tube setup and cooling chart, Image intensifier, Camera system and Viewing of fluoroscopy image, Fluoroscopy Image recording, Fluoroscopy table assembles and accessories, Image quality and quality assurance, C arm equipment, Digital Fluoroscopy with Image Intensifier, Video Camera, Analog-to-Digital Converter, Computer System, Digital Fluoroscopy with Flat-Panel Detectors (FPDs), Limitation of Image Intensifier Technology, Equipment Configuration, Types of Dynamic FPDs, Characteristics of Dynamic FPDs, Operating Principles and Advantages, Connectivity, Digital Image Post-processing, Gray-scale Image Manipulation, Last-Image Hold, Temporal Frame Averaging, Edge Enhancement, Proprietary Post-Processing Techniques, Temporal Subtraction, Energy Subtraction, Advanced Techniques

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Bushberg, J.T., Seibert, J.A., Leidholdt, E.M. and Boone, J.M. (2011) *The Essential Physics of Medical Imaging*, 3rd ed. Lippincott Williams & Wilkins

Course Code : RA 2103
Course Title : Computed Tomography- I
Credits : 03
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 40 hrs, Practical/ Demonstrations - 10 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to explain**:**

1. The physical principles of CT
2. The structure & functioning of CT equipment
3. Advantages & disadvantages of the technique
4. Different types of CT imaging

Course syllabus/ Course Description

Principles of CT, Data acquisition concepts, Image reconstruction, Basic instrumentation, Image post processing and visualization tools, Spiral/Helical CT, 3-D CT, Image quality, Positron Emission Tomography/Computed Tomography scanners, Cardiac CT, CT angiography, CT fluoroscopy, Breast CT, Virtual endoscopy, Applications of CT in radiation therapy, Radiation dose in CT, Quality control of CT scanners

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Hagga, J.R. and Boll, D. (2008) *CT and MRI of the whole body*, 5th ed. Mosby
2. Karthikeyan, D. and Chegu, D. (2007) *Step by Step CT scan*, Jaypee Brothers Medical Publishers Pvt Ltd
3. Romans, L. E. (2011) *Computed Tomography for Technologists – A Comprehensive Text*, 1st ed. Lippincott Williams & Wilkins
4. Seeram, E. (2009) *Computed Tomography: Physical Principles, Clinical Applications and Quality Control*, 3rd ed. Saunders

Course Code : RA 2104
Course Title : Mathematics - II
Credits : 02
Prerequisite : RA 1104

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Utilize mathematical concepts to solve the problems in Physics
2. Explain the method of Legendre transformations to solve problems
3. Solve ordinary and partial differential equations related to Physics problems
4. Describe and apply Laplace and Fourier transformation to solve problems in Physics
5. Apply mathematical concepts to explain the function of radiation therapy equipment and procedures

Course syllabus/ Course Description

Lagrange Multipliers, Infinite series, Vector analysis, First-order differential equation, Higher-order lenear differential equations with constant coefficients, Partial differential equations: Laplace, Heat and wave equation, Fourier series, Integral transformations: Laplace at Fourier transformations, special functions: Legendre, Bessel, Hermite and Laguerrer, Monte Carlo methods.

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Arfken, G.B. (1995) *Mathematical Methods for Physicists*, 2nd ed. Academic press
2. Bose, M. L. (1993) *Mathematical Methods in the Physical Sciences*, 2nd ed. John Wiley & Sons

Course Code : RA 2105
Course Title : Modern Physics
Credits : 02
Prerequisite : RA 1103

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Explain the phenomena of Photoelectric effect and Compton effect in modern Physics
2. Describe the behavior of electromagnetic waves in different media
3. Solve basic problems in Quantum mechanics applying Schrödinger equation
4. Use Hydrogen atom wave functions to explain energy levels
5. Solve problems applying principles of modern Physics

Course syllabus/ Course Description

Electromagnetic theory, Quantum Physics, Plank's theory, Photoelectric effect, Compton scattering and pair production, Dual nature of electromagnetic radiation, Electromagnetic waves in free space, Maxwell's equation, Electromagnetic waves in dielectric and conducting media, Schrödinger equation, Electron spin and fine structures, spin orbit coupling, Quantum states, Hydrogen atoms energy levels, Hydrogen atoms waves function

Assessment	**Percentage Mark**
Continuous Assessment	40%
End Semester Examination	60%

Recommended References:

1. Krane, K.S. (2012) *Modern Physics*, 3rd ed.
2. Ball, J., Moore, A.D. and Turner, S. (2008) *Ball and Moore's Essential Physics for Radiographers*, 4th ed. Wiley-John & Sons

Course Code : RA 2106
Course Title : Care of Patient - I
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Describe basic patient care rules and infection control methods in radiographic procedures

Course syllabus/ Course Description

Routine patient care in an X-ray Department/Radiotherapy unit, Effective communication and team work, First Aid, Infections and basics of microbiology, Care of patients with tubes and catheters (Urinary catheters, Colostomy, NG tubes, IV drips, drainage bags), Care of paediatric and elderly patients, Psychology of illness

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Culmer, P. (1995) *Chesneys' Care of the Patient in Diagnostic Radiography*,7th ed. Wiley-Blackwell
2. Ehrlich, R.A. and Darly, J.A. (2008) *Patient Care in Radiography*, 7th ed. Mosby
3. Torres, L.S., and Dutton, A.G. (2003) *Basic Medical Techniques and Patient Care in Imaging Technology*, 6th ed. Lippincott Williams & Wilkins

Course Code : RT 2101
Course Title : Radiotherapy Equipment and Physics - I
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Identify components of radiotherapy equipment
2. Explain function of components
3. Identify similarities and differences of radiotherapy equipment

Course Syllabus/ Course Description

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.

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Khan, F.M. (2009) *The Physics of Radiation Therapy*, 3rd ed. Lippincott Williams & Wilkins
2. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
3. Cherry, P. and Duxbury, A. (1998) *Practical Radiotherapy: Physics and Equipment*, Greenwich Medical Media
4. Mayles, P., Nahum, A. and Rosenwald, J. (eds.) (2007) *Handbook of Radiotherapy Physics*, Taylor & Francis
5. Thwaites, W., Mijnheer, B.J. and Mills, J.A. (2000) *Radiotherapy Physics in Practice*, 2nd ed. Oxford University Press
6. Smith, F.A. (2000) *A Primer in Applied Radiation Physics*, World Scientific Publishing Co Inc

Course Code : RT 2102
Course Title : Molecular Oncology
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Describe terms related to oncology
2. Explain the mechanism in the formation of malignant tumours
3. Explain clinical application of molecular oncology

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Symonds, P., Deehan, C., Meredith, C. andMills, J. (2002) *Walter and Miller's Textbook of Radiotherapy*, 6th ed. Churchill Livingstone
2. *Radiation Biology: A Handbook for Teachers and Students* (2010) IAEA
3. Hall, E.J. and Giaccia, A. (2011) *Radiobiology for the Radiologist*, 7th ed. Lippincott Williams & Wilkins
4. Joiner, M. and Kogel, A. (2009) *Basic Clinical Radiobiology*, 4th ed. A Hodder Arnold Publication
5. Stephens, F.O. and Aigner, K.R. (2009) *Basics of Oncology*, Springer

LEVEL 2000 – SEMESTER 2

Course Code : RA 2201
Course Title : Ethics in Medical Radiation Sciences
Credits : 01
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 15 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Identify different types of values that have an impact on the ethical decision making
2. Identify the conditions used to assess the proportionality of good and evil in an action
3. Provide patients relevant information to ensure their participation in decision making

Course syllabus/ Course Description

Ethical Issues- Values, Ethical schools of thought, Principles of Beneficence and Non maleficence, Patient Autonomy and Informed Consent, Truthfulness and Confidentiality,
Student Rights, Diversity and Caring, and Challenges

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Thiroux, J. (1998) *Ethics Theory and Practice*, 6th ed. Prentice Hall
2. Cook, D.M.T. and Young, T.A. (1998) *Ethical and Legal Issues for Imaging Professionals*, Mosby

Course Code : RA 2202
Course Title : Medical Image Processing - II
Credits : 03
Prerequisite : RA 1206, RA 2101

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs, Practical/ Demonstrations - 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Operate digital image processing tools and programming languages.
2. Process digital images using frequency domain techniques and spatial domain techniques
3. Detect various types of lesions on medical images

Course syllabus/ Course Description

Introduction to digital medical images: Why digital images, Analog images vs. digital images, Medical image modalities, DICOM image format and its attributes, data types and 2D, 3D and higher dimensional representations, fundamental steps in digital image processing, elements of visual perception, light and electro-magnetic spectrum, image sensing and acquisition, sampling and quantization, relationships between pixels, Image transformations: histogram processing, spatial filtering, Filtering in the frequency domain: Fourier transform, Discrete Fourier Transform (DFT), Morphological image processing: erosion , dilation , opening, closing, gray scale morphology, Image segmentation: point, line and edge detection, thresholding, region based segmentation, watersheds, Representation and description: boundary descriptors, regional descriptors, Digital image compression : lossy and lossless, Object recognition: patterns, pattern classes, classification, introduction to wavelets

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Gonzalez, R.C. and Woods, R.E. (2007) *Digital Image Processing*, 3rd ed. Prentice Hall
2. Gonzalez, R.C., Woods, R.E. and Eddins, S.L. (2003) *Digital Image Processing using MATLAB*, 1st ed. Prentice Hall

Course Code : RA 2203
Course Title : Common Systemic Diseases
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course the students will be able to**:**

1. Recognize the diseases based on history and examination of the dysfunctional systems of a patient
2. Select appropriate investigations for respective disease condition.

Course syllabus/ Course Description

Overview of common diseases; Cardiovascular Diseases, Respiratory Diseases, Diseases of the Liver and Biliary tract, Diseases of Gastrointestinal Tract, Diseases of Loco motor system, Diseases of Nervous System and Muscle Disorders, Renal Diseases, Hematological Diseases

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Boon, N.A., Colledge, N.R. and Walker, B.R. (2010) *Davidson's Principles and Practice of Medicine,* 21st ed. Churchill Livingstone

Course Code : RA 2204
Course Title : Magnetic Resonance Imaging - I
Credits : 03
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 45 hrs

Intended learning outcomes:

At the successful completion of the course the students will be able to**:**

1. Describe the physical basis of MRI and common MRI sequences used in the clinic and for research
2. Acquire, manipulate and post-process MR images, comprehend and explain the post-processing tools
3. Describe the instrumentation and safety issues related to MRI.

Course syllabus/ Course Description

Magnetic Resonance Imaging: A preview, Classical Response of a Single Nucleus to a Magnetic Field, Rotating Reference Frame and Resonance, Magnetization, relaxation and the Bloch equation, The Quantum Mechanical Basis of Precision and Excitation, The Quantum Mechanical Basis of Thermal Equilibrium and Longitudinal Relaxation, Signal Detection Concepts, Introductory Signal Acquisition Methods: Free Induction Decay, Spin Echoes, Inversion Recovery and Spectroscopy, One-Dimensional Fourier Imaging, k-space and Gradient Echoes, Multi-Dimensional Fourier Imaging and Slice Excitation

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Bushong, S.C. (2003) *Magnetic Resonance Imaging: Physical and Biological Principles*, 3rd ed.Mosby Year Book Inc
2. Brown, M. A. and Richard, C. S. (2003) *MRI: Basic Principles and Applications*, 3rd ed.John Wiley & Sons Inc
3. Hagga, J.R. and Boll, D. (2008) *CT and MRI of the whole body*, 5th ed. Mosby
4. McRobbie, D.W.,Moore, E.A., Graves, M.J. and Prince, M.R.(2007) *MRI From Picture to Proton*, 2nd ed. Cambridge University Press
5. Moeller, T.B. and Reif,E. (2003) *MRI Parameters and Positioning*; 1st ed.Thieme
6. Weishaupt, D., Kochi, V.D.andMarincek, B.(2006) *How does MRI work*,2nd ed. Springer
7. Westbrook, C. (1999) *Handbook of MRI Technique*; 2nd ed. Blackwell Science
8. Westbrook, C.,Carolyn, K. and John, T. (2005) *MRI in Practice*, 3rd ed. Blackwell Science Ltd

Course Code : RT 2202
Course Title : Radiotherapy Methods - I
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 18 hrs, Practical/ Demonstrations - 24 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Describe a treatment technique
2. Reason out appropriate technique for a given site

Course Syllabus/ Course Description

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, gynaecological, GIT, prostate, bladder, lung, lymphomas, CNS , head and neck with related to cobalt teletherapy; Mould room technology

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Symonds, P., Deehan, C., Meredith, C. and Mills, J. (2002) *Walter and Miller's Textbook of Radiotherapy*, 6th ed. Churchill Livingstone
2. Ang, K.K. and Garden, A.S. (2011) *Radiotherapy for Head and Neck Cancers*, 4th ed. Lippincott Williams & Wilkins

LEVEL 3000 – SEMESTER 1

Course Code : RA 3101
Course Title : Nuclear Imaging - I
Credits : 03
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 40 hrs, Practical/ Demonstrations - 10 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to**:**

1. Describe radioactive decay, decay equation
2. Describe the principles of nuclear imaging

Course syllabus/ Course Description

Radioactive decay, Decay equation, Successive decay equation, Dose calibrator, Geiger Muller detector, Scintillation detector, Gamma camera, SPECT imaging, PET imaging, Cyclotron produced radio nuclides, Reactor produced radio nuclides, Radionuclide generators, Radiopharmaceuticals, Production of radiopharmaceuticals, Quality control of radiopharmaceuticals, Design of a nuclear pharmacy, Operation of a nuclear pharmacy, Radioactive waste disposal, Internal radiation dosimetry, Radioimmunoassay, Radiation protection in nuclear medicine, Quality assurance in nuclear imaging; Quality control of nuclear medicine equipment, Techniques of nuclear medicine imaging

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Barnier, D.R., Christein, P.A. and Langan, J.K. (2005) *Nuclear Medicine: Technology and Techniques*, 3rd ed. Mosby
2. Shackett, P. (2008) *Nuclear Medicine Technology: Procedures and Quick Reference*, 2nd ed. Lippincott Williams & Wilkins

Course Code : RT 3101
Course Title : Radiotherapy Physics and Equipment - II
Credits : 02
Prerequisite : RT 2101

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 22 hrs, Practical/ Demonstrations - 16 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Identify components of radiotherapy equipment
2. Explain function of components
3. Identify similarities and differences of radiotherapy equipment

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Khan, F.M. (2009) *The Physics of Radiation Therapy*, 3rd ed. Lippincott Williams & Wilkins
2. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
3. Cherry, P. and Duxbury, A. (1998) *Practical Radiotherapy: Physics and Equipment*, Greenwich Medical Media
4. Mayles, P., Nahum, A. and Rosenwald, J. (eds.) (2007) *Handbook of Radiotherapy Physics*, Taylor & Francis
5. Thwaites, W., Mijnheer, B.J. and Mills, J.A. (2000) *Radiotherapy Physics in Practice*, 2nd ed. Oxford University Press
6. Smith, F.A. (2000) *A Primer in Applied Radiation Physics*, World Scientific Publishing Co Inc

Course Code : RT 3102
Course Title : Applied Anatomy in Radiotherapy
Credits : 02
Prerequisite : RA 1203

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 22 hrs, Practical/ Demonstrations - 16 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Identify surface marking of internal organs
2. Identify internal organs in CT, MRI, X-ray images
3. Identify radiotherapy field margins of tumours

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Abrahams, P.H., Belli, A.M. and Weir, J. (2010) *Imaging Atlas of Human Anatomy*, 4th ed. Mosby
2. Ellis, H. (2010) *Clinical Anatomy*, 5th ed. Blackwell Science Ltd
3. Bridge, P. and Tipper, D.J. (2011) *CT Anatomy for Radiotherapy*, M & k Update
4. Kumar, S. (2006) *Surface & Imaging Anatomy*, 1st ed. CBS Publishers & Distributors

Course Code : RT 3103
Course Title : Treatment Planning - I
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 20 hrs, Practical/Demonstrations - 10 hrs, Hospital based training- 20 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Assist in basic planning procedures
2. Explain treatment volumes
3. Take an outline of a patient

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	40%
End Semester Examination	60%

Recommended Reference:

1. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
2. Dobbs, J., Barrett, A., Ash, D., Morris, S. and Roques, T. (2009) *Practical Radiotherapy Planning*, 4th ed. CRC Press
3. Khan, F.M. (2009) *The Physics of Radiation Therapy*, 3rd ed. Lippincott Williams & Wilkins

Course No : RT 3104
Course Title : Clinical Oncology and Radiotherapy - I
Credits : 02
Prerequisite : RT 2202

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 20 hrs, Practical/ Demonstrations - 20 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Communicate effectively and accurately in oral and written forms using appropriate terminology for the malignant disease specified
2. State all major tumor classifications and apply staging principles to clinical example
3. Apply radiotherapy treatment principles to determine appropriate treatment parameters
4. Identify site specific techniques and side effects of radiotherapy

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Perez, C.A., Brady, L.W., Halperin, E.C. and Schmidt-Ullrich, R.K. (2007) *Principles and Practice of Radiation Oncology*, 4th ed. Lippincott Williams & Wilkins
2. Hanna, L., Crosby, T. and Macbeth, F. (2008) *Practical Clinical Oncology*, 1st ed. Cambridge University Press
3. Schwab, M. (2008) *Encyclopedia of Cancer*, 2nd ed. Springer

Course Code : RT 3105
Course Title : Radiotherapy Methods - II
Credits : 02
Prerequisite : RT 2202

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 18 hrs, Practical/ Demonstrations - 24 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Compare treatment methods
2. Identify the most appropriate treatment method for a given tumour site

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Hoskin, P. (2007) *Radiotherapy in Practice: Radioisotope Therapy*, 1st ed. Oxford University Press
2. Hoskin, P.J. and Coyle, C. (2005) *Radiotherapy in Practice: Brachytherapy*, 1st ed. Oxford University Press
3. Tripuraneni, P., Jani, S., Leon, M. and Minar, E. (2001) *Intravascular Brachytherapy: From Theory to Practice*, 1st ed. Remedica
4. Baltus, D., Sakelloiou and Zamboglou, N. (2006) *The Physics of Modern Brachytherapy for Oncology*, 1st ed. Taylor & Francis

Course No : RT 3106
Course Title : Clinical Practice of Radiotherapy - I
Credits : 02
Prerequisite : RT 2202

Compulsory/ Optional : Compulsory

Time Allocation : Hospital based training- 120 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Practice radiotherapy techniques in teletherapy cobalt unit with the required minimum standard
2. Practice ethically
3. Communicate effectively and appropriately

Course Syllabus/ Course Description

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.

Assessment	**Percentage Mark**
Continuous Assessment	50%
End Semester Examination	50%

Recommended Reference:

1. Ang, K.K. and Garden, A.S. (2011) *Radiotherapy for Head and Neck Cancers*, 4th ed. Lippincott Williams & Wilkins
2. Perez, C.A., Brady, L.W., Halperin, E.C. and Schmidt-Ullrich, R.K. (2007) *Principles and Practice of Radiation Oncology*, 4th ed. Lippincott Williams & Wilkins

LEVEL 3000 – SEMESTER 2

Course Code : RA 3201
Course Title : Statistics
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 20 hrs, Practical/ Demonstrations - 20 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Explain the statistical theories.
2. Apply best suited statistical methods and techniques for the problem context

Course syllabus/ Course Description

Introduction to Statistics: Need of Statistics in health sciences, Different types of data, Variables, Data visualization methods, Basic Data Analysis with descriptive measures (Central tendency measures, variability measures, relative position measures and shape measures), Introduction to Probability: Concept of probability, random variables, Binomial, Poisson, Normal and t, chi-square, F distributions. Calculating probability values, Sampling Methods: Definitions of population and sample, parameters and estimates, why sampling?, advantages and disadvantages of sampling over census, probabilistic and non- probabilistic sampling techniques applicable in health related science, sample size selection, Hypothesis testing: Concept of statistical hypothesis, types of errors, decision making, confidence interval, p-values, basic statistical hypothesis tests such as normality tests, one sample and two samples mean, variance, proportion comparison tests, Specific Statistical methods: Correlation and Regression analysis, Categorical data analysis(Chi-square tests, Relative Risks, Odds Ratio measures), One-way and Two-way ANOVA, Basic Medical Demography: Vital statistics, Crude birth and death rates , General and specific fertility rates, Maternal and infant mortality rates , Principles of life table, Life expectancy

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Campbell, M.J., Machin, D. and Walters, S.J. (2007) *Medical Statistics: A Textbook for the Health Sciences*, 4th ed. John Wiley & Sons Ltd.
2. Steel, R. G.and Torrie, J. H. (1960) *Principles and procedures of statistics*, McGraw – Hill, Book Co
3. Campbell, M. J., Machin, D. and Walters, S. J. (2010) *Medical statistics: a textbook for the health sciences*, John Wiley & Sons

Course Code : RT 3201
Course Title : Radiation Protection and Safety in Radiotherapy
Credits : 02
Prerequisite : RA 1202

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Calculate internal exposure and shielding
2. Take precautions to minimize accidental exposure
3. Follow radiation safety procedures in radiation units
4. Describe the equipment used for detection of radiation

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
2. Smith, F.A. (2000) *A Primer in Applied Radiation Physics*, World Scientific Publishing Co Inc
3. Martin, J.E. (2006) *Physics for Radiation Protection – A Handbook*, 2nd ed. Wiley-VCH

Course Code : RT 3202
Course Title : Care of Patient - II
Credits : 02
Prerequisite : RA 2106, RT 3104

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Differentiate between the roles and responsibilities of health care team members treating cancer patients
2. Explain the dynamics of communicating with the cancer patient and family
3. Recognize radiation side effects and complications
4. Identify the factors that influence patient's emotional responses
5. Assess the physical condition of the patient before, during and after treatment delivery

Course Syllabus/ Course Description

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, immobilisation devices; emergency treatments; care of elderly patients, paediatric patients, differently abled patients, unconscious patients, patients with communicable/ noncommunicable diseases, patients with tubes

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Faithfull, S. and Wells, M. (2003) *Supportive Care in Radiotherapy*, 1st ed. Churchill Livingstone

Course Code : RT 3203
Course Title : Treatment Planning - II
Credits : 02
Prerequisite : RT 3103

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 20 hrs, Practical/ Demonstrations - 20 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Explain parameters in treatment planning
2. Calculate doses for Cobalt-60, shielding, brachytherapy
3. Perform a two dimensional manual planning

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	20%
End Semester Examination	80%

Recommended Reference:

1. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
2. Dobbs, J., Barrett, A., Ash, D., Morris, S. and Roques, T. (2009) *Practical Radiotherapy Planning*, 4thed. CRC Press
3. Khan, F.M. (2007) *Treatment Planning in Radiation Oncology*, 2nd ed. Lippincott Williams & Wilkins

Course Code : RT 3204
Course Title : Clinical Oncology and Radiotherapy - II
Credits : 02
Prerequisite : RT 3105

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 20 hrs, Practical/ Demonstrations - 20 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Communicate effectively and accurately in oral and written communication using appropriate terminology for the malignant disease specified
2. State all major tumour classifications and apply staging principles to clinical example
3. Apply radiotherapy treatment principles to determine appropriate treatment parameters
4. Identify site specific techniques and side effects of radiotherapy

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Hanna, L., Crosby, T. and Macbeth, F. (2008) *Practical Clinical Oncology*, 1st ed. Cambridge University Press
2. Schwab, M. (2008) *Encyclopedia of Cancer*, 2nd ed. Springer

Course Code : RT 3205
Course Title : Quality Assurance in Radiotherapy - I
Credits : 02
Prerequisite : RT 2101

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 22 hrs, Practical/ Demonstrations - 16 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Describe quality assurance (QA) programme for radiotherapy units
2. Perform routine QA programme for external beam units, brachytherapy units and simulation units

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
2. Khan, F.M. (2009) *The Physics of Radiation Therapy*, 3rd ed. Lippincott Williams & Wilkins

Course Code : RT 3206
Course Title : Clinical Practice of Radiotherapy - II
Credits : 03
Prerequisite : RT 3105

Compulsory/ Optional : Compulsory

Time Allocation : Hospital based training- 180 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Practice techniques in brachytherapy and Iodine therapy units with the required minimum standard
2. Practice ethically
3. Communicate effectively and appropriately

Course Syllabus/ Course Description

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.

Assessment	Percentage Mark
Continuous Assessment	50%
End Semester Examination	50%

Recommended Reference:

1. Hoskin, P. (2007) *Radiotherapy in Practice: Radioisotope Therapy*, 1st ed. Oxford University Press
2. Hoskin, P.J. and Coyle, C. (2005) *Radiotherapy in Practice: Brachytherapy*, 1st ed. Oxford University Press

LEVEL 4000 – SEMESTER 1

Course Code : RA 4101
Course Title : Research Methodology
Credits : 02
Prerequisite : None

Compulsory / Optional : Compulsory

Time Allocation : Lectures -30 hrs

Intended learning outcomes:

At the successful completion of the course the students will be able to:

1. Describe the value of evidence based practice and the role of research
2. Describe the principles of biostatistics and research methodology as applied in various fields of medical imaging

Course syllabus/ Course Description

Evidence based practice (EBP); usefulness and obtaining the relevant information from scientific literature for EBP; primary and secondary scientific information and the sources of scientific information; systematically organizing searched literature/information for the purpose of utilizing such information in research and EBP; scientific method and process of research. Scales of measurements; data reduction and methods of presenting data; basics in descriptive statistics(measures of central tendency and variation); probability and distributions; the basics of hypothesis testing(p value and confidence interval approaches) and inferential statistics; comparing two means, comparing proportions and exploring associations(correlation and regression) as examples for hypothesis testing; Parametric and non-parametric methods. Conceiving a good research question; an introduction to research designs; generalizing from sample to population; sampling and sample size; structure and function of research; quantitative and qualitative approaches; principles of questionnaire design; specificity, sensitivity, reliability and validity (accuracy and precision) in relation to a test or measurements, Sources of error in research and methods of minimizing errors
Writing a research proposal

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Polgar, S. and Thomas, S.A. (2013) *Introduction to Research in the Health Sciences*, 6th ed.

Course Code : RT 4101
Course Title : Paediatric Radiotherapy
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 20 hrs, Hospital based training- 40 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Identify paediatric tumours
2. Identify the role of radiotherapy in treating paediatric tumours

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Halperin, E., Constine L. S., Tarbell, N. J. and Kun, L. E. (2005) *Pediatric Radiation Oncology*, 4th ed. Lippincott Williams & Wilkins

Course Code : RT 4102 **Course Title** : Quality Assurance in Radiotherapy - II **Credits** : 02 **Prerequisite** : RT 3101	
Compulsory/ Optional : Compulsory	
Time Allocation : Lectures- 20 hrs, Practical/ Demonstrations - 20 hrs	
Intended learning outcomes: At the successful completion of the course, the students will be able to: 1. Explain acceptance tests, commissioning tests and periodic dosimetric checks 2. Perform quality assurance procedures in radiotherapy	
Course Syllabus/ Course Description 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	
Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
2. Khan, F.M. (2009) *The Physics of Radiation Therapy*, 3rd ed. Lippincott Williams & Wilkins
3. Mayles, P., Nahum, A. and Rosenwald, J. (ed.) (2007) *Handbook of Radiotherapy Physics*, Taylor & Francis

Course Code : RT 4103
Course Title : Evidence Based Clinical Practice
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Describe the basic tenets of evidence based practice and the concepts which underpin it
2. Describe the processes associated with translating evidence into practice

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Tammy, H., Bennett, S. and Mar, C.D. (2010) *Evidence-Based Practice Across The Health Professions*, 1st ed. Churchill Livingstone
2. Elk, R. and Landrine, H. (2011) *Cancer Disparities: Causes and Evidence-Based Solutions*, 1st ed. Springer Publishing Company

Course Code : RT 4104
Course Title : Maintenance of Radiotherapy Equipment
Credits : 02
Prerequisite : RT 2201, RT 3101

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 20 hrs, Practical/ Demonstrations - 20 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Handle equipment with appropriate care
2. Perform maintenance procedures with safety precautions

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. Mayles, P., Nahum, A. and Rosenwald, J. (2007) *Handbook of Radiotherapy Physics*, Taylor & Francis
2. Greene, D. and Williams, P.C. (1997) *Linear Accelerators for Radiation Therapy (Series in Medical Physics and Biomedical Engineering)*, 2nd ed. CRC Press

Course Code : RT 4105
Course Title : Radiation Dosimetry and Applications
Credits : 02
Prerequisite : RA 1201

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 25 hrs, Practical/ Demonstrations - 10 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Apply the basic principles in radiation dosimetry, quantities, units and methods in radiotherapy

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005), IAEA
2. Khan, F.M. (2009) *The Physics of Radiation Therapy*, 3rd ed. Lippincott Williams & Wilkins
3. Cember, H. and Johnson, T.E. (2009) *Introduction to Health Physics*, 4th ed. McGraw-Hill Companies
4. Podgorsak, E.B. *Radiation Physics for Medical Physicist*, 2nd ed. Springer
5. Attix, F.H. (2004) *Introduction to Radiological Physics and Radiation Dosimetry*, Wiley
6. Greening, J.R. (1985) *Fundamentals of Radiation Dosimetry*, 2nd ed. Adam Hilger
7. Gerald, J.H., Gordon, L., and Brownell (2013) *Radiation Dosimetry,* Elsevier
8. Orton, C.G.(1986) *Radiation Dosimetry; Physical and Biological Aspects,* Springer

Course Code : RT 4106
Course Title : Clinical Practice of Radiotherapy - III
Credits : 03
Prerequisite : RT 3105

Compulsory/ Optional : Compulsory

Time Allocation : Hospital based training- 180 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Practice radiotherapy techniques in linear accelerator, CT simulation procedures to the required level
2. Follow safety and radiation protection rules and regulations
3. Follow routine QA procedures
4. Practice ethically
5. Communicate effectively and appropriately

Course Syllabus/ Course Description

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.

Assessment	Percentage Mark
Continuous Assessment	50%
End Semester Examination	50%

Recommended Reference:

1. Perez, C.A., Brady, L.W., Halperin, E.C. and Schmidt-Ullrich, R.K. (2007) *Principles and Practice of Radiation Oncology*, 4th ed. Lippincott Williams & Wilkins

LEVEL 4000 – SEMESTER 2

Course Code : RA 4201
Course Title : Research Project
Credits : 06
Prerequisite : RA 4101

Compulsory/ Optional : Compulsory

Time Allocation : Research- 360 hrs

Intended learning outcomes:

At the successful completion of the course the students will be able to:

1. Create hypothesis
2. Conduct literature survey on a given topic
3. Collect, analyse, interpret and summarize data
4. Identify and optimally utilize available resources
5. Write a scientific report
6. Present the findings of the conducted research

Course syllabus/ Course Description

Problem identification and project formulation, search and retrieve information required such as conducting literature surveys, identification and optimal utilization of available resources, project execution, socio-economic, ethical and safety evaluation when applicable, data analysis, scientific report writing and presentation.

Assessment	Percentage Mark
Project proposal formulation and presentation	20%
Dissertation evaluation	40%
Final presentation	20%
Viva	20%

Recommended References:

1. Polgar, S. and Thomas, S.A. (2013) *Introduction to Research in the Health Sciences*, 6th ed.

Course Code : RA 4202
Course Title : Medical Data Communication
Credits : 01
Prerequisite : RA 2101

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 10hrs, Practical/ Demonstrations -10hrs

Intended learning outcomes:

At the successful completion of the course the students will be able to:

1. Operate data communication systems
2. Troubleshoot communication data errors

Course syllabus/ Course Description

Microsoft Windows and Unix-based operating systems, networking essentials, data communication protocols, system and network monitoring tools.

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended References:

1. Johnson, D. and Ed, T. (1999) *Guide to Networking Essentials*, MCSE

Course Code : RT 4201
Course Title : Treatment Planning - III
Credits : 02
Prerequisite : None

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 10 hrs, Practical/ Demonstrations- 20 hrs, Hospital based training- 40 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Perform three dimensional computerized planning
2. Mark and verify plans on treatment machines, conventional simulators

Course Syllabus/ Course Description

Introduction to three dimensional (3D) planning; 3D planning of different clinical cases; IMRT, electron, brachytherapy treatment planning and dose calculation

Assessment	Percentage Mark
Continuous Assessment	20%
End Semester Examination	80%

Recommended Reference:

1. Dobbs, J., Barrett, A., Ash, D., Morris, S. and Roques, T. (2009) *Practical Radiotherapy Planning*, 4th ed. CRC Press
2. Khan, F.M. (2007) *Treatment Planning in Radiation Oncology*, 2nd ed. Lippincott Williams & Wilkins

Course Code : RT 4202
Course Title : Advanced Radiotherapy Methods
Credits : 02
Prerequisite : RT 2202, RT 3105

Compulsory/ Optional : Compulsory

Time Allocation : Lectures- 30 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Identify the advanced approaches in radiotherapy
2. Reflect on the limitations of current knowledge and practice
3. Identify the changes required to enhance future practice outcomes

Course Syllabus/ Course Description

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

Assessment	Percentage Mark
Continuous Assessment	30%
End Semester Examination	70%

Recommended Reference:

1. *Radiation Oncology Physics: A Handbook for Teachers and Students* (2005) IAEA
2. Khan, F.M. (2009) *The physics of Radiation Therapy*, 3rd ed. Lippincott Williams & Wilkins

Course Code : RT 4203
Course Title : In-service Training in Radiotherapy
Credits : 04
Prerequisite : RT 3106, RT 3206, RT 4106, RT 4202

Compulsory/ Optional : Compulsory

Time Allocation : Hospital based training- 240 hrs

Intended learning outcomes:

At the successful completion of the course, the students will be able to:

1. Demonstrate competence in evaluating treatment plan, executing quality assurance procedures and radiotherapy treatment
2. Practice ethically
3. Communicate effectively and appropriately
4. Apply the knowledge in health and safety
5. Assess the patient with regard to treatment toxicity, quality of life and illness

Course Syllabus/ Course Description

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

Assessment	**Percentage Mark**
Continuous Assessment	70%
End Semester Examination	30%

Recommended Reference:

1. Hoskin, P. (2007) *Radiotherapy in Practice: Radioisotope Therapy*, 1st ed. Oxford University Press
2. Perez, C.A., Brady, L.W., Halperin, E.C. and Schmidt-Ullrich, R.K. (2007) *Principles and Practice of Radiation Oncology*, 4th ed. Lippincott Williams & Wilkins