अटल बिहारी वाजपेयी चिकित्सा विश्वविद्यालय, उ0 प्र0 लखनऊ
Atal Bihari Vajpayee Medical University, U.P., Lucknow.

Ordinance & Syllabus

Bachelor in Medical Radiologic & Imaging Technology (BMRIT)

Academic programme

Duration:

3 years&1 year Internship

(8 Semesters)

25/04/2022 (Milad Ahmad)

25/4/2022

(SUNIL KUMAR SEKSAINA)

25/4/22

कुलपति

25/4/2022

Dr. Mohd. Usmeen Khan

25/4/2022

(Dr. KAMAL PANT)

Bachelor in Radiological & Imaging Technology (BRIT)

PART "A"

Learning Objectives:

The Aim of this program is to provide highest accredited educational and clinical experiences that will render qualified, patient focused, compassionate, critical thinkers Medical Radiology and Imaging Technologist for the community. After completion of this course one should be able todo image acquisition, image processing and handle the all radiological and imaging equipment independentlyor as the healthcare team member. They should also able toensure radiation protection, quality assurance, identify and manage emergency situations, provide empathetic professional patient care

1. **Duration of the course:**

   Duration of the course: 4 Years (8 semester)

   Maximum Duration: 7 years

2. **Admission**

   No Intake: 60

   Eligibility Criteria:

   For admission in this course candidate has to pass 10 + 2 or equivalent examination in Science (Biology) conduct by any Board or University incorporated by law and recognized by this University with minimum 50% marks in aggregate in Physics, Chemistry & Biology (Relaxation of 5% marks for SC/ST students).

   The minimum age for admission shall be 17 years on or before 31st Dec. of the year of admission

   Candidate shall be medically fit.

   Mode of Admission:

   Selection of the candidates should be based on the merit of the entrance examination held by university or competent authority or as per regulation of the University from time to time.

3. **Medium of instruction :**

English shall be the medium of instruction in the class and in the University Examination.

4. Methods of Teaching :

The method of teaching adopted shall be a combination of lecturers, demonstrations and practicals by the full time faculty, visiting or part time faculty or guest faculty. But at least one full time faculty is recruited for each theory subject of university examination.

5. Examination:

There shall be an annual University Examination at the end of each academic year in the form of theory papers examination and practical examinations. The candidate shall be required to appear in every subject as specified in the course for each year.

Duration of Examination:

Each theory paper examination shall be of three hours.

Examiners:

The Board of examiners for theory papers examination shall consist of 50 % internal and 50% external examiners and for practical examination there should be one external examiner and one internal examiner (of the institute). All examiners shall be decided by honourable vice chancellor of the University.

Eligibility for Examiner:

Minimum five years teaching experience after Post Graduation

Evaluation:

The answer books of the annual University examination shall be evaluated as per the university rules.

6. Attendance to appear in the annual University Examination:

Each academic semester shall consist of a minimum of 15 weeks instructions. i. e. 15 x 6 = 90 instructional (actual teaching) days.The permission to appear in annual examination shall be granted to such candidate only who have fulfil the condition of 75% attendance in each subject separately in theory and 85% attendance in practical.

The dean of paramedical sciences, on the recommendation of the head of concern department will have the authority to condone deficiency up to 5% of the lecturers/practicals. The director in exceptional cases can also condone deficiency up to another 5% of the lectures/ practicals.

PART "B"

Regulations: Scheme of University Examination

FIRST SEMESTER

Course Code	Subject(s)	External Marks	Internal Marks	Total Marks	Minimum Marks	Total Credits
BRT101	General Anatomy-I	75	25	75	100	03
BRT 102	General Physiology-I	75	25	75	100	03
BRT 103	Basic in Computer & Information Science	75	25	75	100	03
BRT 104	Introduction to Quality And patient Safety	75	25	75	100	03
BRT 105	Applied Physics	75	25	75	100	03
BRT 106	Image Acquisition, Processing & Archieving	75	25	75	100	04
BRT111	General Anatomy-I	75	25	75	100	02
BRT 112	General Physiology-I	75	25	75	100	02
BRT 113	Basic in Computer & Information Science	75	25	75	100	02
BRT 115	Applied Physics	75	25	75	100	03
				TOTAL	**1000**	**31**

SECOND SEMESTER

Course Code	Subject(s)	External Marks	Internal Marks	Total Marks	Minimum Marks	Total Credits
BRT 201	General anatomy-II	75	25	75	100	02
BRT 202	General Physiology-II	75	25	75	100	02
BRT 203	Basic physics including Radiological physics	75	25	75	100	03
BRT 204	Conventional radiography and equipment	75	25	75	100	03
BRT 205	Medical ethics and legal aspects	75	25	75	100	02
BRT 206	Environmental Science	75	25	75	100	02
BRT 211	General anatomy-II	75	25	75	100	01
BRT 212	General Physiology-II	75	25	75	100	01
BRT 213	Basic physics including Radiological physics	75	25	75	100	03
BRT 214	Conventional radiography and equipment	75	25	75	100	03
TOTAL					**1000**	**24**

THIRD SEMESTER

Course Code	Subject(s)	External Marks	Internal Marks	Total Marks	Minimum Marks	Total Credits
BRT 301	Clinical Radiography and positioning-I	75	25	75	100	03
BRT 302	Modern radiological & Imaging Equipment including physics	75	25	75	100	03
BRT 303	Contrast & Special Radiography procedures	75	25	75	100	03
BRT 311	Clinical Radiography and positioning-I	75	25	75	100	03
BRT 312	Modern radiological & Imaging Equipment including physics	75	25	75	100	03
BRT 313	Contrast & Special Radiography procedures	75	25	75	100	03
				TOTAL	**600**	**18**

FOURTH SEMESTER

Course Code	Subject(s)	External Marks	Internal Marks	Total Marks	Minimum Marks	Total Credits
BRT 401	Physics of newer imaging modalities	75	25	75	100	03
BRT 402	Clinical Radiography positioning-II	75	25	75	100	03
BRT 403	Newer modalities imaging techniques including patient care	75	25	75	100	03
BRT 404	Quality control in radiology and radiation safety	75	25	75	100	03
BRT 411	Physics of newer imaging modalities	75	25	75	100	03
BRT 412	Clinical Radiography positioning-II	75	25	75	100	03
BRT 413	Newer modalities imaging techniques including patient care	75	25	75	100	03
BRT 414	Quality control in radiology and radiation safety	75	25	75	100	03
				TOTAL	**800**	24

FIFTH SEMESTER

Course Code	Subject(s)	External Marks	Internal Marks	Total Marks	Minimum Marks	Total Credits
BRT 501	Cross sectional anatomy and physiology	75	25	75	100	03
BRT 502	Physics of advanced imaging technology	75	25	75	100	03
BRT 503	Radiographic techniques of advanced imaging technology	75	25	75	100	03
BRT 504	Research Methodology & Biostatistics –I	75	25	75	100	03
BRT 505	Regulatory requirements in diagnostic radiology & imaging act and rules	75	25	75	100	03
BRT 511	Cross sectional anatomy and physiology	75	25	75	100	03
BRT 512	Physics of advanced imaging technology	75	25	75	100	03
BRT 513	Radiographic techniques of advanced imaging technology	75	25	75	100	03
				TOTAL	800	24

SIXTH SEMESTER

Course Code	Subject(s)	External Marks	Internal Marks	Total Marks	Minimum Marks	Total Credits
BRT 601	Quality assurance & radiation safety	75	25	75	100	03
BRT 602	Hospital practice & care of patients	75	25	75	100	03
BRT 603	Research Methodology & Biostatistics –II	75	25	75	100	04
BRT 611	Quality assurance & radiation safety	75	25	75	100	03
BRT 612	Hospital practice & care of patients	75	25	75	100	03
BRT 613	Project Work				100	03
TOTAL					600	19

INTERNAL ASSESSMENT

- It will be for theory and practical both.
- It will be done through the whole year.
- Candidate must obtain at least 35% marks in theory and practicals separately in internal assessment to be eligible for the annual university examination.
- Internal assessment (Theory) will be done as follows:
  - a) Mid-term and term examinations = 10 marks
  - b) Assignments/Projects/Class test/Clinical Presentations = 10 marks
  - c) Attendance = 05 marks

  Total = 25 marks
- Internal assessment (Practical) will be done as follows:
  - a) Laboratory manual = 10 marks
  - b) Day to day performance = 10 marks
  - c) Attendance = 05 marks

  Total = 25 marks

CRITERIA FOR PASSING

Theory and practical component of the same course shall be considered as separate head.A candidate is declared to have passed University examination in a subject, if he/she secures 50%

of the marks in theory and 50% in practicals separately. For computation of 50% marks in theory, the marks scored in the internal assessment (theory) shall be added to the University conducted written examination and for passing in practical the marks scored in University conducted practical examination and internal assessment (practical) shall be added together.

GRACE MARKS:

- If a candidate fails in one subject (theory only) in the annual University examination, five grace marks will be given to the candidate by the University before the declaration of result.
- Candidate failing in practical examination will be considered as failed.

PROMOTION:

- A candidate appear in odd/even semester university examination and fails in a subjects not more than 50% of the subjects and also secured at least 30% aggregate marks will be promoted to next semester and will be required to appear in next odd/even semester university examination and his/her internal and practical marks will be carry over. Those who secure less than 30% aggregate marks or fail in practical will be shifted back by one semester.
- The candidate will have to take admission in the previous semester and pay the tuition fee for that semester.

DIVISION:

Candidate will be awarded division at the end of 6th Semester as follows:
- Distinction - 75% and above marks in any subject.
- First division - 60% and above in the aggregate of marks of all subjects
- Second division- 50% or more but less than 60% in the aggregate of marks of all subjects.

INTERNSHIP

A candidate will have to undergo internship for a period of one year in a Medical college/hospital having well equipped Radio diagnosis department, which fulfills the norms decided by the University.

Rotational Postings:

1. Conventional Radiography (2 Months)
   (i) General Radiography
   (ii) Processing Room
   (iii) OT Radiography
2. CR, DR and PACS (2 months)
   (i) Emergency & Mobile Radiography
   (ii) Mammography/Dental Radiography/ DEXA
3. Radiographic special procedures including diagnostic and Therapeutic Interventional Procedures (2 Months)
   (i) Special Radiography including Fluoroscopy
   (ii) Intervention Radiology
4. Ultrasonography (1 Month)

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5. Doppler Imaging (1 month)
6. CT (2 Months)
7. MRI (2 Months)

ELIGIBILITY / MAXIMUM DURATION FOR THE AWARD OF THE:

The candidates shall be eligible for the Degree of Bachelor in Radiological & Imaging Technology (BRIT) when they have undergone the prescribed course of study for a period of not less than four years (including one year of compulsory rotator internship) in an institution approved by the University and have passed the prescribed examinations in all subjects.
The maximum period to complete the course successfully should not exceed a period of eight years.

PART – "C"

Fee Structure

Tuition Fee: As decided by University/ UP Government/Governing body of the Institute.

Examination Fee: As decided by University/Governing body of the Institute.

Security Deposit / Caution Money (Refundable after completion of the course): As decided by governing body of the Institute,

PART – "D"

HUMAN RESOURCES REQUIREMENT

Teaching Faculty: Teacher Student Ratio must be (1:10)

Non Teaching Staff such as Librarian, Asst. Librarian, Clerk – 2, Computer Operator – 1, Lab assistant, Driver, and Peon must be at least 7.

Pay Scales of Teaching and Non-Teaching staff will be as per latest U.G.C Norms.

The teaching faculty for the department (for 60 intakes) should have a minimum of

Principal –01, Professor–02, Associate Professor – 04, Assistant Professor/Lecturer – 12

Designation	Essential Qualification
Principal/ Dean	Master in Medical Imaging Technology or Equivalent with at least fifteen years' teaching experience. Senior-most Professor shall be designated as the Principal/ Dean (Medical Imaging Technology) Desirable: PhD in Concern Subject.

Professor:	Master in Medical Imaging Technology or Equivalent with 10 years' teaching experience of which at least 3 years should be at the level of Associate Professor in concern specialty. Desirable: PhD in Concern Subject.
Associate Professor:	Master in Medical Imaging Technology or Equivalent with eight years' experience as Lecturer/Assistant Professorfrom UGC recognized University. Desirable: PhD in Concern Subject.
Assistant Professor/ Lecturer	Master in Medical Imaging Technology or Equivalent degree with at least 55% marks (or an equivalent grade in a point scale wherever the grading system is followed) from UGC recognized University

Non-Teaching Staff: (full time)

(a) Office staff

(i) Steno-Typist - one

(ii) Clerk - one

(b) Laboratory staff

(i) Laboratory Assistant- one

(ii) Attendant - one

PART – "E"

INFRASTRUCTURE

1. Minimum Land requirement: 2 Acres
2. Space for Administration:
   (a) HOD Room - One
   (b) Faculty Room (Professor) – Two
   (c) Faculty Room (Associate Professor) – Three
   (d) Faculty Room (Assistant Professor/Lecturer) - Eleven
   (e) Departmental Office – One
   (f) Staff room – one
3. Space for Teaching

(i) Class rooms total three each one per academic batch to accommodate 60 students 1080 sq. ft each.

(ii) Class rooms – 3 small ones 250 sq. ft. each.

(iii) Toilets (1:6 boys & girls separately)

4. Girls Common Room
5. Anatomy & Physiology Museum – 900 sq. ft.
6. Computer Lab – 1500 sq. ft.

   Essential: Adequate Hardware and Soft ware facilities with Internet connections. Minimum 50 computers should be available in the first year itself.
7. Multipurpose Hall – 3000 sq. ft.
8. OHP & Slide Projector, Multimedia / Computer and its accessories / LCD Projector.
9. Desirable:

   (a) Auditorium

   (b) Seminar Hall
10. Departmental Library – it should provide adequate number of text books, Reference books, Journals, in the core subjects, medical subjects and Allied subjects.
11. Lab facilities for Basic Medical Sciences as per the criteria mentioned in Basic Medical Sciences requirements.
12. Lab equipments for Basic Medical Sciences as per the criteria mentioned in Basic Medical Sciences requirements.
13. Functioning Equipment:
    a. Fixed X-Ray Units:
       1. High Capacity (500 mA and above) X-ray Unit with I.I.T.V.
       2. 300 mA Units for routine radiography and dark room fluoroscopy.
       3. Dedicated Chest X-Ray / Orthopaedic / Casualty X-Ray Units for Demonstration purpose.
       4. C-arm in the operation theatre for demonstration purpose.
       5. Mobile X-ray Units (number to depend on hospital bed strength) including capacitor – discharge units.

    b. Ultrasound Equipment:
       1. Colour Doppler Units with peripheral vascular, Cardiac, Obstetric, small parts ad endocavitary applications for demonstration purpose.

2. Table model Ultrasound unit for routine abdominal and obstetric gynaec works.
3. Portable ultrasound unit for bedside sonography for demonstration purpose.

c. CT Scanner:

Preferably helical multi detector CT scanner with accessories like laser camera, Pressure injector, Phantom for QCT and all application software.

d. MRI:

Preferably 1.5T MRI scanner with accessories like laser camera and all application software like for functional MRI, MR Spectroscopy.

e. Mammography Equipments

f. Processing Equipment:

Automatic and manual Processing.

g. Quality Assurance Kit with all accessories

h. Providing exposure to the following facilities is not a must but it is always advisable to expose the students to these, as it will make them confident to handle all types of equipments when the need arises and also make the course at par with similar degree courses around the world.

1.Digital Radiography

2.Digital Subtraction Angiography

3.Picture Archiving and Communication System

4.Cath Lab

SYLLABUS

FIRST SEMESTER

Course Code	Course Title	Lectures (L)/ Tutorial (T) Hours Per Semester	Practical (P) Hours Per Semester	Total Contact Hours	Total Credits
BRT101	General Anatomy-I	30	40	70	5
BRT 102	General Physiology-I	30	40	70	5
BRT 103	Basic in Computer & Information Science	30	40	70	5
BRT 104	Introduction to Quality And patient Safety	30		30	3
BRT 105	Applied Physics	30	60	90	6
BRT 106	Image Acquisition, Processing & Achieving	40		40	4
BRT 107	English & Communication Skill	30	-	30	3
	TOTAL	**220**	**180**	**400**	**31**

SECOND SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
BRT 201	General anatomy-II	20	20	40	03
BRT 202	General Physiology-II	20	20	40	03
BRT 203	Basic physics including Radiological physics	30	60	90	06
BRT 204	Conventional radiography and equipment	30	60	90	06
BRT 205	Medical ethics and legal aspects	30		30	02
BRT 206	Environmental Science	30		30	02
	Total	**160**	**160**	**320**	**24**

THIRD SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
BRT301	Clinical Radiography and positioning-I	30	60	90	06
BRT302	Modern radiological & Imaging Equipment including physics	30	60	90	06
BRT303	Contrast & Special Radiography procedures	30	60	90	06
BRT304	Workshop (Tele medicine)	20		20	02
	Total	**110**	**180**	**290**	**20**

FOURTH SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
BRT 401	Physics of newer imaging modalities	30	60	90	06
BRT 402	Clinical Radiography positioning-II	30	60	90	06
BRT 403	Newer modalities imaging techniques including patient care	30	60	90	06
BRT 404	Quality control in radiology and radiation safety	30	60	90	06
BRT 405	Work shop	20		20	02
	TOTAL	**140**	**240**	**380**	**26**

FIFTH SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
BRT 501	Cross sectional anatomy and physiology	30	60	90	06
BRT 502	Physics of advanced imaging technology	30	60	90	06
BRT 503	Radiographic techniques of advanced imaging technology	30	60	90	06
BRT 504	Research Methodology & Biostatistics –I	30		30	03
BRT 505	Regulatory requirements in diagnostic radiology & imaging act and rules	30		30	03
	Total	**150**	**180**	**330**	**24**

SIXTH SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
BRT 601	Quality assurance & radiation safety	30	60	90	06
BRT 602	Hospital practice & care of patients	30	60	90	06
BRT 603	Research Methodology & Biostatistics – II	40		40	04
BRT 604	Project			60	03
BRT 605	Work Shop	20		20	02
	TOTAL	**120**	**120**	**300**	**21**

SEVENTH AND EIGHT SEMESTER (INTERNSHIP)

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
BRT 701	Internship	-	1440	1440	30
BRT 702	Research Project & Evaluation	-			05
	Total				**35**

Course Title: GENERAL ANATOMY-I			
Semester: I	**Course code: BRT 101**	**Credits:05**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 40	
Course Pre-requisites:		**Number of sessions: 70**	

Course Introduction

Allied and healthcare professionals (AHPs) includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions.

They work in multidisciplinary health teams in varied healthcare settings including doctors, nurses and public health officials to promote, protect, treat and manage a person 's physical, mental, social, emotional, environmental health and holistic well-being. The study of anatomy helps them in putting into perspective the knowledge that they gain for better good of humanity.

Course Objectives

This course is designed to provide the students the basic knowledge in anatomy. At the end of the course, the student should be able to:

1. Comprehend the normal disposition, inter-relationships, gross, functional and applied anatomy of various structures in the human body.
2. Identify the microscopic structures of various tissues, and organs in the human body & correlate the structure with the functions.
3. Comprehend the basic structure and connections between the various parts of the central nervous system so as to analyse the integrative and regulative functions on the organs and systems.

Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CLO1: Understand the various organ structures with a backdrop of general anatomy (Remember & Understand)

CLO2: Compare the differences between the similar structures in the body and their relevance (Analyze)

CLO3: Learn to apply the knowledge of various structures to clinical aspect of diseases (Apply &Analyze)

CLO4: Augment their learning by making models, charts and learning on simulators (Synthesize, evaluate & create)

Course Pedagogy

The course pedagogy includes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly. Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course Contents

Module 1

1. **Introduction to Anatomical terms of the human body** - Basic anatomical terminology, anatomical position, anatomical planes, levels of organization in the body, organ systems, skeleton, cavities of the body.
2. **Organization of the human body at the cellular level** - Structure of the cell comprising of cell membrane, cytoplasm, cell organelles, nucleus, cell extensions etc.
3. **Organization of the human body at the tissue level** - Epithelial, Connective, Muscular& Nervous tissue.

Module 2

1. **Blood** - Composition of blood, Features of red blood cells, white blood cells, platelets.
2. **Lymphatic system** - Features of lymph vessels, lymphatic tissue & organs, lymphatics, spleen, tonsil, thymus.
3. **Nervous system** - Central nervous system, brain, cerebellum, spinal cord, cranial nerves, autonomic nervous system.
4. **Muscular system** - Skeletal muscle, cardiac muscle, smooth muscle, muscles of the body.
5. **Skeletal system** - Features of bones, axial skeleton, appendicular skeleton.
6. **Musculoskeletal system** - Joints of upper & lower limb.

Module 3

1. **Respiratory system** - Nose & paranasal sinuses, pharynx, larynx, trachea, lungs.
2. **Cardiovascular system** - Heart & blood vessels.
3. **Digestive system** - Oral cavity, pharynx, salivary glands, oesophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas.

4. **Urinary system** - Kidneys, juxtaglomerular apparatus, ureters, urinary bladder, urethra.

Module 4

1. **Introduction to genetics** - Features of chromosomes, DNA.
2. **Reproductive system in females** - External & internal genital organs, breast.
3. **Reproductive system in males** - Penis, scrotum, testes, prostate gland.
4. **Endocrine system** - Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas.
5. **Special senses** - Olfactory system, taste apparatus, external middle & internal ear, eye.
6. **Skin** - Features of skin, hair, sebaceous glands, sweat glands, nails.

The classes will be two theories and two practical including the tutorials in a week

Course Assessment Scheme

Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Text Books:

1. P.R Ashalatha& G Deepa 's Textbook of anatomy & physiology by
2. B.D.Chaurasia's human anatomy

Reference books:

1. Sampath Madhyastha'sManipal manual of anatomy for allied health sciences
2. Krishna Garg & Madhu Joshi's Practical anatomy workbook
3. Dixit's Atlas of Histology for Medical Students
4. Basic Histology: A Color Atlas & Text
5. Jana's Exam Oriented Practical Anatomy
6. Krishan's Anatomy Mnemonics

Online references:

Coursera subscription for physiology topics

Course Title: GENERAL PHYSIOLOGY-I			
Semester: I	**Course code:BRT102**	**Credits:05**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 40	
Course Pre-requisites:		**Number of sessions: 70**	

Course Introduction

As the Indian government aims for Universal Health Coverage, the lack of skilled human resource may prove to be the biggest impediment in its path to achieve targeted goals. The benefits of having AHPs in the healthcare system are still unexplored in India. An enormous amount of evidence suggests that the benefits of AHPs range from improving access to healthcare services to significant reduction in the cost of care. The teaching of physiology aims to integrate their learning in sync with the understanding of the basic functions of the various organs in the body and their clinical aspect so that the knowledge gained can give them an edge in their field.

Course Objectives:

This course is designed to provide the students the basic knowledge in physiology. At the end of the course, the student should be able to:

1. Explain the normal functioning of various organ systems of the body and their interactions.
2. Elucidate the physiological aspects of normal growth and development.
3. Describe the physiological response and adaptations to environmental stresses.
4. Know the physiological principles underlying pathogenesis of disease.

Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CLO1: Understand the various organ functions with a backdrop of general physiology (Remember & Understand)

CLO2: Compare the differences between the similar functions in the body and their relevance (Analyze)

CLO3: Learn to apply the knowledge of various physiological process to clinical aspect of diseases (Apply & Analyze)

CLO4: Augment their learning by making models, charts and learning on simulators (Synthesize, evaluate & create)

Course Pedagogy

The course pedagogy includes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly. Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course Contents and Duration

Course contents and duration: The classes will be two theories and two practical including the tutorials in a week.

Course contents

Module 1

1. **Introduction to physiology of the human body** –Composition of body, Homeostasis, Introduction to chemistry of life.
2. **Organization of the human body at the cellular level** – Function of lipids, carbohydrates, proteins & cell organelles.
3. **Organization of the human body at the tissue level** – Function of Epithelial, Connective, Muscular & Nervous tissues.

Module 2

1. **Blood** – Haemopoesis, haemostasis, coagulation of blood, blood transfusion.
2. **Lymphatic system** – Function of lymph vessels, lymphatic tissue & organs, lymphatics, spleen, tonsil, thymus.
3. **Resistance & immunity** – Innate immunity, acquired immunity, humoral & cell mediated immunity.

Module 3

1. **Nervous system** – Properties of nerve fibres, function of neuroglia, synapse, CNS, CSF, brain, cranialnerves, demonstration of reflexes.
2. **Muscular system** – Properties of skeletal muscle, cardiac muscle, smooth muscle, muscles of the body.
3. **Skeletal system** – Functions of bones, axial skeleton, appendicular skeleton.
4. **Musculoskeletal system** – Movement in the joints of upper & lower limb.

Module 4

1. **Respiratory system** – Physiology of respiration, pulmonary function tests, gas exchange in lungs, transport of gases between lungs & tissues, regulation of respiration.
2. **Cardiovascular system** - Heart & blood vessels: Systemic circulation, pulmonary circulation, ECG, cardiac output, blood pressure.

3. **Digestive system** – Process of digestion, function of oral cavity, pharynx, salivary glands, oesophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas.
4. **Urinary system** – Function of kidneys, juxtaglomerular apparatus, ureters, urinary bladder, urethra, physiology of urine formation, glomerular filtration, tubular reabsorption, water balance, micturition.
5. **Introduction to genetics** - Features of chromosomes, DNA, protein synthesis, dominant inheritance, recessive inheritance, sex linked inheritance.
6. **Reproductive system– female**: Physiology of female reproductive system.
7. **Reproductive system – male**: Physiology of male reproductive system.
8. **Endocrine system** - Mechanism of action of hormones, function of pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas.
9. **Special senses** - Physiology of olfaction, taste, hearing, balance & vision.
10. **Skin** – Function of skin, hair, sebaceous glands, sweat glands, nails, temperature regulation.

Practical: demonstration / observation

Blood test:

1. Microscope
2.Haemocytometer
3. Blood
4. RBC count
5.Hb
6.WBC count
7. Differential Count
8. Hematocrit demonstration
9. ESR
10. Blood group & Rh. Type
11.Bleeding time and clotting time.

Digestion

Test salivary digestions

Excretion

1.Examination of Urine
2.Specific gravity
3. Albumin
4.Sugar
5.Microscopic examination for cells and cysts

Respiratory System:

1.Clinical examination of respiratory system
2.Spirometry
3.Breath holding test

Cardio Vascular System:

1.Measurement of blood pressure and pulse rate

2.Effect of exercise on blood pressure and pulse rate

Course References

1. PR Ashalatha& G Deepa'sTextbook of anatomy & physiology
2. N Geetha 'sTextbook of physiology

Reference Books:

1. C C Chatterjee's Human Physiology
2. C C Chatterjee's Practical Physiology for Paramedical Courses
3. CN ChandraShekhar'sManipal Manual of Medical Physiology
4. RK Maurya's Medical Physiology

Online references:

Courser a subscription for online anatomy topics

Course Title: Basic In Computer& Information Science			
Semester: I	**Course code: BRT 103**	**Credits:05**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 40	
Course Pre-requisites:		**Number of sessions: 70**	

Course Introduction:

As the Indian government aims for Universal Health Coverage, the lack of skilled human resource may prove to be the biggest impediment in its path to achieve targeted goals. The benefits of having AHPs in the healthcare system are still unexplored in India. An enormous amount of evidence suggests that the benefits of AHPs range from improving access to healthcare services to significant reduction in the cost of care. The teaching of computer and information science aims to integrate their learning in sync with the understanding of the basic functions of the various setups of the computers and its software; this knowledge will help them gained confidence and give them an edge in their field.

Course Objectives:

- The course has focus on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation.
- The students will be able to appreciate the role of computer technology and some extent able to gain hand-on experience in using computers.

Course Learning Outcomes:

Upon successful completion of the course, the students should be able to:

CLO1: Understand the various hardware and software of the computer system,

CLO2: Compare the differences between the various functions of the same (Analyze)

CLO3: Learn to apply the knowledge of various fields of the course (Apply & Analyze)

CLO4: Augment their learning by making various presentations and graphics (Synthesize, evaluate & create

Course Pedagogy

The course pedagogy includes a comprehensive study including the various software and hardware of the computer system in order to make the students more competent and skilled in its use and storage. Various aspects about the use for same in health care setups are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing

sessions, written assignments, quiz, presentations are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students.

Module 1

1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
2. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).
3. Processor and memory: The Central Processing Unit (CPU), main memory.
4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

Module 2

1. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
2. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.
3. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.

Module 3

1. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
2. Introduction of Operating System: introduction, operating system concepts, types of operating system.
3. Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
4. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
5. Application of Computers in clinical settings.

Course Title: Introduction To Quality and Patient Safety			
Semester: I	**Course code: BRT 104**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 0**	
Course Pre-requisites:		**Number of sessions: 30**	

1. Course Introduction

As antibiotic resistant strains of bacteria are growing rapidly, making it difficult to cure such patients, the importance of sterilization and proper disposals is only way to prevent it. Well known sayings, prevention is better than cure, the main objective of this course is to focus mainly on the preventive measures and quality assurance to the patients. This course emphasizes more on risk management principles and safe handling of disposals, basic emergency care and basic life support skills which can prove remedy in emergency cases.

2. Course Objectives: The main objective of this course is to teach students quality measures to provide patients with effective methods of treatment with more focus on proper handling of infected specimens and proper treatment with best sterilized and disinfected means to reduce the cross-infection scenario and nosocomial infections, which occurs due to poor handling of infected specimens and improper disposal means polluting environment too. Students are made to learn basic concepts of quality in health care and develop skills to implement sustainable quality assurance program. Introducing students to basic emergency care, infection prevention& control with knowledge of biomedical waste management and antibiotic resistance.

3. Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CL01: Understood quality improvement approaches, NABH, NABL, JCI guidelines which purely focuses on the quality measures and proper handling of disposals providing quality facility to patients. (Understanding Based)

CL02: Understood basic life support skills which can save many lives in urgent cases. (Applying Based)

CL03: Understood proper disposals of biomedical waste, reducing risk of infection to waste handling personnel and cross infection which can occur due to improper handling of infected waste polluting surroundings too. (Applying Based)

CL04: Understood effective hand hygiene, prevention and control of common health care associated infections. (Remembering Based)

CL05: Understood fundamentals of emergency management, disaster preparedness. (Remembering Based)

4. Course Pedagogy

This course will use mixed technique of interactive lectures, digital learning methodologies, regular assignments and power point presentations. Students will be made to prepare project reports by interacting directly with laboratory personnel and visits to hospital to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day to day real world applications. This course will focus mainly on applying based methodologies, students will not be made limited to theory only, but hands on practices and analysing every aspect of the module by themselves.

Course Contents

Module 1. Quality assurance and Management

Introduction, Quality improvement approaches, standards and norms, quality improvement tools, introduction to NABH guidelines.

Module 2. Basic of Emergency care and Life support skills

Basic life support (BLS) following cardiac arrest, recognition of sudden cardiac arrest and activation of emergency response system, early cardiopulmonary resuscitation (CPR) and rapid defibrillation with an automated external defibrillator (AED)

Module 3. Basic emergency care

First aid, choking, rescue breathing methods, ventilation including use of bag valve master (BVMs)

Module 4. Biomedical Waste Management

Definition, waste minimization, BMW-segregation, collection, transportation, treatment and disposal (Including color coding), Liquid BMW, Radioactive waste, metals/chemicals/drug waste, BMW management and methods of disinfection, use of Personal protective equipment (PPE)

Module 5. Infection Prevention and Control

Sterilization, Disinfection, Effective hand hygiene, use of PPE,Prevention and control of common health care associated infections, Guidelines(NABH) and JCI for hospital infection control.

Module 6. Disaster preparedness and management

Fundamentals of emergency management

PRACTICALS (DEMONSTRATION ONLY)

1. Vital signs and primary assessment
2. Basic emergency care- first aid

7.Course References

Texts, Materials, and Supplies:

• Turgeon, Mary Louise. (2015). Clinical Laboratory Science, 7th ed. Maryland Heights, MO: Mosby. ISBN 9780323225458

Required Readings:

• Turgeon, Mary Louise. (2015). Clinical Laboratory Science, 7th ed. Maryland Heights, MO: Mosby. ISBN 9780323225458

Recommended Readings:

• Medical Dictionary

Others

1.disaster management set up in india - opcw.org
www.opcw.org/sites/default/files/documents/event_photos/2010/tabletop_exercise_poland_nov201.

2.natural disasters: hospital management | 2015-10-22 | ahc ...
www.reliasmedia.com/articles/136571-natural-disasters-hospital-management

3. Biomedical waste management in India: Critical appraisal - NCBI - NIH
www.ncbi.nlm.nih.gov/pmc/articles/PMC5784295
4. Vital signs: Understanding what the body is telling us
https://www.coursera.org/learn/vital-signs/
5. Patient Safety and Quality Improvement
https://www.coursera.org/learn/patient-safety

25/4/22

Course Title: Applied Physics			
Semester: I	**Course code: BRT105**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

2. Course Introduction

Applied physics is a science and bridge between physics and engineering. It is applied for particular technological or practical use. The course covers the study of the application of the theories and principles of science to practical purposes.

3. Course Objectives:

The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. This course also provides fundamental idea about circuit analysis, working principles of machines. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application. The main objectives are:

1. To understand the general scientific concepts required for technology
2. Understand the basic concepts of magnetic circuits, AC & DC circuits.
3. To gain knowledge about fundamentals of electronic components and devices.

4. Course Learning Outcomes

Upon successful completion of the course, the students should be able to (knowledge based):

CLO1: Understood the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.

CLO2: Acquired the skills in handling scientific instruments, planning and performing in laboratory experiments.

CLO3: Realized how developments in any science subject helps in the development of other science subjects and vice-versa and how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments.

4. Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of applied physics but also improve skills and techniques for tackling practical problems.

Course contents

MODULE-1

BASIC PHYSICS: Sound -The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction, Doppler's effect

HEAT: Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion.

MODULE-2

FUNDAMENTALS OF DC CIRCUITS: Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, resistivity, series and parallel combination, Voltage-Current relations for resistor, inductor, capacitor, Kirchhoff's laws, EMF.

AC CIRCUITS: A.C. and D.C. power supply with examples, single phase and poly phase power supply, Sinusoids, Introduction to three phase systems - types of connections, relationship between line and phase values.

MODULE-3

MAGNETIC CIRCUITS: Introduction to magnetic Circuits-Simple magnetic Circuits-Faraday's laws, induced emfs and inductances, Galvanometer. Magnets and magnetic field, force on an electric current in a magnetic field, force on electric charge moving in a magnetic field, magnetic field due to straight wire; force between two parallel wires, Ampere's law, electromagnet and solenoids

MODULE-4

RECTIFICATION: Wave form of half wave and full wave current/voltage wave form; Rectifiers: Introduction, energy bands in solids, the semiconductor, p-type and n-type semiconductors, p-n junction, p-n junction diode, p-n junction diode as rectifier (half- wave and full-wave rectifier), rectifiers relative merits and demerits; silicon, germanium diodes.

Course Title: Image Acquisition, Processing &Archieving			
Semester: I	**Course code: BRT106**	**Credits:04**	**Core**
No of sessions Lectures / Tutorial: 40		**No of practical hours:**	
Course Pre-requisites:		**Number of sessions: 40**	

Course Objectives

Demonstrate composition of film, screens, cassette, processing solution, the usage and effect of light.
Perform best storage guidelines for film storage and handling.
Select cassette size,DemonstrateLoading & unloading of films.

Course Learning Outcomes

Upon successful completion of the course, the students should be able to (knowledge based):

CLO1: Understood the basic concepts, fundamental principles, and the scientific theories related to films, screens.

CLO2: Acquired the skills in handling films screens and planning of dark-room and performing in laboratory experiments.

CLO3: Realized how developments in any radio-graphic image quality.how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments.

Course contents

MODULE-1. Composition of single and double coatedradiographic films, Screen &Non Screen films, structure of film, characteristic curve. characteristics (speed, base + fog, gamma, latitude), effect of grain size on film response to exposure, interpretation of characteristics curve, latent image formation, process of film developing (composition of developer, Fixer and other processing solution), common errors and faults while processing (densitometry), automatic processing unit (processing cycle), developer & Fixer replenishment and silver recovery.

MODULE-2. Film storage rules and guidelines, film handling and care (size, construction and function), types ofintensifying screens and relative advantage, loading and unloading of cassettes and their care/maintenance, effects of kV and mA on variation of emitted radiation intensity, determination of relative speeds, film contrast, film screen contact.

MODULE-3. Image formation, latent image, processing: manual processing,automatic processing. Developer, fixer, rinser components, replenisher. Manual technique of developing film, Automatic film processor, common errors in processing.

MODULE-4. Meaning of radiographic image contrast, density,resolution, sharpness,

magnification and distortion of image, noise and blur, radiographic illuminators and viewing conditions, visual acuity and resolution, quality assurance of the related equipment and its benefits with respect to visual assessment

MODULE-5. Introduction, purpose and location of dark room, layout of dark room,entrance, pass box, hatch, hangers, safe light, criteria of safe light, safe light test.

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained. It will not only help students to understand the fundamentals of Imaging and Quality of Radiographs but also improve skills and techniques for tackling practical problems.

Reference books:

Text book of radiology for residents and technician- S K Bhargava.

Dark room procedure- MO and Chesney

Course Title: English & Communication Skill			
Semester: I	**Course code: BRT107**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:**	
Course Pre-requisites:		**Number of sessions: 30**	

Course Introduction:

As the Indian government aims for Universal Health Coverage, the lack of skilled human resource may prove to be the biggest impediment in its path to achieve targeted goals. The benefits of having AHPs in the healthcare system are still unexplored in India. An enormous amount of evidence suggests that the benefits of AHPs range from improving access to healthcare services to significant reduction in the cost of care. The teaching of English and communication skills aims to integrate their learning in sync with the understanding of the basics of spoken English and communication techniques.

Course Objectives:

1. This course trains the students in oral presentations, expository writing, logical organization and structural support.
2. By acquiring skills in the use of communication techniques the students will be able to express better, grow personally and professionally, develop poise and confidence and achieve success.

Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CLO1: Understood the role of radiographer in personal and professional ethics.

CLO2: Understood the handling of patient with good language.

CLO3: Understood the importance of good communication with patient as a health care professional.

Course Pedagogy

The course pedagogy includes a comprehensive study including the various communication skills in order to make the students more competent and skilled in its use and storage. Various aspects about the use for same in health care setups are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, presentations are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students.

Module 1: Basics of Grammar- Part I

Vocabulary, Synonyms, Antonyms, Prefix and Suffix, Homonyms, Analogies and Portmanteau words.

Module 2: Basics of Grammar – Part II

Active, Passive, Direct and Indirect speech, Prepositions, Conjunctions and Euphemisms

Module 3: Writing Skills

Letter writing, E mail, and Essay, Articles, and Memos, one word substitutes, note making and Comprehension

Module 4: Writing and Reading

Summary writing, Creative writing, newspaper reading

Module 5: Practical Exercise

Formal speech, Phonetics, semantics and pronunciation

Communication:

Module 6: Introduction: Communication process, Elements of communication, Barriers of communication and how to overcome them, Nuances for communicating with patients and their attenders in hospitals.

Module 7: Speaking: Importance of speaking efficiently; Voice culture, Preparation of speech. Secrets of good delivery, Audience psychology, handling, Presentation skills, Individual feedback for each student, Conference/Interview technique.

Module 8; Listening: Importance of listening, Self-assessment, Action plan execution, Barriers in listening, Good and persuasive listening.

Module 9: Reading: What is efficient and fast reading, Awareness of existing reading habits, tested techniques for improving speed, Improving concentration and comprehension through systematic study.

Module 10; Non Verbal Communication: Basics of non-verbal communication, Rapport building skills using neuro- linguistic programming (NLP).

Course Title: General Anatomy-II			
Semester: II	**Course code: BRT 201**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 20		**No of practical hours: 20**	
Course Pre-requisites:		**Number of sessions: 40**	

Course Introduction

Allied and healthcare professionals (AHPs) includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions.

They work in multidisciplinary health teams in varied healthcare settings including doctors , nurses and public health officials to promote, protect, treat and manage a person's physical, mental, social, emotional, environmental health and holistic well-being.The study of anatomy helps them in putting into perspective the knowledge that they gain for better good of humanity.

Course learning Outcomes-

CLO- 1 Enumeratethe function of brain, Nervous system, motor system, blood supply of brain, anatomy of brain, cranial nerves, CSF formation and about spinal cord.

CLO-2 Enumerateauditory system.Demonstrateanatomy of urinary system, location of kidney.

CLO-3 Enumerateblood vessels of reproductive system. Enumeratehormone secretion of glands and blood supply.

Course Pedagogy

The course pedagogy incudes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly.Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course contents

MODULE -1 Classification of nervous system
Nerve – structure, classification, microscopy with examples. Neurons, classification with examples. Simple reflex arc.

Parts of a typical spinal nerve/Dermatome:Central nervous system – disposition, parts and functions Cerebrum, Cerebellum, Midbrain & brain stem Blood supply & anatomy of brain.
Spinal cord-anatomy, blood supply, nerve pathways Pyramidal, extra pyramidal system,Thalamus, hypothalamus, Structure and features ofmeninges Ventricles of brain, CSF circulation Development of nervous system & defects.

MODULE-2 Cranial nerves – (course, distribution, functions and palsy) Sympathetic nervous system, its parts and components Parasympathetic nervous system Applied anatomy
MODULE-3 Structure and function of Visual system, Auditory system, Gustatory system, Olfactory system, Somatic sensory system.Pelvic floor, innervations Kidney, Ureter, bladder, urethra.Reproductive system of male, Reproductive system of female

ANATOMY PRACTICAL

1) Identification and description of all anatomical structures.

2) Demonstration of dissected parts

3) Demonstration of skeleton-articulated and disarticulated.

4) Surface anatomy: Surface land mark-bony, muscular and ligamentous. Surface anatomy of major nerves, arteries of the limbs.

Course Reference
Text Books:

- PR Ashalatha& G Deepa 's Textbook of ANATOMY & PHYSIOLOGY by
- B.D.Chaurasia's HUMAN ANATOMY

Reference books:

- SampathMadhyastha'sManipal manual of anatomy for allied health sciences
- Krishna Garg &Madhu Joshi's Practical anatomy workbook
- Dixit's Atlas of Histology for Medical Students
- Basic Histology: A Color Atlas & Text
- Jana's Exam Oriented Practical Anatomy
- Krishan's Anatomy Mnemonics

Online references:
Coursera subscription for physiology topics

Course Title: GENERAL PHYSIOLOGY-II			
Semester: II	**Course code: BRT 202**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 20		**No of practical hours:** 20	
Course Pre-requisites:		**Number of sessions: 40**	

Course Introduction

As the Indian government aims for Universal Health Coverage, the lack of skilled human resource may prove to be the biggest impediment in its path to achieve targeted goals. The benefits of having AHPs in the healthcare system are still unexplored in India. An enormous amount of evidence suggests that the benefits of AHPs range from improving access to healthcare services to significant reduction in the cost of care. The teaching of physiology aims to integrate their learning in sync with the understanding of the basic functions of the various organs in the body and their clinical aspect so that the knowledge gained can give them an edge in their field.

Course learning Outcomes.

CLO-1 Enumerate Physiology of kidney

CLO-2 Explain Physiology of lower Urinary tract

CLO-3 Label Physiology of the endocrine glands

CLO-4 Enumerate Physiology of reproductive system

Course Pedagogy

The course pedagogyincudes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly.Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course contents-

MODULE-1 Physiology of kidney and urine formation Glomerular filtration rate, clearance, Tubular function, Ureter, bladder, urethra

MODULE 2-Physiology of the endocrine glands – , Hormones secreted by these glands, their classifications and functions.
Adrenal, Gonads Thymus, Pancreas. Pituitary, Pineal Body, Thyroid, Parathyroid

MODULE 3-Male -Functions of testes, pubertal changes in males, testosterone -action & regulations of secretion.
Female -Functions of ovaries and uterus, pubertal changes, menstrual cycle, estrogens and progestron -action and regulation.

Course References

1) PR Ashalatha& G Deepa'sTextbook of ANATOMY & PHYSIOLOGY
2) N Geetha 'sTextbook of physiology

Reference Books:

3)C C Chatterjee's Human Physiology
4C C Chatterjee's Practical Physiology for Paramedical Courses
5)CN Chandrashekhar'sManipal Manual of Medical Physiology
6)RK Maurya's Medical Physiology

Online references:Coursera subscription for online anatomy topics

25/4/22

Course Title: Basic physics including radiological physics			
Semester: II	**Course code: BRT 203**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 60	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives:

The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. This course also provides fundamental idea about circuit analysis, working principles of machines. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

Course Learning Outcomes

CLO 1- Use X-ray equipment and maintenance of equipment.Should know the Warm-up procedures of X-ray machine and cooling methods.

CLO 2-To be able to know how to use X-Ray exposure switches.

CLO 3- Demonstrate work flow Digital/IITV fluoroscopy equipment handling. Demonstrate Handling, care and maintenance of equipment & accessories

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of applied physics but also improve skills and techniques for tackling practical problems.

Course contents

MODULE 1 Basic Physics: Sound -The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction, Doppler's effect .

MODULE 2 Heat- Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transferconduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion, Newton's law of cooling, Heat radiation.

MODULE 3 Applied mathematics: Proportion: Direct proportion and inverse proportion, inverse square law with relevant examples, graphical representation of parameters that obey linear and exponential law: example of linear and semilog plotting. Electricity and Magnetism:

A.C. and D.C. power supply with examples, single phase and poly phase power supply, switches, fuses, circuit breakers, earthing etc. main voltage drop: causes and remedy, cables; low tension, high tension. DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Krichoff's law, heating effect of current, Ammeter, voltmeter, Galvanometer. Magnets and magnetic field, force on an electric current in a magnetic field, force on electric charge moving in a magnetic field, magnetic field due to straight wire ; force between two parallel wires, Ampere's law, electromagnet and solenoids .

MODULE 4 Rectification and Transformers: Thermionic emission; - variation of anode current with anode voltage and filament temperature; principle of rectification, wave form of half wave and full wave current/voltage wave form; Rectifiers: Introduction, energy bands in solids, the semiconductor, p-type and n-type semiconductors, density of charge carriers and conductivity, p-n junction, p-n junction diode, p-n junction diode as rectifier (half- wave and full-wave rectifier), rectifiers relative merits and demerits; silicon, germanium diodes. Principles of transformer, Electromagnetic induction, transformer design, efficiency of transformer, source of power loss

MODULE 5 Electromagnetic radiation: Electromagnetic radiation spectrum, common properties of electromagnetic radiation; relationship between energy, frequency, wavelength and velocity e.g. X-rays and gamma rays. Properties of X-rays and gamma rays; General properties of X-rays, velocity, frequency etc., photographic effect, photochemical effect – discolouration of salts, heating effect, biological effect; ionization of gases e.g. air.. Interaction of radiation with matter: Transmission through matter, law of exponential attenuation, half value layer, attenuation coefficients; interaction of radiation with matter, classical scattering, Compton scatter, photo electric absorption, pair production; practical aspects of radiation absorption and transmission through body tissues. Measurement of X-rays: Unit of quantity of radiation exposure - definition and application of 'roentgen', unit of quantity of radiation dose - definition and application of 'rad', 'gray' and 'rem';

MODULE 6 Principle and application of ionizations chamber and ionization reader unit, film and densitometer, thermo luminescent dosimeter (TLD). X. Quality and quantity of X-rays: Specification and explanation of electron volt (eV), kilovolt (kV) and half value layer (H.V.L) as an index of penetration of the radiation. 9. Basic radiation protection: Historical development, dose equivalent limit, international recommendations and current code of practice for the protection of radiation workers and the public against ionizing radiation arising from medical and dental use; protective materials, lead - impregnated substances; building materials, lead equivalents of protective, personal monitoring; film badge, pocket dosimeter TLD badges and their uses and relative merits

PRACTICAL

- X-Ray tubes and accessories, general features.
- Portable X-Ray Equipment.

- Image intensifier, its features, spot film.
- Radiation protection devices
- Effects of kV and mAs.
- Maintenance of X-ray equipment and accessories.
- Mammography X-Ray tube
- Dental X-Ray unit.

Reference and Text Books-

Text book of radiology for residents and technicians- S K Bhargava.

Text book of Radiation physics.

www.wikiedia.co.in

Course Title: Conventional Radiography and equipment			
Semester: II	**Course code: BRT204**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 60	
Course Pre-requisites:		**Number of sessions: 80**	

Course Objectives

The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. This course also provides fundamental idea about circuit analysis, working principles of machines. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

Course learning Outcomes

CLO 1-Able to know production of X-ray.

CLO 2- Explain high tension circuits ,meter and exposure timers.

CLO 3-Able to know interlocking systems, control of scattered radiation.

CLO 4- Able to know handling and mechanism of Fluoroscopy.

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of applied physics but also improve skills and techniques for tackling practical problems.

Course contents

MODULE 1 Production of x-rays: X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x - ray tube; construction, working, methods of cooling the anode, rating chart and cooling chart; rotating anode x - ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x - ray tube; effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x - rays, inherent filter and added filter, their effect on quality of the spectrum.

MODULE 2 High tension circuits: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment; mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of

tube voltage, kV compensator; high tension selector switch, filament circuit, control of tube current, space charge compensation.

MODULE 3 Meters and exposure timers: Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber based timers, integrated timer. 4. Interlocking circuits: Relays: description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.

MODULE 4 Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.

MODULE 5 Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid controlled x-ray tube.

MODULE 6 Care and Maintenance of X-ray equipment; General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.

Reference and Text Books-

Text book of radiology for residents and technicians- S K Bhargava.

Text book of Radiation physics.

www.wikiedia.co.in

Course Title: Medical Ethics and Legal Aspects			
Semester: II	**Course code: BRT205**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:**	
Course Pre-requisites:		**Number of sessions: 30**	

Course Introduction:

Allied and healthcare professionals (AHPs) includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions.

They work in multidisciplinary health teams in varied healthcare settings including doctors, nurses and public health officials to promote, protect, treat and manage a person 's physical, mental, social, emotional, environmental health and holistic well-being. The study of legal aspects and medical ethics helps them in putting into perspective the knowledge that they gain for better future

Course Objectives:

This course is designed to provide the students the basic knowledge in laws and ethics to follow as health professionals.

After completion of the course the students will be able to: Understand the various definitions

Course Learning Outcomes:

Upon successful completion of the course, the students should be able to:

CLO1: Understood the importance of the professional laws and ethics.

CLO2: Understood the legal aspects and medical ethics in health setups.

Course Pedagogy

The course pedagogy includes a comprehensive study including the study of general actions of the drugs. Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, presentations are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. The practical includes the study of drugs via presentations and viva voce.

Course Contents

Module 1

Role, Definition and Interaction with the patients and health care professionals, Ethical, Moral, and Legal Responsibilities, Patient safety and quality, restrain policies and role of health professionals.

Biomedical waste Management, medical records and reports.

Module 2

Medical terminology- The course employs a body systems-oriented, word-analysis approach to learning medical terminology.

Module 3

The goal of the class is to prepare students for the terminology they might encounter in their subsequent coursework, in their clinical rotations and ultimately in their roles as health care professionals.

Course Assessment Scheme

Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Books Recommended

www.wikipedia.in

Course Title: Environmental Science			
Semester: II	**Course code: BRT 206**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:**	
Course Pre-requisites:		**Number of sessions: 30**	

Course Introduction

Environmental Studies is a multidisciplinary subject and hence requires a comprehensive knowledge on various subjects, which primarily include general science, social science, law and management practices. The prime objective of this course is to make the undergraduate students acquainted with the fundamental concepts of environmental science and to adopt eco-friendly technologies to facilitate conservation and regeneration of natural resources.

Course Objectives

The broad objectives of this course are

- To gain an understanding of the concepts fundamental to environmental science
- To understand the complexity of ecosystems and possibly how to sustain them
- To understand the relationships between humans and the environment.
- To understand major environmental problems including their causes and consequences.
- To understand current and controversial environmental issues and possible solutions to environmental problems and their pros and cons.
- To understand the hospital environment in general

Course Learning Outcomes

Upon successful completion of the course, the students should be able to:
CLO1: To gain knowledge on the importance of environmental education and ecosystem.
CLO2: To acquire knowledge about environmental pollution- sources, effects and control measures of environmental pollution.
CLO3: To understand the treatment of wastewater and solid waste management.
CLO4: To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of interdependence.
CLO5: To be aware of the national and international concern for environment for protecting the environment.
CLO6: To understand the environmental issues arising from different labs of the hospital

Course Pedagogy

The course follows the pedagogy of "learning by doing". Instructional design is based on creating situations in which the students have opportunities "to do things". The course would be delivered primarily through presentations and discussions led by students for active learning. The course facilitator would execute the same either by organizing in-class activities or out-of-class projects. A topic would be introduced to the class by the facilitator. Next the students would break off into groups. Group discussions would be conducted to bring in various perspectives on the topic followed by presentations by the students and activities carefully designed around the given theme to achieve the course learning outcomes (CLOs). Performance

of and learning demonstrated through the same activities/ presentations would be used for assessment.

Course Contents

The class would meet twice in a week for a period of 10 weeks approx.

Module 1. Introduction
Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

Module 2. Natural Resources
Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

Module 3. Ecosystems
Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hotspots of biodiversity

Module 4. Environmental Pollution
Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards, Solid waste management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies, Disaster management: Floods, earthquake, cyclone and landslides.

Module 5. Social blemishes and the Environment
From Unsustainable to Sustainable development, urban problems related to energy, Water conservation, rain water harvesting, water shed management Resettlement and rehabilitation of people; its pros and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation, Consumerism and waste products. Environment Protection Act, Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.
Human Population and the Environment, Population growth, variation among nations. Population explosion–Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies.

Module 5. Understanding the Hospital Environment

Module.6 Understanding the environment in the following clinical laboratories:
Microbiology, Biochemistry, Histopathology, Hematology

Module7. Clinical laboratory hazards to the environment from the following and means to prevent:

Infectious material, Toxic Chemicals, Radioactive Material, Other miscellaneous wastes

Course Assessment

Assessment Scheme
Students would be assessed continuously at four assessment points during the course through the activities and deliverables mentioned in the table in point 4 above. Course assessment is based on a student's activity/ assignments/quizzes (records/ evidence of his/her performing and learning). They could be in the form of PowerPoint Presentations, Videos watched etc. The details of the components of assessment are detailed next.

Course References
Text Book:
Chawla S., 2012. A Textbook of Environmental Studies, Tata Mc Graw Hill, New Delhi.

Reference Books:
Reference 1: Jadhav, H &Bhosale, V.M., 1995. Environmental Protection and Laws. Himalaya Pub. House, New Delhi.
Reference 2: Gadi R., Rattan, S., 2006. Environmental Studies, KATSON Books, New Delhi.
Reference 3: Mckinney, M.L. & School, R.M., 1996. Environmental Science Systems & Solutions, Web enhanced edition.
Reference 4: Wanger K.D., 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA

Papers:
- Beckerman, W. (1992). Economic growth and the environment: Whose growth? Whose environment? *World Development, 20(4),* 481-496.
- Lorente, D.B., Shahbaz, M., Roubaud, D., Farhani, S. (2018) How economic growth, renewable electricity and natural resources contribute to CO2 emissions? *Energy Policy, 113(C), 356–367.*
- Kumar Reddy D.H., Lee S.M. (2012) Water Pollution and Treatment Technologies, *J Environ Anal Toxicol, 2(5)* e103.
- Dwivedi, A. K. (2017) Researches In Water Pollution: A Review. *International Research Journal of Natural and Applied Sciences, 4(1)* 118-142.

Course Title: Clinical Radiography Positioning-I			
Semester: III	**Course code: BRT 301**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 60	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

This course is designed to provide the students the basic knowledge in Radiography. At the end of the course, the student should be able to:

1)Explain the role of radiographer and positioning of various body parts, normal functioning of various organ systems of the body and their interactions.
2)Elucidate the radiological aspects of normal growth and development.
3)Describe the patient response and adaptations to environmental stresses.

Course learning Outcomes

CLO 1-Explain how to take good quality images with as low as radiation dose in upper limb and lower limb.

CLO 2-Enumerate immobilization technique and immobilization devices. Use positioning devices.

CLO 3-Work in clinical practice and know about patient care

CLO 4 Able to know and perform dental radiography

CLO 5 Able to know abdominal radiography.

Course Pedagogy

The course pedagogyincudes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly.Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course contents

MODULE 1 Upper limb: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio ulnar joints and humerus supplementary techniques for the above. E.g. Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections. Lower limb: Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella & femur. Supplementary techniques: Stress view for torn ligaments, a. Subtalar joint and talo calcaneal joint. b. Inter condylar projection of the knee. c. Tibial tubercle. d.

Length measurement technique.

MODULE 2 Shoulder girdle and thorax: Technique for shoulder joint, scapular, clavicle, acromio clavicular joints, sternum, ribs, sterno-clavicular joint. Supplementary projections and techniques a. Recurrent dislocation of shoulder. b. Traumatic dislocation of shoulder. c. Cervical ribs.

MODULE 3 Vertebral column: Technique for atlanto-occipital joint, cervical spine, cervico thoracic spine, thoracic spine, thoraco- lumber spine, lumbo sacral spine, sacrum and coccyx. Supplementary techniques to demonstrate: a. Scoliosis. b. Kyphosis c. Spondylolisthesis d. Disc lesion e. Union of spinal graft. Adaptation of techniques to demonstrate specific pathologies. Pelvic girdle and hip region: Technique for whole pelvis. Ilium, ischium, pubic bones, sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter.

MODULE 4 Supplementary techniques- a. Congenital dislocation of hips b. Epiphysis of femur: c. Lateral projections for hip joints to show femoral head and neck relationship. Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders. 8. Skull: Basic projections for cranium, facial bones, nasal bones and mandible. Technique for a. Petrous temporal for mastoids. Internal auditory canal. - Accessory nasal sinuses. b. Tempero - mandibular joint. - Orbits and optic foramen. - Zygomatic arches. c. Styloid process. - Pituitary fossa. - Jugular foramen.

MODULE 5 Dental Radiography: Technique for intra oral full mouth, occlusal projections, extra oral projections including orthopantomography, Supplementary techniques. Upper respiratory system: Technique for post nasal airways, larynx, trachea, thoracic inlet - Valsalva manoeuvre. - Phonation. Lungs and Mediastinum:

MODULE 6 Technique for routine projections: Projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated posteroanterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions.Abdominal viscera: For plain film examination, Projection for acute abdomen patients. Technique to demonstrate:

PRACTICAL

Regional Radiography:.

- All Views of Hip and Pelvis: Theatre procedure for Hip, Pinning and Reduction, Pelvis, Sacro-ilac Joint, Pelvis Bone, Acetabulum.
- All Views and techniques of Vertebral Column: Cervical Spine, Thoracic spine, Lumbar spine, Sacrum, Coccyx
- All views and techniques Abdomen: Gastro-intestinal tract, urinary tract Skeletal Survey.

Books Recommended-

Clark's Radiography- Clark
Radiographic positioning- Garkal
www.wikipedia.co.in
www.radiopedia.co.in

Course Title: Modern radiological & imaging Equipment including physics			
Semester: III	**Course code: BRT 302**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications of mammography and computed radiography and DSA. Should able to scanning also in mammography,computed radiography and DSA.

Course learning Outcomes

CLO 1-Perform the procedure of mammography scanning.

CLO 2-Enumerate and able to know the principle computed radiography.

CLO 3-Able to know and perform vascular imaging with PACS

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of physics of mammography and CT scan but also improve skills and techniques for tackling practical problems.

Course contents

MODULE-1 Mammography, History of mammography, Mammographic equipment, Mammographic radiation dose and exposureDedicated mammographic unit and its special features, Types of mammographRoutine Mammographic Positioning & Views with additional views and technical considerations, Wire localization in mammography.

MODULE 2 Special equipment: Portable and mobile x-ray units, dental x-ray machine, skull table Generator, x-ray tubes; Accessories; Resolution; Quality control; Application and role in medicine. , digital radiographic equipment, digital subtraction techniques. Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of tomographic movements, Dual energy x-ray absorptionometry (DEXA), stats can.

MODULE 3 Computed radiography: its principle, physics & equipment. Digital Radiography. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications.

MODULE 4 Vascular Imaging Equipment: Introduction, historical developments, Principle, scanned projection radiography, digital subtraction angiography, applications and definition of terms. 4. Picture archiving and communication system (PACS)

Practical

1) X-Ray tubes and accessories, generalfeatures.
2) Portable X-Ray Equipment.
3) Image intensifier, its features, spot film.
4) Radiation protection devices
5) EffectsofkVandmAs.
6) Maintenance of X-ray equipment and accessories.
7) Mammography X-Ray tube
8) Dental X-Ray unit.

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

www.wikipedia.co.in

www.radiopedia.co.in

Course Title: Contrast & Special Radiography Procedures			
Semester: III	**Course code: BRT 303**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives-

This course is designed to provide the students the basic knowledge in systematic investigations with using contrast media and image intensifier.

Course learning outcomes-

CLO 1- Explain indication, contraindication and reactions of contrast media.
Demonstrate how to take in minimum numbers of exposures in each special investigation.

CLO 2-Demonstratethe positioning and technique of the special studies.

CLO 3-Explainthe technique of all GIT study according to investigation.

CLO 4- Demonstrate surface anatomy.To be able to know the technique behind the radiography.

Course contents

MODULE 1 Special radiographic procedures Responsibility of Radiographer during Radiological Procedures. Preparation of Patient for Different Procedures. Contrast Media - Positive and Negative, Ionic & Non – Ionic Adverse Reactions To Contrast Media and Patient Management Emergency Drugs in the Radiology Department Emergency Equipments In the Radiology Department Aseptic technique Indications, contraindications, basic techniques and relationship to other techniques of the following special procedures

MODULE 2 Gastrointestinal Tract: Fluoroscopy, general considerations, responsibility of radiographers Barium swallow, pharynx and oesophagus Barium meal and follow through Hypotonic duodenography Small bowel enema Barium Enema routine projections for colon and rectum, colonic activators; double contrast studies; colostomy. Special techniques for specific disease to be examined Water soluble contrast media - eg. gastrograffin studies b. Salivary glands: Routine technique, procedure – sialography c.

MODULE 3 Biliary system: Plain film radiography Intravenous cholangiography Percutaneous cholangiography Endoscopic retrograde cholangio-pancreatography (ERCP) Operative cholangiography Post-Operative cholangiography (T - tube Cholangiography)

MODULE 4 Urinary system: Intravenous urography Retrograde pyelography Antegrade pyelography Cystography and micturatingcystouresthrographyUrethrography (ascending) Renal puncture

MODULE 5 Female reproductive system: Hysterosalpingography. Respiratory system: Bronchography: Awareness. h. Sinusography: Routine technique and procedure.

MODULE 6 Multiple radiography. Uses of soft tissue radiography. l. High kV Radiography:

General principles Relation to patient dose Change in radiographic contrast. Scatter elimination; beam collimation; grid ratio. Speed and type of grid movement. Radiographic factor; application and uses. m. Localization of foreign bodies: General location principles. Ingested; inhaled; inserted; embedded foreign bodies. Foreign bodies in eye. Preparation of the area to be investigated. Appropriate projection for all Techniques to locate non-opaque foreign body.

PRACTICAL

- Radiography in various positions for all the special radiological procedures, using contrast media
- Identification of various films for all the special radiological procedures, using contrastmedia and related pathologies

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

Radiology- Special investigation – champman.

www.wikipedia.co.in//www.radiopedia.co.in

Course Title: Physics of newer imaging modalities			
Semester: IV	**Course code: BRT 401**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 60	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

This course is designed to provide the students the basic knowledge in Radiography with using newer modalities of radiology. At the end of the course, the student should be able to know about ultrasonography Computed Tomography, Generation of CT Scanner, Magnetic resonance imaging, fusion imaging PET, Contrast media using, handling and teleradiology.

Course learning Outcomes

CLO 1 Able to know Computed Tomography its principle, various generations and advancements

CLO 2 Able to know Magnetic Resonance Imaging- its principle, advancements and applications.

CLO 3. Explain and able to know Ultrasonography, Color Doppler- its principle, advancements and applications. Digital Radiography and Digital subtraction angiography equipment- principle, advancements and applications.

CLO 4 Able to know Fusion Imaging including PET-CT, PET- MRI. Digital Mammography, DEXA equipment- principle, advancements and applications.

CLO 5 Able to know tele radiology HIS,RIS and PACS, Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy systems

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of physics of mammography and CT scan/ultrasound/ PACS but also improve skills and techniques for tackling practical problems.

Course Contents

MODULE 1-Basic principle of CT scan, history of CT Scan, EMI, advantages anddisadvantages, Equipment description.

MODULE 2-Scanning principle, Image acquisition, Image reconstruction,Image manipulation, Image display and documentation, Scanning parameters.Advantages and disadvantages.

MODULE 3-History of MRI, Magnetism, Basic Principle, hardware etc. Types of Contrast agents used in MRI. Physical and physiological basis of magnetic relaxation, Image contrast and noise. Spin Echo, Inversion Recovery, Gradient Echo

MODULE-4 Applications and Apparatus for nuclear medicine,Application, Function and instrumentation . Definition, Applications, Clinical uses, advantages & disadvantages of PET-CT. Definition, Applications, Clinical uses, advantages & disadvantages of PET-MRI

MODULE -5 Benefits vs risk or PET-CT and PET-MRI.Characteristics and half-life of Radionuclides Commonly used Radionuclides. Routine protocols Indication and contraindications of PET. Patient preparation technique in PET Scan.

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

Radiology- Special investigation – champman.

CT made Easy

www.wikipedia.co.in

www.radiopedia.co.in

Course Title: Clinical Radiography Positioning –II			
Semester: IV	**Course code: BRT 402**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 60	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

ThiscourseisdesignedtoprovidethestudentsthebasicknowledgeinRadiography.At theend of the course, the student should be able to:

Course Learning Outcomes

CLO1-Explain the role of radiographer and positioning of various body parts, normal functioning of various organ systems of the body and their interactions.

CLO2-Elucidate the radiological aspects of normal growth and development.

CLO3-Describe the patient response and adaptations to environmental stresses.

Course Pedagogy

The course pedagogyincudes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly.Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course contents-

MODULE 1 Radiography technique comprising of the complete. Radiography of Skull and Radiography of cranial bones; including special techniques for sellaturcica, orbits, opticforamina, superior orbital fissure and inferior orbital fissure etc. Facial bones; Paranasal sinuses, Temporal bone and Mastoids. Dental Radiography: Radiography of teeth-intra oral, extra oral and occlusal view.

MODULE 2 Abdomen: Preparation of patient. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen. Macroradiography: Principle, advantage, technique and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry.

MODULE 3 High KV techniques principle and its applications. Soft tissue Radiography .

Localization of foreign bodies. Various techniques Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.

MODULE 4 Operation theatre techniques: General precautions, Asepsis in techniques - Checking of mains supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid processing techniques. Trauma radiography/Emergency radiography. Neonatal and Paediatric Radiography, Tomography and TomosynthesisDual energy X-ray absorptiometry . Forensic Radiography

Practical

a. All views and techniquesAbdomen: Gastro-intestinaltract,urinarytract
b. SkeletalSurvey.

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

Radiology- Special investigation – champman.

www.wikipedia.co.in//www.radiopedia.co.in

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Course Title: Newer Modalities Imaging Techniques including patient care			
Semester: IV	**Course code: BRT 403**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

ThiscourseisdesignedtoprovidethestudentsthebasicknowledgeinRadiography with patient care and code of ethics.At theend of the course, the student should be able to

Course Learning Outcomes

CLO1- Understood about Introduction to hospital staffing and Medical records and documentation.

CLO2 – Must know about Legal issues and Professional ethics.

CLO3- How to handle and must know Departmental Safety and Infection control

CLO4- Understood Body mechanics and transferring of patient

Course Contents-

MODULE 1 Interventional Radiography: Basic angiography and DSA: a. History , technique, patient care b. Percutaneous catherisation, catheterization sites, Asepsis c. Guidewire, catheters, pressure injectors, accessories d. Use of digital substraction- single plane and bi-plane All forms of diagnostic procedures including angiography, angioplasty, bilary examination, renal evaluation and drainage procedure. Central Nervous System: a. Myelography b. Cerebral studies c. Ventriculography Arthrography: Shoulder, Hip, Knee, Elbow 4. Angiography: a. Carotid Angiography (4 Vessel angiography) b. Thoracic and Arch Aortography c. Selective studies: Renal, SMA, Coeliac axis d. Vertebral angiography e. Femoral arteriography f. Angiocardiography Venography: a. Peripheral venography b. Cerebral venography c. Inferior and superior venocavography d. Relevant visceral phlebography 6. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophyiology,

MODULE 2 Microbiology 1. Introduction and morphology - Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria. 2. Growth and nutrition -nutrition, culture media, types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test Sterilization and disinfection - principles and use of equipments of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, anti-septic and disinfectants. Introduction to immunology, bacteriology, parasitology, mycology.

MODULE 3 Hospital procedure: Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other

members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping. Care of the patient : FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients (for example clean linen and receptacles , nursing care; temperature pulse and respiration; essential care of the patient who has a tracheostomy; essential care of the patient who has a colostomy; bedpans and urinals; simple application of a sterile dressing.

MODULE 4 First aid: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons. 4. Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc. 5. Principles of asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filamented swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department (for study by radio imaging students only) 6. Departmental procedures: Department staffing and organisations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department;

PRACTICAL

Newer Modalities Imaging Techniques including patient care

1. Medical records and documentation
2. Legal issues in radiology department, PNDT Act
3. Professional ethics and Code of conduct of radiographer
4. Handling of patients: Seriously ill and traumatized patients, visually impaired, hearing and speech impaired patients, mentally impaired patients, infectious patients
5. Departmental Safety
6. Infection control: skin care, donning of gowns, gloves, face masks, head caps, shoe covers.
7. Vitals signs
8. Body mechanics and transferring of patient, draw sheet lift, use of slide boards, wheelchair to couch, couch to wheelchair, couch to table, three men lift and four men lift.
9. First aid: artificial respiration, haemostasis

10. Local anaesthesia and general anaesthesia
11. Facilities regarding general Anaesthesia in the X-ray department
12. Management of adverse reactions to contrast media

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

Radiology- Special investigation – champman.

www.wikipedia.co.in

www.radiopedia.co.in

Course Title: Quality control in radiology and patient safety			
Semester: IV	**Course code: BRT 404**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 60	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

ThiscourseisdesignedtoprovidethestudentsthebasicknowledgeinRadiography.At theend of the course, the student should be able to:

1-Radiation protection

2-Biological effects of radiation

3-Planning of radiation installation-protection primary &secondaryradiation

4-Personnel monitoring systems

Course learning Outcomes

CLO 1-Enumerate the guidelines of all respective organization. Enumerate the risk and effects of the radiation.

CLO 2-Label &Demonstrate how to use and care of all types of lead aprons

CLO 3-Demonstrate the handling and how to use TLD's and badges as per guidelines

Course contents

MODULE 1 Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance. Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance. Quality assurance programme at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration

MODULE 2 Quality assurance programme tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance – LASER printer - Light beam alignment; X-ray out-put

and beam quality check; KVp check; Focal spot size and angle measurement; Timer check; mAs test; Grid alignment test; High and low contrast resolutions; Mechanical and electrical checks; Cassette leak check; Proper screen-film contact test; Safe light test; Radiation proof test; Field alignment test for fluoroscopic device; Resolution test; Phantom measurements - CT, US and MRI.

MODULE 3 Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern 6. Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme. Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.

MODULE 4 Radiation safety in diagnostic Radiology 1. Radiation Quantities and Units: Radiation- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor - Flux-Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public.

MODULE 5 Biological Effects of radiation: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus - Somatic effects and hereditary effects- stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields. Radiation detection and Measurements: Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters-scintillation detectors – liquid semiconductor detectors – Gamma ray spectrometer. Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter – chemical dosimeter-Thermoluminescent Dosimeter. -Pocket dosimeterRadiation survey meter- wide range survey meter -zone monitor-contamination monitor their principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD

in mammography. 4. Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey – ALARA- personnel dosimeters (TLD and film batches) occupational exposure.

MODULE 6 Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.

PRACTICAL

1) Knowledge of all hazards, education of general Public by posters and seminars
2) Safety of women and children , pregnant women, safety of patient attendants, radiation workers and hospital staff, checking of lead aprons, leakage radiation from tube head, radiation survey in and around X – ray installation.
3) Use of TLD film badges, GM counters, Scintillation detectors, Liquid scintillator, Pocket dosimeters and use of protective devices etc. Keeping of dose records of radiation workers, steps after high exposure report and investigations.
4) Biological effects of radiation- The cell effect of ionizing radiation on cell.
5) Somatic effects and hereditary effect. Stochastic and deterministic effect.

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

Radiology- Special investigation – champman.

www.wikipedia.co.in // www.radiopedia.co.in

Course Title: Cross Sectional anatomy and Physiology			
Semester: V	**Course code: BRT 501**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Introduction

Allied and healthcare professionals (AHPs) includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions.

They work in multidisciplinary health teams in varied healthcare settings including doctors , nurses and public health officials to promote, protect, treat and manage a person's physical, mental, social, emotional, environmental health and holistic well-being.The study of anatomy helps them in putting into perspective the knowledge that they gain for better good of humanity.

Course learning outcomes-

CLO 1 Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images.

CLO 2 Describe anatomical structural relationships.Recognize normal anatomy and build a personal resource system for future study.

CLO 3. Locate and identify pertinent cerebral, upper thorax, mid-thorax, and abdominal anatomy. On CT and MR images, identify anatomical structures of the body and of the head.

CLO 4 Distinguish between arterial and venous anatomy of the entire body's vascular system. Classify the various sections of anatomical regions and their associated parts.

Course Pedagogy

The course paedagogyincudes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly.Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course contents

MODULE 1 Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology.

MODULE 2 Anatomy of the upper thorax- Surface anatomy relationships, Bony structures and muscles, Blood vessels. Divisions of the mid-thorax, heart and great vessels- Lungs, heart and great vessels, Esophagus

MODULE 3 CT/MRI Images of the Thorax - Normal and pathologic . Anatomy of the Abdomen- Major organs and their accessories, Abdominal blood vessels CT/MR Images of Abdomen - Normal and pathologic

MODULE 4 Anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems . Reproductive Organs CT/MR Images of the Male/Female Pelvis- Normal and pathologic . Neuro Anatomy- Scan planes . Brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves Spine- Vertebra and disc, Spinal cord and meninges Neck- Arterial/venous systems, Muscles, Glands and pharynx

Text Books:

- PR Ashalatha& G Deepa 's Textbook of ANATOMY & PHYSIOLOGY by
- B.D.Chaurasia's HUMAN ANATOMY

Reference books:

- SampathMadhyastha'sManipal manual of anatomy for allied health sciences
- Krishna Garg &Madhu Joshi's Practical anatomy workbook
- Dixit's Atlas of Histology for Medical Students
- Basic Histology: A Color Atlas & Text
- Jana's Exam Oriented Practical Anatomy
- Krishan's Anatomy Mnemonics

Course Title: Physics of advance imaging technology			
Semester: V	**Course code: BRT 502**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

COURSE OBJECTIVES-

ThiscourseisdesignedtoprovidethestudentsthebasicknowledgeinMagneticresonanceimaging investigations with using contrast media and imaging instrumentation, pulse sequences, bio-effects and safety in advance CT,MRI and USG.

Course learning outcomes-

CLO 1-Enumerate the principle and hardware of the equipment.

Explain the dose of contrast media and conduct all procedure of CT.

CLO 2-Demonstrate how to take good quality of image

Perform the scan &Should know the principle of protocol

CLO 3-Demonstrate the patient care in MRI

Enumerate technical aspects, protocol and planning techniques for all scans

CLO 4-Enumerate all types of artefacts and its correction

CLO 5 Able to know all procedure and patient care in USG

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of physics of mammography and CT scan/ultrasound/ PACS but also improve skills and techniques for tackling practical problems with patient handling in MRI scans also.

Course contents

MODULE 1 Basic Computed Tomography- Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display Advanced Computed Tomography Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose, patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography – (Aortogram, selective angiogram head, neck and peripheral) image

documentation and Filing, maintenance of equipment and accessories.

MODULE 2 Advanced technique & instrumentation of MRI a. Basic Principles: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image. b. Pulse sequence : Spin echo pulse sequence – turbo spin echo pulse sequence - Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences.

MODULE 3MR Instrumentation: Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers. d. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP. e. MR contrast media – MR angiography – TOF & PCA – MR Spectroscopy – functional MRI

MODULE 4 Ultrasonography a. Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. b. Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing. c. Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam. d. Ultrasound display modes: A, B, M e. Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements. f. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety. g. Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography,

PRACTICAL:

1) Physics, scanning principle and image formation in USG,CT and MRI
2) Identification of different parts of MR scanner
3) Applications of various procedures in well-equipped Hospitals and Diagnostic Centers.

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

Radiology- Special investigation – champman.

www.wikipedia.co.in // www.radiopedia.co.in

MRI made easy

CT made easy

Course Title: Radiographic techniques of advanced imaging technology			
Semester: V	**Course code: BRT503**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

COURSE OBJECTIVES-

This course is designed to provide the students the basic knowledge in Computed Tomography imaging and Magnetic resonance imaging investigations with using contrast media and imaging instrumentation Generation of Quality assurance and control.

Course learning outcomes-

CLO-1 Able to know scanning of MSK, Vascular and cardiopulmonary system.

Enumerate- distinguish all types of bones, joints and connective tissue

CLO 2-Explainthe history and generations CT/MRI

Perform the scan and Demonstrateall technical aspects and protocols

CLO 3-Explain different types of Artefacts and correction. Demonstratethe QA and QC doing himself and take care of QA & QC papers

CLO 4 Able to know USG and Doppler techniques

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of physics of mammography and CT scan/ultrasound/ PACS but also improve skills and techniques for tackling practical problems with patient handling in MRI scans also.

Course contents

MODULE 1 Ultrasonography/ Doppler studies: Techniques of sonography-selection-Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols clinical applications display methods – quality image reproducible extend – biopsy procedures, assurance to patients.

MODULE 2 CT scan studies acquisition/ protocols /techniques: CT of head and neck – thorax – abdomen – pelvis – musculo skeletal system – spine – PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.

MODULE 3 MRI Scanners: Methods of MRI imaging methods – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI.

PRACTICAL

1) Physics, scanning principle and image formation in CT/MRI/USG
2) Identification of different parts of CT /MRI/USG scanner
3) Applications of various procedures in well-equipped Hospitals and Diagnostic Centers
4) Quality control of CT /MRI

Books Recommended-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava

Radiographic positioning- Garkal

Radiology- Special investigation – champman.

www.wikipedia.co.in // www.radiopedia.co.in

MRI made easy

CT made easy

Course Title: RESEARCH METHODOLOGY & BIOSTATISTICS-I			
Semester: V	**Course code: BRT 504**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial:30		**No of practical hours:**	
Course Pre-requisites:		**Number of sessions:30**	

Course Introduction

As the Indian government aims for Universal Health Coverage, the lack of skilled human resource may prove to be the biggest impediment in its path to achieve targeted goals. The benefits of having AHPs in the healthcare system are still unexplored in India. Although an enormous amount of evidence suggests that the benefits of AHPs range from improving access to healthcare services to significant reduction in the cost of care, though the Indian healthcare system still revolves around the doctor-centric approach. The privatization of healthcare has also led to an ever-increasing out-of-pocket expenditure by the population. However, many examples assert the need of skilled allied and healthcare professionals in the system, such as in the case of stroke survivors, it is the support of AHPs that significantly enhance their rehabilitation and long term treatment ensures return to normal life. The basic knowledge of research methodology will help them in their chosen profession and will be of immense use in the same.

Course Objectives:

This course is designed to provide the students the basic knowledge in research process and Bio-statistics. At the conclusion of the course, the students will have the knowledge of data collection, statistical application and finally, presentation of the statistical data. The first part shall be conducted in second semester and second part shall be covered in third semester

Course Learning Outcomes:

Upon successful completion of the course, the students should be able to (knowledge based):

Upon successful completion of the course, the students should be able to:

CLO1: Understand the needs of research in clinical field of Radiology.

CLO2: Understand the difference between the various types of research methodologies.

CLO3: Understand the various types of data collecting methods.

CLO4: Understand and learn about the knowledge of research to be used in clinical areas.

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real

world applications. It will not only help students to understand the fundamentals of applied physics but also improve skills and techniques for tackling practical problems.

Course contents and duration: The classes will be two theories and two practical including the tutorials in a week

Course contents

Module 1: Need for Research in the field of cardiology. Introduction to research methods, conducting a literature review, Research design, Sampling methods, Data collection and data collection tools, Data analysis: Quantitative and Qualitatively, Public health research, Issues in Research of research problems and writing research questions, Hypothesis, Null and Research Hypothesis, Type I and Type II errors in hypothesis testing

Module 2: Introduction of epidemiology, Descriptive epidemiology, Experimental and non-experimental research designs, Screening, Sampling methods, Biological variability, normal distribution

Module 3: Bias and Confounding, Association and causation, Odds ratio and relative risk, sensitivity and specificity Data collection methods- Observation method, Interview method, Questionnaires and schedules Construction,

Course References

1. Research Methodology: Kothari
2. Methods in Biostatistics by B.KMahajan
3. Probability and Statistics byMurray
4. Research Methodology by SMIsrani

Course Title: Regulatory requirements in diagnostic radiology & imaging act and rules.			
Semester: V	**Course code: BRT505**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:**	
Course Pre-requisites:		**Number of sessions: 30**	

COURSE OBJECTIVES-

AERB safety code and ethics

Patient Protection-Safe work practice in diagnostic radiology-

Radiation emergencies- situation handling.

Course learning outcomes-

CLO 1-Enumerate how to work as per the AERB safety guideline in clinical setup.

CLO 2-Demonstrateradiation protection and patient care

CLO 3-Enumerate radiation emergencies &radiation protection and patient care

Course contents

MODULE 1 Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements.

MODULE 2. Role of Radiographer in Planning, QA & Radiation Protection: Role of technologist in radiology department - Personnel and area monitoring., Setting up of a new X-Ray unit, staffrequirement, AERB specifications for site planning and mandatory guidelines – Planning of X-ray rooms, dark rooms – Inspection of X-Ray installations - Registration of X-Ray equipment installation- Certification

MODULE 3 Evaluation of workload versus radiation factors – Occupational exposure and protection Tools/devices. ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDT Act and guidelines

Books Recommended-

Text book of radiology for residents and technicians- s k bhargava

www.wikipedia.co.in // www.radiopedia.co.in

Guide lines of AERB

Course Title:Quality assurance & radiation safety			
Semester: VI	**Course code: BRT 601**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

COURSE OBJECTIVES-

AERB safety code and ethics

Patient protection-Safe work practice in diagnostic radiology-

Radiation emergencies- situation handling.

Course learning outcomes-

CLO 1-Enumerate how to work as per the AERB safety guideline in clinical setup.

CLO 2-Demonstrateradiation protection and patient care

CLO 3-Enumerate radiation emergencies &radiation protection and patient care

Course contents

MODULE 1 Quality Assurance and quality control of Modern Radiological and Imaging Equipment which includes Digital Radiography, Computed Radiography, CT scan, MRI Scan, Ultrasonography and PACS related.

MODULE 2 Image artifacts their different types, causes and remedies, Newer Radiation safety protocols and recent advances in radiation safety including AERB guidelines

MODULE-3 National & international agencies, AERB, BARC, ICRP, WHO, IAEA and their role.

MODULE- 4AERB safety code and ethics: Built in safety specifications for diagnostic x-ray, fluoroscopy and CT units, Specifications for radiation protection devices-room layout. Operational safety-Radiation protection programme- Personnel requirements and responsibilities-regulatory controls.

MODULE-5 Radiation emergencies- situation handling, safety and prevention-legal requirements recent developments in radiation safety related topics.

Books Recommended-

Text book of radiology for residents and technicians- s k bhargava

www.wikipedia.co.in // www.radiopedia.co.in

Guide lines of AERB

Course Title: Hospital Practice and Patient care			
Semester: VI	**Course code: BRT 602**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

COURSE OBJECTIVES-

ThiscourseisdesignedtoprovidethestudentsthebasicknowledgeinRadiography.At theend of the course, the student should be able to-

Course learning Outcomes-

CLO 1 Introduction to hospital staffing, Medical records and documentation

CLO 2 Understood the Legal issues, Professional ethics.

CLO 3 Must know Departmental Safety and Infection control

CLO 4 Body mechanics and transferring of patient

Course Pedagogy

The course pedagogyincudes a comprehensive study including the study of general structures and the specialized organs in a manner aimed at being student friendly. Various clinical aspects are discussed in relevance to the topic taught so as to relieve the monotony of the subject. Regular doubt clearing sessions, written assignments, quiz, chart and poster making and model making are some of the measures for learning. Periodic and surprise tests are taken to apprise and evaluate the students. They are taught on simulators for a live feeling. The practical includes the study of structures through mannequins which helps in holding the interest of the students.

Course contents

MODULE 1 Hospital staffing and administration, records, professional, ethics, co-operation with other staff and departments, Departmental organisations. Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non-English speaking patients. Understanding patient needs - patient dignity of inpatient and out patients. Interaction with the patient's relatives and visitors.

MODULE 2 Methods of effective communication - verbal skills, body language, professional appearance, visual contact etc. Elementary personal and departmental hygiene, dealing with receptacles, bed pans and urinaletc. General preliminaries to the exam.

MODULE 3 Moving chair and stretcher, patient. Unconscious patient, general comfort and reassurance for the patient. Vital signs and oxygen - patient's Haemeatasis status. Body temp, respiratory rate, pulse, blood pressure, oxygen therapy, oxygen devices, Chest tubes

and lines.

MODULE 4 First aid - shock, electrical shock, haemorrhage, burns, Asphyxia, fractures, loss of consciousness. Emergency treatment to the collapsed patient. Artificial respiration and resuscitation. Preparation of patient for general and special radiological examinations. Supervision of patients undergoing special examination. Administration of drugs and contrast media. Aseptic and sterile procedures. Handling of infections patients in the department or in the ward. Regulation of dangerous drugs. Trolley set up for special x-ray examinations, Radiation hazardous and protective measures.

PRACTICAL

Medical records and documentation

Legal issues in radiology department, PNDT Act

Professional ethics and Code of conduct of radiographer

Handling of patients: Seriously ill and traumatized patients, visually impaired, hearing and speech impaired patients, mentally impaired patients, infectious patients

Departmental Safety

Infection control: skin care, donning of gowns, gloves, face masks, head caps, shoe covers.

Vitals signs

Body mechanics and transferring of patient, draw sheet lift, use of slide boards, wheelchair to couch, couch to wheelchair, couch to table, three men lift and four men lift.

First aid: artificial respiration, haemostasis

Local anesthesia and general anesthesia

Facilities regarding general Anesthesia in the X-ray department

Management of adverse reactions to contrast media

Course References

1) PR Ashalatha& G Deepa'sTextbook of ANATOMY & PHYSIOLOGY
2) N Geetha 'sTextbook of physiology

Reference Books:

3)C C Chatterjee's Human Physiology
4) C C Chatterjee's Practical Physiology for Paramedical Courses
5)CN Chandrashekhar'sManipal Manual of Medical Physiology
6)RK Maurya's Medical Physiology

Online references:Coursera subscription for online anatomy topics

Course Title: Research Methodology & Biostatistics-II

Semester: VI	Course code: BRT 603	Credits:04	Core
No of sessions Lectures / Tutorial: 40		No of practical hours:	
Course Pre-requisites:		Number of sessions: 40	

Course Introduction

As the Indian government aims for Universal Health Coverage, the lack of skilled human resource may prove to be the biggest impediment in its path to achieve targeted goals. The benefits of having AHPs in the healthcare system are still unexplored in India. Although an enormous amount of evidence suggests that the benefits of AHPs range from improving access to healthcare services to significant reduction in the cost of care, though the Indian healthcare system still revolves around the doctor-centric approach. The privatization of healthcare has also led to an ever-increasing out-of-pocket expenditure by the population. However, many examples assert the need of skilled allied and healthcare professionals in the system, such as in the case of stroke survivors, it is the support of AHPs that significantly enhance their rehabilitation and long term treatment ensures return to normal life. The basic knowledge of research methodology will help them in their chosen profession and will be of immense use in the same.

Course Objectives:

This course is designed to provide the students the basic knowledge in research process and Bio-statistics. At the conclusion of the course, the students will have the knowledge of data collection, statistical application and finally, presentation of the statistical data. The first part shall be conducted in second semester and second part shall be covered in third semester

Course Learning Outcomes

Upon successful completion of the course, the students should be able to (knowledge based):

CLO1: Understand the various research methodology (Remember & Understand)

CLO2: Compare the differences between the central tendency and measures of dispersion.

CLO3: Learn to apply the knowledge of various types of research to clinical aspect of diseases (Apply &Analyze)

CLO4: Augment their learning by making abstracts, charts, diagrams, graphs and learning on visiting hospitals for practical skills in research methods (Synthesize, evaluate & create)

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of applied physics but also improve skills and techniques for tackling practical problems.

Course contents and duration: The classes will be two theories and two practical including the tutorials in a week

Course contents

Module 1: Critical analysis of research papers, conducting a literature review, Writing Research proposals, Development of conceptual framework in research

Module 2: Introduction to Biostatistics

Introduction to Statistics, Classification of data, Source of data, Method of scaling - nominal, ordinal, ratio and interval scale, measuring reliability and validity of scales, Measures of Central tendency, Measures of Dispersion, Skewness and kurtosis, Sampling, Sample size determination, Introductionandmethodofcollectingandpresentingofstatisticaldata. Calculationandinterpretationofvariousmeasureslikemean,median,standarddeviations, Skewness andKurtosis, Probabilitydistribution, Correlation andregression Significance tests and confidenceintervals

Course References

1. Research Methodology: Kothari
2. Methods in Biostatistics by B.KMahajan
3. Probability and Statistics byMurray
4. Research Methodology by SMIsrani

Course Title: Project			
Semester: VI	**Course code: BRT 604**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial:		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 60**	

PROJECT REPORT

Students have to carry out a research project (on any topic related to radiology) under the supervision of a faculty. The project report has to be prepared on the basis of the research work carried out. The assessment is done on the basis of the work done and the presentation and viva.