

Bachelor of Science in Radiological & Imaging Techniques

(B.Sc. - Radiological & Imaging Techniques)

ORDINANCE

Ordinance & Syllabus

For

B.Sc. in Radiological & Imaging

Techniques

academic programme

Duration :

3 years

&

6 months Internship

Bachelor of Science in Radiological & Imaging Techniques (B.Sc. - Radiological & Imaging Techniques)

ORDINANCE

**(To be added after Chapter of First Statutes of CSJM University,
Kanpur)**

Chapter

"A"

1. B.Sc. - Radiological & Imaging Techniques degree will be under the faculty of ~~MEDICINE~~ Science of C.S.J.M. University, Kanpur.
2. **Duration of Course :**
 - B.Sc. in Radiological & Imaging Techniques course will be a full time course.
 - Duration will be three years followed by compulsory 6 months internship.
 - This course shall be divided into three professional examinations namely B.Sc. in Radiological & Imaging Techniques (B.Sc.- Radiological & Imaging Techniques) Part-I at the end of first academic year, B.Sc.- Radiological & Imaging Techniques Part-II at the end of second academic year and B.Sc.- Radiological & Imaging Techniques Part-III at the end of third academic year.
3. **No. of Seats :**

Total no. of Students to this course **shall be 60.**
4. **Admission.**

Eligibility Criteria:
For admission in this course candidate has to pass 10 + 2 or its equivalent examination in Science (Biology) conducted 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 student).

Mode of Admission :
The candidates for admission to this course shall be selected through an entrance test conducted by the University/ procedure decided by the governing body of the institute or on the basis of merit of marks obtained (Physics, Chemistry & Biology) in 10 + 2 or its equivalent examination.
5. **Medium of instruction :**

English shall be the medium of instruction in the class and in the University examination.
6. **Method of Teaching :**

The method of teaching adopted shall be a combination of lectures, demonstrations and practicals by the full time faculty, visiting or part time or guest faculty.

7. 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 structure for each year.

Duration of Examination :

Each theory paper examination shall be of three hours duration.

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 honorable Vice Chancellor of the University.

Evaluation :

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

8. Attendance to appear in the annual University examination :

The permission to appear in annual examination shall be granted to such candidate only who have fulfill the condition of 75% attendance in each subject separately in theory and practical as per the university rule.

Regarding attendance requirements students will have to fulfill the condition of 75% attendance. 15% relaxation in attendance, in exceptional circumstances can be made by the Vice Chancellor on recommendation of the head of the institute/department.

"B"

Regulations : Scheme of Examination

B.Sc. in Radiological & Imaging Techniques Part-I (First Year) University Examination

S. No.	Subjects	Subject code	THEORY MARKS				PRACTICAL MARKS				Total marks
			Theory Paper	Internal Assessment	Total	Minimum marks	Practical	Internal Assessment	Total	Minimum Marks	
1	Human Anatomy	BRIT-101	80	20	100	50	80	20	100	50	200
2	Human Physiology	BRIT -102	80	20	100	50	80	20	100	50	200
3	Clinical Biochemistry	BRIT -103	80	20	100	50	80	20	100	50	200
4	Fundamental of Medical Imaging & Radiotherapy	BRIT -104	80	20	100	50	80	20	100	50	200
5	Basic Radiation Physics	BRIT -105	80	20	100	50	-	-	-	-	100
6	Community Healthcare	BRIT -106	80	20	100	50	-	-	-	-	100
Grand Total											1000

B.Sc. in Radiological & Imaging Techniques Part-II (Second Year) University Examination

S. No.	Subjects	Subject code	THEORY MARKS				PRACTICAL MARKS				Total marks
			Theory Paper	Internal Assessment	Total	Minimum marks	Practical	Internal Assessment	Total	Minimum Marks	
1	Advanced Radiographic Techniques	BRIT-201	80	20	100	50	80	20	100	50	200
2	Special Radiographic Techniques & Procedures	BRIT-202	80	20	100	50	80	20	100	50	200
3	General Pathology & General Microbiology	BRIT-203	80	20	100	50	80	20	100	50	200
4	Radiation Physics & Radiation Protection	BRIT-204	80	20	100	50	-	-	-	-	100
5	Equipments of Radiotherapy	BRIT-205	80	20	100	50	-	-	-	-	100
6	Pharmacology	BRIT-206	80	20	100	50	-	-	-	-	100
7	Hospital Posting	BRIT-207	-	-	-	-	-	-	100	50	100
Grand Total											1000

B.Sc. in Radiological & Imaging Techniques Part-III (Third Year) University Examination

S. No.	Subjects	Subject code	THEORY MARKS				PRACTICAL MARKS				Total marks
			Theory Paper	Internal Assessment	Total	Minimum marks	Practical	Internal Assessment	Total	Minimum Marks	
1	Radiotherapy Planning and Quality Control	BRIT-301	80	20	100	50	80	20	100	50	200
2	Equipments of Radio Diagnosis	BRIT-302	80	20	100	50	80	20	100	50	200
3	Interventional Radiology & drugs used in diagnostic Radiology	BRIT-303	80	20	100	50	80	20	100	50	200
4	Radiotherapy & Brachytherapy techniques in Malignant and Non-Malignant diseases	BRIT-304	80	20	100	-	-	-	-	-	100
5	Orientation in Clinical Sciences	BRIT-305	80	20	100	-	-	-	-	-	100
6	Hospital Posting	BRIT-306	-	-	-	-	-	-	100	50	100
Grand Total											900

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 = 05 marks
 - c) Attendance = 05 marks

Total = 20 marks

Internal assessment (Practical) will be done as follows :

a) Laboratory manual	= 10 marks
b) Day to day performance	= 05 marks
c) Attendance	= 05 marks
Total	= 20 marks

Internal assessment of subjects without practicals will be done as :

a) Mid Term and term examinations	= 10 marks
b) Assignments/ Projects/ class test/ Clinical Presentations	= 05 marks
c) Attendance	= 05 marks
Total	= 20 marks

Criteria for Passing

- 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.

Supplementary Examination:

- A candidate failing in a subject but securing at least 30% aggregate marks will be required to appear in the university examination after 3 months in that subject/ subjects while attending classes of next year. Those who secure less than 30% aggregate marks will be required to appear in all the subjects.
- If the candidate fails in supplementary examination his/her session will be shifted by one year. The candidate will have to take admission in the previous year and pay the tuition fee for the academic year. He/she will have to appear in all the subjects in the examination.
- Supplementary examination will be held not earlier than 3 months and later than 6 months from the date of annual University examination.

Division:

- Candidate will be awarded division at the end of 3rd academic year 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 six calendar months in a medical college/hospital having well equipped Radiodiagnosis department; which fulfill the norms decided for the University.

Degree:

- The degree of B.Sc. in Radiological & Imaging Techniques (B.Sc.- Radiological & Imaging Techniques) course of the University shall be conferred on the candidates who have pursued the prescribed course of study for not less than three academic years and have passed examinations as prescribed under the relevant scheme and completed 6 months of compulsory rotatory internship.

"C"

Fee Structure

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

Examination fee, Enrollment Fee, Application Form Processing Fee & Games Fee : As per the other Paramedical Courses of the University.

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

Sl. No.	Subjects	Subject Code	Teaching hours		Total
			Theory	Practical	
1.	Human Anatomy	BRIT-101	80	40	120
2.	Human Physiology	BRIT-102	80	40	120
3.	Medical Biochemistry	BRIT-103	40	40	80
4.	Fundamentals of Medical Imaging & Radiography	BRIT-104	50	30	80
5.	Basic Radiation Physics	BRIT-105	30	0	30
6.	Computer Graphics	BRIT-106	30	0	30
7.	English	BRIT-107	40	0	40

*Not included for University Examination.

B.Sc. in Radiological & Imaging Techniques Part-II (Second Year)

Sl. No.	Subjects	Subject Code	Teaching hours		Total
			Theory	Practical	
1.	Advanced Radiographic Techniques	BRIT-201	50	50	100
2.	Special Radiographic Techniques & Procedures	BRIT-202	40	50	90
3.	General Pathology & General Microbiology	BRIT-203	70	40	110
4.	Emergency Procedures & Palliative Procedures	BRIT-204	40	0	40
5.	Immunology of Radiology	BRIT-205	30	0	30
6.	Pharmacology	BRIT-206	30	0	30
7.	English	BRIT-207	40	0	40

Bachelor of Science in Radiological & Imaging Techniques (B.Sc. - Radiological & Imaging Techniques) Syllabus

Course of Study

B.Sc. in Radiological & Imaging Techniques Part-I (First Year)

Sl.	Subjects	Subject Code	Teaching hours		
			Theory	Practical	Total
1.	Human Anatomy	BRIT-101	80	60	140
2.	Human Physiology	BRIT -102	80	50	130
3.	Clinical Biochemistry	BRIT -103	70	60	130
4.	Fundamentals of Medical Imaging & Radiotherapy	BRIT -104	50	50	100
5.	Basic Radiation Physics	BRIT -105	50	-	50
6.	Community Healthcare	BRIT -106	50	-	50
7.	Computer*		30	30	60
8.	English*		40		40

*Not included for University Examination

B.Sc. in Radiological & Imaging Techniques Part-II (Second Year)

Sl.	Subjects	Subject Code	Teaching hours		
			Theory	Practical	Total
1.	Advanced Radiographic Techniques	BRIT-201	50	50	100
2.	Special Radiographic techniques & procedures	BRIT-202	50	50	100
3.	General Pathology & General Microbiology	BRIT-203	70	60	130
4.	Radiation Physics & Radiation Protection	BRIT-204	60	-	60
5.	Equipments of Radiotherapy	BRIT-205	50	-	50
6.	Pharmacology	BRIT-206	50	-	50
7.	Hospital Posting	BRIT-207	-	120	120

B.Sc. in Radiological & Imaging Techniques Part-III (Third Year)

Sl.	Subjects	Subject Code	Teaching hours		
			Theory	Practical	Total
1.	Radiotherapy Planning and Quality Control	BRIT-301	50	50	100
2.	Equipments of Radio diagnosis	BRIT-302	50	50	100
3.	Interventional Radiology & drugs used in diagnostic Radiology	BRIT-303	50	60	110
4.	Radiotherapy & Brachytherapy techniques in Malignant and Non-Malignant diseases	BRIT-304	50	-	50
5.	Orientation in Clinical Sciences	BRIT-305	80	-	80
6.	Hospital Posting	BRIT-306	-	120	120

Internship

- There shall be six months of Internship after the final year examination for candidates declared to have passed the examination in all the subjects.
- During the internship candidate shall have to work full time average 7 hours per day (each working day) for 6 Calendar months.
- Each candidate is allowed maximum of 6 holidays during entire Internship Program and in case of any exigencies during which the candidate remains absent for a period more than 6 days, he/she will have to work for the extra days during which the candidate has remained absent.
- The Internship should cover all the services provided by Radio-diagnosis department of medical college/hospital. Based on the attendance and work done during posting the Director/Principal/ head of institution/department shall issue '**Certificate of Satisfactory Completion**' of training following which the University shall award the B.Sc. in Radiological & Imaging Techniques degree or declare the candidate eligible for the same.
- **No candidate shall be awarded degree without successfully completing six months internship.**
- Institution shall have to satisfy themselves that satisfactory infrastructure facilities of Radio-diagnosis department exist in the Institute / Hospital where the internship training has to be undertaken. Following parameters / guidelines have been suggested:
 - a. It is mandatory for the Institution to have its own well equipped and modern Radio-diagnosis department.
 - b. Senior Radiologist should manage Radio-diagnosis department in the Institutes/Hospitals.
- Institute's Director / Principal can at his discretion grant NOC to the students to do the Internship at the place of his choice provided the concerned Hospital fully satisfies the above criteria. For the purpose of granting NOC the candidate shall have to submit to the Institution the status of ophthalmology services available at the place where he intends to do his Internship.

B.Sc. in Radiological & Imaging Techniques First Year

Human Anatomy

Subject code - BRIT- 101

Min. Hrs. - Theory: 80 Hrs. & Practical: 60 Hrs.

THEORY

1. Introduction :

Human body as a whole: Definition of anatomy and its divisions, Terms of location, positions and planes, Cell and its organelles, Epithelium-definition, classification, describe with examples, function, Glands- classification, describe serous & mucous glands with examples, Basic tissues – classification with examples.

2. Locomotion and Support :

Cartilage – types with example & histology, **Bone** – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of bones, vertebral column, inter vertebral disc, fontanelles of fetal skull, **Joints** – Classification of joints with examples, synovial joint (in detail for radiology), **Muscular system**- Classification of muscular tissue & histology, Names of muscles of the body.

3. Cardiovascular System :

Heart-size, location, chambers, exterior & interior, Blood supply of heart, Systemic & pulmonary circulation, Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery, Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses, Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief.

4. Gastro-intestinal System :

Parts of GIT, Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring, Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, Radiographs of abdomen.

5. Respiratory System :

Parts of RS, nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, histology of trachea, lung and pleura, Names of paranasal air sinuses.

6. Peritoneum: Description in brief

7. Urinary System :

Kidney, ureter, urinary bladder, male and female urethra, Histology of kidney, ureter and urinary bladder.

8. Reproductive System :

Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology), Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology), Mammary gland gross.

9. Endocrine Glands

Names of all endocrine glands in detail, Pituitary gland, Thyroid gland, Parathyroid gland, Suprarenal gland (gross & histology).

10. Nervous System

Neuron, Classification of NS, Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology), Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei, Blood supply of brain, Cranial nerves, Sympathetic trunk & names of parasympathetic ganglia.

11. Sensory Organs :

Skin: Skin-histology, Appendages of skin, *Eye:* Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply, *Ear:* parts of ear- external, middle and inner ear and contents.

12. Embryology :

Spermatogenesis & oogenesis, Ovulation, Fertilization, Fetal circulation, Placenta

PRACTICAL

1. Histology of types of epithelium, Histology of serous, mucous & mixed salivary gland.
2. Histology of the 3 types of cartilage, Demo of all bones showing parts, radiographs of normal bones & joints, Histology of compact bone (TS & LS), Demonstration of all muscles of the body, Histology of skeletal (TS & LS), smooth & cardiac muscle.
3. Demonstration of heart and vessels in the body, Histology of large artery, medium sized artery & vein, large vein, Microscopic appearance of large artery, medium sized artery & vein, large vein, pericardium, Histology of lymph node, spleen, tonsil & thymus, Normal chest radiograph showing heart shadows, Normal angiograms.
4. Demonstration of parts of respiratory system, Normal radiographs of chest, Histology of lung and trachea.
5. Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder, Radiographs of abdomen-IVP, retrograde cystogram.
6. Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary, Radiographs of pelvis – hysterosalpingogram.
7. Demonstration of the glands, Histology of pituitary, thyroid, parathyroid, suprarenal glands.
8. Histology of peripheral nerve & optic nerve, Demonstration of all plexuses and nerves in the body, Demonstration of all part of brain, Histology of cerebrum, cerebellum and spinal cord.
9. Histology of thin and thick skin, Demonstration and histology of eyeball, Histology of cornea & retina.
10. Demonstration of Skelton - articulated and disarticulated.
11. Surface anatomy :
 - Surface landmark- bony, muscular & Ligamentus.
 - Surface anatomy of major nerve, arteries of the bone.

Human Physiology

Subject code - BRIT- 102

Min. Hrs. - Theory: 80 Hrs. & Practical: 50 Hrs.

THEORY

1. **Cell** - Structure and function
2. **Blood** - Blood cells, Haemoglobin, Blood groups, Coagulation Factors , Anaemia
3. **Muscular system- muscles:** Types & their function.
4. **Cardiovascular system**
Heart rate, Cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse.
5. **Lymphatic system** -Lymph glands and its function, spleen -structure and functions.
6. **Respiratory System** -Ventilation , Functions , Lungs volumes and capacities.
7. **Gastrointestinal System** -Process of digestion in various parts.
8. **Endocrinology**
List of Endocrine glands, Hormones : Their secretion and functions (in brief).
9. **Excretion system** -Structure of nephron , Urine formation

10. Central Nervous System

Parts, Sliding Filament Theory, Neuro Muscular Junction, Wallerian Degeneration, Motor Nervous system - Upper motor neuron system & lower motor neuron system. Sensory nervous system, Sympathetic Nervous system & Parasympathetic nervous system.

11. Skin - Structure and functions

12. Reproductive system

Functions of male & female reproductive organs, menstruation, puberty, menopause, fertilization and development of fertilized ovum, placenta and its function.

13. Special senses

Structure and function of eye and ear, common diseases of eye and ear (in brief)

PRACTICAL

1. Microscope and its use.
2. Microscopic appearance of prepared slide.
3. Identification of blood cells by study of peripheral blood smear.
4. Measurement of pulse and blood pressure.
5. Elicitation of Reflexes and jerks.
6. Spirometry to major various lung capacities, Respiratory rate, Tidal volume, IRV, IC, ERV, EC, residual volume on Spirometry.

Clinical Biochemistry

Subject code - BRIT- 103

Min. Hrs. - Theory: 70 Hrs. & Practical: 60 Hrs.

THEORY

1. **Basics of energy metabolism, nutrition & dietetics :**
Unit of measuring energy, calorific value of food, BMR & factors affecting it, SDA of food, calculation of energy requirement, balanced diet, nutrition in health & diseases (protein energy malnutrition).
2. **Chemistry of carbohydrates & their related metabolism -**
Introduction, definition, classification, biomedical importance & properties.
Brief outline of metabolism :
Glycogenesis & glycogenolysis (in brief), Glycolysis, citric acid cycle & its significance, HMP shunt & Gluconeogenesis (in brief), regulation of blood glucose level.
3. **Amino acids -** Definition, classification, essential & non essential amino acids.
4. **Chemistry of Proteins & their related metabolism -**
Introduction, definition, classification, biomedical importance
Metabolism :
Transformation, Decarboxylation, Ammonia formation & transport, Urea cycle, metabolic disorders in urea cycle.
5. **Chemistry of Lipids & their related metabolism -**
Introduction, definition, classification, biomedical importance, essential fatty acids.
Brief outline of metabolism :
Beta oxidation of fatty acids, fatty liver, Ketosis, Cholesterol & its clinical significance, Lipoproteins in the blood composition & their functions in brief, Atherosclerosis.
6. **Enzymes -**
Introduction, definition, classification, coenzymes, isoenzymes, properties, factors affecting enzyme action, enzyme inhibition, diagnostic value of serum enzymes -

Creatinine kinase, Alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc.

7. **Acid base balance concepts & disorders** - pH, Buffers, Acidosis, Alkalosis
8. **Hyperglycemia & hypoglycemia** -
Diabetes mellitus - definition, types, features, gestation diabetes mellitus.
Hypoglycemia & its causes
9. **Vitamins :**
Water & fat soluble vitamins, sources, requirement, biochemical functions & deficiency disorders.

PRACTICAL

- 1- Introduction
Aim, basis, interpretation, safety in clinical biochemistry laboratory.
- 2- Laboratory organisation
Instruments, glassware, sample collection & specimen labeling, routine tests, anticoagulants, reagents, cleaning of glassware, isotonic solution, standardization of methods, preparation of solution & interpretation of result, normal values.
- 3- Identification of Carbohydrates (qualitative tests).
- 3- Identification of Proteins (qualitative tests).
- 4- Urine analysis – normal & abnormal constituents of urine.
- 5- Uses, Care and Maintenance of various instruments of the laboratory.

Fundamentals of Medical Imaging & Radiotherapy

Subject code - BRIT- 104

Min. Hrs. - Theory: 50 Hrs. & Practical: 50 Hrs.

THEORY

The X-Ray machine :

1. X-ray production, emission & interactions with matter
2. Radiographic film, latent Image, intensifying screens, Grids
3. Radiographic exposure, Film developing & processing, Radiographic Quality
4. Physical principles of diagnostic Ultrasound Piezoelectric Effect.
5. Acoustic intensity, reflection, impedance & absorption.
6. Ultra Sound transducer, Beam, Operational Modes & Biological effects.
7. Compound Tomography, Principles of operation system components & image reconstruction.
8. Physical principles of Magnetic Resonance Imaging: Basic concept, system components, biological hazards, advantage over CT

PRACTICAL

1. X-ray tubes general features and mobile equipments.
2. Care and maintenance of X-ray equipments and image intensifier
3. To study effects of Kilo Voltage Peak (KVP) and Milli Ampere Second (MAS)
4. To check the safety of dark room.
5. To check the speed of intensifying screen.
6. To check the developing time test and function.
7. Silver recovery method

Basics. Radiation Physics
Subject code - BRIT- 105
Min. Hrs. - Theory: 50 Hrs.

THEORY

Fundamental of Physics

- Matter & energy
- Radiation & spectra
- Electricity and Magnetism
- Atoms & nuclei
- Radioactivity

X-rays

- Production
- Properties
- Measurement
- Interaction of X-rays- Gamma rays and electron radiation with matter and principles of differential absorption in biological materials.

Community Healthcare
Subject code - BRIT- 105
Min. Hrs. - Theory: 50 Hrs.

THEORY

1. Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.
 - a. National Health Policy
 - b. National Health Programmes (Briefly objectives and scope)
 - c. Population of India and Family welfare programme in India.
2. Family :
 - b. The family, meaning and definitions
 - c. Functions of types of family
 - d. Changing family patterns
 - e. Influence of family on individuals Health, family and nutrition, the effects of sickness in the family and psychosomatic disease.
3. Community:
 - a. Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.
 - b. Urban community – Meaning and features – Health hazards of urbanities
4. Culture and Health Disorders :
 - a. Social Change
 - b. Meaning of social changes
 - c. Factors of social changes
 - d. Human adaptation and social changes
 - e. Social changes and stress
 - f. Social changes and deviance
 - g. Social changes and health programme
 - h. The role of social planning in the improvement of health and rehabilitation

5. Social Problems of disabled:
 - a. Consequences of the following social problems in relation to sickness and disability
 - b. Population explosion.

Computer
(Not for University Examination)
Min. Hrs - Theory : 30 Hrs., Practical : 30 Hrs.

Course Contents:

1. Input and Output units:

Their functional characteristics, main memory, cache memory read only memory, overview of storage devices – floppy disk, hard disk, compact disk, tape. Computer Networks and Communication: Network types, network topologies.

2. Internet:

Evolution , Protocols, Interface Concepts, Internet vs Intranet, Growth of Internet, ISP, SSS Connectivity – Dial-up, Leased line, VSAT etc. URLs, Domain names, Portals. E-MAIL- Concepts, POP and WEB based E-mail, merits, address, Basics of Sending & Receiving, E-mail Protocols, Mailing List, Free E-mail services.

3. Electronic Payment Systems:

Introduction, Types of Electronic payment systems, Digital Token- Based, Electronic payment systems, Smart Card and Electronic payment systems, Credit Card- Based Electronic payment systems, Risk and Electronic payment systems.

4. Html :

Concepts of Hypertext, Versions of HTML, Elements of HTML syntax, Head & Body Sections, Building HTML documents, Inserting texts, Images, Hyperlinks, Backgrounds and Color Controls, Different HTML tags, Table layout and presentation, Use of font size & Attributes, List types and its tags, Use of Frames and Forms in web pages. Overview of MS Front Page, Macromedia Dream weaver, and other popular HTML editors, designing web sites using MS Front Page (using at least Front Page 2000)

PRACTICAL

Unit I

Concept in Computer:

Definition of Computer, History of Computer , Generations, Characteristic and Application of Computers, Classification of Computers, Computer Hardware, CPU, Various Types of I/O devices, Peripherals Devices, Storage Devices. Management Introductory concepts in operating system, textual vs GUI Interface, Introduction to DOS

Unit III

Starting MS WORD, Creating and formatting a document, Changing fonts and point size, Table Creation and operations, Autocorrect, Auto text, spell Check, Word Art, Inserting objects, Page setup, Page Preview, Printing a document, Mail Merge.

Unit III

Starting Excel, Work sheet, cell inserting Data into Rows/ Columns, Alignment, Text wrapping , Sorting data, Auto Sum, Use of functions, referencing formula cells in other formulae , Naming cells, Generating graphs, Worksheet data and charts with WORD, Creating Hyperlink to a ORD document , Page set up, Print Preview, Printing Worksheets.

Unit IV

Starting MS–Power Point,, Creating a presentation using auto content Wizard, Blank presentation, creating, saving and printing a presentation, Adding a slide to presentation, Navigating through a presentation, slide sorter, slide show, editing slides, Using Clipart, Word art gallery, Adding Transition and Animation effects, setting timings for slide show, preparing note pages, preparing audience handouts, printing presentation documents, MS- Access, Creating tables and database, Internet, Use of Internet (Mailing, Browsing, Surfing).

English **(Not for University Examination)** **Min. Hrs. - Theory : 40 Hrs.**

1. Introduction:

Study techniques, Organisation of effective note taking and logical processes of analysis and synthesis, the use of the dictionary, enlargement of vocabulary & effective diction.

2. Applied Grammar:

Correct usage, the structure of sentences, the structure of paragraphs.

3. Written Composition:

Precise writing and summarising, writing of bibliography, enlargement of vocabulary.

4. Reading and comprehension

Review of selected materials and express oneself in one's words, enlargement of vocabulary.

5. The study of various forms of composition paragraph, essay, letter, summary, practice in writing.

6. Verbal communication:

Discussions and summarization, debates, oral reports, use in teaching.

B.Sc. in Radiological & Imaging Techniques Second Year

Advanced Radiographic Techniques

Subject code - BRIT- 201

Min. Hrs. - Theory: 50 Hrs. & Practical :50 Hrs.

THEORY

- 1. Ultra Sound :**
 - Principle of Ultra Sound
 - Types of Ultra sound
 - Description of Equipment
 - Indication and clinical Application
- 2. CT Scan :**
 - Basic principle of CT scan
 - Description of Equipment
 - Conventional CT Scan
 - Indications and Contra indications
- 3. MRI**
 - Preparation of Patients
 - Contrast Media
 - Indication and Contraindication
 - Clinical application, Procedure
 - MR Angiography

PRACTICAL

1. Based on Theory topics.

Special Radiographic Techniques & Procedures

Subject code - BRIT- 202

Min. Hrs. - Theory: 50 Hrs. & Practical :50 Hrs.

THEORY

1. Special procedure and related Contrast Media
 - Contrast Media
 - Emergency in Radiology Department
 - Excretory System
 - a) IVP
 - b) RGU
 - c) MCU
 - Oral Cholecystography
 - Percutaneous Trans Hepatic Cholecystography
 - G.I. Tract
 - a) Barium Swallow
 - b) Barium Meal Series
 - c) Barium Meal Follow Through
 - d) Barium Enema
 - Hystero Salpingography
 - Angiography

- Tomography
- 2. Radiography of body parts and their poisoning
 - Upper limb
 - Lower limb
 - Abdomen, Head and Neck
- 3. Guideline for design and location of X-ray equipments
- 4. Dark Room designing
 - Outline structure of Dark Room
 - Material used
 - Miscellaneous

PRACTICAL

1. Radiography in various positions for all the special radiological procedures, using contrast media as per syllabus.
2. Positioning and treatment of various cases patients by using:
 - a. Prescribed filters and wedges
 - b. Protection of various organs

General Pathology & General Microbiology

Subject code - BRIT - 203

Min. Hrs. - Theory: 70 Hrs. & Practical: 60 Hrs.

THEORY

General Pathology:

1. Cell Injury and Cellular Adaptations:

- Normal Cell
- Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling (in brief)
- Cell death : types- autolysis, necrosis, apoptosis & gangrene (in brief)
- Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia (in brief)

2. Inflammation :

- Acute inflammation - vascular event, cellular event, inflammatory cells(in brief)
- Chronic Inflammation - general features, granulomatous inflammation, tuberculoma (in brief)

3. Haemodynamic Disorders :

- Oedema, hyperemia, congestion, haemorrhage, circulatory disturbances, thrombosis, ischaemia & infarction (in brief)

4. Neoplasia :

- Definition, how does it differ from hyperplasia, difference between benign tumor and malignant tumor (in brief)

5. Healing:

- Definition, different phases of healing, factors influencing wound healing. (in brief)

General Microbiology :

1. General characters and classification of Bacteria.

2. Sterilization and Disinfection :

- Physical agents- Sunlight, Temperature less than 100⁰C, Temperature at 100⁰C, steam at atmospheric pressure and steam under pressure, irradiation, filtration.
- Chemical agents- Alcohol, Aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

3. Staining Methods :

- Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, Negative Impregnation .

4. Collection and Transportation of Specimens :

- General Principles, Containers, Rejection.
- Samples - Urine, Faeces, Sputum, Pus, Body fluids, Swab, Blood

5. Disposal of Laboratory/Hospital Waste :

Non-infections waste, infected sharp waste disposal, infected non-sharp waste disposal.

6. Parasitology :

Parasitism, host & vectors etc., classification of parasites, diseases caused by various parasites (in very brief)

7. Mycology :

Morphology & structure of fungi (in brief), classification of fungi, lab diagnosis of fungal infections, opportunistic fungal infection

8. Virology :

General characters of viruses, classification of viruses, lab diagnosis of viral infections (in brief).

9. Nosocomial Infections (in brief)

PRACTICAL

General Pathology :

1. Estimation of Hemoglobin, R.B.C., W.B.C., T.L.C., D.L.C., E.S.R. Count.
2. Blood indices, Blood grouping, Bleeding & Clotting time.

General Microbiology :

1. Preparation of Swabs/ sterile tubes & bottles.
2. Preparation of smear.
3. Staining : Grams & Ziehl- Neelson
4. Identification of culture media.
5. Identification of instruments.
6. Identification of common microbes.
7. Culture media used for fungus.

Radiation Physics & Radiation Protection

Subject code - BRIT - 204

Min. Hrs. - Theory: 60 Hrs.

THEORY

Radiation Physics :

1. Atomic structure as applied to generation of X-rays and radioactivity spectrum of diagnostic imaging and therapy X ray.
2. Effects of variation of tube voltage current, filtration, III waveform and target material on X-ray production lows of radioactivity and decay schemes of different alpha, Beta, gamma ray. Megatron and position emitters as used in medicine especially in radiotherapy.
3. Artificial radionuclide generators employed in medicine in general and radiotherapy sources in particulars.
4. Interaction of radiation with matter attenuation absorption and scattering phenomenon.
5. Photoelectric absorption Compton scattering pair-production and annihilation process ionization, effects of geometry of thickness of the absorber. Dependence on the nature and atomic number of the absorber and on radiation quality.
6. Transmission of X-ray through body tissues linear energy transfer.
7. Range of secondary electrons and electron build up relative amount of scatter from homogeneous and homogenous beam defining the passage through a patient.
8. Physical requirements of beam defining devices e.g. cones, diaphragm, collimators etc.
9. Units of radiation measurements specification of quality and half- valve thickness (HIV) and its measurements, filters and filtration.
10. Measurement of radiation and dosimetric procedures.
11. Radiation detectors and their principles of working.
12. Definition of Bragg-peak , percentage depth dose, peak scatter factor, tissue air-ratio, tissue maximum ratio, scatter air ratio, isodose curves and radiation penumbra of different beams.
13. Wedge filters, wedge angle, hinge angle.
14. Compensator beams flatterring filters, scattering foils.
15. Physical properties of phantom materials, bolus and substitutes.
16. Factor used for treatment dose calculations, Daily treatment time and monitor units calculation method, physical aspects of electron and neutron therapy.

Radiation Protection :

1. Definition of radiation hazards maximum permissible dose and annual limit of intake (ALI) permissible dose levels on and around sealed source housing and installation principles of radiation protection and MPD of different ICRP rules, stochastic and non-stochastic effects.
2. Importance of 'ALARA' physical principles of design and planning of installation safe work practice in teletherapy and brachytherapy.
3. Shielding materials Radiation survey and personnel monitoring devices film badge, TLD badges pocket dosimeters.

Equipments of Radiotherapy

Subject code - BRIT - 205

Min. Hrs. - Theory: 50 Hrs.

THEORY

1. Orthovoltage equipment with special reference to physical design equipment of tube and its accessories and interlocks, gamma ray sources used in radiotherapy especially cobalt 60 source its construction and source housing and handling mechanism.
2. Principles of isocentric Tele-isotope machines, megavoltage x-ray and electron beam accelerators and betatron.
3. Salient features of components of Linear Accelerator like tube design, wave guide, target design, beam bending system.
4. Radio-frequency generators like magnetron and klystron.
5. Basic principle of remote after-loading system/machines and sources used.
6. Principles of simulators and vacuum forming machines for making casts.
7. Stereolithography template cutting system introduction to radio-surgery.
8. Equipment and dosimetry equipment.

Pharmacology

Subject code - BRIT - 206

Min. Hrs. - Theory: 50 Hrs.

1. General Pharmacology:

- Introduction, Definitions, Classification of drugs, Sources of drugs, Routes of drug administration,
- Distribution of drugs, Metabolism and Excretion of drugs, Pharmacokinetics, Pharmacodynamics,
- Factors modifying drug response.
- Elementary knowledge of drug toxicity, drug allergy, drug resistance, drug potency, efficacy & drug antagonism.
- Adverse drug reactions & management

2. Autonomic Nervous system:

- General considerations – The Sympathetic and Parasympathetic Systems, Receptors, Somatic Nervous System
- Cholinergic and Anti-Cholinergic drugs, Adrenergic and Adrenergic blocking drugs, Peripheral muscle relaxants.

3. Cardiovascular Pharmacology :

- Antihypertensive and drugs useful in Angina.

4. Neuropharmacology (in brief) :

- Sedative-Hypnotic Drugs: Barbiturates, Benzodiazepines
- Antianxiety Drugs: Benzodiazepines, Other Anxiolytics

5. Inflammatory/Immune Diseases-

- Non-narcotic Analgesics and Nonsteroidal Anti-Inflammatory Drugs: Acetaminophen, NSAIDs, Aspirin, Nonaspirin NSAIDs, drug Interactions with NSAIDs
- Glucocorticoids: Pharmacological Uses of Glucocorticoids, adverse effects, Physiologic Use of Glucocorticoids

6. Digestion and Metabolism (in brief):

- Gastrointestinal Pharmacology: Peptic Ulcer Disease, Constipation, Diarrhea
- Drugs Used in Treatment of Diabetes Mellitus: Insulin, Oral Hypoglycemics

7. Pharmacology of different dyes used in Radiological procedures.

Hospital Posting

Subject code - BRIT - 207

Min. Hrs. - Practical : 120 Hrs.

Students shall be deputed to various labs of Radiology department wherein they shall undergo practical training of handling patients, collection and processing of investigation (X Ray, Special procedures, CT Scan, MRI, Ultrasound etc) and equipments.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection to different labs.

Process of performing various tests in different labs.

Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty concerned.

PRACTICAL

1. Identification of patients
2. Dealing with equipments
3. Maintenance of all radiological equipments
4. Safety of critical regions in preparing methods. Role of treatment shall be maintained in patients up to and including
5. Completion of radiological investigations with reference to dose and duration
6. Use of radiological equipment in radiology

Equipments of Radio Diagnosis

Subject code - BRIT- 302

Min. Hrs. - Theory: 50 Hrs. & Practical: 50 Hrs.

THEORY

Description:

B.Sc. in Radiological & Imaging Techniques Third Year

Radiotherapy Planning and Quality Control Subject code - BRIT- 301

Min. Hrs. - Theory: 50 Hrs. & Practical :50 Hrs.

THEORY

1. Definition of treatment planning.
2. Planning procedure in general with special emphasis on turnout localization and target volume measurement by conventional radiographic method and simulator imaging.
3. Role of special contrast medium base radiotherapy.
4. CT/MRI/Ultrasound/ radionuclide imaging methods physical and clinical requirements of field selection of treatment in Teletherapy, role of portal films in treatment planning. Choice of central axis percentage depth dose data and isodose curve form a spectrum of radiotherapy beams used treatment.
5. Requirement and practice of organ shielding single multiple fields, and rotational field therapy, planning procedures.
6. Computerized treatment planning system, choice of dose, time and fraction.
7. Safety of critical organs in planning methods, Role of treatment shell immobilization devices and laser in patients set up and positioning.
8. Acceptance tests on therapy, simulator telescope megavoltage X-ray and electron beam machines.
9. Contribution of technologist in radiation calibration of quality control assurance in execution of radiation treatment.

PRACTICAL

1. Treatment planning of patient
2. Dealing with equipments
3. Maintenance of all radiological equipments
4. Safety of critical organs in planning methods, Role of treatment shell immobilization devices and laser in patients set up and positioning.
5. Computerized treatment planning system uses in radiation dose, time and fraction.
6. Uses of special contrast medium in radiotherapy.

Equipments of Radio Diagnosis Subject code - BRIT- 302

Min. Hrs. - Theory: 50 Hrs. & Practical :50 Hrs.

THEORY

Equipments and description :

1. Color Doppler
 - Flow Imaging
 - indication
 - clinical Application

2. CT Scan

- Advancement in CT
- Spiral CT
- Preparation of Patient
- Contrast Media
- Indication and Contraindication
- Technical aspects of various procedures in CT

3. Nuclear medicines, PET scan and Mammography

- Definition
- Characteristic of Radio Nuclide
- Commonly used Radio Nuclides
- Description of Equipment

PRACTICAL

1. Application of various procedures in well equipped Hospitals and Diagnostic Centers.
2. Uses and functioning method of ultrasound probe.
3. Patient evaluation on different disease and their diagnosis.
4. Working method of CT scan and MRI.
5. Calculation of radio nuclide isotopes.

Interventional Radiology & Drugs used in diagnostic Radiology

Subject code - BRIT- 303

Min. Hrs. - Theory: 50 Hrs. & Practical :50 Hrs.

THEORY

Interventional Radiology

- Definition
- Indication
- Clinical Application
- Name of different type of procedures

Anaesthesia in Diagnostic Radiology

- Facilities regarding general Anesthesia in the X-ray Department.
- Anesthetic Problems associated specific technique)
 - a) Vascular Studies
 - b) Carotid Angiography
 - c) Venography
 - d) T and NMR

PRACTICAL

1. Radiography in various positions for all the special radiological procedures, using contrast media as per syllabus.
2. Positioning and treatment of various patients by using
 - a) Prescribed filters and wedges
 - b) Protecting various organs
 - c) Handle all patients in special and general radiography.

Radiotherapy & Brachytherapy techniques in Malignant and Non-Malignant diseases

Subject code - BRIT- 304

Min. Hrs. - Theory: 50 Hrs.

THEORY

1. Orthovoltage Techniques in skin tumours, and cancers of the breast, Advantages and disadvantages of orthovoltage in radiotherapy.
2. Tele isotope cobalt therapy Techniques in skin and deep sealed tumours parallel opposed fields and small beam directed therapy and wedge field Techniques in head and neck tumours especially cancers of larynx treatment, Techniques for cancer of maxillary antrum and pituitary tumours.
3. Treatment techniques in cancer of breast by telecobalt and low energy megavoltage X-rays and electron beam.
4. Tele and brachy-therapy techniques of treatment of different stages of carcinoma cervix uteri with special emphasis on HDR and LDR brachytherapy.
5. Three field Techniques in cancer of esophagus and bladder.
6. Radiotherapy technique in medulo blastoma. Whole body and hemi body radiation Techniques.
7. Treatment Techniques of malignant and non malignant conditions in ovarian and kidney tumors.
8. Radiation Treatment techniques of lymphomas with special emphasis on mantle field irradiation radiotherapy, techniques in head and neck cancer.

Salient features of computers in radiotherapy and its application.

1. Introduction to computer, Hardware and software component.
2. Input and output data systems computerized treatment planning systems in tele brachytherapy and documentations.

Radiological protection

1. Dose limits of occupational workers & Publics.
2. Principle & Method of Protection.
3. Monitoring devices.

Orientation in Clinical Sciences

Subject code - BRIT- 305

Min. Hrs. - Theory: 80 Hrs.

THEORY

Medicine

- **Respiratory & cardiac diseases:** Pericarditis, Valvular diseases, Rheumatic Heart Disease, Heart failure , Chronic Bronchitis, Emphysema, Brochitis, Pneumonia, Tuberculosis, Pleural effusion, Empyema, Spontaneous Phenumo thorax.
- **Gastro intestinal diseases:** Aclasia cardia, Peptic ulcer, Intestinal obstruction, Crohn's disease, Ulcerative colitis, Pancreatitis, Portal Hypertension, Ascitis, Cirrhosis, Cholecystitis, Diseases of Renal System, Glomerulo nephritis, Nephrotic Syndrome,
- **Renal diseases:** Urinary calculi, Polycystic Kidney disease
- **Disease of brain:** Cerebral Vascular Disorders, Meningitis, Encephalitis.

Orthopaedics

- Fracture
- Type, mechanism, Healing, Delayed Union, Non- complication
- Injuries of the shoulder girdle, Dislocation of shoulder
- Fracture of Humerus, Elbow Forearm
- Fracture of Distal Radius & ulna
- Injuries of the carpal
- Dislocation of Hip
- Femur, Tibia, Ankle, calcaneum
- Acute & chronic osteo arthritis
- Rhematoid arthritis
- Paget's Disease
- Ankylosing spondylitis
- Club foot
- Bone Tumour-Benign Malignant

Surgery

- Cholelithiasis
- Peritonitis
- Supraphrenic Abscess
- Appendicitis
- Benign Hypertrophy of prostate
- Sinusitis

Obstetrics

- Diagnosis of Pregnancy
- Normal Labour

Hospital Posting

Subject code - BRIT- 306

Min. Hrs. - Practical: 120 Hrs.

Students shall be deputed to various labs of Radiology department wherein they shall undergo practical training of handling patients, collection and processing of investigation (X Ray, Special procedures, CT Scan, MRI, Ultrasound etc) and equipment.

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