Mangalayatan University

Beswan,Aligarh–202145

MANGALAYATAN UNIVERSITY
Learn Today to Lead Tomorrow

Curriculum

B.Voc in Radiology & Medical Imaging Technology

Institute of Vocational Studies

2025

TotalProgramCreditsforB.Voc

S.N.	Semester	Credits
1	I	22
2	II	26
3	III	22
4	IV	22
5	V	26
6	VI	22
	Total	140

Induction Program

Conduction of induction program as per UGC/Regulatory Body‘s guideline.

CourseStructure

I – Year				
Semester-I				
S. No.	**Course Code**	**Course Title**	**Course Type**	**Credits**
1	BVORAD-101	Functional English	General Academic Component	2
2	BVORAD-102	General Human Anatomy & Physiology	Skill Development Component	4
3	BVORAD-103	Fundamentals of Radiology and Imaging	Skill Development Component	4
4	BVORAD-104	Orientation in Para clinical science	Skill Development Component	4
5	BVORAD-105	Medical Ethics and Patients Care	Skill Development Component	4
6	BVORAD-106	Basic diagnostics (Lab)	Skill Development Component	4
Total Credits				22

Semester-II				
S. No.	**Course Code**	**Course Title**	**Course Type**	**Credits**
1	BVORAD-201	Professional Communication	General Academic Component	2
2	BVORAD-202	Human Anatomy & Physiology-II	General Academic Component	4
3	BVORAD-203	Patient positioning & clinical Radiography	General Academic Component	4
4	BVORAD-204	Special Radiographic Procedure	Skill Development Component	4
5	BVORAD-205	Dark room techniques	Skill Development Component	4
6	BVORAD-206	Radiation Physics	Skill Development Component	4
7	BVORAD-207	Basic Imaging Practical Lab	Skill Development Component	4
Total Credits				26

Semester-III				
S. No.	**Course Code**	**Course Title**	**Course Type**	**Credits**
1	BVORAD-301	Environment Science	General Academic Component	2
2	BVORAD-302	Principles of CT and Mammography	Skill Development Component	4
3	BVORAD-303	Component of CT and Mammography	Skill Development Component	4
4	BVORAD-304	CT procedure and Imaging Process	Skill Development Component	4
5	BVORAD-305	Advanced CT and Mammography	Skill Development Component	4
6	BVORAD-306	Fault analysis & Repairs - Lab	Skill Development Component	4
Total Credits				22

Semester-IV				
S. No.	**Course Code**	**Course Title**	**Course Type**	**Credits**
1	BVORAD-401	Professional Communication	General Academic Component	2
2	BVORAD-402	MRI Principle and Physics	General Academic Component	4
3	BVORAD-403	MRI Component and Procedure	General Academic Component	4
4	BVORAD-404	Ultrasound imaging	Skill Development Component	4
5	BVORAD-405	Organization and Management of imaging department	Skill Development Component	4
6	BVORAD-406	Electronics Devices Circuits Lab	Skill Development Component	4
Total Credits				22

Exit Option-Advance Diploma in Radiology

III – Year				
Semester-V				
S. No.	**Course Code**	**Course Title**	**Course Type**	**Credits**
1	BVORAD-501	Economics	General Academic Component	2
2	BVORAD-502	Dental radiography and BMD	General Academic Component	4
3	BVORAD-503	Quality Control and Safety Measure	General Academic Component	4
4	BVORAD-504	Radiation hazard and safety	General Academic Component	4
5	BVORAD-505	Angiography	Skill Development Component	4
6	BVORAD-506	MRI, Image Processing and Recording	Skill Development Component	4
7	BVORAD-507	INTERNSHIP-I	Skill Development Component	4
Total Credits				26

Semester-VI				
S. No.	**Course Code**	**Course Title**	**Course Type**	**Credits**
1	BVORAD-501	Advancement In imaging Modalities	General Academic Component	4
2	BVORAD-502	Interventional Radiography	General Academic Component	4
3	BVORAD-503	Doppler Ultrasound and PET Scan	General Academic Component	4
4	BVORAD-504	INTERNSHIP-II/Practical Training	General Academic Component	6
5	BVORAD-505	Project Report	Skill Development Component	4
Total Credits				22

Functional English BVORAD 101

Unit I *Communication:*

Introduction, Definition, Nature and Scope of Communication, Importance and Purpose of Communication, Process of Communication; Encoder and Decoder, Message, Types of Communication; Verbal and Non-Verbal Communication Personal Appearance, Gestures, Postures, Facial Expression, Eye Contacts, Body Language (Kinesics), Time language, Silence Inter and Intra Personal Communication.

Unit II *Language Skills:*

Four Language Skills; Receptive Skills, Productive Skills, Listening: Listening-concept and cycle, Barriers to Effective Listening, Physical Barriers, Psychological Barriers, Linguistic Barriers, Listening for general content, Listening for filling up information.

Unit III *Vocabulary:*
Chosen list of general commonly used everyday words Synonyms, Antonyms, Homonyms, Homographs, Homophones.

Unit IV *Removing grammatical Errors I:*
Difference between Mistakes and errors, Wrong use of preposition, wrong use of tenses, misplaced modifiers, confused adverbs, confused adjective, confused nouns and other words.

Unit V Removing grammatical Errors II:

Subject-Verb Agreement, Indefinite and Unnecessary articles, Correct order of words, confusion of number, negatives and questions, un-English expressions, Incorrect/Omission/unnecessary prepositions.

Books Recommended:

1. *You can win, Shiv Khera, Macmillan Publishers, India*
2. *Listening Skills: Year1/2 and P2/3 Bk.3, Graeme Beals, Jean Edwards, Prim-Ed Publishi ng*
3. *A Practical Course for developing speaking skills in English, Gangal J. K., PHI*
4. *A Practical Course for developing writing skills in English, Gangal J. K., PHI*
5. *Little Red Book: Modern Writings Skills, Terry O Brien, Rupa Publications*

General Human Anatomy & Physiology BVORAD-102

UNIT-1

Anatomy : Introduction to human body , definition of anatomy, planes, position and movement of human body, anatomy of head and neck, cranial cavity, mouth pharynx, nose, pectoral region, shoulder, scapular region, upper and lower limbs ,bones and joints, pericardium and heart, lungs , diaphragm, trachea, esophagus, thoracic duct, brief introduction of skeletal system, organization of skeleton, definition, classification, constituents of bones and bone tissue, growth and development of bones, bones of cranium, electronic microscopic structure of cell, Structure of arteries, veins and capillaries

UNIT-2

Anatomy: Tissue- classification, functions and structure of primary tissues – epithelial tissue, connective tissue, muscular tissue, nervous tissue, function of arteries, veins and capillaries, cardiac cycle and heart

sound, factors affecting heart rate and its regulation, physiological variations, factors controlling blood pressure, hemorrhage and shock, disease related to cardiovascular system, definition and classification of muscular tissue, characterization of skeletal, smooth, cardiac muscles, types of cartilage, skeletal, smooth and cardiac muscle.

UNIT-3

Physiology: introduction on physiology, cell-description of cell and its components, functions of cell, homeostasis, basics about different organs and systems, structure and functions of urinary system, organs of urinary system, glomerular filtration, physiology of urine formation, functions of kidney, glomerular filtration rate.

UNIT-4

Physiology: Introduction to blood and its components, functions of RBCs, WBCs and platelets, difference between serum and plasma components and organs of lymphatic system, introduction to reproductive system, structure and functions of male and female reproductive organs, parts of male and female reproductive organs.

Fundamentals of Radiology and Imaging BVORAD-103

UNIT- 1

Atomic and nuclear structure (protons, neutrons, electrons), Atomic number, atomic masses, nuclides and isotopes, early atomic models, the hydrogen spectra, difficulties with Rutherford's model, Bohr's model, limitations of Bohr's model, the wave function of an electron, Quantum mechanics of hydrogen atom, Quantum numbers, Pauli exclusion principle, periodic table of element. Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere, Fundamental and derived quantity, SI unit, various physical/radiation quantity used in diagnostic radiology and its unit (for example, KvP, mA, mAS, Heat unit (HU), Radiation exposure, Absorbed dose, Equivalent dose, etc.). Measurements, significant figures/digits in calculation, uncertainty in measurement, Propagation of errors, kinetic and potential energy, conservation of energy, work done by constant forces, work done by variable forces. Elastic and inelastic collisions.

UNIT -2

X-Ray tube : historical aspects, construction of X-Ray tubes, requirements for X-Ray production (electron source, target and anode material), tube voltage, current, space charge, early X-Ray tubes (coolidge tubes, tube envelop and housing) cathode assembly, X-Ray production efficiency, advances in X-Ray tubes, anode angulation and rotating tubes. Common factors affecting thermionic emission, specialized types (metallic, biangular, fluoro, CT) grid controlled and high speed tubes, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation). Interlocking and X-Ray tube overload protection. Heat dissipation methods, tube rating, heat units, operating conditions, maintenance and Q.A procedures.

UNIT -3

X-Ray films and film processing ,Image characteristics , Interaction of ionising radiation with matter , Detection of ionising radiation . Dosimetry , Biological effects of ionising radiation , Radiation protection

(related to Phase-II topics) , Biological effects of non-ionizing radiation , Quality assurance , Presentation and viewing of radiographs , Basic Mammography , Xeroradiography, Introduction of Dental Radiography. Interaction of ionizing radiation with matter . Types of interactions of X- and gamma radiation, Photoelectric & Compton, Bremsstrahlung, pair production, annihilation radiation..Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.. Radiation intensity and exposure, photon flux and energy flux density. . LET, range of energy relationship for alpha, beta particles and XRays, Characteristics X-Rays, factors affecting X-Ray emission spectra, X-Ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets

UNIT -4

Filament current and voltage, X-Ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits, falling load generators, capacitors discharge and grid control systems. Types of generators, 3 phase, 6 and 12 pulse circuits, falling load generators, capacitors discharge and grid control systems.

Orientation in Para clinical science BVORAD-104

UNIT-1

PARASITOLOGY
Entamoeba Histolytica , Leishmania , Material Parasites of man ,Helminthology
Taenia Saginata ,Taenia Soleum , Echinococcusgranulosus ,
Ascaris Lumbricoides Ancy losto maduodenale , Strong ylidsstercoralis

UNIT-2

MICROBIOLOGY
Morphology & Physiology of Bacteria , Staphylococcus ,. Streptococcus Mycobacterium tuberculosis ,Spirochetes, Cornybacterium Diptheria.

UNIT-3

VIRUS 1
General Properties of Virus, Herpes virus , Poliovirus ,Hepatitis virus ,Oncogenic virus , HIV

UNIT-4

PATHOLOGY
Inflammation,Neoplasia ,Osteomyelitis , Fractures , Osteoporosis , Rickets.

Medical Ethics and Patients Care BVORAD-105

UNIT 1

Medical ethics

Definition - Goal - Scope Introduction to Code of conduct Basic principles of medical ethics – Confidentiality Malpractice and negligence - Rational and irrational drug therapy

Autonomy and informed consent - Right of patients Care of the terminally ill- Euthanasia Organ transplantation, ethics and law

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

UNIT -2

Hospital structure and organization, Radiography as a profession - professionalism, projecting professional image, professional and personal qualities (both essential and desirable) of the radiographer, Communication and Relational Skills - development of appropriate communication skills with patients, verbal and non-verbal communication, appearance and behaviour of the radiographer, Moving and lifting patients - hazards of lifting and manoeuvring patients, rules for correct lifting, transfer from chair or trolley to couch and vice-versa, safety of both “Lifter” and “the Lifted” must be emphasised. Highlight on handling of geriatric, paediatric and trauma patients.

UNIT -3

Communicable diseases (special reference to AIDS), cross infection and prevention, patient hygiene, personal hygiene, departmental hygiene, handling of infectious patients in the department, application of asepsis, inflammation and infection processes, Patient vital signs - temperature, pulse, respiration and blood pressure - normal values and methods of taking and recording them, Medico-legal considerations - radiographers clinical and ethical responsibilities, misconduct and malpractice ; handling female patients, practic in pregnancy.

UNIT-4

Radiological contrast media - classification, need for radiological contrast media, methods of administration, dosage, reactions to contrast media, role of the imaging department and the radiographer in management of patient with contrast reaction. Basics of emergency care and life support skills Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs),Choking, rescue breathing methods, One- and Tworescuer CPR, Using an AED (Automated external defibrillator),Managing an emergency including moving a patient

Basic diagnostics (Lab) BVORAD-106

1. X–Ray Imaging
X–Ray Tubes.
Stationary & Rotation Anode.
X–ray Consolestation (Demo of KV, MA and exposure time settings).

Procedures to reduce Scattered Radiation.
Focus Principle.
Grids.
Screen.
Image intensifiers.
Use of contrast materials.

2. Dark Room Technique

Images to ring devices.
Film cassette construction.
Duplicating a films
Spectrum.
Films types - Specialized use.
Operation, storage.
Photo chemistry.
Development.
Fixing.
Radiation protection, counters.
Assessment.

3. Radiological Positioning

Patient transfer technique.
Turning the patient.
Restraint techniques - Trauma, Pediatric, Geriatric, physically handicapped, disturbed patients, an aesthetized patient, moving chair & stretcher patients.
Tubes & catheters, Nasogastric, chest, Urinary, intravenous, oxygen & other (Castsurgical& cardiac) Alcoholic, bed pans & urinals.
Assessment.

Professional Communication (BVORAD-201)

UNIT 1

Recognizing and Understanding Communication Styles: Passive Communication, Aggressive Communication, Passive-Aggressive Communication, Assertive Communication, Verbal and NonVerbal Communication, Barriers and Gateways to Communication.

UNIT 2

Listening Skills: Types of Listening (theory /definition), Tips for Effective Listening Academic Listening- (lecturing), Listening to Talks and Presentations, Basics of Telephone communication

Writing Skills: Standard Business letter, Report writing, Email drafting and Etiquettes, Preparing Agenda and writing minutes for meetings, Making notes on Business conversations, Effective use of SMS, Case writing and Documentation.

UNIT 3

Soft Skills: Empathy (Understanding of someone else point of view), Intrapersonal skills, Interpersonal skills, Negotiation skills, Cultural Aspects of Communication.

UNIT 4

Group Communication: The Basics of Group Dynamics, Group Interaction and Communication, How to Be Effective in Groups, Handling Miscommunication, Handling Disagreements and Conflicts, Constructive Criticism.

REFERENCE BOOKS

-Mckay, M., Davis, M. & Fanning, P.(2008). Messages: The Communication Skills Book, New Harbinger Publications

-Perkins, P.S., & Brown, L. (2008). The Art and Science of Communication: Tools for effective communication in the workplace, John Wiley and Sons

-Krizan et al (2010). Effective Business Communication, Cengage Learning.

-Scot, O. (2009). Contemporary Business Communication, Biztantra, New Delhi.

-Chaney & Martin (2009). Intercultural Business Communication, Pearson Education

Human Anatomy & Physiology-II BVORAD-202

UNIT 1

1. 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.

2. 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.

3. Respiratory System

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

4. Peritoneum: Description in brief

UNIT 2

1. Urinary System

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

2.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 glandgross.

3. Endocrine Glands

Names of all endocrine glands in detail on pituitary gland, thyroid gland, parathyroid gland, suprarenal glad (gross & histology).

4.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

5. Sensory Organs

Skin: Skin-histology, Appendages of skin, Eye: Parts of eye & lachrymal apparatus, Extraocular muscles & nerve supply, Ear: parts of ear- external, middle and inner ear and contents

UNIT 3

Cardiovascular System

Respiratory System

Excretory System

UNIT-4

Reproductive System

Endocrine System

Lymphatic System

Patient positioning & clinical Radiography BVORAD-203

UNIT 1

1. Upper extremity - basic views

2. Lower extremity (including pelvis) - basic views

3. Chest including thoracic age and sternum

4. Spine - Cervical, dorsal, lumbar, lumbo-sacral (including functional views).

5. Skull – including trauma cases

6. Facial bones (nasal bones, zygoma, orbits, maxilla)

7. Mandible, Temporo-Mandibular Joints, Mastoids, petrous temporal bones

8. Abdomen - erect, supine, lateral decubituS

UNIT 2

Soft tissue radiography : Larynx, pharynx, nasopharynx, thoracic inlet

Dental radiography

Foreign body localization

High kV technique

Macroradiography

UNIT 3

1.General Pediatric Radiography

Special needs of patient and radiographer – equipment considerations (use of dedicated equipment and accessories) Technical considerations - the need to modify "adult" techniques – selection of exposure factors – image quality considerations – radiation protection of the patient - special techniques peculiar to children as follows : – Anorectal malformation – contrast study,intersex disorders - contrast study – esophageal atresia – pre/post op. – intussusception – congenital dislocation of hip – scoliosis – Leg–length measurements – assessment of bone age – non accidental injury – radiography of babies in incubators

2. Geriatric radiography

Understanding patient profile - possible difficulties during radiography – TechniSpecial Radiographic Procedure BVORAD-204

UNIT-1

Urinary system imaging (IVU, MCU, RGU) Revision of anatomy and physiology, clinical indications and contraindications - patient preparation - contrast media used and dosage - physiological process by which urinary tract is outlined film sequence (projection and timing), normal anatomy on films, additional techniques, radiation protection, care of patient during and after examination. Pathological conditions of urinary system : kidneys, ureter, urinary bladder, urethra.

UNIT 2

Gastrointestinal tract imaging (Barium swallow, Barium meal upper GI, Barium meal follow through, Barium enema, small bowel enema, distal colography, defaecography).Revision of anatomy and physiology - clinical indications and contraindications - contrast media used : preparation and dosage - patient preparation – preparation of equipment – control of radiographic and fluoroscopic equipment – film sequence – radiographic projections – radiation protection – patient management – after care of patient – radiographer's role in the team. Pathological conditions of the GI tract.]

UNIT 3

Biliary system (PTC, ERCP, T-Tube cholangiography, per-op. cholangiography) Revision of anatomy and physiology – clinical indications and contraindications – contrast media – patient preparation – film series - radiation protection – patient care - normal anatomy. Pathological conditions of biliary system. [D] Sialography and sinography Anatomy - Clinical indications and contraindications – patient preparation – contrast media and dosage – injection procedure – techniques for radiographic projections - radiographic appearances – radiation protection – patient care

UNIT 4

Hysterosalpingography (HSG) Revision of anatomy and physiology – clinical indications and contraindications – contrastinjection-projections – radiation protection – patient care Procedures which are obsolete or rarely

Myelography :indications and contraindications – contrast used – patient preparation – injection technique – film sequence – projections – patient care • Pelvimetry

Oral cholecystography/intravenous cholangiography

Dacrocystography

Arthrography

Discography

cal considerations – need to carry out standardised projections in unconventional position – equipment and accessories – exposure factor considerations in view of variations in skeletal tissue – special care

UNIT 4

1.Operation theatre radiography

Operative cholangiography – orthopaedic procedures – pre-operative chest. Strict observation of asepsis – preparation of radiographer and equipment/accessories – careful safe use of mobile and fluoroscopic equipment – radiation protection – patient care – protection of theatre staff – rapid availability of radiographic image

2.Trauma/Emergency Radiography

Limb fractures - Fracture of thoracic cage, spine, skull – GIT obstruction – lung collapse – pleural effusion – pneumo-thorax. Selection of suitable X-Ray equipment – patient position

radiographic projections and sequence for each patient – modification of routine positioning, X-Ray tube and film – radiation protection – patient care

Dark room techniques BVORAD-205

UNIT-1

Dark room design and accessories Site

Layout and safe light compatibility

UNIT-2

X-Ray film and Image processing Composition of single and double coated radiographic films, structure of emulsion, film 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 fixer, developer and other processing solution), common errors and faults while processing (densitometry), automatic processing (processing cycle), developer replenishment, silver recovery and economics. Image intensifiers and cassettes (structure and function) ; types of image intensifiers 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. Film storage, handling.

UNIT-3

Cassettes Structure and function Types - single, gridded, filmholder. Design features and consideration with loading/unloading Care and maintenance (cleaning)

Grid Purpose and function, effect on radiation exposure, use of grid, structure and material,stationary, parallel, focused, cross-hatch Moving grids.
Purpose,advantages,disadvantages.

UNIT 4

Intensifying screens Structure and functions, common phosphors used for determination of relative speeds, types, screen mounting, care and maintenance of film screen contact

Radiation Physics BVORAD-206

UNIT 1

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, Ultrasonic wave, production of ultrasonic wave

(piezoelectric effect) in ultrasonography. Use of principle of Doppler's effect in Diagnostic radiology (e.g. Echo, blood flow measurement). Heat

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

UNIT 2

Electrostatics

Electric charge (positive and negative charge), Coulomb's law, Electric field, electric potential and potential difference, equipotential lines, the eV (electron volt), Electric potential due to a point charge, Capacitance, dielectric, Capacitor, series and parallel combination of capacitors, energy stored on capacitor, charging and discharging of capacitors, use of capacitors in diagnostic radiology (e.g Mobile X-Ray generators, radiation detectors etc.).

UNIT 3

Electricity and Magnetism

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.

UNIT-4

Electromagnetic Induction

(A.C. Circuit) Induced EMF, Faraday's Law, Lenz's law, EMF induced in a moving conductor, changing magnetic flux produces electric field, Transformer, Inductance, Energy stored in a magnetic field, resonance in A.C circuit. Light Index of refraction, Snell's law, total internal reflection, lens law, rectilinear propagation of light, umbra and penumbra effect, use of principle of rectilinear propagation of light in radiology (e.g. magnification, patient positioning device, setting areas for exposure, etc.). Photometry : Total radiation flux, luminosity of radiant flux, Luminous flux : relative luminosity, luminous efficiency, Illuminance, Inverse square law, Lambert's cosine law. Electromagnetic waves Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere

Basic Imaging Practical Lab BVORAD-207

1. Test to check the x-ray films and screen contact in the cassette

2. Test to check light leakage in the cassette.

3. To check the effect of safe light on exposed as well as unexposed x-ray film

Environmental Sciences (BVORAD-301)

UNIT 1

The Multidisciplinary Nature of Environmental Studies Definition, Scope and Importance, Need for public awareness Natural Resources Renewable and Non-Renewable Resources, Natural Resources and Associated Problems- a) Forest Resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people Role of individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles
UNIT 2

Ecosystems- Concept of ecosystem, Structure and function of ecosystem, Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

UNIT 3

Biodiversity and its conservation- Introduction- Definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, Aesthetic and option values, India as a mega-diversity nation, Hot-sports of biodiversity, Threats to bio-diversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of bio-diversity: In-Situ and Ex-situ conservation of biodiversity

UNIT 4

Social Issues and the Environment- From Unsustainable to Sustainable development, Urban problems related to energy, Re-settlement and rehabilitation of people; its problems and concerns, Environmental ethics: Issues and possible solutions, Climate changes, global warming, acid rain, ozone layer depletion, Consumerism and waste products, Environment Protection Act, Issues involved in enforcement of environmental legislation, Public awareness

UNIT 5

Human Population and the Environment Population growth, variation among nation, Population explosion- Family Welfare Programme, Environment and Human Health, Human Rights, Value Education, Role of Information Technology in Environment and Human health

REFERENCE BOOKS

-Environmental Studies by Kumarasamy K., A. Alagappa Moses, M. Vasanthy from Bharathids an University Publications 2004, Trichy

-Environmental Studies by Rajamannar EVR College Publications 2004

Principles of CT and Mammography BVORAD-302

UNIT-1

Description of CT, its Working Mechanism & Physical Principles, Limitations of radiography and conventional tomography, Lambert-Beer's law, Homogenous and a heterogenous beam of radiation, Data acquisition geometry and data processing, CT numbers and the linearattenuation coefficient. High kVp CT

UNIT 2

CT numbers and the gray scale of the CT image.
Window Width (WW)
Window Level (WL) Format of the CT image.
Field of view (FOV), pixel size and matrix size.
Identify the equipment components that make up a CT

UNIT-3

Physics and Basic Principle of Mammography, Generations Of Mammography, Alternative modalities and pathological indications of mammography, Pathologic Indications for Mammography, Clinical applications for
Mammography, Screening Mammography, Diagnostic Mammography, Advantages and Disadvantage of Mammography

Component of CT and Mammography BVORAD-303

UNIT 1

Types of CT scan Equipment, Conventional CT Scanning (CCT), Spiral/Helical CT Multi Slice CT, Electron Beam Computed Tomography, Mobile Computed Tomography, Importance of various types of CT, Differences between various types, Indication of a particular type

UNIT-2

Major systems of a CT scanner, Instrumentation, Image Display, Room Layout for CT Equipment, CT gantry (including the x-ray tube and generator, as well as the data acquisitions system), and the basic features of the patient table., CT computer and image processing system, Image display, storage, and recording in CT, Main components of a CT control console, Several hardware and software options for CT, Accessories for use in CT, Modular Design Concept, Operating Modes of the Scanner, Typical Room Layout for a CT Scanner Major technical specifications and features of a CT scanner.

UNIT -3

Details of Mammography Equipment., Room Layout Mammography equipment.

CT procedure and Imaging Process BVORAD-304

UNIT -1

Patient Preparation for CT, Patient Positioning for CT

Various CT protocols in plain and contrast for different areas of interest, Spiral CT protocol in plain and contrast for Head, Spiral CT protocol in plain and contrast for Neck, Spiral CT protocol in plain and contrast for Chest, Spiral CT protocol in plain and contrast for Abdomen/Pelvis, Spiral CT protocol in plain and contrast for Vascular System, Spiral CT protocol in plain and contrast for Bone, Importance of positioning, Precautions to be taken for preparing & positioning the patient.

UNIT-2

Data Acquiring Concepts, Basic concept of data acquisition. Data acquisition geometrics, Slip-Ring Technology, Design and Power Supply of a CT Room., Advantages of Slip-Ring Technology, CT Detector Technology, Characteristics of the Detector, List and describe the Types of Detectors, Explain Plug-in Detector Modules., Describe Multi-Slice Detectors, Detector Electronics, Functions of Detectors, Components of Detectors, Data Acquisition and Sampling.

UNIT 3

CT Scan of Brain (Plain)

CT Scan of Brain (Plain + Contrast)

CT Scan of Orbit (Plain)

CT Scan of Temporal Bones (Axial)

CT Scan of Paranasal Sinus (Coronal)

CT Scan of Neck (Plain)

CT Scan of Chest (Plain)

CT Scan of H R C T Chest

CT Scan of Abdomen and Pelvis (Plain)

UNIT-4

Sequence of events after the signals leave the CT detectors, State the Algorithm, Explain the Fourier transform, Explain the Convolution, Explain the End Interpolation, Trace the History of Reconstruction Techniques., Identify the problems in CT, filter back projection, Iterative Algorithms., Fourier Reconstruction., Image Reconstruction in Single and Multiple Slice Spiral/Helical CT, Types of data in Image Reconstruction, Comparison of Reconstruction Algorithms, 3D Algorithm, CT artifact.

BVORAD-305 Advanced CT and Mammography

Fault analysis & Repairs - Lab BVORAD-306

1. Classification of fault
2. Identification of fault
3. Rectification of fault
4. Repairing/Replacing Module
5. Analysis for the different types of equipment's

Smartphones

Air Conditioning

Security systems

Electronically controlled doors

6. Fault analysis based on hardware and software component
7. Diagnostic and Testing Methods
8. Visual Inspection

9. Earth Continuity Test

10. Insulation Resistance Test

Professional Communication (BVORAD-401)

UNIT 1

Recognizing and Understanding Communication Styles: Passive Communication, Aggressive Communication, Passive-Aggressive Communication, Assertive Communication, Verbal and Non Verbal Communication, Barriers and Gateways to Communication.

UNIT 2

Listening Skills: Types of Listening (theory /definition), Tips for Effective Listening Academic Listening- (lecturing), Listening to Talks and Presentations, Basics of Telephone communication

Writing Skills: Standard Business letter, Report writing, Email drafting and Etiquettes, Preparing Agenda and writing minutes for meetings, Making notes on Business conversations, Effective use of SMS, Case writing and Documentation.

UNIT 3

Soft Skills: Empathy (Understanding of someone else point of view), Intrapersonal skills, Interpersonal skills, Negotiation skills, Cultural Aspects of Communication.

UNIT 4

Group Communication: The Basics of Group Dynamics, Group Interaction and Communication, How to Be Effective in Groups, Handling Miscommunication, Handling Disagreements and Conflicts, Constructive Criticism.

REFERENCE BOOKS

-Mckay, M., Davis, M. & Fanning, P.(2008). Messages: The Communication Skills Book, New Harbinger Publications

-Perkins, P.S., & Brown, L. (2008). The Art and Science of Communication: Tools for effective communication in the workplace, John Wiley and Sons

-Krizan et al (2010). Effective Business Communication, Cengage Learning.

-Scot, O. (2009). Contemporary Business Communication, Biztantra, New Delhi.

-Chaney & Martin (2009). Intercultural Business Communication, Pearson Education

MRI Principle and Physics BVORAD-402

UNIT-1

Basic Principles of MRI, Atomic Structure, Motion in the atom, MR Active Nuclei, Alignment, Precession, Larmor Equation, Resonance and Result of Resonance, MR signal, Free Induction Decay Signal (FID), Relaxation, T 1 Recovery and T 2 Decay, Pulse Timing Parameters, Instrumentation and Equipment of MRI
Introduction,Magnetism,PermanentMagnets,Electromagnets,SuperconductingElectromagnets ,Fringe Fields, Shim Coils, Gradient Coils, Radio Frequency (RF Patient Transportation System, MR Computer Systems and the User Interface, MRI safety and Site Planning

UNIT-2

Government Guidelines

Safety Terminology

Hardware and Magnetic Field Considerations

Radio Frequency Fields

Gradient Magnetic Fields

The Main Magnetic Field

Projectiles

Siting Considerations

MRI Facility Zones

Safety Education

UNIT 3

Protection of General Public from the Fringe Field

Implants and Prostheses

Pacemakers

Patient Conditions

Safety Policy

Image weighting and Contrast in MRI

Introduction

Image Contrast

Contrast Mechanisms

Relaxation in Different Tissues

T1 Contrast & T2 Contrast

Proton Density Contrast Weighting

UNIT 4

Introduction to Pulse Sequences

The spin echo pulse sequence

Timing parameters in spin echo

The gradient echo pulse sequence

Gradients

The advantages of gradient echo pulse sequences

The disadvantages of gradient echo pulse

Timing parameters in gradient echo

Weighting and contrast in gradient echo

MRI Component and Procedure BVORAD-403

UNIT 1

MRI Systems and Components, Encoding, Data Collection & Image Formation, Image Quality, Signal to Noise Ratio (SNR) Contrast to Noise Ratio (CNR),Spatial Resolution, Scan Time, Trade – Offs, Decision Making, Volume Imaging Uses, Volume Imaging Resolution, Pulse Sequences, Spin Echo Pulse Sequences, Gradient Echo Pulse Sequences, Parallel Imaging Techniques, Mechanism of Flow Phenomena, Various Artifacts and their Compensation

UNIT-2

MRI of Head and Neck

1.MRI of Body

2.MRI of Extremities

UNIT-3

3.Vascular and Cardiac Imaging

4. Functional Imaging Techniques

5. Contrast Agents in MRI

Ultrasound imaging BVORAD-404

UNIT-1
Basics of Ultrasound
1. Ultrasound Imaging Artifacts
2. Transducer and Machines
3. Ultrasound Physics
UNIT-2
1. Doppler
2. The Ultrasound Scanning Room
UNIT-3
Indications, Technique, Preparation, Scanning Techniques of -
Abdomen
Abdominal Aorta
Inferior Vena Cava
Liver
Gall Bladder and Biliary Duct
Pancreas
Spleen
Peritoneal Cavity and Gastrointestinal Tract
UNIT -4
Scrotum and Testis
Urinary Bladder
Kidneys and Ureter
Neonates`
Neck
Ultrasound Guided Needle Puncture

Organization and Management of imaging department BVORAD-405

Demonstration of:
• Outline of Radiological Department
• X-ray department,
• Ultrasonography department as well as CT and MRI Scans
• Details of the role of radiology departments in infections.
• Radiation Protection

Electronics Devices Circuits Lab BVORAD-406

1. Study of Lab Equipments and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.

2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.

3. Applications of PN Junction diode: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor.

4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.

5. Application of Zener diode: Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.

Economics BVORAD-501

Unit I

Health Care Market An Introduction : Main Problems in the Market for Health Care, Health Care and
Economic Basics, Analyzing Health Care Markets. Demand-Side Considerations: Demand for Health
and Health Care, Market for Health Insurance

Unit II

Supply-Side Considerations: Managed Care, Health Care Professionals, Hospital Services, Confounding Factors Public Policy in Medical Care: Policies to Enhance Access, Policies to Contain
Costs, Medical Care Systems Worldwide,

UNIT-III

Health Sector in India: An Overview Health Outcomes; Health Systems; Health Financing Evaluation of Health Programs Costing, Cost Effectiveness and Cost-Benefit Analysis; Burden of
Diseases ,Role of WHO , Health Care Budget: purpose, types & practices in Indian context.

UNIT-IV

Health Economics: Fundamentals of Economics: Scope & coverage of Health Economics, demand for
Health Sciences; Health as an investment, population, Health &Economic Development.
Tools of Economics-Concepts of need, demand, supply & price in Health Services.
Methods & Techniques of Economic Evaluation of Health Programmes: Cost benefit &cost effective methods-output & input analysis.
Market, monopoly, perfect & imperfect competition. Health Financing from various sources – Public ,
Private, TPA.
Economics of Health Programmes for Nutrition, diet &population control, economics of abuse of
tobacco& alcohol, environmental influences on health and feeding.
Economics of Communicable (STDs & Malaria) & non-communicable (IHD & Cancers)

diseases.

Dental radiography and BMD BVORAD-502

UNIT 1

Details of Working Mechanism (Physics) of Orthopantography, Details of the History of Orthopantomography (OPG), Details of the Basic Principle and Working Mechanism for Orthopantomography, Details of Orthopantomography Equipment Details of the Generations of OPG, Details of Artifacts in OPG, Clinical Application of Orthopantography, Details of Clinical Applications of OPG with respect to Impacted Teeth, Periodontal bone loss and Periapical Involvement, Dental Implants

UNIT 2

Pre and Post-operative Orthodontic Assessment, Diagnosis of developmental anomalies, Temporo mandibular Joint (TMJ) Disorders ,Dental Bridge, Salivary Stones (Sialolithiasis), Details of Positioning and Radiation Safety in OPG Details of patient preparation in OPG, Details of the technique used in OPG, Details of Positioning in Cephalometry, Details of Radiation Safety in OPG with reference to following points:-

Licensed Dentist and X-ray Machine Registrant Responsibilities

Patient Protection

Responsibilities of Dental Personnel Operating X-ray Equipment

UNIT 3

Details of Working Mechanism (Physics) of Bone Densitometry, Details of History of Bone Densitometry, Indications for BMD Testing, Details of Bone Physiology and Remodelling, Details of Basic Principle of BMD, Details of the following Types of Bone Densitometry Equipment's, Single Photon Absorptiometry (SPA), Dual Photon Absorptiometry (DPA), Dual-Energy X-ray Absorptiometry (DXA or DEXA) Dual X-ray Absorptiometry and Laser (DXL), Single Energy X-ray absorptiometry (SEXA), Quantitative Computed Tomography (QCT), Quantitative Ultrasound (QUS),Digital X-ray Radio grammetry (DXR), Details of Artifacts

UNIT 4

Details of Limitations of BMD, Details of Interpretation and Clinical Application of Bone Densitometry, Identify the Clinical Application of Bone Densitometry Demonstrate the Image Analysis and Interpretation of BMD Study, Discuss What is Osteopenia, Discuss What is Osteoporosis ,Demonstrate different Positioning of the patient, Demonstrate the protocol for Radiation Safety in Bone Densitometry Demonstrate Patient Preparation in Bone Densitometry, Demonstrate DEXA/DXA Positioning with reference to following points, Routine Positioning, Additional Positioning, Peripheral Measurements, Demonstrate the protocol for Radiation Safety with reference to following points, Patient Dose, Radiation

Protection for the Patient, Radiation Protection for the Technologist, Radiation Protection to Public

Quality Control and Safety Measure BVORAD-503

Unit 1

Quality control

Unit 2

Safety measure

Unt 3

TLD Badges

Radiation hazard and safety BVORAD-504

UNIT 1
Somatic and genetic effect of ionising radiation need for protection, principle of radiation protection
ALARA

UNIT 2
Radiation monitoring devices (film badge and TLD)
Radiation shielding devices available for protecting staff
Patient and public and how to use them

UNIT 3
(Methods of Radiation Protection of patients, radiation workers and public).
Natural and background radiation (cosmic, terrestrial)
Principles of radiation protection, time - distance and shielding, shielding calculation and Radiation survey

UNIT 4
Personnel dosimeters (TLD and film batches), occupational exposure, radiation protection of Self and patient, ICRP, NRPB, NCRP and WHO guidelines for radiation protection, Pregnancy and radiation protection.

Angiography BVORAD-505

UNIT 1

Details of Different Types of Cardiac Diseases

Cardiac Catheterization /Angiography Procedure

Angioplasty / PTCA Procedure

Coronary Artery Bypass Graft (CABG) Procedure

UNIT-2

Catheters

Instruments

Sterilization Techniques of catheters and instruments

UNIT -3

Various Cardiac Cath Lab Equipment

Physics Test Procedures for Cardiac Cath Labs

Radiation MeasurementsDetails of Angiography examination techniques

Coronary Angiography examination techniques

Micro - Angiography examination techniques

Peripheral Angiography examination techniques Details of Neuro - vascular Angiography examination techniques

Renal Angiography examination techniques

Angiography Equipment and its components

Desired accessories

Consumables

Layout installation plan

Prerequisites

UNIT-4

Broad Goals of Preventive Cardiology

Preventive Cardiology

Cardiac Rehabilitation ECG machine

Abnormal ECGs, Stress test, 2D Echo

BVORAD-506 MRI, Image Processing and Recording

BVORAD-507 INTERNSHIP-I

Advancement In imaging Modalities BVORAD-501

UNIT-1

Film archieving systems:

Image recording devices Laser imager/camera-functioning. Multi formatter Automatic film handling systems Picture archieving and communications systems (PACS) Systems designs, transfer restrictions. Optical Disc. System (ODS)

UNIT-2

Digital radiography systems

Image acquisition Digital Spot Imaging DSI

Unit-3

Digital chest radiography

Future developments

UNIT-4

fluoroscopy and flurography

Equipment for mobile radiography

Equipment for MMR radiography

Interventional Radiography BVORAD-502

UNIT-1

1. Interventional Radiology

Definition of Interventional Radiology

Indication for various Interventional procedures

Clinical Application : Disease diagnosis, Severity interpretation

Name of different type of procedure

UNIT-2

1.Equipment used in various interventional procedures

C-arm equipment: Instrumentation and working procedure

Catheters: Classification, Catheters used for different studies, Balloon angioplasty catheters, Sterilization of catheters, Guide wires

2. Angiography (Cerebral, Peripheral, Visceral

a) Anatomy of blood vessels

b) Definition, Indication and Contraindication , Patient preparation and Contraindication

b) Direct needle puncture , Catheter angiography

UNIT-3

1. ANAESTHESIA AND EMERGENCY DRUGS USED IN DIAGNOSTIC RADIOLOGY

Facilities regarding general Anaesthesia in the X-ray Department

2. Anaesthetic Problems associated with specific technique

a)Vascular Studies

b) Carotid Angiography c) Venography

UNIT-4

Sterile Techniques in angiography procedures

Doppler Ultrasound and PET Scan BVORAD-503

UNIT-1
Basics of Ultrasound
1. Ultrasound Imaging Artifacts
2. Transducer and Machines
3. Ultrasound Physics
UNIT-2
1. Doppler
2. The Ultrasound Scanning Room
UNIT-3
Indications, Technique, Preparation, Scanning Techniques of -
Abdomen
Abdominal Aorta
Inferior Vena Cava
Liver
Gall Bladder and Biliary Duct
Pancreas
Spleen
Peritoneal Cavity and Gastrointestinal Tract
UNIT -4
Scrotum and Testis
Urinary Bladder
Kidneys and Ureter
Neonates`
Neck
Ultrasound Guided Needle Puncture

BVORAD-504 INTERNSHIP-II/Practical Training

BVORAD-505 Project Report