DIPLOMA: X –RAY/ RADIOGRAPHER TECHNICIAN (DXR)

R.K.D.F. UNIVERSITY, BHOPAL

DIPLOMA: X –RAY/ RADIOGRAPHER TECHNICIAN (DXR)

Study and Evaluation SchemeProgramme: Diploma in X-Ray/ Radiographer Technician (DXR) Course Duration:2 year (24 month)

S.No	Subject Code	Subject	Sessional						
			Internal Assessment		Theory		Practical		Total
			Max marks	Min marks	Max marks	Min marks	Max marks	Min marks	Max marks
1.	DXR 101	Paper 1. Physics	50	20	100	40	50	20	200
2.	DXR 102	Hospital practice and care of the patient	50	20	100	40	50	20	200
3.	DXR 103	Anatomy physiology and pathology (basic)	50	20	100	40	50	20	200
4.	DXR 104	Equipment of radio diagnostic radiography	50	20	100	40	50	20	200
5.	DXR 201	Radio graphic technique	50	20	100	40	50	20	200
6.	DXR 202	Cardiac Angiography and Cytography	50	20	100	40	50	20	200
7.	DXR 203	Elementary system-Technique for routine projections	50	20	100	40	50	20	200
8.	DXR 204	Assignment (Based on the syllabus)	50	20	100	40	50	20	200
			400	**160**	**800**	**320**	**400**	**160**	**1600**

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I. Syllabus for Diploma: X –ray/ Radiographer

First Year

DXR- 101 Paper 1. Physics

DXR- 102.Paper 2. Hospital practice and care of the patient

DXR- 103.Paper 3. Anatomy physiology and pathology (basic)

DXR- 104.Paper 4. Equipment of radio diagnostic radiography

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Course	Subject	Subject Code
DXR	PAPER 1 - PHYSICS	DXR-101

Course Objective:

Basic ideas on measurement and units; mechanical force, work and energy heat temperature and energy, heat conduction, convention and radiation.

Course Outcome:

To gain the basic knowledge on measurement and units; mechanical force, work and energy heat temperature and energy, heat conduction, convention and radiation and to know the uses and application in X-ray technology.

Course Content: Paper 1

(a) BASIC PHYSICS:

Basic ideas on measurement and units; mechanical force, work and energy heat temperature and energy, heat conduction, convention and radiation.

(b) ELECTRICITY AND X-RAYAPPARATUS: Electrostatics-

Related to X-ray production X-ray valve and tubes- construction of x-ray tubes (inserts and fields) filament design, anode design, methods of cooling, simple high tension circuits- self rectified, half wave full wave, H.T. cables, measurement of high tension, control and indicating equipment- control of tube voltage auto transformer mains voltage compensator, methods of tube voltage indication, control of tube current, filament transformer primary and secondary circuits, tube current indication, control of exposure, contactor and basic principles of times, feeder cables, fuses mains switches earthing, insulation , voltage, electrical hazards.

(c) RADIATION PHYSICS:

Outline of atomic structure, electromagnetic radiation waves and quanta, general properties of electromagnetic radiation- = fundamentals of radioactivity. Light- intensity and quality, spectrum of white light, line spectra, photo electric emission, photocell, fluorescence X-ray, production intensity and quality, continuous and characteristic spectra, effects of variation of tube and current production for therapeutic purposes, X-ray and processes of interaction secondary radiation emission and ionisation transmission of a homogeneous beam through an object, transmission through body tissues, transmission of homogeneous X- ray beams reduction in intensity due to absorption and inverse square law, filtration relative amount of scattered radiation in an X-ray beam during its measurement chemical, simple principles of dose meters, the fluorescent specifications and measurement, KVP, half value layer, routine method of checking quality. Basic principles of ultrasound, MRI & C.T.

(c) X-ray PROTECTION:

Historical development, permissible exposure, international recommendations for protection of persons exposed to ionising radiation, the protective materials lead, lead-impregnates substances, building materials, lead equivalents and variation with quality, design of tube and room protection, survey of department personnel monitoring.

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Course	Subject	Subject Code
DXR	Hospital practice and care of the patient	DXR-102

Course Objective:

Basic ideas on Hospital practice and care of the patient, organisation, records relating to patients and departmental statistics, professional attitude of the patients and other members of the staff,

Course Outcome:

Hospital staffing and organisation, records relating to patients and departmental statistics'first contact with patient in the department handling of chair and stretcher patients, lifting of ill and injured patients, elementary hygiene, personal cleanliness, hygiene in relation to patients

Course Content: Paper 2

(a) Hospital staffing and organisation, records relating to patients and departmental statistics, professional attitude of the radio grapher to patients and other members of the staff, medico legal aspects, minimising waiting time, appointments organisation stock taking and stock keeping.

(b) Care of patient: - first contact with patient in the department handling of chair and stretcher patients, lifting of ill and injured patients, elementary hygiene, personal cleanliness, hygiene in relation to patients. E.g. clean Lenin and receptable nursing care, temperature.

(c) First Aid: - Shock, asphy, convulsions, artificial respiration, electric shock, burns, scalds, haemorrhage, pressure point, tourniquet, fractures, splints, bandaging, foreign bodies, poisons, drug, reactions, administration of oxygen.

(d) Preparation of a patient for general X-ray examinations. Departmental instruction to out patients or ward staff, use of aperients, enema and colonic irrigation, flatulence and flatus causes and methods of relief, principles of antheterisation and intubations, premeditation, its uses and methods, anaesthetised patients, nursing care before and after special X-ray examinations e.g. in neurological, vascular and respiratory conditions diabetic patients, special attention to food, trauma hazards.

(e) Preparation of patients for special x-ray examinations barium enema, barium meal, intravenous pyelography cholecystography etc. and their administration.

(f) Principles and aspects: - Methods of sterilisation, care and identification of instruments and surgical dressings in common use, setting of trays and trolleys for various examinations etc. intravenous pyelography, biopsy, elementary operating theatre produce.

(g) Drugs in department- storage, labellings checking, regulations regarding

(h) Contrast media- barium preparations, iodine,

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Course	Subject	Subject Code
DXR	Anatomy physiology and pathology (basic)	DXR-103

Course Objective:

To know the general anatomical terms, like head, skull, bones etc, regime of the body, Structure of will and general tissues simple, compound etc.

Course Outcome:

Have an enhanced knowledge and appreciation of mammalian physiology, understand the functions of important physiological systems including the cardio-respiratory, renal, reproductive and metabolic systems;understand how these separate systems interact to yield integrated physiological responses to challenges such as exercise, fasting and ascent to high altitude, and how they can sometimes fail.

Course Content:Paper 3.

(a) General anatomical terms

(b) Regime of the body

(c) Structure of will and general tissues simple, compound etc.

Heart and blood vessels, structure and function of heart, pericardium peripheral muscular system names of the main arteries and veins circulation, common terms used in connection with diseases of this system.

(i) Respiratory system, nasal passage and accessory sinuses, pharynx and larynx, trachea, bronchi and lungs, pleura nature and function of respiration common terms used in connection with diseases of this system.

(j) Lymphatic system, lymph and tissues fluid, main lymphatic gland groups and drainage, lymphoid tissue and tonsil**.**

(k) Reticule endothelial system, spleen and liver, bone marrow extent and nature life cycle of the red and white corpuscles of the blood.

(l) Alimentary system- mouth, tongue and teeth, salivary glands, pharynx and esophagus, stomach small and large bowel liver and billiard tract pancreas, motor functions of alimentary tract, nature of food\, digestion and absorption, nature and metabolism, nutrition and dietetics, common terms used in connection with diseases of this system.

(m) Urinary tract kidneys, ureters, bladder and urethra, urinary secretion.

(n) Reproductive system, male genital tract, testis, epididtmus and prostate, female genital tract, fallopian tubes, overics, uterus vagina and vulva, the mammary gland pregnancy common terms used in connection with diseases of this system.

(o) Nervous system- brain, main subdivision & lobes, ventricles, spinal cord, crucial and main system nerve tracts, meaning and cerebrospinal fluid, its circulation autonomic nervous system common terms used in connection with diseases of this system.

(p) Special sense organs – structure and function of eye, structure and function of ear**.**

(q) Topographical relation of organs of the neck and trunk elementary pathology inflammation, benign and malignant tumours and endocrine disorders**.**

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Course	Subject	Subject Code
DXR	Equipment of radio diagnostic radiography	DXR-104

Course Objective:

To know the general anatomical termsEquipment of radio diagnostic radiographyetc.

Course Outcome:

Demonstrate the knowledge and skills in basic medical radiology and imaging technology to facilitate their overall professional development, Plan, implement and evaluate programme to address identified medical radiology and imaging technology needs in corporation with patients. Explain how social, organizational individual's factors influence medical radiology and imaging technology, Demonstrate the leadership role to coordinate, delegate and supervise care safely, manage risk and remain accountable for the care given actively; involve and respect others.

Course Content:Paper 4.

(a) High-tension control equipment – Diagnostic H.T. circuits, high tension generators, half wave full wave three phase, condensers discharge, contact voltage high tension switches, control and establishing equipment, tube filament supply, mains compensator mains resistance compensator. X-ray tubes – design, rating and care of X-ray tubes, practical considerations in choice of focus, inherent filtration. MAS meter elementary principles and construction, importance as check on**.**

(i) Radiographic results.

(ii) Apparatus behaviour and additive tube loading, exposure timers – spring activated, synchronous motor, value (Low-tension ionisation testing timer accuracy). Interlocks and safety devices.

(iii) Circuits – Simple circuit diagram and illustration of sequence from mains supply to control X-ray exposure bean. Centering devices – mechanical and optical, interaction of X-rays and the body transmission in body tissues.

(b) Scattered radiation – control of scattered radiation, cones, diaphragm, single and multiple filters grid ratio in relation to KV, construction and operation, focused and non – focused, single stroke reciprocating and oscillating potter – bucky, diaphragms, criss cross grids, stationary grids, use etc.

(c) Production of X-ray tubes and high tension circuits for the production of control panel and control safety device and interlocks, basic principles of mega voltage X-ray machines.

(d) Fluoroscopy – Tube filtration, diaphragm, tilting couch screen grid and exploratory and control safety devices, compressors, protection, electrical radiographic and mechanical control, use and care of couch accessory fittings**.**

(e) Special equipment – body section radiography, apparatus and controls simultaneous multi section accessories specialised couches, skull table, mobile units. Image intensifiers, principles, optical systems, for viewing and recording final image electrical and x-ray supply protection, applications, including cine radiography, mass miniature radiography, special radiography, equipment for high speed serial techniques (etc.) rapid cassette changer rapid films changer, roll films, full size and miniature, biplane equipment, grids, protection, problems of processing and presentation, care and maintenance – general principle and routine use of charts supplied by manufactures, radiographic calibration procedure.

Second Year

DXR- 201 Paper 5. Radio graphic technique

DXR- 202 Paper 6. Cardiac Angiography and Cytography

DXR- 203- Paper 7. Elementary system-Technique for routine projections

DXR- 204- Assignment (Based on the syllabus)

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Course	Subject	Subject Code
DXR	Radiographic technique	DXR-201

Course Objective:

To know the general anatomical termsEquipment of radio diagnostic radiographyTechniques.

Course Outcome:

Apply appreciate procedures for complex radiological and imaging examinations. Provide care to patients – efficiently and in a cost-effective way – in a range of settings, and maintain foremost the interests of individual patients.Understand core concepts of clinical ethics and law of medical radiology and imaging technology to their practice as healthcare service providers.Demonstrate excellent communication skills with effective exchange of professional information.Create, select and apply current tools and techniques of pharmacy field tools necessary for solving pharmaceutical problems.Recognise the need to engage in lifelong learning through continuing education and research

Course Content: Papers 5.

(a) Photographic aspects of radiography – the fundamentals of the photographic process, light sensitive salts of silver, the photographic emulsion gelatine as suspension medium, size and frequency of the silver halide grain in relation to sensitively and contrast, formation of the latent image, chemical development, construction of x-ray film

base material, substratum coating, emulsion, coating anti-abrasive super coating sensitivity, storage of unexposed film.

(b) X-ray materials: - Type of emulsion, characteristics and control screen films, non screen films, dental films, comparative speed and contrast to light and x-rays. Characteristics of x-ray emulsions, characteristics curves of x-ray film assessment of the results of correct exposure under & over exposure, density (D max) speed, contrast (Gamma infinity) graduation, fog, grain, exposure, kilovoltage and developing latitude. Intensifying screens fluorescence application of fluorescence in radiography, construction of an intensifying screen, types of emulsion in relation to type of salt, size of grain, coating, weight, kilovoltage, mounting and general care of screens, after glow test for reciprocate failure, intermittency effect. The X-ray, testing a cassette for proving good screen contact, general case of cassettes. X-ray developers – characteristics and detail freedom from chemical fog and staining, long life possibility of degeneration. Standardisation of quality of developers and development – function and constituents of an x-ray developer, standardisation by time and temperature development latitude, exhaustion of a developer, replenishment of developers, ultra rapid developers, combined developer and fixer, fixers and fixing, hardening agent, time of fixation, exhaustion of a fixer, electrolytic silver recovery and fixer regeneration, rapid fixers, separate hardening. Rinsing, washing and drying – objects of rinsing and washing, methods, employed, methods of drying films, processing – preparation of solutions, available water supply, nature of mixing, vessels, order of mixing solutions, filtration, making stock solutions, storage of dry chemicals, storage of solutions.

Technical and processing faults: - Chemical reduction – chemistry and characteristics of reducer, local and general application the x-ray dark room size, light proof entrances, construction of walls for protection against chemicals and radiation, ceiling, colour schemes water proofing of floors, loading bench design, disposition of processing and accessory equipment for efficient working, arrangement of drying cabinets in darkroom or in adjacent drying room, darkroom illumination and testing for safety, ventilation. The radiographic image radiographic factors affecting image contrast and sharpness, variation in exposure time in accordance with quality of radiation filters distance, intensifying screens, girls film speed, developer and development. Presentation of the radiograph – identification of film aspect for direct viewing, mounting dental films**. Accessories –** Viewing boxes, including high intensity illumination of small areas, illuminators, projectors and viewing screens for miniature and cine radiography, magnifiers, embossing machine, inscribing materials, film trimmors and corner cutters, dental mouths and cutters filling units.

Fluorescent screen photography: - Optical principles, basic principles of a camera construction of a camera lens, speed, focal length, function of lens diaphragm focusing, conjugate distances, mirror systems.

Equipment for miniature radiography – Camera unit with conventional lens, camera unit with mirror system, cassettes, manual and motor driven for single and serial exposures, assessment of photographic requirements, fluorescent screen, spectral omission to provide maximum brightness. Optimum resolution, sensitive material, speed resolutions, colour sensitive material, speed resolution, colour sensitivity of films in relation to spectral omission. Dark room illumination and speed spectral sensitivity of film methods of processing sizes of roll and out film, technique of mass miniatures radiography, exposure technique uniformity, special protective measures, projection records, fillings. Conversant with the following radiographic technique: -

(a) Protection – radiation hazards,

(b) Contrast media – General principles, relationship of x-ray transmission to density and atomic weight of materials employed. Barium Operations –

Barium sulphate, particle size suspending agents concentration, adaption of preparation for a particular uses e.g. dry powder, cream thick and thin liquids, additional modifications, activators, non flocculating suspension, flavouring agents, food mixtures for children, iodine preparations organic, water soluble group, inorganic percentage tests, side effects, dangers, quantity, methods of introduction.

Skeletal system – Upper limit, techniques for whole hand fingers thumb, wrist, joint, carpus, forearm, elbow joint, radio-ulnar joints, lower two thirds humorous, supplementary techniques, carpal tunnel, scaphoid ulnar grove head of radius, supracondylar projections, etc.

Lower limb: - Techniques for whole foot, toes, great toes, calcaneum, talocalcaneal, joint, ankle joint lower leg, knee joint, patella, tibial tubercle, lower two thirds fomur, supplementary techniques, position for torn ligaments, comprehensive projections for congenital and acquired flat fleet, axial projection to include the talocalocaneal and joint, projections, for loose bodies in knee, infrasuprior for patella, arthrography, etc.

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Course	Subject	Subject Code
DXR	Cardiac Angiography and Cytography	DXR-202

Course Objective:

To know the general Cardiac Angiography and Cytographydiagnostic cytographyTechniques.

Course Outcome:

Cardiac anatomy as seen on CT. Different types of cardiac CT examinations and their roles such as calcium score, CT coronary angiogram, CT pulmonary veins and TAVI. How to interpret cardiac CT examinations and CT angiography.How to acquire images at the scanner whilst reducing radiation dose and to do image post-processing for analysis. More advanced utilization of cardiac CT in coronary artery disease, such as ventricular function and CT FFR.

Course Content: Paper 6.

Cardiac angiography: Abdominal angiography, portal venography.

(d) Respiratory system: Upper respiratory passage, techniques for post nasal airway, larynx, trachea, thoracic inlet, thyroid and Para thyroid gland supplementary techniques for routine projection, supplementary techniques for antroposterior, oblique, lordotic projections, unilateral density, full inspiration and expiration, Val salve maneuovers, etc.

Lungs- technique to define fluid levels, effusions, adhesions, oblique lordoticdecubites, projections, supplementary techniques full inspiration and expiration, etc.

Diaphragmatic excursion – double exposure technique, fluoroscopy media stinum techniques, for routines projections, bronochography , danger of anaesthetised larynx inhibitation of cough reflex – methods of introducing contrast medium and positioning during the introduction. Precautions for fluoroscopic control.

(f) Genit-urinary system: Techniques for plain film for examination, supplementary, techniques, erect, lateral and cross projection, inspiration expiration and double exposure technique, IVP techniques, special consideration, time factor variation with different contrast media and pathological conditions, ureteric compression, danger and contra indications, supplementary techniques oblique, lateral, erect, prone and tilt projections, retrograde techniques special consideration position and identification of ureteric catheters, fluoroscopic control.

Cystography– Injection, relaxed and straining techniques: Fistulae, micturating – cystography urethrography, selective renal angiography, etc.

(g) Obstetrics and Gynaecology: - Radiation - Precaution special consideration in pregnancy. Factors and accessories, compensatory filters, pregnancy techniques for estimation of fatal development, maturity normality, position and multiplicity, placental localisation soft tissue and contrast media techniques, cystography and arteriography reclining lateral projections – pelvimetry, inlet outlet and erect lateral projections, cephalometry, hysterosalpinography, preparation of theatre and departmental procedure, techniques for routine projection, etc.

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Course	Subject	Subject Code
DXR	Elementary system-Technique for routine projections	DXR-203

Course Objective:

To know the general Elementary system-Technique for routine projections**.**

Course Outcome:

How to interpret cardiac CT examinations and CT angiography.How to acquire images at the scanner whilst reducing radiation dose and to do image post-processing for analysis. More advanced utilization of cardiac CT in coronary artery disease, such as ventricular function.

Course Contents:

Techniques for routine projections. Barium swallow Pharynx and oesophagus, supplementary techniques, trachea – oesophagus fistula, Valsalvamanceuvor. Barium meal and follow through stomach, small and large intestine, compression technique, appropriate timing of film series, the mucosalpattern, serial exposures supplementary techniques, intestine obstructions, etc.

Diaphragmatic hernia, perforation, post operative techniques Barium Enema.

CT – Principles of CT – Basic Physics – Recent developments, applications etc. MRI – Magnetic Resonance Imaging – Principle – Physics – Techniques – Types of coils – Basic term used in MRI Operations, Applications, etc. U/S Physics – Types of ultrasound – Techniques of ultrasound scanning in different parts – positioning and filming – Principles of Doppler effect and colourDoppler.Structure of x-ray films- Types of X-ray films, manufacture of films characteristics of X-ray films, safe light – testing, safe light – special sensitivity. Latent image formation – development techniques – factors affecting quality of x-ray films in processing. Testing the safe light.Cassettes for X-ray screen films, construction, intensifying screens.Types& effects, cleaning &maintenance.Factors affecting the quality of Radiography.

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Course	Subject	Subject Code
DXR	Assignment	DXR-204

DXR- 204- Assignment (Based on the syllabus)

Course Outcome: After completing the **Diploma in X-Ray Technology Course**, candidates become capable of working in the career employment areas like: Private Clinics. Doctor's Office.Medical Labs.