

CURRICULUM

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Technical School Leaving Certificate
in
Radiography



Council for Technical Education and Vocational Training
CURRICULUM DEVELOPMENT DIVISION

Sanothimi, Bhaktapur

2011

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1. Introduction:

This curriculum is designed to produce lower level human resources in the field of human health radiography services equipped with knowledge, skills and attitude necessary for this level of technicians so as to meet the demand of such technician in the country.

2. Aim:

The aim of the programme is to produce radiography assistant to provide radiography services to the people through established health institutions by performing all routine and some special radiographic procedures independently and accurately.

3. Objectives:

After completing this curricular program, the students will be able:

1. To be familiar with radiographic procedures and practices applicable in diagnosing human health disorders
2. To perform radiography photography procedures
3. To carryout radiographic film development
4. To handle radiographic equipments and materials including x-ray unit
5. To manage x-ray clinic including handle and care of the patients
6. To assist in special radiographic procedures and investigations
7. To carryout first aid activities
8. To be familiar with radiation physics including radiation hazards and its control
9. To assist in managing radiology department
10. To assist in quality assurance in the department of radiology

4. Programme Description:

This course is based on the job required to be performed by a radiography assistant at different level health institutions in Nepal. This course intends to provide knowledge about basic level radiological procedures. It especially, provides the knowledge and skills focussing on various radiological examinations and procedures as provisioned by the government of Nepal. It also deals with radiation safety and patient care.

5. Target group:

The target group for this training will be all the interested individuals of the country with academic qualification of SLC pass.

6. Target location:

The target location of this training program will be all over Nepal.

7. Group size:

The group size of this training program will be not more than 40.

8. Entry criteria:

Individuals who meet the following criteria will be allowed to enter into this program:

- Should have passed SLC
- Should pass entrance examination administered by CTEVT
- Final selection will be made on the basis of merit list.
- Candidates should submit the following documents at the time of application
 - SLC pass certificate
 - Character certificate
 - Citizenship certificate (for the name, parents' name, age, date of birth and address verification purpose only)
- Special quota for different category of students will be as per the policy of CTEVT
- Preference will be given to female, Dalit, Janjati, Conflict affected people and disadvantaged Groups (DAGs)

9. Medium of Instruction:

The medium of instruction will be in English and/or Nepali language.

10. Course Duration:

This course will be completed within 12 months / 52 weeks / 1560 hours. In addition, 3-months/ 480 hours on-the-job assignment should also be completed for issuing successful completion of the course.

11. Pattern of Attendance:

The students should have 80% attendance in theory classes and 90% in practical/ performance to be eligible for internal assessments and final examinations.

12. Teacher and Student Ratio:

- Overall ratio of teacher and student must be 1:10 (at the institution level).
- Teacher and students ratio for theory class should be as per nature of classroom
- Teacher and student ratio for practical should be 1:10
- Minimum 75% of the teachers must be fulltime.

13. Instructional Media and Materials:

The following instructional media and materials are suggested for the effective instruction and demonstration.

- Printed Media Materials (Assignment sheets, Case studies, Handouts, Information sheets, Individual training packets, Procedure sheets, Performance Check lists, Textbooks etc.).
- Non-projected Media Materials (Display, Models, Photographs, Flip chart, Poster, Writing board etc.).
- Projected Media Materials (Opaque projections, Overhead transparencies, Slides etc.).

14. Teaching Learning Methodologies:

The methods of teaching for this curricular program will be a combination of several approaches. Such as Illustrated Lecture, Group Discussion, Demonstration, Simulation, Guided practice, Practical experiences, Fieldwork, Radiography observation, Hospital visit, Report writing, Term paper presentation, Case analysis, Tutoring, Role-playing, Heuristic and Other Independent learning.

- Theory: Lecture, Discussion, Assignment, Group work.
- Practical: Demonstration, Observation and Self-practice.
- OJT

15. Evaluation Details:

1. Continuous evaluation of the students' performance is to be done by the related instructor/ trainer to ensure the proficiency over each competency under each area of a subject specified in the curriculum.
2. Related technical knowledge learnt by students will be evaluated through written tests.
3. Students must score a minimum of 40% marks in theory test and 60% in practical test in all subjects.

4. There will be three internal assessments and one final examination in each subject. Moreover, the mode of an assessment and an examination will include both theory and practical or as per the nature of instruction as mentioned in the course structure.
5. Students should pass internal assessments both in theory and practical tests in all subjects.
6. The ratio between the theory and practical tests will be 20:80 in case of a practical nature subject.
7. Out of 100%, 50% weightage is allotted for the internal assessments and the remaining is allotted for the final examination
8. The on-the-job training has to be evaluated keeping 300 as full marks. The evaluation of the performance of the student is to be carried out by the three agencies; **the concerned institute, industry/organization where the student worked and the CTEVT** unless otherwise directed by office of the Controller of examinations /Technical Division of the CTEVT. Here also the student has to score 60% or above for successful completion of the course.

16. Grading System:

The grading system will be as follows:

<u>Grading</u>	<u>Overall marks</u>
Distinction	80% or above
First division	75% or above
Second division	65% or above
Third division	Pass aggregate to below 65%

17. Certificate Requirements:

The council for technical education and vocational training will award certificate in “**Technical School Leaving Certificate in Radiography**” to those students who successfully complete the requirements as prescribed by the curriculum.

18. Career Path:

The graduate will be eligible for the position equivalent to Non-gazetted 2nd class/level 4 (technical) as Radiography Assistant or as prescribed by the Public Service Commission. The graduate is eligible for registration with the Nepal Health Professional Council in the grade as mentioned in the concerned Council's Act.

Course Structure on TSLC in Radiography

S. N	Subjects	Nature	Hours / Week	Theory & Practical hours			Full Marks
				Total Theory Hours	Total Practical Hours	Grand Hours (T+P)	
1.	Applied Integrated Science	T+P	4	40	116	156	100
2.	Radiological Anatomy	T+P	4	42	114	156	100
3.	Radiography Technique I	T+P	6	60	174	234	150
4.	Radiography Technique II	T+P	2	15	63	78	50
5.	Radiographic Photography	T+P	4	30	126	156	100
6.	Radiographic Equipment	T+P	4	30	126	156	100
7.	Radiation Physics	T+P	2	15	63	78	50
8.	Health Management & Health Care System	T+P	2	15	63	78	50
9.	First Aid & Communicable Diseases	T+P	2	30	48	78	50
10.	Field Practice (Hospital Settings)		10	0	390	390	250
Total			40	277	1283	1560	1000

On the Job Training

Subject	Nature of Instruction	Duration (Hrs.)	Full marks
On -the -Job Training (OJT)	Practical	480	300
Grand total		2040	1300

T = Theory, P = Practical

Applied Integrated Science

Total: 156 hours

Theory: 30 hours

Practical: 126 hours

Course description

This course is designed to provide a basic knowledge of anatomy and physiology. They will gain knowledge about basic mathematical calculations and basic units and their conversions.

Course objectives

After the completion of the course, the student will be able to:

1. Understand about anatomy and physiology of human body.
2. Perform basic mathematical calculations.

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	Identify human cells and tissues List functions of the different human cells and tissues	Introduction of cell Structure of cells Different types of cells Introduction of tissue Types of tissues, observation of normal cells and tissue	2	8	10
2.	Identify the bones of human skeletal system List functions of the different organs of human skeletal system	Basic concept of structure and functions of Skeletal system including: Bones of Skull Bones of Vertebral column Bones of Upper extremities, ribs and sternum Pelvic bones and bones of lower extremities, observation of skeleton module	4	20	24
3.	Identify the organs of human muscular system List functions of the different organs of human muscular system	Basic concepts of structure and functions of human muscular system including: Voluntary muscle Involuntary muscle Cardiac muscle Deltoid muscle Gluteal muscle Muscles of face	2	8	10
4.	Identify different organs of human circulatory system List functions of the different organs of human circulatory system	Basic concept of structure and functions of circulatory system including: Structure of Heart Circulation of blood Structure of Veins, Arteries, capillaries Method of blood sample collection and observation of normal blood cells	2	8	10

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
5.	Explain about the composition of blood, blood group and organs of human lymphatic system	Basic concepts of structure and functions of blood and lymphatic system including: Blood components Lymphatic vessels and lymph nodes Circulation of lymph Blood grouping	2	8	10
6.	Identify the organs of human nervous system List functions of the different organs of human nervous system	Basic concepts of structure and functions of nervous system including: Brain Spinal cord Peripheral nervous system Neurons Autonomous nervous system Observation of human nervous system – Brain, Spinal cord from module/chart	3	12	15
7.	Identify the organs of human excretory system List functions of the different organs of human excretory system	Basic concepts of structure and functions of the excretory system: Structure and function of Kidney, ureters, urinary bladder, urethra. Urine- formation of constituent, methods of urine sample collection	2	8	10
8.	Identify the organs of human respiratory system List functions of the different organs of human respiratory system	Basic concepts of structure and functions of respiratory system including: Structure and function of nasal cavity, larynx, pharynx, trachea bronchi, lungs. Types of respiration Method of sputum and throat swab collection	2	8	10
9.	Identify the organs of human	Basic concepts of structure and	2	8	10

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
	digestive system List functions of the different organs of human digestive system	functions of digestive system including: Structure and function of Oral cavity, Oesophagus, Stomach, Small intestine, Large intestine Accessory organs of Digestive system (Salivary gland, Pancreas, Liver) Digestion absorption and metabolism of carbohydrate, protein, fat, minerals and vitamins			
10.	Identify the organs of human reproductive system List functions of the different organs of human reproductive system	Basic concepts of structure and functions of reproductive system including: Structure and function of Male and female reproductive organs Menstruation cycle and fertilization	2	8	10
11.	Identify parts of human skin List functions of the different layers and glands	Basic concepts of structure and functions of human skin including: Structure and function of layers of skin Sebaceous glands	2	8	10
12.	Identify the organs of human endocrine system List functions of the different organs of human endocrine system	Basic concepts of structure and functions of human endocrine system including: Pituitary gland Thyroid gland Adrenal gland etc.	2	8	10
13.	Identify special sense organs of human body List functions of the different organs of human sensory system	Introduction of special sense organs of human body (Structure and function of eye, ear, nose, tongue, skin)	2	8	10
14.	Perform Basic mathematical calculations	Basic concept of Metric system, Units of measurements; SI unit, weight measurement, IU, mEq, and Somogyi unit	1	6	7

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
		Unitary methods, decimals, percentage, fractions.			
		Total	30	126	156

Reference books

1. Anatomy and Physiology for Nurses – Jean R W Ross
2. Anatomy and Physiology for Radiographers - ELBS

Radiological Anatomy

Total: 156 hours

Theory: 30 hours

Practical: 126 hours

Course description

This course is designed to provide knowledge and skills on Radiological Anatomy in radiological perspective. This course includes of bones and joints, muscular system, digestive system, cardiovascular system, respiratory system, lymphatic system, urinary system, reproductive system, endocrine system, nervous system and surface anatomy.

Course objectives

After successfully completing this course the student will be able to;

1. Describe the body structure in carrying out radiological procedure, and
2. Analyze and interpret the findings.

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	<p>Identify anterior, posterior, median, lateral, superior, inferior, proximal, distal, extension, flexion, abduction, adduction, saggital, coronal, palmar, dorsal, ventral, rotation, crest, surface, oblique, apical, in human body</p> <p>Observe different cells and tissue of human body</p>	<p>Describing structure, functions and types of cell and tissue</p> <p>Naming different systems in human body as a whole and their relationship.</p> <p>Recalling various important anatomical terminology: anterior, posterior, median, lateral, superior, inferior, proximal, distal, extension, flexion, abduction, adduction, saggital, coronal, palmar, dorsal, ventral, rotation, crest, surface, oblique, apical, decubitus, and other important cross sectional</p>	5	20	25
2.	<p>Identify border, canal, condyle, epicondyle, foramina, fossa, process, spine, surface, tubercle, trochanter.</p> <p>Identify the parts of the following</p> <p>Cranial bones</p> <p>Facial bones and nasal sinus</p> <p>Teeth structure and eruption process.</p> <p>Observe the ossification centres on the x-ray and determine the age of the child using these x-rays.</p> <p>Identify the parts</p> <p>Clavicle, scapula, humerus, ulna, radius, carpals, metacarpals and phalanges.</p> <p>Femur, tibia, fibula, tarsals, metatarsals and phalanges.</p> <p>Identify joints in human body</p> <p>Observe the movements of the</p>	<p>Recalling border, canal, condyle, epicondyle, foramina, fossa, process, spine, surface, tubercle, trochanter.</p> <p>Stating classification, structure and functions of the following bones:</p> <p>Cranial bones</p> <p>Facial bones and paranasal sinuses</p> <p>Teeth structure and eruption process.</p> <p>Describing the ossification and gross anatomy of followings</p> <p>Clavicle, scapula, humerus, ulna, radius, carpals, metacarpals and phalanges.</p> <p>Femur, tibia, fibula, tarsals, metatarsals and phalanges.</p> <p>Describing the bones of axial skeleton</p> <p>Defining and classify joints</p> <p>Describing the process of movements of the following joints: shoulder, elbow, wrist, knee, foot, ankle, temporomandibular, intervertebral, and interphalangeal</p>	10	46	56

	following joints: shoulder, elbow, wrist, knee, foot, ankle, sacroiliac, temporomancibular, intervertebral, interphalangeal,				
3.	Identify naso-pharynx, pharynx, larynx, trachea, bronchi, bronchioles, alveoli and pleura. Identify thoracic cage and diaphragm Identify the outline of pleura and lungs with surface marking	Stating the functions of respiratory system State size, shape, relationship and functions of. naso-pharynx, pharynx, larynx, trachea, bronchi, bronchioles, alveoli and pleura. Describing the structure of thoracic cage and diaphragm Describing the process of respiration	5	20	25
4.	Identify kidney, ureter, urinary bladder and urethra Describe the surface marking of kidneys	Stating size, shape, relationship and functions of the organs associated with urinary system including kidney, ureter, urinary bladder and urethra Describing the process of formation of urine and its composition Describing mechanism of micturation	5	20	25
5.	Identify the different organs on the body surface Identify the different bones of radiological importance in human body Identify the different land marks of radiological importance in human body		5	20	25
		Total	30	126	156

Text books

1. Anatomy and Physiology for Nurses – Jean R W Ross
2. Anatomy and Physiology for Radiographers - ELBS
3. Surface & radiological Anatomy - A. Halim

Reference books

1. Radiographic Anatomy of Human Skeleton – Bryan G
2. Pocket Atlas of Cross-sectional Anatomy CT & MRI Volume I & II – Georgthema
Stattgart

Radiography Technique I

Total: 234 hours

Theory: 60 hours

Practical: 174 hours

Course description

This course provides knowledge and skills on routine radiographic techniques. This course deals on performing routine radiographic technique for upper limbs, lower limbs, thoracic cage, abdomen, spine, pelvis and skull. This course also deals with the registration process.

Course objectives

After successfully completing this course the student will be able to;

1. Understand the registration procedure for patients.
2. Perform routine radiographic techniques for upper limbs, lower limbs, thoracic cage, abdomen, spine, pelvis and skull,

SN	Task Statements	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	Prepare radiography request form and registry form	Listing the steps of registration of patients.	2	5	7
2.	Prepare monthly and annual record form Prepare invoice form Observe different forms used in radiology departments Observe the steps of registration of patients. Observe radiographs and reports (x-ray no., hospital number, patient's name, cross reference bill, with patient's name, etc). Fill up the request forms.	Stating the importance of a monthly and annual record, filing system and prepare the proforma invoices. Filing of radiographs and reports (x-ray no., hospital number, patient's name, cross reference bill, with patient's name, etc).	5	15	20
3.	State and use radiographic positioning terminologies in x-ray request form	Defining the radiographic positioning terminology.	2		2
4.	Practice some abbreviations and common medical terms.	Listing abbreviations and terms used in radiography practice	2		2
5.	Perform all routine radiographic examination of upper limb including fingers, thumb, hand, wrist, forearm, elbow, humerus, shoulder, scapula and clavicle.	Describing the process of all routine radiographic examination of upper limb including fingers, thumb, hand, wrist, forearm, elbow, humerus, shoulder, scapula and clavicle.	6	20	26
6.	Observe and assist to perform the examination of head of humerus & axial shoulder, acromio-clavicular joints, sterno-clavicular joints and foreign body in the hand	Describing the examination of head of humerus & axial shoulder, acromio-clavicular joints, sterno-clavicular joints and foreign body in the hand	3	12	15
7.	Perform all routine radiographic	Describing the all routine			

SN	Task Statements	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
	examination of the lower limb including toes, foot, calcaneum, ankle, tibia, fibula, knee, femur, hip joint, neck of femur and pelvis.	radiographic examination of the lower limb including toes, foot, calcaneum, ankle, tibia, fibula, knee, femur, hip joint, neck of femur and pelvis.	6	20	26
8.	Observe and assist the examination of foreign body in the foot, weight bearing, skyline view of patella and tibial tuberosity	Describing the examination of foreign body in the foot, lateral foot, weight bearing, skyline view of patella and tibial tuberosity	5	12	17
9.	Perform all routine radiographic examinations of the thoracic cage including chest, heart, ribs and sternum.	Describing technique of all routine radiographic examinations of the thoracic cage including chest, heart, ribs and sternum.	5	15	20
10.	Perform the supine & erect abdomen x-ray	Describing the technique of plain & erect abdomen x-ray Indications of abdominal x-ray	2	5	7
11.	Observe and assist the supplementary views of the chest and abdomen including apical views, lordotic view & decubitus view, oblique views for heart size	Explaining the supplementary views of the chest and abdomen including apical views, lordotic view & decubitus view, oblique views for heart size	3	10	13
12.	Observe and assist lateral view with barium swallow, thoracic inlet, diaphragm excursion, inhaled or swallowed foreign body and imperforated anus.	Explaining the lateral view with barium swallow, thoracic inlet, diaphragm excursion, inhaled or swallowed foreign body and imperforated anus. State the purposes of these views	4	10	14
13.	Perform all routine radiography of	Describing all routine	3	10	13

SN	Task Statements	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
	the spines (cervical, thoracic, lumbar, sacrum and coccyx, sacro-illac joint).	radiography of the spines (cervical, thoracic, lumbar, sacrum and coccyx, sacro-illac joint).			
14.	Observe and assist the supplementary views for neck, odontoid peg (open-mouth), vertebral foramina of cervical spine, upper thoracic spine, oblique lumbar spine, lumbo-sacral junction, oblique sacro-iliac joints, ilium, acetabulum, pelvimetry, and skeletal survey.	Explaining the supplementary views for neck, odontoid peg (open-mouth), vertebral foramina of cervical spine, upper thoracic spine, oblique lumbar spine, lumbo-sacral junction, oblique sacro-iliac joints, ilium, acetabulum, pelvimetry and skeletal survey.	6	20	26
15.	Perform routine examination of the bones of skull including cranium, face and mandible	Defining radiographic anatomical landmarks of the skull. Explaining the process of routine examination of the bones of skull including cranium, face and mandible	3	10	13
16.	Perform the supplementary views for the skull including town's view, temporo-mandibular joint and paranasal sinuses	Explaining the supplementary views for the skull including town's view, temporo-mandibular joint, and paranasal sinuses	3	10	13
	Total		60	174	234

Reference books

3. Clark's Positioning in Radiography -R. A. Swallow E. Naybr
4. Merrill's Atlas of Radiographic Positioning and Diagnostic Procedure, Volume I & II – Philip W Ballinger
5. Manual of Radiographic Technique - T. Holm. PES. Palmer,
6. Text book of Radiology technicians - Satish K. Bhargava
7. Merrill's Atlas of Radiographic Positioning and Diagnostic Procedure, Volume I & II – Philip W Ballinge
8. Manual of Radiographic Technique - T. Holm. PES. Palmer,

Radiography Technique II

Total: 78 hours

Theory: 15 hours

Practical: 63 hours

Course description

This course provides knowledge on specialized radiographic techniques. This course deals on radiographic investigation on gastro-intestinal tract using contrast media, urinary tract and hystero-salpinogram. This course deals with vascular and neurological examination and special examinations as well. Additionally, this course also describes about portable and mobile X-rays for radiographic examinations.

Course objectives

After successfully completing this course the student will be able to;

1. Assist special radiographic techniques with the use of contrast media for examination of the alimentary, biliary, genito-urinary, vascular and neurological system, and
2. Handle portable and mobile X-rays.

S. No.	Task Statements	Related Technical Knowledge	Times (hrs)		
			T	P	Tot.
1.	Identify the types of contrast media. Observe and perform methods of introducing the contrast media.	Defining the contrast media. List types of contrast media. Describe methods of introducing the contrast media.	2	5	7
2.	Make a chart to manage reactions of contrast media. Observe and make a list of the emergency equipments and drugs needed to cope with reactions Practice Cardiopulmonary resuscitation	Listing reactions of contrast media. Identify name of the emergency equipments and drugs needed to cope with reactions Explain cardiopulmonary resuscitation	2	6	8
3.	Observe the following procedures. Barium Swallow. Barium Meal. Barium Follow through. Gastrographic examination of GI tract. Ba-enema. Small bowel enema. Loopogram.	Describing indications, contraindications, preparation, technique and after care of the patient on the following procedures. Barium Swallow. Barium Meal. Barium Follow through. Gastrographic examination of GI tract. Ba-enema. Loopogram. State the role of a radiographer during fluoroscopy.	4	15	19
4.	Perform preparation, technique and instructions to be given in case of Intravenous Urogram (IVU) examination	Describing indications, contraindication, preparation, technique and instructions to be given to the patient for Intravenous Urogram (IVU).	2	10	12
5.	Observe preparation, technique and instructions to be given on Hystero salpinogram (HSG) examination	Describe indications, contraindication, preparation, technique and instructions to be given for a patient undergoing Hystero salpinogram (HSG)	2	7	9
6.	Observe the technique of using ward	Listing the uses of mobile or portable x-	1	10	11

S. No.	Task Statements	Related Technical Knowledge	Times (hrs)		
			T	P	Tot.
	radiography. Perform the technique of using portable/mobile unit in the hospital ward	ray machine. Describe the technique of using ward radiography.			
7.	Observe the following procedures: Endoscopic retrograde cholangio pancreatography (ERCP). T-tube cholangiography.	Describing indications, contraindication, preparation, technique and instructions to be given on the following procedures: Endoscopic retrograde cholangio pancreatography (ERCP). T-tube cholangiography	1	5	6
8.	Observe the following procedures: Myelogram Mammogram Soft tissue radiography	Describing indications, contraindication, preparation, technique and instructions to be given on the following procedures: Myelogram Mammogram Soft tissue radiography	1	5	6
		Total	15	63	78

Reference books

1. Clark's Positioning in Radiography -R. A. Swallow E. Naybr
2. Merrill's Atlas of Radiographic Positioning and Diagnostic Procedure, Volume I & II – Philip W Ballinge
3. Manual of Radiographic Technique - T. Holm. PES. Palmer,
4. Text book of Radiology technicians - Satish K. Bhargava

Radiographic Photography

Total: 156 hours

Theory: 30 hours

Practical: 126 hours

Course description

This course provides knowledge and skills on photographic process involved in producing a radiograph. This course deals with photographic film processing, and cassette and intensifying screens. This course also deals with storage of radiographic materials as well as dark room management for preparing radiographic images.

Course objectives

After successfully completing this course the student will be able to;

1. Handle photographic process involved in producing a radiograph.
2. Manage all the practical aspects of darkroom work in radiography using manual and automatic processing and to care for the darkroom equipment.
3. Recognize the more common photographic faults and be able to correct them.
4. Understands basic darkroom design and materials used to protect the darkroom from ionizing radiation.

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	Observe different types and sizes of x-ray film	Defining x-ray film Stating characteristics of x-ray film. Explaining construction of x-ray film. Listing types of x-ray film.	2	6	8
2.	Identify film speed, contrast and density. Construct a characteristic curve.	Defining spectral sensitivity. Stating film speed, contrast and density. Defining sensitometry. Defining characteristic curve. Identify production of the radiographic image.	3	8	11
3.	Perform manual film processing (including all the processing cycle)	Describing the process of manual film processing (processing cycle) including Development Rinsing Fixation Washing Process Drying Process Tanks and containers for processing chemicals, processing units. Mixing Chemicals. Storage of chemicals. Film hanging. Stating the advantages and disadvantages of manual film processing	6	30	36
4.	Observe and perform functioning of automatic processor	Stating basic principle & functioning of automatic film processor State the advantages and disadvantages of automatic processing	2	10	12
5.	Observe the design of cassettes. Identify different types of cassette. Perform cleaning of cassettes,	Describing functions and design of cassettes. Listing types of cassette. Listing the process of cleaning of	2	10	12

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
		cassettes			
6.	Make a chart showing situation and lay out of dark room. Observe darkroom	Describing the situation lay out of dark room. Stating the location, size and importance of the dark room.	2	10	12
7.	Perform darkroom activities	Describing the followings Construction of walls, floor & ceilings. Radiation protection. Ventilation. Light tight entrances. Illumination. Safe lights. Cassette hatches. Loading bench. Dark room routine. Replacement of developer and fixer. Silver recovery	4	12	16
8.	Observe the sharpness of image, radiographic contrast, exposure factors and resolution	Identifying the components of the radiography image including sharpness of image, radiographic contrast, exposure factors and resolution	3	8	11
9.	Identify the radiograph and present such radiograph for reporting with supporting documents	Describing the methods of identifying the radiograph. Identify technique for presenting the radiograph for reporting with documents	3	10	13
10.	Maintain the viewing equipment and its condition	Identifying viewing equipment and its condition	1	8	9
11.	Prepare the forms required for ordering and storage of x-ray films	Describing ordering and storage of x-ray films	1	8	9
12.	Observe and perform proper method for storage of chemical	Explaining the proper method for storage of chemical and film filing	1	6	7

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
	and film filing system	system.			
		Total	30	126	156

Text books

1. Radiological & Imaging secrets - L.C. Gupta, and Abhitabh
2. Radiography Imaging - DN and MO Chesney
3. Manual of dark-room technique - P. E. S. Palmer

Reference books

1. Radiographic and dark-room procedures - L.C. Gupta, and Abhitabh

Radiographic Equipment

Total: 156 hours

Theory: 30 hours

Practical: 126 hours

Course description

This course is designed to provide knowledge and skills on x-ray equipment and accessories used for general and special radiography. This course deals on historical background of x-rays and its production, control panel, x-ray tables and tube column. This course also deals on handling of fluoroscopic equipment, portable and mobile x-ray unit, photo-fluorographic equipment and Rapid serial radiographic equipment. Additionally this course focuses on control of scattered radiation.

Course objectives

After successfully completing this course the student will be able to;

1. Describe historical background of x-rays and its production,
2. Handle and Care various radiographic equipments,
3. Control scattered radiation, and
4. Familiarize with recent advances in imaging technology.

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	Observe x-ray tubes including high speed rotating anode. Do care of x-ray tube.	Describing X-ray tubes and its development. Differentiating between stationary and rotating anode x-ray tube including basic designs, line focus principle and tube shielding. Stating recent advances in x-ray tube design including high speed rotating anode and choice of target angle. Describing the process of tube rating, cooling and care of x-ray tube and its faults.	6	10	16
2.	Observe the exposure control Observe different x-ray tables. Observe x-ray tube support (ceiling & floor type).	Stating the process of exposure control Differentiating x-ray table and its type. Defining x-ray tube support (ceiling & floor type).	4	16	20
3.	Observe fluorescent screen. Observe fluoroscopic image. Observe fluoroscopic table with image intensification and TV monitoring Observe radiation protection measures taken.	Describing components and functioning mechanism of: Fluorescent screen. Fluoroscopic image. Fluoroscopic table with image intensification and TV monitoring Radiation protection. in fluoroscopy	4	25	29

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
4.	Observe beam limiting devices, beam centering devices Perform beam centering Observe grid movement and secondary radiation grid	Describing components and functioning mechanism of: Significance of scattering of x-ray Beam limiting devices Beam centering devices Secondary radiation grid Grid movement	4	15	19
5.	Observe: Portable x-ray equipment Dental x-ray unit Dental x-ray unit Mammogram C-arm and their uses	Describing components, functioning mechanism of: Portable x-ray equipment Dental x-ray unit Mammogram C-arm	4	25	29
6.	Observe various angiography equipments and angiograms	Describing various machines and accessories used for angiographic examinations including conventional and modern angiography equipment 3-D reconstruction in angiographic images	4	15	19
7.	Observe the functioning and images of Ultrasound, CT Scan, MRI, DSA and isotope scanning	Discussing the introduction, principle and uses of Ultrasound, CT Scan, MRI, DSA and isotope scanning	4	20	24
		Total	30	126	156

Text books

1. Chesneys' equipment for student radiographers -Peter

Reference books

1. Physic and Equipment in imagine modalities- Stephanie Mass

Radiation Physics

Total: 78 hours

Theory: 15 hours

Practical: 63 hours

Course description

This course is designed to provide specific knowledge and skills on x-ray production and protection. This course deals with electricity static & current/ x-ray tubes & valves x-ray, interaction of x-ray, x-ray measurement, X-ray protection.

Course objectives

After successfully completing this course the student will be able to;

1. Describe and handle x-ray equipments, and
2. Observe precautions against radiation and electrical hazards.

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	Be familiar with wave and wavelength, energy transmission Observe reflection, refraction, interference and diffraction.	Defining transverse, longitudinal, progressive and stationary waves with examples. Defining amplitude, wavelength, frequency, period and velocity of the wave. Describing how a wave carries only energy from one point to another and no material particle is transmitted in the wave motion. Showing that a wave undergoes reflection, refraction, interference and diffraction phenomenon	2	8	10
2.	Be familiar with audible and ultrasonic sound. Enlist medical use (Diagnostic and Therapeutic) of ultrasonic waves.	Differentiating between noise and music Defining the term sonic (audible), infrasonic, ultra sonic and super sound. Defining intensity level, bel and decibel. Explain the threshold of hearing and threshold of pain. Explaining ultrasonic waves and its medical uses.	2	8	10
3.	Identify conductor, insulator and semiconductor. Demonstrate conduction and induction.	Explaining the properties of electrical charges. Distinguishing between conductor, insulator and semiconductor. Explaining the phenomenon of charging by friction, conduction and induction.	1	4	5
4.	Observe conduction and resistance of a conductor. Observe the function of	Discussing the current as the rate of flow of charge. Stating and verify Ohm's law. Defining resistance and resistivity.	2	10	12

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
	galvanometer, Voltmeter and Ammeter.	<p>Listing the factors that influence resistance of a conductor.</p> <p>Distinguishing between ohmic and non-ohmic conductors.</p> <p>Finding the equivalent resistance from the series and parallel combination of resistors.</p> <p>Observing the performance of the conversion of galvanometer into voltmeter and ammeter.</p>			
5.	Observe different types of transformer and their function.	<p>Describing alternating current (AC) and its interpretation.</p> <p>Explaining the working of a transformer and its losses. Describe step up and step down transformers.</p> <p>Defining stabilized voltage.</p>	1	5	6
6.	Be familiar with nature, production and property of cathode rays.	<p>Explaining the particle nature of electricity.</p> <p>Discussing the nature, production and properties of cathode rays.</p>	1	4	5
7.	<p>Construct spectrum of an electromagnetic radiation.</p> <p>Observe the process of measuring radiation absorbed dose.</p> <p>Observe ultrasound and its components including accessories.</p>	<p>Drawing the well labeled diagram of modern x-ray tube.</p> <p>Explaining the production mechanism of x-rays.</p> <p>Discussing the properties of x-rays.</p> <p>Explain the factors influencing quality and intensity of an x-ray</p> <p>Describing the sequence of events were radiation in absorbed by a biological medium.</p> <p>Defining attenuation, absorption & scattering of the radiation.</p> <p>Explaining the transmission of a beam</p>	2	8	10

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
		<p>through body tissues in diagnostic radiology.</p> <p>Explaining basis of x-ray & x-ray measurements</p> <p>Defining radiation absorbed dose.</p>			
8.	<p>Make a chart of maximum permissible dose.</p> <p>Tabulate the recommended maximum permissible doses for the different parts of the body.</p> <p>Prepare a chart listing of code of conduct in radiography practice.</p> <p>Observe the protective materials and lead impregnated substances & building material for ionizing radiation.</p> <p>Observe personnel monitoring & monitoring instruments including film badge, ionisation chamber & thermo-luminescent dosimeter.</p> <p>Prepare a chart listing limit of the exposure of the patients to ionizing radiation.</p>	<p>Explaining the difference between natural and artificial radioactivity.</p> <p>Listing the main properties of α, β and γ radiation.</p> <p>Explaining why α, β and γ forms of radiation have energy on the order of mega electron voltage.</p> <p>Writing down the formula that shows that the relationship n between half-life and decay are constant.</p>	2	8	10
9.	<p>Follow protection measures against the radiation.</p> <p>Tabulate the recommended maximum permissible doses for the different parts of the body.</p> <p>Apply code of conduct in radiography practice.</p>	<p>Explaining historical introduction or why the protection is necessary against the radiation.</p> <p>Defining maximum permissible dose.</p> <p>Tabulating the recommended maximum permissible doses for the different parts of the body.</p>	2	8	10

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
	Identify the protective materials and lead impregnated substances & building materials for ionizing radiation. Perform instruments monitoring including film badge, ionisation chamber & thermo-luminescent dosimeter. Apply basic techniques for diagnostic uses of x-rays to limit the exposure of the patients to minimum value & also to protect other persons from ionizing radiation.	Describing the Code of conduct in radiography practice. Identifying the protective materials and lead impregnated substances & building material for ionizing radiation. Defining lead equivalent & explain its variation with quality. Describing the necessity of personnel monitoring & monitoring instruments including film badge, ionisation chamber & thermo-luminescent dosimeter. Describing basic techniques for diagnostic uses of x-rays to limit the exposure of the patients to minimum value & also to protect other persons from ionizing radiation.			
		Total	15	63	78

Text books

1. First Year Physics for Radiographer – George A Hay

Reference books

1. X-ray Physics and Equipments - Ashworth
2. Physics of Radiology – Johns Charles
3. Physic and Equipment in imagine modalities- Stephanie Mass

Health Management and Health Care System

Total: 78 hours

Theory: 15 hours

Practical: 63 hours

Course description

This course is designed to help students to acquaint knowledge and skills on health and health cares system of Nepal in broader perspectives. This course also focuses on to the principles of radiography management, leadership skills, personnel management, quality control and health care delivery system.

Course objectives

After the completion of the course, the student will be able to:

1. Familiarize with health care delivery system in Nepal,
2. Manage radiology department,
3. Comprehend health care data system,
4. Supervise quality control, and
5. Orient with ethical aspects and professional standard.

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	Observation of health care delivery system in Nepal at different level health institutions.	Health care delivery system in Nepal. Healthcare management models Patient care in radiology department	3	12	15
2.	Be familiar with professional ethics, responsibilities and Learn legal & ethical aspects and confidentiality	Professional responsibility and ethics. (Code of ethics of Nepal Health Professional Council) and Legal & Ethical Aspects and confidentiality of Healthcare	1	4	5
3.	Construct different charts and forms used in radiology department	Records & Record Keeping Coding & Classification Patient Records Hospital Information Systems	1	5	6
4.	Observe communication system in radiology practice	Principles of Computer Operations Operating Systems Application programs Communications & Networks Workstations Database Management Systems	1	4	5
5.	Use computers to archive useful materials	Computer Aided Learning Multimedia Internet Distance Learning & Teaching	1	4	5
6.	Be familiar with radiography design	Basic concept of radiological organization; Location, space requirement, light, ventilation, temperature control, electrical supply, water supply, sanitation, noise control, fume hood/safety hood, partition of the section, floor management, standard size of working benches, base cabinets, installation of fire	2	8	10

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
		extinguisher, accountability for future plan, rest room, selection of the furniture.			
7	Be familiar with flow of the people	Flow of the people in test /report area, flow of the people in material management area.	1	4	5
8	Be familiar with flow of the material in the radiology department	Films, cassettes, chemicals, reagents, contrast medias, etc.	1	4	5
9	Be familiar/practice the personnel management	Staff duty rotation, continue medical education/trainings, upgrading of the staff.	1	4	5
10	Learn about the Standard Operating Procedures (SOP)	Introduction and importance to follow standard operatic procedures (SOP) for every procedure.	1	4	5
11	Be familiar with/practice radiography safety	Introduction to prevention of: fire/ electrical / chemical / biological hazards, personal protective equipment, health and safety of the staff, equipment safety	2	10	12
		Total	15	63	78

Reference books:

1. Basic Principles of Management - Shrestha, B.M.. Akshyulak Publication, Nepal. 2039B.S.
2. Modern Management Methods and the Organization of Health Services, Public Health Papers #55. WHO. 1974.
3. Inventory Control and Basic Logistics Procedure Manual on Store Management for PHC/HP and SHP Personnel. HMG/JSI. 2054B.S.
2. Textbook of Preventive and Social Medicine - Park, K. Bhandrasidas Bhanot, Jabalpur, India. 2000.

First Aid and Communicable Diseases

Total: 78 hours

Theory: 30 hours

Practical: 48 hours

Description:

This course is designed to provide students with a basic concept of health and safe practice in the laboratory, first aid and communicable diseases. This course is developed for awareness of first aid and its techniques needed for primary treatment before going to the hospital for further management. Every day laboratory personnel work with acids, alkalis, electricity, sharp cuts etc. and there is always a chance of accidental events as well as infection with various disease causing agents.

Objectives:

At the end of this course, the students will be able to:

1. Explain health and safe practice in the laboratory.
2. Minimize health laboratory accidents.
3. Apply first aid and basic treatment during laboratory work.
4. Understand communicable and hospital borne diseases.

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
1.	Be familiar with health and related hazards	Definition of Health, infection, communicable diseases. Hazards: Risk assessment, Accidents, Health and safety.	2		2
2.	Identify common causes of accidents	Basic concept on hazards and associated accidents: unsafe laboratory practice, naked flame, microbial hazard, chemical hazard, glassware hazard, equipment hazard, explosions, infestation by ants, rodents, cockroaches and unreliable water supply.	2	3	5
3.	Identify general factors contributing to the occurrence of accidents	Basic concept on factors associated with accidents: Lack of training, attitude, work load, untidy work, rush and loss of concentration.	2	2	4
4.	Be familiar with code of safe laboratory practice and personal safety measures	Introduction, unsafe laboratory practice, associated accidents, safety measures, safe working environment and practice, personal health/ hygiene and practice. Use of safety signs and Biohazard symbols.	2		2
5.	Identify the microbial hazard and preventive measures	Basic concept on microbial hazard: Classification of infective microorganisms, risk groups, Safe working: safety cabinet, safe transport, safe pipetting and dispensing. Method of decontamination of infectious materials and disposal of laboratory waste	2	3	5
6.	Identify the chemical and reagent hazards	Basic concepts on flammable chemicals, toxic, harmful and irritating chemicals, oxidizing chemicals, corrosive chemicals, explosive chemicals, safe storage and use.	2	4	6
7.	Identify the glassware and equipment hazard and fire safety.	Basic concepts on equipment related accidents and prevention of accidents, safe handling of glassware and safe management after breakage.	2	4	6

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
		Fire management, fire fighting equipment, guidelines to reduce the risk of fire and preventive measures.			
8.	Define first aid	Introduction: definition, aims, steps and treatment of first aid, factors influencing the skill development.	1		1
9.	Manage the first aid and emergency treatment	Basic concepts on Emergency first aid procedure: Emergency management of cuts, bleeding, resuscitation, electric shock, heat burns, chemical burns, fainting and poisoning	2	4	6
10.	Provide first aid for bites / burns (heat and chemical)/injuries (needle stick) cuts and wounds/ fracture/ frost bite and electric shock	Introduction, definition, types of bites (insects, snake, dog) and first aid treatment to victim Injuries: cut and wound care, dressing and its types, procedures and special techniques of dressing. Definition, aim, types, application types of bandage.	2	6	8
11.	Provide first aid for epistaxis/ hemorrhage/ choking/ drowning	Introduction, definition, first aid treatment of hemorrhage, epistaxis, choking, drowning, fainting.	1	4	5
12.	Provide first aid for poisoning	Definition, sign and symptoms and first aid for poisoning (chemical and gases).	1	4	5
13.	Provide first aid by cardio pulmonary resuscitation	Definition, purpose, and procedure of cardio pulmonary resuscitation	1	4	5
14.	Be familiar with community health	Introduction to epidemiology and its concept, terms used in epidemiology	1		1
15.	Be familiar with communicable diseases	Definition, types, carrier and concept of diseases.	1	2	3
16.	Interpret agents as disease causing factors.	Host and environment factors, differences between communicable and non	1	2	3

S. No	Task Statement	Related Technical Knowledge	Time (Hrs)		
			T	P	Tot
		communicable diseases, community and hospital acquired microbial infections.			
17.	Specify communicable diseases of respiratory system	Introduction to viral, bacterial, protozoal and helminthes infection: signs and symptoms of infection and prevention.	1	2	3
18.	Be familiar with communicable diseases of digestive system	Introduction to Viral, bacterial, protozoal and helminthes infection: signs and symptoms of infection and prevention.	1		1
19.	Be familiar with communicable diseases of other body systems.	General introduction to rabies, tetanus, leprosy, sexually transmitted infections (STIs), typhoid fever: sign and symptoms of infections and their prevention.	1		1
20.	Measure blood pressure and body temperature	General introduction to blood pressure: principle, procedure, normal values of systolic and, diastolic pressure and its variations. Body temperature: principle, procedure, temperature at different parts of body, physiological and pathological variations, application in health laboratory services.	2	4	6
		Total	30	48	78

Recommended Text Books

1. First Aid - St. John Ambulance
2. First Aid -ICRC

Reference Books:

1. Annual Report - Department of Health Services, Ministry of Health
2. WHO Publications (related issues) - WHO, Geneva
3. First Aid and Emergency Nursing - N. N. Yalayyaswamy
4. Emergency first AID safety oriented - Harvinder popli, Nirmal

Comprehensive Radiography Practice (In Clinical Radiology Setting)

Course description

This field experience program is designed to help students to apply the comprehensive knowledge and skills on actual situation. The program is offered at the end of in house training but before placing for On-the-Job Training.

Course objectives

At the end of the course, the students will be able to:

1. Acquire knowledge about radiological procedures from health institutions/hospitals,
2. Perform all routine and some special radiological procedures independently and accurately,
3. Build confidence in radiographic procedures.

Duration: 390 hours

Placement schedule

The whole class of students will be divided into five groups and placed for the following sections of clinical radiology.

S. No.	Subject Area/Sections	Duration
1	Receiving patients, filling up of the forms, distribution of reports, and organization of clinical radiology	50 hours
2.	Routine radiography (Technique 1)	170 hours
3.	Special radiography (Technique 2)	40 hours
4.	Emergency radiography	30 hours
5.	Darkroom	100 hours
Total		390 hours

Students should be present in the departments at least 90% of the allotted days to be eligible to sit in the final examination. Students will have to perform all tests under the supervision of departmental staffs and may be allowed to perform tests independently if the supervisor finds them perfect.

Students should keep their practical records (logbook) signed periodically by their supervisor/instructor at the end of the posting in each subject.

Evaluation Scheme

Under this scheme students will have to perform a prescribed number of tests in each department. At the end of the term the teacher or supervisor closely evaluates their performance for accuracy and precision according to the evaluation sheet proposed. At the end of the course there will be a final practical examination.

Paper I: Routine radiography and management of radiology department

Paper II: Special radiography and darkroom work

Distribution of marks for evaluation

Section	Evaluator/Paper	Distribution of marks			Total Marks
		Internal	Final	Time	
1	Related radiography supervisor/Radiologist/Radiology Technologist/Radiographer (continuous evaluation) Paper I Paper II	50 50			100
2	Related institute/school supervisor/teacher (continuous evaluation) Paper I Paper II	40 35			75
3	CTEVT appointed examiner (at the end of the field practice) Paper I Paper II		40 35	3 hrs 3 hrs	75
	Total				250

Important note: Each student must pass in each of the section of the evaluation as presented above with a minimum of 60% marks.

Suggested Reading Materials

9. Clark's Positioning in Radiography -R. A. Swallow E. Naybr
10. Merrill's Atlas of Radiographic Positioning and Diagnostic Procedure, Volume I & II – Philip W Ballinger
11. Manual of Radiographic Technique - T. Holm. PES. Palmer,
12. Text book of Radiology technicians - Satish K. Bhargava
13. Merrill's Atlas of Radiographic Positioning and Diagnostic Procedure, Volume I & II – Philip W Ballinge
14. Manual of Radiographic Technique - T. Holm. PES. Palmer,
15. Text book of Radiology technicians - Satish K. Bhargava
16. Radiographic and dark-room procedures - L.C. Gupta, and Abhitabh
17. X-ray equipment for student- D. N Chesney & M.O. Chesney
18. Chesneys' equipment for student radiographers -Peter
19. Physic and Equipment in imagine modalities-Stephanie Mass
20. Physics of Radiology – Johns Charles
21. Physic and Equipment in imagine modalities-Stephanie Mass
22. First Year Physics for Radiographer – George A Hay
23. X-ray Physics and Equipments - Ashworth
24. Anatomy and Physiology for Nurses – Jean R W Ross
25. Anatomy and Physiology for Radiographers - ELBS
26. Surface & radiological Anatomy - A. Halim
27. Radiographic Anatomy of Human Skeleton – Bryan G
28. Pocket Atlas of Cross-sectional Anatomy CT & MRI Volume I & II – Georgthema Stattagart
29. First Aid - St. John Ambulance
30. First Aid - ICRC
31. Park's Textbook of Preventive and Social Medicine - K Park
32. Annual Report - Department of Health Services, Ministry of Health
33. WHO Publications (related issues) - WHO, Geneva
34. Primary Child Care- M King
35. First Aid and Emergency Nursing - N N.Yalayyaswamy
36. Park's Textbook of Preventive Social Medicine.

Text Books:

Technique – I

37. Clark's Positioning in Radiography -R. A. Swallow E. Naybr
38. Merrill's Atlas of Radiographic Positioning and Diagnostic Procedure, Volume I & II – Philip W Ballinger
39. Manual of Radiographic Technique - T. Holm. PES. Palmer,
40. Text book of Radiology technicians - Satish K. Bhargava
41. Merrill's Atlas of Radiographic Positioning and Diagnostic Procedure, Volume I & II – Philip W Ballinge
42. Manual of Radiographic Technique - T. Holm. PES. Palmer,
43. Text book of Radiology technicians - Satish K. Bhargava

Technique – II

Experts Involved in Curriculum Revision

CTEVT would like to extend its heartfelt thanks to the following experts who contributed in the process of revising the curriculum on Radiography.

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