

**CURRICULUM**  
**Proficiency Certificate Level**  
**Diagnostic Radiography**

**(Three-year program-yearly system)**



Council for Technical Education and Vocational Training  
**Curriculum Development and Equivalence Division**  
**Sanothimi, Bhaktapur**

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**Council for Technical Education and Vocational Education (CTEVT)**  
**Sanothimi, Bhaktapur**

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**Introduction:**

The Government of Nepal has called for the provision of basic health service to all by establishing a network of health services in all over Nepal. In this regard, the Council for Technical Education and Vocational Training (CTEVT) has been contributing towards the development of different level of health personnel. In the field of Radiography and imaging, CTEVT has been running a program to produce middle level radiography and imaging service providers. The Certificate in Diagnostic Radiography graduates will be able to perform routine works related to technology in different level of hospitals, health institutions and imaging centres.

This program is of three academic years' duration. The first-year course focuses on basic science and foundational subjects, the second-year course focuses on basic radiography and imaging related subjects and the third year is given to the application of learned skills and knowledge within the comprehensive practical settings in hospitals, health institutions and imaging centre recognized by the ministry of health and population or concerned authority.

The foundational subjects like English, Nepali, Physics, Chemistry and Mathematics are applicable for middle level health professional. The disciplinary subjects related to radiography field are included in second and third year. Along with the core radiography practice, the graduates will be capable of providing first aid, basic maternity care and basic public health care. This curricular program also makes the provision of practical exposure as well as real work practices in the specific areas of radiography and imaging technology. The curriculum structure and the subject-wise content reflect the details of this curriculum. In brief, this curriculum will guide to its implementers to produce competent and highly employable middle level technical workforces in the field of radiography and imaging technology.

**Rationale of Revision:**

Certificate in Diagnostic Radiography curriculum was developed in 2004. This is the third revision after the implementation of its second revision. The rationales behind its revision are as follows:

It crossed the 5 years maturity period of its implementation after the second revision and similarly the implementing agencies/college have requested to revise this curriculum based on their teaching experiences and development of new technologies and machineries.

The year-wise re-adjustments of the existing subjects are felt necessary.

Some new subjects seem to be introduce as per the advancement in technology. It is needed to revisit its contents, weightage in both theory and practical marks and contents to make it more practical oriented.

Furthermore, technology of Mechatronics occupation upgraded rapidly and new technology are introducing in the recent year. With the advent in technology trained technicians are needed throughout the world. To cope with the national and international demand, the knowledge and the skills should be updated to make the skills relevant and pertinent to the industry. Hence this curriculum is revised to equip the students as per the changing technology in changing environmental context.

**Curriculum Title:**

Certificate in Diagnostic Radiography.

**Aim:**

This program aims to produce middle level technical personnel with sound academic knowledge equipped with perfect technical skills that can be faced in real life situation.

**Objectives:**

This curriculum has following objectives:

- Prepare mid-level competent workforce in the related field.
- Perform all routine radiography/and assist in special X-Ray examination.
- Maintain photographic and X-Ray equipment in good working order.
- Possess knowledge on recent advances in imaging technology.
- Protect the patients and staff from possible radiation hazards.
- Maintain records of X-Ray examinations, filing of radiographs & ordering of necessary radiographic supplies.
- Provide care of the patients in the X-Ray department.
- Prepare radiography set up as per required for routine and special investigations.
- Practice quality control system in radiology department to deliver quality reports.
- Familiarize middle level radiography management works, supervision of subordinates and preparation of reports.
- Provide basic first aid Treatment.
- Prepare such technicians who are able to work in the Radiography sector related local hospital and health post settings of the country.

**Group Size:**

The group size is maximum 30 (Thirty) students in a batch.

**Entry Criteria:**

- SLC Pass with second division or SEE with GPA 2.0 having Compulsory Mathematics, English & Science or as per the provisions mentioned in the admission guidelines of Office of the Controller of Examinations, CTEVT.
- Pass entrance examination as administered by Office of the Controller of Examinations, CTEVT.

**Duration:**

The total duration of this curricular program is three academic years. The program is based on yearly system. Moreover, one academic year consists of 35 academic weeks and one academic week consists up to 40 hours excluding evaluation period.

**Medium of Instruction:**

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

**Pattern of Attendance:**

Minimum of 90% attendance in each subject is required to appear in the respective final examination.

**Teacher (Instructor) and Student Ratio:**

The ratio between teachers and students must be:

- Overall ratio of teacher and student must be 1:10 (at the institution level)
- 1:30 for theory and tutorial class.

- 1:10 for practical class.
- 75 % of the technical teachers should be full timer.

#### **Qualification of Instructional Staff:**

- The disciplinary subject related Instructor and Demonstrators should be bachelor's degree in the related area or as per minimum requirement of NHPC and CTEVT.
- The demonstrators should be a bachelor's degree holder or diploma or equivalent with 3 years work experience in the related subject area.
- The foundational subject related Instructor should be master degree holder in the related area.

#### **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, performance checklists, textbooks etc.
- **Non-project media materials:** Displays, models, photographs, flipchart, poster, writing board etc.
- **Projected media materials:** Slides, Multimedia Projector.
- **Audio-visual materials:** Audiotapes, films, slide-tapes, videodisc, etc.
- **Computer based instructional materials:** Computer based training, interactive video etc.
- **Web-Based Instructional Materials** (Online learning)
- **Radio/Television/Telephone**
- **Education-focused social media platform.**

#### **Teaching Learning Methodologies:**

The methods of teachings for this curricular program will be a combination of several approaches such as illustrated lecture, tutorial, group discussion, demonstration, simulation, guided practice, practical experiences, fieldwork, report writing, term paper presentation, community campaign, case analysis, role-playing, heuristic and other independent learning.

- **Theory:** Lecture, discussion, presentations, seminar, interaction, assignment, group work.
- **Practical:** Demonstration, observation, guided practice, self-practice and clinical practice etc.

#### **Approach of Learning**

There will be inductive, deductive and learner-centered approaches of learning.

#### **Examination and Marking Scheme**

##### **a. Internal assessment**

- There will be a transparent/fair evaluation system for each subject both in theory and practical exposure.
- Each subject will have internal assessment at regular intervals and students will get the feedback about it.
- Weightage of theory and practical marks are mentioned in course structure.

- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.

**b. Final examination**

- Weightage of theory and practical marks are mentioned in course structure.
- Students must pass in all subjects both in theory and practical for certification. If a student becomes unable to succeed in any subject, s/he will appear in the re-examination administered by CTEVT.
- Students will be allowed to appear in the final examination only after completing the internal assessment requirements.

**c. Requirement for final practical examination**

- Professional of relevant subject instructor must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 24 students.
- Practical examination should be administered in actual situation on relevant subject with the provision of at least one internal evaluator from the concerned or affiliating institute led by external evaluator nominated by CTEVT. Question for practical exam is managed by ECD, CTEVT.
- Provision of re-examination will be as per CTEVT policy.

**d. Final practicum evaluation will be based on**

- Institutional practicum attendance - 10%
- Logbook/Practicum book maintenance - 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement) - 40%
- Viva voce:
  - Internal examiner - 20%
  - External examiner - 20%

**e. Pass marks**

- The students must secure minimum 40% marks in theory and 40% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

**Provision of Back Paper:**

There will be the provision of back paper but a student must pass all the subjects of all year within six years from the enrolment date; however, there should be provision of chance exam for final year students as per CTEVT rules.

**Disciplinary and Ethical Requirements**

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by the review of the disciplinary review committee of the institute.
- Dishonesty in academic or practical activities will result in immediate suspension followed by administrative review, with possible expulsion.
- Illicit drug use, bearing arms in institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by administrative review with possible expulsion.

## **Grading System**

The grading system will be as follows:

<u>Grading</u>	<u>Overall marks</u>
• Distinction:	80% and above
• First division:	65% to below 80%
• Second division:	50 % to below 65%
• Pass division:	Pass marks to Below 50%

### **Certification Awarded:**

- Students who have passed all the components of all subjects of all 3 years are considered to have successfully completed the course.
- Students who have successfully completed the course will be awarded with a degree of "**Certificate in Diagnostic Radiography**".

### **Career Path:**

The graduates will be eligible for the position equivalent to Non-gazette 1<sup>st</sup> class / Level 5 (technical) or as prescribed by the Public Service Commission of Nepal and other related agencies. The graduate will be eligible for registration with the related Council in the grade as provisioned in the related Council Act (if any).

### **General Attitudes Required**

A student should demonstrate following general attitudes for effective and active learning.

Acceptance, Affectionate, Ambitious, Aspiring, Candid, Caring, Change, Cheerful, Considerate, Cooperative, Courageous, Decisive, Determined, Devoted, Embraces, Endurance, Enthusiastic, Expansive, Faith, Flexible, Gloomy, Motivated, Perseverance, Thoughtful, Forgiving, Freedom, Friendly, Focused, Frugal, Generous, Goodwill, Grateful, Hardworking, Honest, Humble, Interested, Involved, Not jealous, Kind, Mature, Open minded, Tolerant, Optimistic, Positive, Practical, Punctual, Realistic, Reliable, Distant, Responsibility, Responsive, Responsible, Self-confident, Self-directed, Self-disciplined, Self-esteem, Self-giving, Self-reliant, Selfless, Sensitive, Serious, Sincere, Social independence, Sympathetic, Accepts others points of view, Thoughtful towards others, Trusting, Unpretentiousness, Unselfish, Willingness and Work-oriented.

## Question Patterns for Final Written Exam

The question patterns for the written exam are suggested as follows.

### For subject with full marks 80

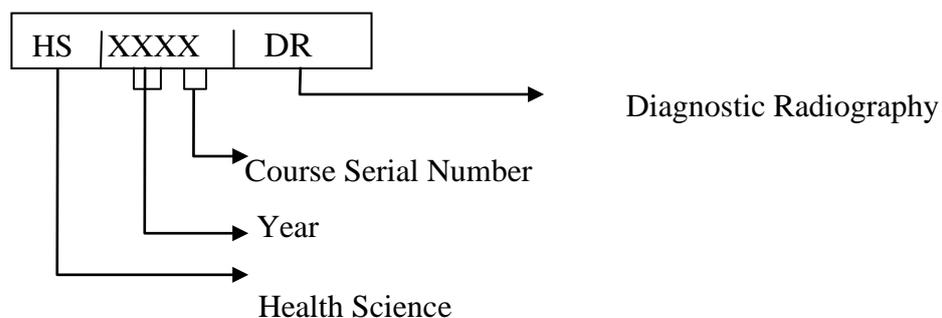
S.N.	Type of question	No of Question	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	2	10	20	60 min	1
2	Short	4	5	20	60 min	2
3	Very short	10	2	20	40 min	2
4	Multiple	20	1	20	20 min	
	Total	23		80	180min	

### For subject with full marks 40

S.N.	Type of question	No of Question	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	1	10	10	30 min	1
2	Short	2	5	10	30 min	1
3	Very short	5	2	10	20 min	1
4	Multiple	10	1	10	10 min	
	Total	18		40	120 min	

### Subjects Codes:

Each subject is coded with a unique number preceded and followed by certain letters as mentioned in following chart:



**Proficiency Certificate Level (Diagnostic Radiography)**

**Curriculum Structure**

**Year: II**

Teaching Schedule			Mode						DISTRIBUTION OF MARKS						Total Marks	Remark
SN	Course Code	Course Title	L	T	P	Lab	Weekly Hours	Credit Hours	Theory			Practical				
									*Asst Marks	Final Marks	Time Hours	*Asst Marks	Final Marks	Time Hours		
1	HS- 0201- DR	Radiographic Technique	4		2	-	6	5	20	80	3	30	20	3	150	*Continuous assessment
2	HS- 0202- DR	Radiological Procedures	4		2	-	6	5	20	80	3	30	20	3	150	
3	HS- 0203- DR	Radiographic Imaging	4		2	-	6	5	20	80	3	30	20	3	150	
4	HS- 0204- DR	Radiographic Equipment	4		2	-	6	5	20	80	3	30	20	3	150	
5	HS- 0205- DR	Basic Radiation physics	4		2	-	6	5	20	80	3	30	20	3	150	
6	HS- 0206- DR	Radiological Anatomy	4		1	-	5	5	20	80	3	25	-	0	125	
7	HS- 0207- DR	First Aid and Patient Care	4		1	-	5	5	20	80	3	25	-	0	125	
		<b>Total</b>	<b>28</b>		<b>12</b>		<b>40</b>	<b>35</b>	<b>140</b>	<b>560</b>		<b>200</b>	<b>100</b>		<b>1000</b>	

## Curriculum Structure

**Year: III**

\*Details on the distribution of marks for Radiography Practical I & II evaluation are mentioned in the respective section of the curriculum.

Teaching Schedule			Mode						DISTRIBUTION OF MARKS						Total Marks	Remark
5 weeks																
SN	Course Code	Course Title	L	T	P	Lab	Weekly Hours	Credit Hours	Theory			Practical			Total Marks	Remark
									*Asst Marks	Final Marks	Time Hours	*Asst Marks	Final Marks	Time Hours		
1	HS- 0301- DR	Basic Radiographic Pathology	14	-	6	-	20	3	10	40	1.5	25	-	0	75	*Continuous assessment
2	HS- 0302- DR	Clinical Practice and Ethics	14	-	6	-	20	3	10	40	1.5	25	-	0	75	
30 weeks																
3	HS- 0303- DR	Radiography Practicle I	21 weeks							-	-	360	240	6	600	
4	HS- 0304- DR	Radiography Practical II	9 weeks							-	-	150	100	6	250	
		<b>Total</b>	<b>4</b>		<b>36</b>		<b>40</b>	<b>23</b>	<b>20</b>	<b>80</b>		<b>560</b>	<b>360</b>		<b>1000</b>	

### Master Plan for Second Year

R.T=Radiographic Technique R.P= Radiological Procedures R.I = Radiographic Imaging R.E = Radiographic Equipment B.R.P= Basic Radiation physics R.A = Radiological Anatomy FAP = First Aid and Patient Care

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Study Block												R.T and R.P.			Study Block				R.I and R.E						
27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	46	47	48	49	50	51	52	
Vacation								Study Block					B.R.P, R.A and FAP				Revision / Internal Exam				Final exam				

**Master plan for third year**

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>
Study Block					Radiography Practical I																				
<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>48</b>	<b>49</b>	<b>50</b>	<b>51</b>	<b>52</b>
Vacation								Radiography Practical II								Revision / Internal Exam						Final exam			

## **First Year**

**See Separate Curriculum for Health Science First Year All**

## **Second Year**

### **Subjects**

1. HS- 0201- DR -Radiographic Technique
2. HS- 0202- DR -Radiological Procedures
3. HS- 0203- DR -Radiographic Imaging
4. HS- 0204- DR -Radiographic Equipment
5. HS- 0205- DR -Radiation physics
6. HS- 0206- DR -Radiological Anatomy
7. HS- 0207- DR -First Aid and Patient Care

# HS0201DR-Radiographic Technique

**Total Hours: 6 Hrs./week**  
**Theory Hours: 4 Hrs./week**  
**Practical Hours: 2 Hrs./week**

## **Course Description:**

This course provides knowledge and skills on routine and supplementary radiographic techniques for different parts of the human body. This course deals on performing routine radiographic examination techniques for upper and lower limbs, thoracic cage and abdomen, spine and skull. This course also deals supplementary radiographic views for the spine and pelvis, and skull. Additionally, this course also deals with the registration process.

**Course Objectives:** On the completion of the course, the student will be able to:

- Describe and perform all routine radiographic and supplementary examinations for upper and lower limbs, thoracic cage and abdomen, spine, pelvis and skull.
- Describe and perform basic dental radiographic examinations.
- Describe and perform registration and identification procedures for patients.

## **Course Contents: Theory**

### **Unit 1: Introduction to Radiographic Technique**

**12 hrs.**

#### **1.1 Anatomical and radiological terminologies**

**7 hrs.**

1.1.1 Definition of anatomical position, sagittal plane, coronal plane, axial plane, median sagittal plane, anterior, posterior, dorsal, ventral, supine, prone, erect, medial, lateral, superior, inferior, cranial, caudal, flexion, extension, abduction, adduction, circumduction, rotation, proximal, distal, oblique, decubitus, superficial, deep, palmar, plantar, inversion, and eversion, apical, foramen, condyle, fossa, process, radiographic baseline.

1.1.2 Definition of Projection and View, Postero-anterior, antero-posterior, RAO, LAO, RPO, LPO, dorsal decubitus, ventral decubitus, lateral decubitus, OF, OM, SID, SOD, OFD.

#### **1.2 Radiographic Work Drill**

**5 hrs.**

1.2.1 Definition and process. of radiographic work drill.

1.2.2 Patient identification: Purpose, process and significance of patient identification.

1.2.3 Usage and significance of radiographic request form.

1.2.4 Practice common medical terms and abbreviations in radiographic request forms.

1.2.5 Identify the patient registration process, and record keeping process.

1.2.6 State the importance of a monthly and annual record, filing system.

1.2.7 Define patient identification and verification with use of x-ray identification numbers, hospital numbers, patient's name, cross reference bill with patient's name.

1.2.8 Describe the process of filing of radiographs and reports.

1.2.9 Usage and importance of radiographic examination logbook.

**Unit 2: Radiographic Technique for the Extremities 45 hrs**

**2.1 Radiographic Technique for Upper Limb 23 hrs**

2.1.1 Radiographic examination technique (basic and supplementary views) for:

- Fingers, Thumb, Hand , Wrist , Forearm, Elbow, Humerus, Shoulder and Acromio-clavicular joints

2.1.2 State the purposes of these views.

**2.2 Radiographic Technique for Lower Limb 22 hrs**

2.2.1 Radiographic examination technique (basic and supplementary views) for:

- Toes, Foot, Ankle joint, Calcaneum, Leg, Knee joint, Patella, Thigh and Hip joint

2.2.2 Weight bearing projections and its significance (knee and foot).

2.2.3 State the purposes of these views.

2.2.4 Leg alignment projections and its purpose.

**Unit 3: Radiographic Technique for the Chest and Abdomen 31 hrs**

**3.1 Radiographic Technique for Chest 22 hrs**

3.1.1 Radiographic examination technique (basic and supplementary views) for:

- Pharynx and larynx, Thoracic inlet, Lungs, Heart, Ribs , Sternum, Clavicle, Scapula, Sternoclavicular joints and foreign body

3.1.2 State the purpose of these views.

**3.2 Radiographic Technique for Abdomen 9 hrs**

3.2.1 Radiographic examination technique (basic and supplementary views) for:

- Abdomen and KUB

3.2.2 State the need of these x-rays and purpose of these views.

**Unit 4: Radiographic technique for the Spine and Pelvic cavity 27 hrs**

**4.1 Radiographic Techniques for the spine 13 hrs**

4.1.1 Radiographic examination technique (basic and supplementary views) for:

- Cervical spine, Dorsal/thoracic spine, Lumbar spine, Sacrum, Coccyx, Sacro-iliac joints, and Skeletal survey

4.1.2 State the purpose of these views.

**4.2 Radiographic Techniques for the Pelvis 14 hrs**

4.2.1 Radiographic examination technique (basic and supplementary views) for:

- Pelvis, Ilium, and symphysis pubis
- 4.2.2 State the purpose of these views.

**Unit 5: Radiographic technique for the Skull**

**19 hrs**

**5.1 Routine techniques for the Skull**

5.1.1 Radiographic examination technique (basic and supplementary views) for:

- Cranium, Face, Mandible, Mastoids, Internal auditory meatus, Nasal bone, Optic foramen, Para nasal sinuses, Orbit, Internal auditory meatus, and Styloid Process

5.1.2 State the purpose of these views.

**Unit 6: Dental Radiography**

**6 hrs**

**6.1** Definition and types.

**6.2** technique for: intra-oral dental radiography and extra-oral dental radiography (OPG-Orthopantomography, Cephalometry)

**Note:** Radiographic Technique (wherever mentioned) is described as Indications, Contra-indications, Exposure factors, procedure and image criteria, technical considerations and radiation protection.

**Course Contents: Practical**

**Unit 1:**

**4 hrs**

- 1.1 Prepare a chart of common medical terminologies and abbreviations used in radiography.
- 1.2 Prepare chart for radiographic work drill.
- 1.3 Design radiographic request forms.
- 1.4 Design radiographic examination log register.
- 1.5 Prepare the proforma invoices.

**Unit 2:**

**18 hrs**

**With A Dummy Patient**

- 2.1 Practice radiography of fingers. Thumb, Hand, Wrist, Forearm, Elbow, Humerus, Shoulder, clavicle, Acromio-clavicular joints, Sterno-clavicular joints, Scapula, Toes, Foot, Calcaneum, Ankle, Tibia, Fibula, Knee, Femur, Hip joint, and Femur.
- 2.2 Practice radiation protection during the extremity radiography.
- 2.3 Conduct observation of the images of all projection.

**Unit 3:**

**10 hrs**

**With A Dummy Patient:**

- 3.1 Practice radiography of chest and abdomen (basic and supplementary).
- 3.2 Practice radiation protection during the chest and abdomen radiography.
- 3.3 Conduct observation of the images of all projection.

**Unit 4:**

**18 hrs**

**With A Dummy Patient:**

- 4.1 Practice spine examination: Cervical spine, thoracic spine, lumbar spine, sacrum and coccyx, Swimmer's lateral projection, pelvis (basic and alternate), sacro-iliac joints, and hip joints.
- 4.2 Practice radiation protection measures during pelvic radiographic examination.
- 4.3 Practice radiation protection during spinal radiographic examination.
- 4.4 Conduct observation of the images of all projection.

**Unit 5:**

**18 hrs**

**With A Dummy Patient:**

- 5.1 Practice basic radiography of skull (basic and supplementary).
- 5.2 Practice radiation protection during the skull radiography.
- 5.3 Conduct observation of the images of all projection.

**Unit 6:****2 hrs****With A Dummy Patient:**

- 6.1 Practice dental radiography.
- 6.2 Practice radiation protection during the dental radiography.
- 6.3 Conduct observation of the dental x-ray machine.

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	Total
Unit Hours	12	45	31	27	19	6	140
Marks	7	26	18	15	11	3	80

**Reference Books:**

- Thapa, N. *Textbook of radiographic technique*. Heritage Publication.
- Whitley, A. S., Sloane, C., Hoadley, G., Moore, A., Anderson, C., & Holmes, K. (2016). *Clark's positioning in radiography* (13th ed.). Oxford University Press: CRC Press.
- Ballinger, P. W., & Frank, E. D. (2003). *Merrill's atlas of radiographic positions & radiologic procedures* (Vols. I & II). Mosby. (Latest edition).
- Rollins, J. H., & Smith, B. J. (2015). *Merrill's atlas of radiographic positioning and procedures: 3-volume set*. Elsevier Health Sciences. (Latest edition).
- Holm, T., & Palmer, P. E. S. (1896). *Manual of radiographic technique*. WHO Press.
- Bhargava, S. K. *Textbook of radiology technicians*. CBS Publishers & Distributors. (Latest edition).

# HS0202DR-Radiological Procedure

**Total Hours: 6 Hrs./week**  
**Theory Hours: 4 Hrs./week**  
**Practical Hours: 2 Hrs./week**

## Course Description:

This course provides knowledge and skills on specialized radiographic procedures. This course deals on radiographic investigation of different body systems using contrast media as well as the special radiological procedures. Additionally, this course also describes mammography, portable and mobile X-ray examinations.

**Course Objectives:** After completion of this course, students will be able to:

- Understand about contrast media, classification and their adverse effects as well as management.
- Perform and assist special radiographic procedures with the use of contrast media for examination of the Uro-genital system.
- Perform and assist special radiographic procedures with the use of contrast media for examination of the Gastro-intestinal Tract.
- Assist special radiographic procedures with the use of contrast media for examination of the Vascular and lymphatic system.
- Assist special radiographic procedures with the use of contrast media for examination of the Neurological system, joint, Eye and Salivary glands.
- Handle portable and mobile machine for ward and theatre radiography.
- Perform routine and special mammographic examination with and without contrast media.

## Course Contents: Theory

### Unit 1: Contrast Media

**15 hrs.**

- 1.1 Introduction
- 1.2 Classification
  - 1.2.1 Positive and negative
  - 1.2.2 Ionic and Non-ionic
  - 1.2.3 HOCM and LOCM
  - 1.2.4 List the example
- 1.3 Chemical Composition of contrast media with generic name
- 1.4 Different routes-IV, IM, IA, IT, per oral and per rectum.
- 1.5 Pharmacological agent used for radiological examination.
- 1.6 Adverse effect of contrast media- Idiosyncratic and Non-idiosyncratic
- 1.7 Common symptoms and management of different reaction
  - 1.7.1 Mild reaction
  - 1.7.2 Moderate reaction
  - 1.7.3 Severe reaction
  - 1.7.4 Delayed reaction
- 1.8 Emergency drugs and equipment.

**Unit 2: Radiographic investigation of gastro-intestinal tract using contrast media. 22 hrs.**

**2.1 Barium Swallow**

- 2.1.1 Definition
- 2.1.2 Indications
- 2.1.3 Contraindications
- 2.1.4 Equipment's
- 2.1.5 Contrast media
- 2.1.6 Patient preparation
- 2.1.7 Discussion about Procedure/ technique for barium swallow with filming
- 2.1.8 List the complications and after care
- 2.1.9 Radiation protection during Procedure

**2.2 Barium Meal**

- 2.2.1 Definition
- 2.2.2 Indications
- 2.2.3 Contraindications
- 2.2.4 Equipment's
- 2.2.5 Contrast media
- 2.2.6 Patient preparation
- 2.2.7 Discussion about procedure/technique for barium meal with filming
- 2.2.8 List the complications and after care
- 2.2.9 Radiation protection during Procedure

**2.3 Barium Follow Through**

- 2.3.1 Definition
- 2.3.2 Indications
- 2.3.3 Contraindications
- 2.3.4 Equipment's
- 2.3.5 Contrast media
- 2.3.6 Patient preparation
- 2.3.7 Discussion about procedure/technique for barium follow through with filming
- 2.3.8 List the complications and after care
- 2.3.9 Radiation protection during procedure

**2.4 Enteroclysis (Small Bowel Enema)**

- 2.4.1 Definition
- 2.4.2 Indications
- 2.4.3 Contraindications
- 2.4.4 Equipment's
- 2.4.5 Contrast media
- 2.4.6 Patient preparation
- 2.4.7 Discussion about Procedure/technique for Enteroclysis with filming
- 2.4.8 List the Complications and After care
- 2.4.9 Radiation protection during Procedure
- 2.4.10 Advantage and Disadvantage of BFT and Enteroclysis.

**2.5 Barium Enema**

- 2.5.1 Definition
- 2.5.2 Indications
- 2.5.3 Contraindications
- 2.5.4 Equipment's
- 2.5.5 Contrast media
- 2.5.6 Patient preparation
- 2.5.7 Discussion about Procedure/technique for Barium Enema with filming

- 2.5.8 List the complications and after care
- 2.5.9 Radiation protection during procedure

#### 2.6 **Loopogram**

- 2.6.1 Definition
- 2.6.2 Mention the Procedure with filming
- 2.6.3 Complications of above procedure
- 2.6.4 Radiation protection during Procedure

#### 2.7 **Gastrografin study**

- 2.7.1 Definition of Gastrographic examination
- 2.7.2 Indications
- 2.7.3 Contrast used for this examination- Gastrografin
- 2.7.4 Description of the Procedure with filming
- 2.7.5 Advantage and disadvantage

### **Unit 3: Radiographic Investigation of Uro-genital System Using Contrast Media. 22 hrs.**

#### 3.1 **Intravenous Urography**

- 3.1.1 Definition
- 3.1.2 Indications
- 3.1.3 Contraindications
- 3.1.4 Equipment's
- 3.1.5 Contrast media
- 3.1.6 Patient preparation
- 3.1.7 RFT/e-GFR
- 3.1.8 Discussion about Procedure/technique for Intravenous urography with filming
- 3.1.9 List the complications and after care
- 3.1.10 Radiation protection during Procedure

#### 3.2 **Cystogram**

- 3.2.1 Definition
- 3.2.2 Indications
- 3.2.3 Contraindications
- 3.2.4 Equipment's
- 3.2.5 Contrast media
- 3.2.6 Patient preparation
- 3.2.7 Discussion about Procedure/technique for Cystogram with filming
- 3.2.8 Radiation protection during Procedure

#### 3.3 **Retrograde Urethrography (RGU)**

- 3.3.1 Definition
- 3.3.2 Indications
- 3.3.3 Contraindications
- 3.3.4 Equipment's
- 3.3.5 Contrast media
- 3.3.6 Patient preparation
- 3.3.7 Discussion about Procedure/technique for retrograde urethrography with filming
- 3.3.8 List the Complications and After care
- 3.3.9 Radiation protection during Procedure

#### 3.4 **Micturating Cysto-Urethrography (MCU/MCUG)**

- 3.4.1 Definition
- 3.4.2 Indications
- 3.4.3 Contraindications
- 3.4.4 Equipment's
- 3.4.5 Contrast media

- 3.4.6 Patient preparation
- 3.4.7 Discussion about Procedure/technique for MCU with filming
- 3.4.8 List the Complications and After care
- 3.4.9 Radiation protection during Procedure
- 3.5 Retrograde/ Antegrade Pyelogram**
  - 3.5.1 Definition
  - 3.5.2 Indications
  - 3.5.3 Contraindications
  - 3.5.4 Equipment's
  - 3.5.5 Contrast media
  - 3.5.6 Patient preparation
  - 3.5.7 Discussion about Procedure/technique for retrograde pyelogram with filming
  - 3.5.8 List the Complications and After care
  - 3.5.9 Radiation protection during Procedure
- 3.6 Hysterosalpingography (HSG)**
  - 3.6.1 Definition
  - 3.6.2 Indications
  - 3.6.3 Contraindications
  - 3.6.4 Equipment's
  - 3.6.5 Contrast media
  - 3.6.6 Patient preparation
  - 3.6.7 Discussion about Procedure/technique for HSG with filming
  - 3.6.8 List the Complications and After care
  - 3.6.9 Radiation protection during Procedure

**Unit 4: Radiographic investigation of Biliary System using contrast media. 18 hrs.**

- 4.1 Oral Cholecystography and Intravenous Cholecystography**
  - 4.1.1 Definition
  - 4.1.2 Limitation
- 4.2 Percutaneous Trans hepatic Cholangiogram and Drainage (PTC/ PTCD)**
  - 4.2.1 Definition
  - 4.2.2 Indications
  - 4.2.3 Contraindications
  - 4.2.4 Equipment's
  - 4.2.5 Contrast media
  - 4.2.6 Patient preparation
  - 4.2.7 Bleeding Parameter- (BT, CT, PT, INR )
  - 4.2.8 Discussion about Procedure/technique for PTCD with filming
  - 4.2.9 List the Complications and After care
  - 4.2.10 Radiation protection during Procedure
- 4.3 Endoscopic Retrograde Cholangio-Pancreatography (ERCP)**
  - 4.3.1 Definition of ERCP
  - 4.3.2 Indications
  - 4.3.3 Contraindications
  - 4.3.4 Equipment's
  - 4.3.5 Contrast media
  - 4.3.6 Patient preparation
  - 4.3.7 Discussion about Procedure/technique for ERCP with filming
  - 4.3.8 List the Complications and After care
  - 4.3.9 Mention about Therapeutic use of ERCP
  - 4.3.10 Radiation protection during Procedure

#### **4.4 Intra-operative Cholangiography (IOC)**

- 4.4.1 Definition of IOC
- 4.4.2 Indications
- 4.4.3 Contraindications
- 4.4.4 Equipment's
- 4.4.5 Contrast media
- 4.4.6 Patient preparation
- 4.4.7 Discussion about Procedure/technique for IOC with filming
- 4.4.8 List the complications and after care
- 4.4.9 Radiation protection during Procedure

#### **4.5 T-Tube Cholangiography**

- 4.5.1 Definition of T-Tube Cholangiography
- 4.5.2 List the
- 4.5.3 Indications
- 4.5.4 Contraindications
- 4.5.5 Equipment's
- 4.5.6 Contrast media
- 4.5.7 Patient preparation
- 4.5.8 Discussion about Procedure/technique with filming
- 4.5.9 List the complications and after care
- 4.5.10 Radiation protection during Procedure

### **Unit 5: Radiographic investigation of Vascular System using contrast media. 24 hrs.**

#### **5.1 Angiography**

- 5.1.1 Definition
- 5.1.2 Contrast media used
- 5.1.3 Equipment used
- 5.1.4 Patient Preparation for angiography
- 5.1.5 Discussion of seldinger's technique
- 5.1.6 Complications and after care of Angiography
- 5.1.7 Radiation protection during procedure

#### **5.2 Cerebral Angiography**

- 5.2.1 Definition
- 5.2.2 Indications
- 5.2.3 Contraindications
- 5.2.4 Procedure/technique for Cerebral Angiogram with filming
- 5.2.5 Radiation protection during procedure

#### **5.3 Carotid Angiography**

- 5.3.1 Definition of carotid angiography
- 5.3.2 Indications
- 5.3.3 Contraindications
- 5.3.4 Procedure/technique for Carotid Angiogram with filming
- 5.3.5 Radiation protection during procedure

#### **5.4 Aortography**

- 5.4.1 Definition of Aortography
- 5.4.2 Indications
- 5.4.3 Contraindications
- 5.4.4 Procedure/technique for Aortography with filming
- 5.4.5 Radiation protection during procedure

#### **5.5 Peripheral Angiography**

- 5.5.1 Definition of Peripheral Angiography with types

- 5.5.2 Radiation protection during procedure
- 5.6 **Upper Limb and Lower Limb Angiography**
  - 5.6.1 Definition
  - 5.6.2 Indications
  - 5.6.3 Contraindications
  - 5.6.4 Procedure/technique for upper and lower limb angiogram with filming
  - 5.6.5 Radiation protection during procedure
- 5.7 **Venography/Phlebography**
  - 5.7.1 Definition of Venography
  - 5.7.2 Indications
  - 5.7.3 Contraindications
  - 5.7.4 Procedure/technique for Venography with filming
  - 5.7.5 Radiation protection during procedure
- Unit 6: Other Radiological Procedure using contrast media      21 hrs.**
  - 6.1 **Myelogram**
    - 6.1.1 Definition
    - 6.1.2 Indications
    - 6.1.3 Contraindications
    - 6.1.4 Equipment's
    - 6.1.5 Contrast media
    - 6.1.6 Patient preparation
    - 6.1.7 Discussion about Procedure/technique for myelogram with filming
    - 6.1.8 List the complications and after care
    - 6.1.9 Radiation protection during Procedure
  - 6.2 **Sailography**
    - 6.2.1 Definition
    - 6.2.2 Indications
    - 6.2.3 Contraindications
    - 6.2.4 Equipment's
    - 6.2.5 Contrast media
    - 6.2.6 Patient preparation
    - 6.2.7 Discussion about Procedure/technique for Sailography with filming
    - 6.2.8 List the Complications and After care
    - 6.2.9 Radiation protection during Procedure
  - 6.3 **Dacryocystography (DCG)**
    - 6.3.1 Definition
    - 6.3.2 Indications
    - 6.3.3 Contraindications
    - 6.3.4 Equipment's
    - 6.3.5 Contrast media
    - 6.3.6 Patient preparation
    - 6.3.7 Discussion about Procedure/technique for DCG with filming
    - 6.3.8 List the complications and after care
    - 6.3.9 Radiation protection during Procedure
  - 6.4 **Sinogram/Fistulogram**
    - 6.4.1 Definition
    - 6.4.2 Indications
    - 6.4.3 Contraindications
    - 6.4.4 Equipment's
    - 6.4.5 Contrast media

- 6.4.6 Patient preparation
- 6.4.7 Discussion about Procedure/technique for Sinogram/ Fistulogram with filming
- 6.4.8 List the Complications and After care
- 6.4.9 Radiation protection during Procedure
- 6.5 **Mammogram**
- 6.5.1 Definition
- 6.5.2 Indications and Contraindications and patient preparation
- 6.5.3 Mention of Basic and Supplementary view
- 6.5.4 Discussion about Ductogram procedure with filming
- 6.6 **Soft Tissue radiography**
- 6.6.1 Definition of Soft Tissue Radiography
- 6.6.2 List the different radiographic examination for soft tissue
- 6.6.3 Discussion of positioning and exposure technique for this
- 6.6.4 List advantage and disadvantages
- 6.7 **High kV Technique**
- 6.7.1 Definition
- 6.7.2 List the different radiographic examination for High kV technique.
- 6.7.3 Describe Positioning and exposure technique
- 6.7.4 List advantage and disadvantage

## **Unit 7: Ward and Theatre Radiography**

**18 hrs.**

### **7.1 Ward Radiography**

- 7.1.1 Definition
- 7.1.2 List the different radiographic examination for Ward Radiography
- 7.1.3 Description the Positioning for Chest, Abdomen, Cervical spine, Pelvis, Femur and Neonatal x-ray
- 7.1.4 Radiation Protection during ward radiography

### **7.2 Theatre Radiography**

- 7.2.1 Definition
- 7.2.2 List the different radiographic examination for Theatre Radiography.
- 7.2.3 Description the positioning, technique and filming for hip Pinning and operative Cholangiography
- 7.2.4 Radiation Protection during theatre radiography

## **Course Contents: Practical**

### **Unit:1 Contrast Media**

**7 hrs.**

- Identify the types of contrast media.
- Observation and performing methods of introducing the contrast media.
- Pharmacological agent used for radiological examination.
- List Pharmacological agent used for radiological examination.
- List a chart to manage reactions of contrast media.
- List a chart of the emergency equipment and drugs needed to cope with reactions.

### **Unit:2**

**12 hrs.**

#### **2.1 Observation of:**

- Barium Swallow.
- Barium Meal.
- Barium Follow through.

- Enteroclysis
- Ba-enema.
- Loopogram.
- Gastrographic examination of GI tract
- Identification of structure in images of above procedures.

**Unit 3**

**10 hrs.**

**3.1 Observation of :**

- Intravenous Urogram (IVU).
- Cystogram.
- Micturating Cystogram.
- Urethrogram.
- Retrograde pyelogram.
- Hysterosalpingogram (HSG)
- Identification of structure in images of above procedures.

**Unit 4.**

**8 hrs.**

**4.1. Observation of following Procedure:**

- Percutaneous transhepatic cholangiography and drainage (PTC and PTCD)
- Endoscopic retrograde cholangio pancreatography (ERCP).
- IOC & T-Tube Cholangiogram
- Identification of structure in images of above procedures.

**Unit 5:**

**10 Hrs.**

**5.1. Observation of following Procedure:**

- Catheterization Technique in Angiogram
- Cerebral Angiogram
- Carotid Angiogram
- Aortography
- Peripheral Angiogram

**Unit 6:**

**10 hrs.**

**6.1. Observation of following Procedure:**

- Myelogram
- Sialogram
- Dacryo-cystogram
- Sinogram/ Fistulogram
- Mammogram
- Microradiography, Soft tissue Radiography and High kV Technique

**Unit 7:**

**19 hrs.**

**7.1. Observation of following Procedure:**

- Ward Radiography
- Theatre Radiography

### Final written exam marking scheme

Unit	1	2	3	4	5	6	7	Total
Unit Hours	15	22	22	18	24	21	18	140
Marks	9	12	12	10	14	12	11	80

#### Reference Books:

- Chapman, S., & Nakielny, R. *A guide to radiological procedure* (5th ed.).
- Thapa, N. *Radiographic photography & technique II*. Heritage Publication.
- Lakhar, B. N. *Radiological procedure: A guideline*. Arya Publication.
- Ballinger, P. W. *Merrill's atlas of radiographic positioning and diagnostic procedures* (Vols. I & II).
- Holm, T., & Palmer, P. E. S. *Manual of radiographic technique*.
- Bhargava, S. K. *Textbook of radiology technicians*.

# HS0203DR-Radiographic Imaging

**Total Hours: 6 Hrs./week**  
**Theory Hours: 4 Hrs./week**  
**Practical Hours: 2 Hrs./week**

## Course Description:

This course provides knowledge and skills on imaging process involved in producing a radiographic image. This course deals with radiographic films, cassettes, intensifying screens, film processing, and digital image receptors and procedures. This course also deals with storage of radiographic materials as well as equipment for preparing-radiographic images.

**Course Objectives:** After completion of this course, students will be able to:

- Describe imaging films and image characteristics.
- Explain about image recording system.
- Describe the formation of radiographic image.
- Explain the sensitometry and prepare a characteristic curve.
- Describe concept of film processing.
- Describe about concept of image processing areas.
- Describe digital imaging system, types and digital image receptors.
- Recognize the common film artefacts and their remedies.
- Use and understand patient identification on radiograph.
- Perform presentation of radiographs.
- Perform handling and storage of imaging films.
- Explain digital imaging and processing.
- Describe the concept of PACS and teleradiology.

## Course Contents: Theory

<b>Unit 1: Image Receptor in Radiography</b>	<b>36 hrs.</b>
<b>1.1.X-ray film</b>	<b>18 hrs.</b>
1.1.1 Definition of x-ray film	
1.2.1 Construction of different types of x-ray film.	
1.3.1 Characteristics features of film base material for x-ray film.	
1.4.1 Definition of spectral sensitivity.	
1.5.1 Classification of x-ray film used in imaging on the basis of structure and Spectral sensitivity.	
1.6.1 Film used in CR and DR.	
<b>1.2.Intensifying screen</b>	<b>9 hrs.</b>
1.2.1. Definition of the terms: Luminescence, Fluorescence and Phosphorescence.	
1.2.2. Definition, Construction, use and advantage of intensifying screen.	
1.2.3. Film screen contact test.	
1.2.4. Care and maintenance of intensifying screen.	
<b>1.3.Radiographic cassette</b>	<b>9 hrs.</b>
2.1.1. Definition, Construction and Function of radiographic cassette.	
2.1.2. Different types of radiographic cassette (Conventional and digital: CR and DR)	
2.1.3. Care and maintenance of radiographic cassette.	

<b>Unit 2: Radiographic image formation</b>	<b>10 hrs.</b>
<b>2.1. Radiographic image</b>	<b>7 hrs.</b>
2.1.1. Definition of radiographic image	
2.1.2. Components of the radiographic image: definition, radiographic contrast, resolution, unsharpness and noise.	
2.1.3. Digital Image characteristics: Pixel, Matrix, Spatial resolution, Bit depth and windowing	
<b>2.2. Formation of latent image</b>	<b>3 hrs.</b>
2.2.1. Definition of latent image.	
2.2.2. Mechanism of formation of latent image: Gurney-Mott theory of latent image formation.	
<b>Unit 3: Sensitometry and characteristic curve</b>	<b>13 hrs.</b>
<b>3.1. Sensitometry</b>	<b>3 hrs.</b>
3.1.1. Definition of Sensitometry.	
3.1.2. Sensitometer, step wedge and densitometer.	
3.1.3. Spectral sensitivity.	
<b>3.2. Characteristic Curve</b>	<b>10 hrs.</b>
3.2.1. Definition of Characteristic curve.	
3.2.2. Definition of photographic density (Optical density)	
3.2.3. Features of characteristics curve:	
o Base density, fog and threshold.	
o Contrast and latitude, gradient and gamma.	
o Maximum density and reversal.	
3.2.4. Uses of characteristics curve.	
<b>Unit 4: Radiographic Film Processing</b>	<b>29 hrs.</b>
4.1. Manual film processing and Automatic film processing	
4.2. Advantage and disadvantages of manual and automatic film processing	
4.3. Manual Vs automatic film processing.	
<b>Unit 5: Digital Imaging</b>	<b>11 hrs.</b>
5.1. Definition of digital imaging system: CR and DR .	
5.2. Construction of CR cassette and DR detector.	
5.3. Principle of Digital Imaging , and its advantages and disadvantages.	
<b>Unit 6: Image Artifacts</b>	<b>3 hrs.</b>
6.1. Definition of image artifacts.	
6.2. Image artifacts: Types (Conventional and digital image artifacts)	
6.3. Causes and remedy of image artifacts	
<b>Unit 7: Film Processing Areas</b>	<b>18 hrs.</b>
7.1. Design and construction of darkroom	
7.2. Requirement and consideration in designing digital image processing area	
7.3. General introduction to dry film technology	
<b>Unit 8: Identification &amp; Presentation of the radiograph</b>	<b>11 hrs.</b>
<b>8.1. Patient Identification</b>	<b>7 hrs.</b>
8.1.1. Definition of patient identification.	
8.1.2. Types of information included in patient identification: Essential, technical and miscellaneous.	
<b>8.2. Presentation of Radiograph</b>	<b>4 hrs.</b>
8.2.1. Definition of view box.	
8.2.2. Construction of viewing equipment and its advancement .	
8.2.3. Features of good view box	
<b>Unit 9: Handling and Storage of x-ray film</b>	<b>5 hrs.</b>

- 9.1. Different storage areas for x-ray film: Hospital or department store, and storage in radiography room.
- 9.2. Ideal feature for x-ray film store: Location, Light, temperature, humidity, harmful gases and radiation sources.
- 9.3. Technique for handling x-ray film in store.

**Unit 10 : PACS and Teleradiology** **4 hrs.**

- 10.1. Introduction, requirements, advantages and challenges.

**Course Contents: Practical**

**Unit 1:** **14 hrs.**

1. Identify and handle X-ray films.
2. Load unexposed film in conventional radiography.
3. Unload of exposed film in conventional radiography.
4. Load of digital imaging films.
5. Identify intensifying screens.
6. Recognize different parts of radiographic cassette.
7. Recognize different types of cassette.
8. Perform cassette clean.

**Unit 2:** **7 hrs.**

1. Recognize components of radiographic image.
2. Recognize digital image characteristics.
3. Identify formation of latent image.

**Unit 3:** **7 hrs.**

1. Demonstrate sensitometer and its use.
2. Demonstrate aluminum step wedge.
3. Demonstrate densitometer.
4. Demonstrate characteristic curve for a particular film screen system.

**Unit 4:** **7 hrs.**

1. Demonstrate developing tank, fixing tank, washing tank, drier cabinet.
2. Demonstrate process of manual film processing.
1. Identify components of automatic film processor.
2. Prepare developer and fixer solution.
3. Prepare developer and fixer solution for automatic processor.
4. Process exposed film in automatic processor.

**Unit 5:** **6 hrs.**

1. Identify CR image receptor.
2. Identify DR image detector.
3. Demonstrate the use of CR cassette.
3. Demonstrate the use of detector panel.

**Unit 6:** **5 hrs.**

1. Identify image artefacts on radiographs.
2. Differentiate the types of image artefacts.
3. Recognize the cause of image artefacts.
4. Find out the remedies of image artefacts.

**Unit 7:** **7 hrs.**

1. Prepare a layout of dark room.
2. Observe the digital imaging setup.
3. Observe the dry film technology.

- Unit 8:** **7 hrs.**
1. Identify and recognize different methods for patient identification on radiograph.
  2. Identify different parts of the viewing equipment
  3. Demonstrate function of viewing equipment

- Unit 9:** **5 hrs.**
1. Perform ordering and storage of x-ray films.
  2. Observe ideal features of film storage.
  3. Demonstrate handling of x-ray film in store.

- Unit 10:** **5 hrs.**
1. Observe PACS and Teleradiology system.
  2. Perform image achieving.

**Final written exam marking scheme**

<b>Unit</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>Total</b>
<b>Unit Hours</b>	<b>36</b>	<b>10</b>	<b>13</b>	<b>29</b>	<b>11</b>	<b>3</b>	<b>18</b>	<b>11</b>	<b>5</b>	<b>4</b>	<b>140</b>
<b>Marks</b>	<b>21</b>	<b>6</b>	<b>7</b>	<b>17</b>	<b>6</b>	<b>2</b>	<b>10</b>	<b>6</b>	<b>3</b>	<b>2</b>	<b>80</b>

**Reference Books:**

- Chesney, D. N., & Chesney, M. O. (1994). *Radiographic imaging* (4th ed.). Delhi: CBS Publishers & Distributors.
- Ball, J., & Price, T. (1998). *Chesney's radiographic imaging* (6th ed.). London: Blackwell Science Ltd.
- Eastman Kodak Company Ltd. *Fundamentals of radiographic photography*.
- Bushong, S. C. (2017). *Radiologic science for technologists: Physics, biology, and protection* (11th ed.). Missouri: Elsevier Inc.
- Bushberg, J. T., Seibert, J. A., Leidholdt, E. M., & Boone, J. M. (2012). *The essential physics of medical imaging* (3rd ed.). Philadelphia: Wolters Kluwer: Lippincott Williams & Wilkins.
- Fosbinder, R., & Orth, D. (2012). *Essentials of radiologic science* (1st ed.). Baltimore: Wolters Kluwer/Lippincott Williams & Wilkins.
- Thapa, N., Paudel, M., & Khadka, K. K. (2022). *Radiographic photography with MCQs* (2nd ed.). Kathmandu: Heritage Publishers and Distributors Pvt. Ltd.
- Sah, R. (2021). *A textbook of radiographic photography* (1st ed.). Kathmandu: Samiksha Publication Pvt. Ltd.
- Shah, P., & Sharma, A. (2018). *A handbook of photography and radiographic equipment* (1st ed.). Kathmandu: Samiksha Publication Pvt. Ltd.

## HS0204DR -Radiographic Equipment

**Total Hours: 6 Hrs./week**  
**Theory Hours: 4 Hrs./week**  
**Practical Hours: 2 Hrs./week**

### 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, Tomography and Vascular radiographic equipment. Additionally, this course focuses on control of scattered radiation and familiarise with the recent imaging technology.

**Course Objectives:** After completion of this course, students will be able to:

- Describe historical background of X-rays and method of its production.
- Demonstrate a comprehensive understanding of the principles of operation radiographic equipment. This includes knowledge of X-ray tubes, generators, collimators, bucky-tables, film processors.
- Safely and effectively operate a variety of radiographic equipment.
- Apply radiographic equipment to produce high-quality diagnostic images. This includes understanding the factors that affect image quality and how to optimize these factors.
- Troubleshoot and resolve common radiographic equipment problems. This includes identifying and correcting errors in exposure, positioning, and image processing. Adhere to radiation safety protocols to protect themselves, their patients, and their colleagues from unnecessary radiation exposure. This includes understanding the principles of radiation protection and following safe operating procedures.
- Contribute to the effective and efficient use of radiographic equipment in a clinical setting. This includes understanding the role of radiography in the diagnostic process and working effectively with other healthcare professionals.
- Introduce recent imaging modalities.

### Course Contents: Theory

<b>Unit 1: X-ray Tube</b>	<b>19 Hrs.</b>
<b>1.1 History of discovery of X-ray &amp; its production</b>	<b>7 Hrs.</b>
1.1.1 History of X-ray discovery	
1.1.2 Historical X-ray tubes; Crook's x-ray tube & Coolidge x-ray tube.	
1.1.3 Factors affecting quality and quantity of x-ray Production	
<b>1.2 Construction of X -ray tube</b>	<b>7 Hrs.</b>
1.2.1 Definition of X-ray tubes.	
1.2.2 Descriptions of components of X-ray tubes	
1.2.3 Types of X-ray tubes.	
1.2.4 Line focus principle	

1.2.5	Anode angle and its choice	
1.2.6	Anode heel effect and its applications.	
<b>1.3</b>	<b>X -ray tube Rating &amp; Fault</b>	<b>5 Hrs.</b>
1.3.1	X-ray tube rating, types and their application	
1.3.2	Different tube cooling methods and uses.	
1.3.3	Common faults of x-ray tube, their effect and ways to prevent them.	
1.3.4	Care and maintenance of x-ray Equipment	
<b>Unit 2:</b>	<b>Control Panel, x-ray table and tube support</b>	<b>17 Hrs.</b>
<b>2.1</b>	<b>Control Panel</b>	<b>8 Hrs</b>
2.1.1	Definition of Control Panel, its construction and working principle.	
2.1.2	Use of various Knobs and indicators used in control panel ( analog & digital)	
2.1.3	Exposure parameters-KV, mA and Timer.	
<b>2.2</b>	<b>X-ray Table</b>	<b>5 Hrs.</b>
2.2.1	Definition of X-ray table.	
2.2.2	Ideal X-ray table and constructions of x-ray table	
2.2.3	List of different types of x-ray tables and their use.	
2.2.4	Bucky (horizontal & Vertical) along with their construction, working principle, uses, advantages and disadvantages.	
<b>2.3</b>	<b>X-ray Tube Support</b>	<b>4 Hrs.</b>
2.3.1	X-ray tube support and its importance.	
2.3.2	Descriptions of tube support systems including Ceiling support, Floor support, Ceiling to floor support and C-arm support system.	
2.3.3	Detail about different lock used in each parts. Movement and access of tube.	
<b>Unit 3:</b>	<b>Fluoroscopic equipment</b>	<b>20 Hrs.</b>
<b>3.1</b>	<b>Conventional Fluoroscopy</b>	<b>7 Hrs.</b>
3.1.1	Fluoroscopy, Fluorescent screen, its construction including descriptions of all layers and materials used as phosphor.	
3.1.2	Limitations of conventional fluoroscopy.	
<b>3.2</b>	<b>Modern Fluoroscopy</b>	<b>13 Hrs.</b>
3.2.1.	Definition of II tube, its components	
3.2.2.	Working Principle of II tube.	
3.2.3.	Automatic brightness control (ABC), Flux gain, and Minification gain.	
3.2.4.	Limitation of II tube, like vigneting. Distortion.	
3.2.5.	TV monitoring and recording of fluoroscopic images.	
3.2.6.	Definition of Digital Fluoroscopy.	
<b>Unit 4:</b>	<b>Scatter radiation and its control</b>	<b>21 Hrs.</b>
<b>4.1</b>	<b>Scatter radiation</b>	<b>7 Hrs.</b>
4.1.1	Concept of scatter radiation	
4.1.2	Sources of scatter radiation.	
4.1.3	Significances of scatter radiation	
<b>4.2</b>	<b>Control of scatter radiation</b>	<b>14 Hrs.</b>

4.2.1	Techniques of controlling Scatter radiation (use of compression band and air gap technique).	
4.2.2	Construction and working of different devices used to control scattered radiation including beam limiting devices.	
4.2.3	Definition, construction and working of grid. Grid ratio, grid lattice and concept of proper choice of grid ratio.	
4.2.4	Types of grids (Parallel, Focused and crossed).	
4.2.5	Stationary and moving grid.	
4.2.6	Grid error	
4.2.7	Advantages and disadvantages of grid.	
<b>Unit 5: Portable/Mobile X-ray equipment</b>		<b>15 Hrs.</b>
5.1	Mobile and portable x-ray equipment.	
5.2	Different components of Mobile and portable x-ray equipment.	
5.3	Comparison between mobile and portable x-ray.	
5.4	Working and proper use of Mobile image intensifier for O. T.	
<b>Unit 6: Tomography</b>		<b>4 Hrs.</b>
6.1	Definition of tomography.	
6.2	Basic principle of linear tomography	
<b>Unit 7: Equipment for Vascular Imaging Technology</b>		<b>15 Hrs.</b>
7.1	Vascular imaging equipment and its working	
7.2	Brief description about accessories required in Vascular imaging.	
7.3	Pressure injector: its basic settings, use and advantages	
7.4	Definition of DSA and use.	
<b>Unit 8: Introduction to Modern Medical Imaging Modalities</b>		<b>29 Hrs.</b>
<b>8.1 Computerized Radiography (CR)</b>		<b>9 Hrs.</b>
8.1.1	Definition of CR.	
8.1.2	Definition of PSP, construction and working of PSP	
8.1.3	Construction of CR Cassette.	
8.1.4	Working of different components of CR.	
8.1.5	Basic concept of image formation in PSP plate and Scanning of PSP plate to form image.	
<b>8.2 Direct Digital Radiography (DR)</b>		<b>7 Hrs.</b>
8.2.1.	Definition of DR.	
8.2.2.	Definition of Detector, construction and working of Scintillation Detector.	
8.2.3.	Working of different components of DR.	
8.2.4.	Basic concept of image formation in DR.	
8.2.5.	Differentiate between CR and DR	
<b>8.3 Mammographic equipment</b>		<b>4 Hrs.</b>
8.3.1.	Definition and basic concept of Mammography.	
8.3.2.	Discussion of mammography x-ray tube, filters used and compression used.	
8.3.3.	Brief introductions and working of different components of Mammography.	
8.3.4.	Use of Mammography.	

- 8.4 Additional imaging modalities** **9 Hrs.**  
 8.4.1. Definition and use of  
 • CT,MRI,USG,DEXA,OPG and CBCT

**Course Contents: Practical**

- Unit 1.** **9 Hrs.**  
 1.1 Identify different parts of Morden x-ray tube including cathode, filament, anode, target material, tube shieldings  
 1.2 Identify the Morden x-ray tubes including stationary and rotating anode.
- Unit 2.** **8 Hrs.**  
 2.1 Identify control panel  
 2.2 Identify kV selector, mA selector and exposure timer  
 2.3 Identify and handle different types of x-ray tables.  
 2.4 Identify and handle different types of x-ray tube support.
- Unit 3:** **8 Hrs.**  
 3.1 Identify fluoroscopic screen.  
 3.2 Identify component of fluoroscopic equipment- input screen, output screen
- Unit 4:** **11 Hrs.**  
 4.1 Identify beam limiting devices-cone, diaphragm, LBD, beam centering device and compression devices.  
 4.2 Identify different types of grids.
- Unit 5:** **10 Hrs.**  
 5.1 Identify portable and mobile x-ray equipment- x-ray tube, tube stand, locks and components of control panel.  
 5.2 Demonstrate handling of portable and mobile x-ray equipment- x-ray tube, tube stand, locks and components of control panel.
- Unit 6:** **5 Hrs**  
 6.1 **Identify Tomographic equipment with different movement.**
- Unit 7:** **8 Hrs**  
 7.1 Identify different size of catheter, guide wire,  
 7.2 Identify auto injector  
 7.3 Identify angiographic table.
- Unit 8:** **11 Hrs.**  
 8.1 Identify CR cassette  
 8.2 Identify PSP  
 8.3 Identify Detector  
 8.4 Identify Mammography machine.

**Final written exam marking scheme**

<b>Unit</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>Total</b>
<b>Unit Hours</b>	19	17	20	21	15	4	15	29	140
<b>Marks</b>	11	10	12	12	8	2	8	17	80

### **Reference Books:**

- Thapa, N. *Textbook of radiographic equipment*. Heritage Publication.
- Carter, P. H., & Chesney, A. M. *Chesneys' equipment for student radiographers*.
- Paterson, M. L., Thornton, A. P., Hyatt, A., Milne, A., & Pirrie, J. R. [*Title of the book*].
- Mass, S. *Physics and equipment in imaging modalities*.
- Thylan, K. *Physics of radiology and imaging*.
- Curry, T. S. III., Dowdey, J. E., & Murry, R. E. Jr. *Christensen's physics of diagnostic radiology*.

# HS0205DR-Basic Radiation Physics

**Total Hours: 6 Hrs./week**  
**Theory Hours: 4 Hrs./week**  
**Practical Hours: 2 Hrs./week**

## Course Description:

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

## Course Objectives:

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

- Describe static electricity, current electricity and thermionic emission
- Describe the capacitor, transformer and rectifier.
- Describe the principle and working of x-ray circuit and identifying the x-ray equipment.
- Explain the fundamental concept of atoms and atomic structures.
- Explain about the physics of x-rays and its production.
- Describes the interaction of radiation with matter
- Describe principles of radiation protection and dose reduction technique in different modalities.
- Explain the radiation detection and measurement device used in radiology.
- Describe principle of radiation biology and effects of radiation on human body

## Course Contents: Theory

### Unit 1: Electricity and magnetism 13 Hrs.

- 1.1 Basic concept of Electric charge, Electric current, Types of electric current (AC and DC), and voltage
- 1.2 Basic principle of capacitor
- 1.3 Basic concept of magnet, magnetic field and magnetic flux
- 1.4 Electromagnetic induction, faradays law of electromagnetic induction, and types of electromagnetic induction (self and mutual induction).
- 1.5 Basic principle and working of transformer, types of transformers used in the x-ray production (step up, step down and autotransformer), ripple factor

### Unit 2: Rectification and x-ray circuit 13 Hrs

#### 2.1 Rectification 6 Hrs

- 1.1.1 Basic concept of thermionic emission and diodes
- 1.1.2 Types of rectifiers used in the x-ray circuit and its advantage, disadvantage and applications.

#### 2.2 X-ray circuit 7 Hrs

- 1.2.1 Draw the well labelled diagram of x-ray circuit
- 1.2.2 Basic concept of:
  - voltage compensator
  - x-ray generator and its types
  - high frequency generator
  - kVp and mA selector: location and its functions

- 1.2.3 Exposure timer and its types
- 1.2.4 Principle and working of Automatic exposure control(AEC)

**Unit 3: Fundamental concept of atom and physics of x-ray production** **23 Hrs**

**3.1 Atom and Atomic structures** **9 Hrs**

- 1.3.1 Basic concept of atom and atomic structure
  - Atomic number and mass number
  - Isotopes and isobars
- 1.3.2 Concept of ionization and excitation
- 1.3.3 Basic concept of electron binding energy (EBE)
- 1.3.4 Radioactivity and half life(Technetium, iodine, fluorine)

**3.2 Physics of X-Ray Production** **14 Hrs**

- 3.2.1 Basic concept and types of Radiation
- 3.2.2 Discovery of x-rays and properties of x-rays
- 3.2.3 Principle of x-ray production and its types
  - Bremsstrahlung x-ray production
  - Characteristics x-ray production
- 3.2.4 Define x-ray spectrum and its types, factor affecting the x-ray spectrum.
- 3.2.5 Describes the factor affecting the x-ray quality and quantity.

**Unit 4: Attenuation** **9 Hrs**

- 4.1 Concept of attenuation and law of exponential (Beer-lambert law)
- 4.2 Monochromatic and polychromatic x-ray beam
- 4.3 Attenuation coefficient and its types
  - Linear attenuation coefficient
  - Mass attenuation coefficient
- 4.4 Factor affecting the attenuation coefficient
- 4.5 Concept of Half Value Layer (HVL) and its importance
- 4.6 Inverse square law and its importance
- 4.7 Filtration and different types of filters used in x-ray tube

**Unit 5: Interaction of Radiation with Matter** **18 Hrs**

- 5.1 Different types of interaction of radiation with matter
  - 5.2.1 Coherent scattering
  - 5.2.2 Compton scattering
  - 5.2.3 Photoelectric absorption
  - 5.2.4 Pair production
  - 5.2.5 Photon disintegration
- 5.2 **Concept of Differential Absorption and Effective Atomic Number of Different Body Tissue (Fat, Air, Lung, Soft Tissue And Bones)**

**Unit 6: Radiation detection and measurements.** **18 Hrs**

- 6.1 **Define Radiation Detector And Types Of Radiation Detector Used In Radiology**
  - 6.1.1 Gas filled detector
    - Ionization chamber
  - 6.1.2 Solid state detector

- Scintillation detector

## 6.2 Concept of Personnel Monitoring Dosimeter (PMD), Explain the Principle and Working, Advantage, Disadvantages and Method of Wearing Technique

- Film badge
- TLD
- Pocket dosimeter
- Optically Stimulated Luminesces(OSL)

## 6.3 Fundamental Of Radiation Units And Measurements

- 6.3.1 Activity
- 6.3.2 Exposure
- 6.3.3 Absorbed Dose
- 6.3.4 Equivalent Dose
- 6.3.5 Effective Dose

## Unit 7: Radiobiology

18 Hrs

### 7.1 Fundamental Principle Of Radiobiology

- 7.1.1 Law of Bergonie and Tribondeau
- 7.1.2 Radio sensitivity
- 7.1.3 Hormesis

### 7.2 Biological effect of ionizing radiation

- 7.2.1 Stochastic effect and non-stochastic/deterministic effect

### 7.3 Concept of Acute radiation syndrome

## Unit 8: Radiation protection

28 Hrs

### 8.1 Sub-unit 8.1: Radiation protection

- 8.1.1 Historical background of radiation protection
- 8.1.2 Principle of radiation protection
  - Cardinal principle of radiation protection
  - ICRP-(justification of practice, optimization of dose and dose limits)
- 8.1.3 Concept of dose limits
  - Maximum permissible dose/effective dose limit/annual dose limit
  - Tabulation of dose limit recommended by ICRP
- 8.1.4 Different types of radiation protective apparels and devices:
  - Apron, Gloves, Goggles, Window, Thyroid shield and Gonad shield

### 8.2 Sub-unit 8.2: Designing for radiation protection

- 8.1.5 Design of protective barriers
  - Primary radiation barrier
  - Secondary radiation barrier
- 8.1.6 Radiographic protective features
  - Control panel
  - SID indicator
  - Collimation
  - Positive beam limitation
  - Beam alignment
  - Filtration
  - Operator shield

8.1.7 Fluoroscopic protection features

- SID
- Primary protective barriers
- Exposure control
- Cumulative timer
- Dose area product

**Radiation physics- Practical**

**Unit 1: Electricity and magnetism**

**12 Hrs**

- 1.1 Observe the use of capacitor, charging & discharging of a capacitor through a resistor.
- 1.2 Observe the different types of magnet and electromagnetic phenomenon
- 1.3 Observe phenomenon of the different types of transformer used during the x-ray production.

**Unit 2: Rectification and x-ray circuit**

**12 Hrs**

- 2.1 Identify the types of diodes.
- 2.2 Explain the phenomenon of thermionic emission.
- 2.3 Describe a self-rectified circuit.
- 2.4 Compare half-wave and full-wave circuits.
- 2.5 Measure different types of high voltage.
- 2.6 Draw a diagram of an x-ray circuit.
- 2.7 Inspect x-ray cable fuses, switches, earthing, insulation, and the necessary wiring in switches and fuses.

**Unit 3: Atom and atomic structures**

**5 Hrs**

- 3.1 Draw spectrum of an electromagnetic radiation.

**Unit 4: Attenuation**

**8 Hrs**

- 4.1 Observe different types of filters used in radiology department

**Unit 5: Interaction of radiation with matter**

**5 Hrs**

- 5.1 Observe the differential absorption in different body tissues with their effective atomic number.

**Unit 6: Radiation detection and measurements**

**10 Hrs**

- 6.1 Observe different radiation measuring devices.
- 6.2 Observe different personnel monitoring devices.

**Unit 7: Radiation protection**

**18 Hrs**

- 7.1 Observe the protective materials and lead impregnated substances & building material for ionizing radiation.
- 7.2 Practice different radiation protection technique applied for different radiological procedures
- 7.3 Observe lead protective apparels like Lead gloves, thyroid shields, lead goggles, lead apron, gonad shield, lead window etc.

### Final written exam marking scheme

<b>Unit</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>Total</b>
<b>Unit hours</b>	<b>13</b>	<b>13</b>	<b>23</b>	<b>9</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>28</b>	<b>140</b>
<b>Marks</b>	<b>8</b>	<b>8</b>	<b>13</b>	<b>5</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>16</b>	<b>80</b>

#### Reference Books:

- Bushong, S. C. *Radiologic science for technologists: Physics, biology, and protection.*
- Ashworth, [First Initial]. *X-ray physics and equipment.*
- Johns, C. *Physics of radiology.*
- Mass, S. *Physics and equipment in imaging modalities*

# HS0206DR-Radiological Anatomy

**Total Hours: 5 Hrs./week**  
**Theory Hours: 4 Hrs./week**  
**Practical Hours: 1 Hrs./week**

## Course Description:

This course is designed to provide knowledge and skills on Radiological Anatomy in a radiological perspective. This course studies the essential structures crucial for interpreting medical images accurately. This course includes anatomical terms, 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:

- **Demonstrate Proficiency in Anatomical Terminology:** Define and apply the fundamental anatomical terms and concepts necessary for effective communication in the field of radiography.
- **Identify and Describe Skeletal Structures:** Identify and describe the major bones and joints of the human body, including axial and appendicular skeletons, with a focus on their radiological appearances.
- **Recognize Soft Tissue Anatomy:** Understand the anatomy of organs, muscles, blood vessels, and other soft tissues, and correlate this knowledge with radiographic images.
- **Analyze Radiographic Images:** Develop the skills to critically analyze and interpret radiographic images, correlating findings with anatomical structures to identify normal and abnormal presentations.
- **Explain and identify different anatomical landmarks and relation of different organs in radiography.**

## Course Contents: Theory

### Unit 1: Anatomical Terminology

**9 Hrs.**

#### 1.1 Anatomical position.

##### 1.1.1 Viewing radiograph.

- Imaging planes: Sagittal, Coronal, Axial.

#### 1.2 Anterior, posterior, dorsal, ventral, supine, prone, erect, medial, lateral, superior, inferior, cranial, caudal, flexion, extension, abduction, adduction, circumduction, rotation, proximal, distal, oblique, decubitus, superficial, deep, palmar, plantar, inversion, eversion, apical, foramen, condyle, fossa, process, body habitus, abdominal regions & quadrants, and other important cross sectional anatomical terminology.

#### 1.3 Posteroanterior (PA), Anteroposterior (AP), Right anterior oblique (RAO), Left anterior oblique(LAO), Right posterior oblique( RPO), Left posterior oblique(LPO), dorsal decubitus, ventral decubitus, lateral decubitus. Occipito Frontal(OF), Occipito mental (OM).

### Unit 2: Bones and Joints

**25 Hrs.**

#### 2.1. Bones

**22 Hrs.**

##### 2.1.1 Composition of Bone.

2.1.2	Function of Bone.	
2.1.3	Process of ossification.	
2.1.4	Types of Bones- according to position, composition, shape and ossification.	
2.1.5	Classification, structure of the following bones:	
	○ Cranial bones and Sutures	
	○ Facial bones and nasal sinuses	
2.1.6	Teeth structure and Dental formula.	
2.1.7	Radiological anatomy of followings	
	○ Clavicle, scapula, humerus, ulna, radius, carpals, metacarpals and phalanges.	
	○ Femur, tibia, fibula, tarsals, metatarsals and phalanges.	
2.1.8	Bones of axial skeleton.	
<b>2.2.</b>	<b>Joints</b>	<b>3 Hrs.</b>
2.2.1	Definition of Joint	
2.2.2	Functions of Joints	
2.2.3	Types of joints	
	○ Fibrous, cartilaginous and synovial joint.	
2.2.4	Characteristics of synovial Joint.	
2.2.5	Process of movement of different joints.	
2.2.6	Radiological anatomy of joints ( Shoulder, elbow, wrist, Hip, Knee and Ankle)	
<b>Unit 3:</b>	<b>Muscular System.</b>	<b>7 Hrs.</b>
3.1.	Types of muscles-skeletal, smooth and cardiac muscle.	
3.2.	Identification of major muscles around major joints (Shoulder, Hip and Knee).	
3.2.1	Location and Function of these Muscles.	
	○ Respiratory muscles-external and internal intercostal muscles, Diaphragm.	
	○ Pectoralis major and minor muscles.	
	○ Rotator cuff muscles.	
	○ Psoas muscle.	
3.2.2	Muscles used for giving IM injection.	
<b>Unit 4:</b>	<b>Digestive system</b>	<b>18 Hrs.</b>
<b>4.1</b>	<b>Alimentary Canal</b>	<b>11 Hrs.</b>
4.1.1	Parts of alimentary canal.	
4.1.2	Structure of GI tract and its modification in different parts of GI tract.	
4.1.3	Comparison between Small and Large intestine.	
4.1.4	List of Radiological investigations for different parts of GI system	
<b>4.2</b>	<b>Accessory Glands of GI tract.</b>	<b>7 Hrs</b>
4.2.1	Salivary Glands, Pancreas and Liver.	
4.2.2	List the Location, structure of liver, pancreas and salivary glands.	
4.2.3	Biliary Tree.	
<b>Unit 5:</b>	<b>Respiratory system</b>	<b>9 Hrs.</b>
5.1	Size, shape, relationship of Naso-pharynx, pharynx, larynx, trachea, bronchi, bronchioles, alveoli, pleura and Lungs.	
5.2	Structure of thoracic cage and diaphragm	
5.3	Outline of pleura and lungs with surface marking	
<b>Unit 6:</b>	<b>Cardiovascular system</b>	<b>18 Hrs.</b>
<b>6.1</b>	<b>Blood and its constituents</b>	<b>3 Hrs</b>
6.1.1.	Composition of Blood-Plasma and Blood Cells.	
6.1.2.	Normal Level of Blood Urea and Creatinine and its significance.	
<b>6.2</b>	<b>Heart &amp; Major blood vessels</b>	<b>15 Hrs.</b>

6.2.1	Structure of Heart and its location.	
6.2.2	Circulation of Blood in heart (external and internal).	
6.2.3	Structures of arteries, veins and capillaries.	
6.2.4	Branches of Aorta and its supply.	
6.2.5	Portal circulation- formation of portal vein and its tributaries.	
6.2.6	Pulmonary circulation	
<b>Unit 7: Lymphatic system</b>		<b>4 Hrs.</b>
7.1	Definition of Lymph.	
7.2	Composition and function of lymph.	
7.3	Lymph vessels- Thoracic duct and right lymphatic duct and area drained by them.	
7.4	Structure of lymph nodes, Spleen, Thymus.	
<b>Unit 8: Urinary System</b>		<b>11 Hrs</b>
8.1	Size, shape, relationship and functions of the organs associated with urinary system including kidney, ureter, urinary bladder and urethra	
8.2	Surface marking of kidneys	
8.3	Formation and composition of urine	
<b>Unit 9: Endocrine system</b>		<b>11 Hrs</b>
9.1	Definition of hormone and its function.	
9.2	Location, Structure, functions of Pituitary, Thyroid, Pancreas, Adrenal, Ovary, and Testis.	
<b>Unit 10: Reproductive System</b>		<b>7 Hrs</b>
10.1	<b>Female Reproductive system.</b>	<b>5 Hrs</b>
10.1.1	External and internal genital organs.	
10.1.2	Location and structure of vagina, uterus, uterine tubes and ovary.	
10.1.3	Menstruation and ovulation.	
10.1.4	Location and structure of Breast.	
10.2	<b>Male Reproductive system.</b>	<b>2 Hrs.</b>
10.2.1	Location and structure of testes, epididymis, vas deferens seminal vesicles, ejaculatory duct and prostate.	
<b>Unit 11: Nervous System.</b>		<b>14 Hrs.</b>
11.1	<b>Central and peripheral nervous system</b>	<b>9 Hrs.</b>
11.1.1	Location, structure and function of brain and spinal cord.	
11.1.2	Meninges –layers and function.	
11.1.3	Formation and circulation of CSF, Ventricular system.	
11.1.4	Cranial nerves, spinal nerves and nerve plexus.	
11.2	<b>Structure and location of organs of special senses.</b>	<b>5 Hrs.</b>
11.1.1	Nose, Ear, Eye, Tongue, Skin	
<b>Unit 12: Surface Anatomy.</b>		<b>7 Hrs</b>
12.1	Anatomy of the skeleton and body systems from planar and projectonal radiographic images.	
12.2	Radiographic appearance, location, vertebral levels and anatomical relationships of major organs, vessels and structures.	
12.3	Surface markings, relating them to internal anatomy and radiographic appearance.	
<b>Radiological Anatomy- Practical</b>		
<b>Unit 1: Anatomical Terminology</b>		<b>3 Hrs</b>

- 1.1 Identify anatomical position, Sagittal, coronal, axial, Anterior, posterior, dorsal, ventral, supine, prone, erect, medial, lateral, superior, inferior, cranial, caudal, flexion, extension, abduction, adduction, circumduction, rotation, proximal, distal, oblique, decubitus, superficial, deep, palmar, plantar, inversion, eversion. Apical, foramen, condyle, fossa, process, Posteroanterior, Anteroposterior, RAO, LAO, RPO, LPO, dorsal decubitus, ventral decubitus, lateral decubitus. OF, OM. Identify border, canal, condyle, epicondyle, foramina, fossa, process, spine, surface, tubercle, trochanter.
- 1.2 Assess body habitus.
- 1.3 Identify abdominal regions and quadrants.

**Unit 2: Bones and Joints**

**6 Hrs**

- 2.1 Identify the parts of the following bones
  - 2.1.1 Cranial bones and sutures
  - 2.1.2 Facial bones and nasal sinus
  - 2.1.3 Teeth structure
- 2.2 Observe the ossification centers on the x-ray.
- 2.3 Identify the parts
  - 2.3.1 Clavicle, scapula, humerus, ulna, radius, carpals, metacarpals and phalanges.
  - 2.3.2 Femur, tibia, fibula, tarsals, Metatarsals and phalanges.
- 2.4 Identify joints in human body
- 2.5 Observe the movements of the following joints: shoulder, elbow, wrist, hip, knee, foot, ankle, temporomandibular, atlantooccipital.

**Unit 3: Muscular System**

**2 Hrs**

- 3.1 Identify major muscles around major joints and also be able to identify them on radiograph. (Diaphragm, Psoas, Pectoralis Major).
- 3.2 Identify surface marking of some important muscles and their action.
- 3.3 Identify Muscles used for giving IM injection.

**Unit 4: Digestive system**

**4 Hrs**

- 4.1 Identify the salivary glands, pharynx, esophagus, stomach, liver, gallbladder, biliary tract, pancreas, small intestine, large intestine, rectum and anus.

**Unit 5: Respiratory system**

**2 Hrs**

- 5.1 Identify naso-pharynx, pharynx, larynx, trachea, bronchi, bronchioles, Lungs and pleura.
- 5.2 Identify thoracic cage and diaphragm.

**Unit 6: Cardiovascular system**

**4 Hrs**

- 6.1 Identify the different structures in the heart.
- 6.2 Identify the major blood vessels in the body with surface marking.
- 6.3 Identify Boundary of heart on chest X-ray.

**Unit 7: Lymphatic system**

**1 Hr**

- 7.1 Identify location of important groups of lymph nodes.

**Unit 8: Urinary System**

**2 Hrs**

- 8.1 Identify kidney, ureter, urinary bladder and urethra and should identify them on radiograph.

<b>Unit 9: Endocrine system</b>	<b>3 Hrs</b>
9.1 Identify Pituitary, Thyroid, Pancreas, Adre, Ovary and Testis.	
<b>Unit 10: Reproductive System</b>	<b>3 Hrs</b>
10.1 Identify the organs of male and female reproductive system.	
<b>Unit 11: Nervous System</b>	<b>3 Hrs</b>
11.1 Identify brain, spinal cord	
11.2 Identify organs of special sense	
<b>Unit 12: Surface Anatomy</b>	<b>2 Hrs</b>
12.1 Identify the different organs on the body surface	
12.2 Identify the different bones of radiological importance in human body	
12.3 Identify the different landmarks of radiological importance in human bod	

**Final written exam marking scheme**

Unit	1	2	3	4	5	6	7	8	9	10	11	12	Total
Unit Hours	9	25	7	18	9	18	4	11	11	7	14	7	140
Marks	5	15	4	11	5	10	2	6	6	4	8	4	80

**Reference Books:**

- Waugh, A., & Grant, A. (2014). *Ross and Wilson: Anatomy and physiology in health and illness*. Edinburgh: Churchill Livingstone Elsevier.
- Warrick, C. K. *Anatomy and physiology for radiographers*. Hodder Arnold.
- Halim, A. *Surface and radiological anatomy*. CBS Publishers & Distributors.
- Glenister, T. W. A., & Ross, J. R. W. *Anatomy and physiology for nurses*. London: Heinemann.
- Moeller, T., & Reif, E. *Pocket atlas of sectional anatomy: Computed tomography and magnetic resonance imaging*. Thieme.
- Ryan, S., McNicholas, M., & Eustace, S. J. *Anatomy for diagnostic imaging*. Saunders Ltd

## HS0207DR-First Aid and Public Health

**Total Hours: 5 Hrs./week**  
**Theory Hours: 4 Hrs./week**  
**Practical Hours: 1 Hrs./week**

### Course Description:

This course provides the students with the knowledge of first aid and patient care with regard to the patients coming to Radiology department. This course also makes the students familiar with various emergency conditions and their primary management. The course provides an insight into the latest health plans, policies of the Health care delivery system of Nepal along with the basics of public health and epidemiology.

**Course Objectives:** At the end of this course the students will be able to:

- Demonstrate knowledge of the roles and responsibilities of a First Aider
- Conduct a primary and secondary survey to assess the condition of a casualty.
- Conduct a full body examination and monitor vital signs.
- Correctly use the different techniques for the different types of emergency conditions.
- Perform CPR and place a casualty in the recovery position.
- Learn about the latest policies, basic public health and epidemiology.

### Course Contents: Theory

<b>Unit 1. FIRST AID</b>	<b>63 Hrs.</b>
<b>1.1 Introduction to first Aid</b>	<b>5 Hrs.</b>
1.1.1 Define and explain first aid, Purpose of first aid, Procedures for assessment and interventions in first aid,	
1.1.2 Disposal and communication responsibilities, Principles of triage with multiple causalities.	
<b>1.2 Shock</b>	<b>5 Hrs</b>
1.2.1 Definition of Fainting and Shock, Types and causes of Shock (Anaphylactic, Septic, Cardiogenic, Hypovolemic, Neurogenic), Signs and symptoms of each types of shock, Methods of recording Vital signs, First aid management of Fainting and Shock.	
<b>1.3 Poisoning</b>	<b>4 Hrs</b>
1.3.1 Definition, Causes, Sign symptoms, Risk, Antidotes, Management and Prevention of each types of poisoning (Organophosphorus, Corrosive, petroleum products, Diazepam, Alcohol, Drugs),	
1.3.2 Common poisonings in Nepal and Prevention of poisoning	
<b>1.4 Cardiopulmonary Resuscitation (CPR)</b>	<b>5 Hrs</b>
1.4.1 Define CPR, Principles of CPR, Conditions which require CPR., Process of CPR, Precaution to be taken while performing CPR, Process to perform CPR in infants and adults	
<b>1.5 Foreign Body in Ear, Nose, Throat &amp; Eye</b>	<b>4 Hrs</b>
1.5.1 Common causes, Sign and symptoms, and Risks of foreign body in Ear, Nose, Throat and Eye, Indications for immediate referral, DO'S and DONT'S in foreign body in Ear, Nose, and Throat, Heimlich maneuver	
<b>1.6 Injury/wound</b>	<b>6 Hrs</b>

- 1.6.1 Definition and types of Closed and Open wound, recommended first aid treatment of each types of wound: (Abrasions, Incised, Contusions, Hematoma, Lacerations, Punctured/ stab, Perforating/Gun shoot)
- 1.6.2 First aid assessment and treatment of injury/wounds, Techniques of bandaging, Complications of wounds, Process of wound healing, Factors delaying wound healing and factors promote in wound healings.
- 1.7 Hemorrhage 6 Hrs**
- 1.7.1 Definition and types of Haemorrhages, Sign and Symptoms of haemorrhage, First Aid management of haemorrhage, Complication of haemorrhage, Describe the precautions on transporting a haemorrhagic patient
- 1.8 Burn and Scald 6 Hrs**
- 1.8.1 Definition of Burn and Scald, Common causes, Classification, Sign and symptoms, and Complications of burns
- 1.8.2 First aid assessment and treatment of burns and scalds, Application of the “Rule of nines” to estimate extent of burn, Fluid therapy for burn victims, Pain management for burn victim, Referral after stabilization of burn.
- 1.9 Mountain sickness (Altitude sickness) /Hypothermia/Frost bite 5 Hrs**
- 1.9.1 Definition, clinical features, first aid management and prevention of altitude illnesses and Acute Mountain Sickness (AMS), High Altitude Cerebral Edema (HACE), High Altitude Pulmonary Edema (HAPE), Frost bite, Process of Acclimatization
- 1.10 Heat stroke (Heat reaction) 3 Hrs**
- 1.10.1 Definition cause, Clinical features and of heat stroke, Definition of Heat cramps, Heat exhaustion and Heat stroke, Emergency treatment of Heat exhaustion and Heat stroke, Prevention of Heat illness
- 1.11 Fracture and Dislocation 9 Hrs**
- 1.11.1 Define sprain, Fracture, Subluxation, dislocation and muscle injury with their causes, Signs and symptoms and complications
- 1.11.2 Fracture: Types, Splinting techniques for Fractures, Uses of RICE (Rest, Immobilize, Cold and Elevate)
- 1.11.3 Emergency treatment including the use of improvisation for strains, sprains, fractures and dislocation
- 1.11.4 Prevention of bones and joints fracture
- 1.11.5 Referral management
- 1.12 Rabid Animal bite, Snake bite, and Insect stings 5 Hrs**
- 1.12.1 Explain the dangers of Animal bites and insect stings, Incidence of injury due to snake bites, animal bites, Insect stings and poisoning, Types of Snake poison (Neuro-toxic and Hemato-toxic), Sign and symptoms, and emergency Management of poisonous snake bites.
- 1.12.2 Aetiology, reservoir and modes of transmission, Incubation period of rabies and management of suspected rabid animal bites, Prevention and control of rabies in animal and human population including vaccinations, Common insect bites (Wasp, Hornet and Bee) and its management.
- 1.12.3 Ways to reduce the incidence of Bites, Stings and Poisonings through community education

**Unit-2. Primary Health Care (PHC)**

**45 Hrs.**

**2.1 Introduction to Health**

**9 Hrs**

- 2.1.1 Concept of health given by WHO, Physical mental and social dimensions of health, Major Health Indicators Determinants of health
- 2.1.2 Scope of health care: Promotive, Preventive, Curative and Rehabilitation, Levels of disease prevention with examples, Relationship between Health for All and Primary Health Care.

## **2.2 Concept of PHC**

**9 Hrs**

Define PHC. Explain the principle, strategy, and element of PHC, Scope of PHC

- 2.2.1 Latest National health policy, and Health care delivery system of Nepal, Concept of health planning and management, Millennium Development Goal (MDG)

## **2.3 Maternal and Child Health**

**27 Hrs**

- 2.3.1 Definition and scope of MCH, Essential MCH services, Antenatal, Intranatal and Postnatal care, High risk pregnancy.
- 2.3.2 Newborn care Safe motherhood programme: Scope of Maternity care, Antenatal, Intranatal, postnatal and new born care at Basic level health care centres as recommended by national maternity care guidelines and Elements of safe motherhood
- 2.3.3 Breast feeding: Advantages of Breast feeding, Disadvantages of bottle feeding, Benefits of exclusive breast feeding, Management of common problems related to breast feeding, Recommendations regarding the frequency and duration of breast feeding, Composition of breast milk and Alternatives of breast feeding: formula feeding, animal feeding, Cup feeding
- 2.3.4 Define immunization/vaccination and discuss the significance of immunization in disease prevention, Explain the National Immunization Schedule, Discuss the doses and routes of administration of vaccines recommended by EPI programme.
- 2.3.5 Definition of family planning, Scope of family planning services, Eligible couples, Relationship between family planning and improved MCH.
- 2.3.6 Classifications of contraceptive methods, Different categories of contraceptive methods available in Nepal: Temporary methods: Barrier, IUCD, Hormonal, Miscellaneous, Permanent methods: Vasectomy, Laparoscopy (Minilap), Tubectomy
- 2.3.7 Postpartum Temporary infertility, Contraception for breastfeeding women, Locational amenorrhoea method and COCs on lactation
- 2.3.8 Types, Eligibility, Procedure, Mode of action, Client instructions and Common side effects of emergency contraception with COCs and other Hormonal methods, Factors affecting the use of emergency contraception by COCs, Management of emergency contraception and current laws pertaining to termination of unwanted pregnancy.

## **Unit-3: Patient care in Radiology**

**18 Hrs**

- 3.1 Definition of patient care, Meaning of ABC, Vital signs- BP, Pulse Rate, Respiratory rate, normal range and values and Temperature Informed and written consent, Responsibilities of a Radiographer
- 3.2 Professionalism in patient care: Diversity, equity and inclusion, Emotional Intelligence, Developing professional attitudes (Teamwork, work ethic, healthcare model, sympathy, compassion), Communication, Age and generation specific communication, Patient interactions, Psychological considerations
- 3.3 Patient Identification methods, Patient records, Procedure explanation, Interactions with patient's family members

## **Unit-4: Basic Epidemiology**

**14 Hrs**

4.1 Definition, concept and contribution of epidemiology, traditional model of infectious disease causation by epidemiologic triad, measurement of epidemiology on the basis of frequency, distribution and determinant

4.2 How and what are the measure of transmitted, prevented and control of disease?

4.3 Discuss about screening of diseases.

#### **List of Practical**

**35 Hrs**

- Demonstrate knowledge of the roles and responsibilities of a First Aider
- Conduct a primary and secondary survey to assess the condition of a casualty.
- Demonstrate, explain and conduct a full body examination and monitor vital signs.
- Demonstrate, explain and perform by correctly using the different first aid techniques for the different types of emergency conditions in skill lab/real or simulated setting (dividing the students into different groups and using the method of roleplay):
  - Fracture and dislocations
  - Fainting and shock
  - Poisoning
  - CPR
  - Foreign Body
  - Injury/wound
  - Burns and scalds
  - Acute Mountain sickness/ Hypothermia/Frostbite
  - Heat stroke
  - Rabid Animal Bite/Snake bite/ Insect Stings
- Perform splinting and bandaging
- Demonstrate lifting and transporting technique a patient who must remain immobile.
- Observation of health care delivery system in Nepal at different level health institutions.
- Prepare simple media for health education like poster, flannel graph, models, charts, graphs, puppets and pamphlets.
- Prepare chart, demonstrate and explain about the safe motherhood along with the importance of Antenatal, intranatal, postnatal and newborn care.
- Prepare chart, demonstrate and explain proper Breastfeeding techniques along with its advantages and its alternatives
- Prepare chart, demonstrate and explain the disease cycle and its screening techniques.
- Prepare chart, demonstrate and explain the immunization schedule and its importance according to national guidelines.
- Prepare chart, demonstrate and explain about the importance of contraceptives along with its different types in skill lab setting.
- Demonstrate and perform the professionalism, ethics, patient identification and proper communication with the patients from diverse areas and states creating a simulative environment.
- Explain about the teamwork in healthcare system.

### Final written exam marking scheme

Unit	1	2	3	4	Total
Unit Hrs	63	45	18	14	140
Marks	36	26	10	8	80

#### Reference Books:

- St. John Ambulance UK. (2016). *First aid* (10th ed.).
- International Committee of the Red Cross. (2006). Switzerland.
- Sharma, A. K., & Sharma, S. K. (2015). *Principles of surgery* (Latest ed.). Kathmandu: Makalu Publication House.
- Park, K. (n.d.). *Park's textbook of preventive and social medicine* (Latest ed.). India: Banarsidas Bhanot Publishers.
- Department of Health Services, Ministry of Health. *Annual reports*.
- World Health Organization. [Title of WHO publication related to the issue]. Geneva: WHO Publications.
- King, M., King, F., & World Health Organization. (2009). *Primary child care: A manual for health workers* (2nd ed.). Oxford: Macmillan Publishers Ltd.
- Yalayaswamy, N. (2011). *First aid and emergency nursing* (Latest ed.). CBS Publisher & Distributors P Ltd.
- Shrestha, B. M. *Basic principles of management*. Nepal: Akshyulak Publication.
- World Health Organization. (1974). *Modern management methods and the organization of health services* (Public Health Papers No. 55).
- Bedi, Y. P. *A handbook of hygiene and public health*.
- Ramachandran, L., & Dharmalingam, T. (2001). *A textbook of health education*. New Delhi: Vikas Publishing House Pvt. Ltd.
- World Health Organization. (2002). *World health report 2002: Reducing risk, promoting healthy life*. Geneva: World Health Organization.



## **Third Years**

### **Subject**

1. **HS- 0301- DR-Basic Radiographic Pathology**
2. **HS- 0302- DR-Clinical Practice and Ethics**
3. **HS- 0303- DR-Radiography Practical I**
4. **HS- 0304- DR-Radiography Practical II**

# HS0301DR-Basic Radiographic Pathology

**Total Hours: 20 Hrs./week**  
**Theory Hours: 14 Hrs./week**  
**Practical Hours: 6 Hrs./week**

## Course Description:

This course introduces, pathological terminology related to radiological science. Student will be able to understand clinical history the diagnostic process applied to the particular indication and imaging modalities to particular organ system.

**Course Objectives:** On completion of the course the learner will be able to:

- Identify the etiologies, pathology and clinical features of common systemic disorders and communicable diseases.
- Identify indications that a case requires consultation to a higher level or specialty facility.
- Identify indication and contraindication for radiological procedure.

## Course Content: Theory

Unit 1: Introduction to Common pathological

**8 Hrs**

### Terminology:

- 1.1 Traumatic Pathology: Fracture, Stenosis, Dislocation, Subluxation, Hemorrhage, Sprain and Stroke
- 1.2 Tumor: Benign and Malignant
- 1.3 Infective Pathology: Tuberculosis, Arthritis, Infection, Inflammation and Infestation

### Unit 2: Chest

**22 Hrs**

- 2.1 **Introduce common pathology of chest:** Pneumonia, lung abscess, Tuberculosis, COPD, Ca Lung, Medistinal mass, Atelactasis, foreign bodies, emphysema, Pneumothorax, Haemothorax, pleural effusion, Cardiomegaly, CTR, Dextrocardia, Cytus inversus, common fracture in chest cavity, breast cancer

### Unit 3: Bones and joints

**24 Hrs**

#### 3.1 Introduce common pathology of Bone and joints:

- Dislocation, Subluxation of common bones and joints.
- Arthritis, Degenerative joint disease, Osteomyelitis. Osteoporosis, Gout, pag Paget's disease

- 3.2 **Introduce common pathology of Spine:** Lordosis, Scoliosis, Kyphosis, Spondylosis and Spondylolisthesis, Bone Tumor and bone metastasis, Lumbarization, Sacralization,

### Unit 4: Abdomen and Pelvis

**24 Hrs**

#### 4.1 Introduce common pathology of Abdomen and Pelvic:

- Acute abdomen condition, Ascities, Perforation, Bowel obstruction, TOF, Ca Stomach, Crohn's disease, Intussusception, Volvulus, Ca Colon, TB intestine
- Haematuria, UTI, Nephrolithiasis, Urolithiasis, Ectopic Kidney, Horseshoe kidney, Hydronephrosis, cystitis, Veseco-ureteric reflux, pyelonephritis, Diveticula, urethral stricture, Renal failure
- Infertility, Ca ovary, ectopic pregnancy

## Course Content: Practical

- Unit 1.** **6 Hrs**
1. Recognize normal radiograph
  2. Recognize common fracture in Radiograph.
  3. Demonstrate common pathology
- Unit 2.** **11 Hrs**
1. Identify normal radiograph of lung and mediastinum.
  2. Identify common pathology in Radiograph like PTB, Cardiomegaly, Pneumothrox,
  3. Pleural effusion, Dextrocardia ,Cytus inversus
- Unit 3.** **9 Hrs**
1. Recognize Normal radiograph of Abdomen and Pelvis.
  2. Recognize common pathology in Radiograph like Fracture, dislocation, Spondylolisthesis, Osteomyelitis. Osteoporosis, Gout, Paget's disease: Lordosis, scoliosis, Kyphosis, Spondylosis and spondylolisthesis.
  3. Identify Bone Tumor and bone metastasis
- Unit 4.** **13 Hrs**
1. Recognize Normal radiograph of Abdomen and Pelvis
  2. Recognize common pathology in Radiograph like Acute Abdominal Condition, Calculus, Intestinal obstruction, Perforation, Ectopic kidney.
  3. Identify urethral structure, Reflux and Tubal Blockage

**Final written exam marking scheme**

<b>Unit</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Total</b>
<b>Unit Hours</b>	<b>8</b>	<b>22</b>	<b>24</b>	<b>24</b>	<b>78</b>
<b>Marks</b>	<b>4</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>40</b>

**Reference Books:**

- Kowalczyk, N. *Radiographic pathology for technologists* (6th ed.).
- Eisenberg, R. L., & Johnson, N. M. *Comprehensive radiographic pathology* (6th ed.). Elsevier.
- Martensen, K. M. *Radiographic image analysis* (4th ed.). Elsevier.
- Edwards, C. R. W., & Bouchier, I. A. D. *Davidson's principles and practice of medicine*. Churchill.

## HS0302DR-Clinical Practice & Ethics

**Total Hours: 20 Hrs./weeks**

**Theory Hours: 14 Hrs./weeks**

**Practical Hours: 6 Hrs./weeks**

### **Course Description:**

This course provides the students with knowledge of general Clinical practice and ethics with regard to the patients coming to Radiology department and in bedside Radiography. This course also provides knowledge of Medico-legal aspects and Code of Practices in radiography.

### **Course Objectives:**

On the completion of the course, the learner will be able to:

- Apply patient care in Radiology department.
- Apply attitude & communication skill in patient care. Explain why patient interaction is important to patients, as well as their family and friends. Analyze effective methods of communicating with patients of various ages.
- Demonstrate safe techniques for patient moving and transferring, using the principles of good body mechanics.
- Explain medical ethics and medico-legal aspect, code of ethics and code of practice applicable to radiography practice and patient care.

### **Course Content: Theory**

#### **Unit 1: Patient care in Radiology**

**Theory: 30 Hrs**

##### **1.1 Introduction of Patient care**

**Theory: 17 Hrs**

1.1.1 Definition of patient care

1.1.2 Meaning of ABC

1.1.3 Vital signs- BP, Pulse Rate, Respiratory rate and Temperature

1.1.4 Informed and written consent.

##### **1.2 Bedside radiography**

**Theory: 13 Hrs**

1.1.1 Introduction of bedside radiography

1.1.2 Define traction and its types and importance

1.1.3 Factors under consideration during bedside radiography

- Control of infection
- Handling of patient
- Radiation Protection
- Handling of x-ray equipment and its accessories.
- Communication skills

#### **Unit 2: Safety, Transfer, Positioning & Communication**

**Theory: 22 Hrs**

2.1 Work place safety.

2.2 Patient Transfer.

2.2.1 Preparation for transfer

2.2.2 Stretcher transfer

2.2.3 Wheel chair transfer

2.3 Positioning for safety and comfort

2.3.1 Body positions

- 2.3.2 Support and padding
- 2.3.3 Restraints and immobilization
- 2.4 Age specific care and communication
- 2.5 Communication in special circumstances.

**Unit 3: Standard ethics for Radiographer**

**Theory: 28 Hrs**

- 3.1 Describe Medical ethics and medico legal issues
  - 3.1.1 Patients right
  - 3.1.2 Torts : Assault ,Battery, False Imprisonment, Defamation ,Fraud
  - 3.1.3 Negligence
  - 3.1.4 Malpractice prevention
- 3.2 Role of radiographer in work place.
- 3.3 Codes of ethics for radiographer
- 3.4 Scope of professional practice.
- 3.5 NHPC (Nepal Health Professional Council)
  - 3.5.1 Introduction and function
- 3.6 Standard Ethics of Radiographer according to ISRRT
- 3.7 Internal / Societies relating to Radiography Roles (ISRRT, ASRT, ACR, ECR)

**Course Content: Practical**

**Unit 1.**

17 Hrs.

- 1.1 Measure vital signs like BP, pulse rate, respiratory rate, temperature etc.
- 1.2 Students will able to fill consent form citing pros and cons of procedure to patients and their relatives
- 1.3 Observe the ABC and traction,
- 1.4 Handle equipment independently.

**Unit 2.**

8 Hrs.

- 2.1 Demonstrate different types of patient transfer device.
- 2.2 Involving students in different types of patient transfer.
- 2.3 Demonstrating patient restrainer & immobilization devices.
- 2.4 Demonstrate the skill of work place safety
- 2.5 Demonstrate different communication skills

**Unit 3.**

14 Hrs.

- 3.1 Recognize medical ethics & medico legal, issues.
- 3.2 Recognize role of radiographer in work place.
- 3.3 Recognize code of ethics.
- 3.4 Perform professional practice.

**Final written exam marking scheme**

Unit	1	2	3	Total
Unit Hour	30	22	28	80
Marks	16	10	14	40

**Reference Books:**

- Ehrlich, R. A., & Daly, J. A. *Patient care in radiography with an introduction to medical imaging.*
- Ryan, T. A. *Patient care in imaging technology.*

- Park, J. *Preventive and community medicine.*

# **HS0303DR-Radiography Practical I**

## **Practical Only**

### **(21 weeks)**

#### **Course Description:**

This field experience comprehensive clinical practical program is designed to help students apply the knowledge and skills on actual situation supervised by trained professionals. The program is offered after completing second year.

**Course Objectives:** On the completion of the course, the students will be able to:

- Fill up the request forms and carry out registration process .
- Perform routine and supplementary radiographic techniques for upper and lower limbs, thoracic cage, abdomen, spine and skull.
- Apply modified techniques for various disabilities and type of subject.
- Perform radiation protection and practical methods of reducing dose to the patient.

#### **Course Content: Practical**

#### **Unit 1: Introduction To Radiographic Technique: 20 Hrs.**

- 1.1 Observe and perform all the anatomic positioning techniques and projections; supine, prone, erect, medial, lateral, flexion, extension, cranial, caudal, proximal, distal, oblique, decubitus, etc
- 1.2 Recognize the radiographic work drill, radiographic request forms, and radiographic examination log register.
- 1.3 Recognize patient identification- x-ray no., Hospital number, patients name, bill no.

#### **Unit 2: Radiographic Technique For Extremities 400 Hrs.**

##### **2.1 Radiographic Techniques For Lower Limb 200 Hrs.**

- 2.1.1 Explain the patient for patient preparation, including removal of radiopaque materials.
- 2.1.2 Ask for last menstruation period (LMP) of female patient of reproductive age and apply 10 day rule.
- 2.1.3 Prepare the equipment and set the appropriate exposure factors for examination of toes, foot, calcaneum, ankle, tibia, fibula, knee, femur, hip joint, neck of femur and pelvis.
- 2.1.4 Apply radiation protection rules to reduce the dose to the patient and obtain a radiograph.
- 2.1.5 Check the radiographs for any artifacts and essential image criteria.

##### **2.2 Radiographic Techniques For Upper Limb 200 Hrs.**

- 2.2.1 Explain and instruct the patient for patient preparation, including removal of radiopaque materials.
- 2.2.2 Ask for last menstruation period (LMP) of female patient of reproductive age and apply 10 day rule.
- 2.2.3 Prepare the equipment and set the appropriate exposure factors for examination of fingers, thumb, hand, wrist, forearm, elbow and humerus.
- 2.2.4 Apply radiation protection rules to reduce the dose to the patient and obtain a radiograph.
- 2.2.5 Check the radiographs for any artifacts and essential image Criteria.

**Unit 3: Radiographic Technique For Shoulder Girdle And Clavicle 60 Hrs.**

- 3.1 Explain and instruct the patient for patient preparation, including removal of radiopaque materials.
- 3.2 Ask for last menstruation period (LMP) of female patient of reproductive age and apply 10 day rule.
- 3.3 Prepare the equipment and set the appropriate exposure factors for examination of Shoulder joint, scapula, acromio-clavicular joint, clavicle, sternoclavicular joint, sternum and ribs.
- 3.4 Apply radiation protection rules to reduce the dose to the patient and obtain a radiograph.
- 3.5 Check the radiographs for any artifacts and essential image Criteria.

**Unit 4: Radiographic Technique For Pelvic Girdle And Hip Region 60 Hrs.**

- 4.1 Explain and instruct the patient for patient preparation, including removal of radio-opaque materials.
- 4.2 Ask for last menstruation period (LMP) of female patient of reproductive age and apply 10 day rule.
- 4.3 Prepare the equipment and set the appropriate exposure factors for examination of the whole pelvis, sacro-iliac joints, hip joint and neck of femur.
- 4.4 Apply radiation protection rules to reduce the dose to the patient and obtain a radiograph.
- 4.5 Check the radiographs for any artifacts and essential image Criteria.

**Unit 5: Radiographic Technique for Vertebral Column 80 Hrs.**

- 5.1 Explain and instruct the patient for patient preparation, including removal of radiopaque materials.
- 5.2 Ask for last menstruation period (LMP) of female patient of reproductive age and apply 10 day rule.
- 5.3 Prepare the equipment and set the appropriate exposure factors for examination of atlanto-occipital joint , cervical spine, cervico-thoracic junction , thoracic spine, lumbar spine , sacrum and coccyx
- 5.4 Apply radiation protection rules to reduce the dose to the patient and obtain a radiograph.
- 5.5 Check the radiographs for any artifacts and essential image Criteria.

**Unit 6: Radiographic Technique for Chest and Abdomen 200 Hrs.**

- 6.1 Explain and instruct the patient for patient preparation, including removal of radiopaque materials.

- 6.2 Ask for last menstruation period (LMP) of female patient of reproductive age and apply 10 day rule.
- 6.3 Prepare the equipment and set the appropriate exposure factors for examination of Chest, Abdomen and Pelvis.
- 6.4 Apply radiation protection rules to reduce the dose to the patient and obtain a radiograph.
- 6.5 Check the radiographs for any artifacts and essential image Criteria.

**Unit 7: Radiographic Technique for Skull**

**80 Hrs.**

- 7.1 Explain and instruct the patient for patient preparation, including removal of radiopaque materials.
- 7.2 Ask for last menstruation period (LMP) of female patient of reproductive age and apply 10 day rule.
- 7.3 Prepare the equipment and set the appropriate exposure factors for examination of cranium, facial, PNS, mandible
- 7.4 Apply radiation protection rules to reduce the dose to the patient and obtain a radiograph.
- 7.5 Check the radiographs for any artifacts and essential image Criteria.

**Evaluation methods:** logbook duty signed by the supervisor.

**Practical and oral examination**

**Teaching / Learning Activities / Resources:** Clinical posting in radiology department and case study

**Note:**

- Students should be present in the hospital departments at least 90% of the allotted days to be eligible to sit in the final examination.
- Students will have to perform all examinations under the supervision of departmental staffs and may be allowed to perform examinations independently if the supervisor finds them perfect.
- Students should keep their practical record (**log-book**) signed periodically by their supervisor/demonstrator at the end of the posting.

**Reference Books:**

- Thapa, N. *Textbook of radiographic technique*. Heritage Publication.
- Ballinger, P. W. *Merrill's atlas of radiographic positioning and diagnostic procedures* (Vols. I & II).
- Holm, T., & Palmer, P. E. S. *Manual of radiographic technique*.
- Bhargava, S. K. *Textbook of radiology for residents and technicians*.
- Whitley, A. S., Sloane, C., Hoadley, G., Moore, A., & Anderson, C. *Clark's positioning in radiography* (Updated ed.).

# **HS0304DR-Radiography Practical II**

## Practical (9 weeks)

### **Course Description:**

This course is designed to help students apply the comprehensive knowledge and skills on actual situation supervised by competent and trained professionals. The program is offered after completing second year. During this period student should acquire practical knowledge to be able to independently handle the some of the cases and be able to assist specialists on special radiographic procedures.

**Course Objectives:** On the completion of the course, the learner will be able to:

- Perform some of the Radiological investigations and assist Radiological technologist / Radiologist during special radiographic procedure with/ without the use of contrast media.
- Handle portable and mobile X - rays machines with absolute precision.
- Handle CR and Direct digital radiography in proper way.
- Select contrast media according to specific examination.
- Identify adverse contrast media reactions and its management.

### **Course Content: Practical**

#### **Unit 1: Radiographic Investigation Of Gastro-Intestinal Tract Using Contrast Media** **120 Hrs**

- 1.1 Explain the patient about Barium series.
- 1.2 Check for the patient preparation and necessary equipment.
- 1.3 Check brief medical history of the patient.
- 1.4 Look for any absolute contraindication.
- 1.5 Take informed written consent for procedure.
- 1.6 Prepare the barium contrast media of different concentration.
- 1.7 Take the necessary exposures at accurate timing
- 1.8 Describe about aftercare and complication.

#### **Unit 2: Radiographic Investigation Of Uro-Genital Tract Using Contrast Media** **125 Hrs**

- 2.1 Explain the patient about Uro-genital tract examination.
- 2.2 Check for the patient preparation and necessary equipment.
- 2.3 Check brief medical history of the patient.
- 2.4 Look for any absolute contraindication.
- 2.5 Take informed written Consent for procedure.
- 2.6 Prepare contrast media of different examination.
- 2.7 Take the necessary exposures at accurate timing
- 2.8 Describe about aftercare and complication.

**Unit 3: Radiographic investigation of Biliary tract & Vascular tract using contrast media**  
**50 Hrs**

- 3.1 Explain the patient about biliary tract and vascular examination.
- 3.2 Check for the patient preparation and necessary equipment.
- 3.3 Check brief medical history of the patient.
- 3.4 Look for any absolute contraindication.
- 3.5 Take informed written Consent for procedure.
- 3.6 Prepare contrast media of different examination.
- 3.7 Take the necessary exposures at accurate timing
- 3.8 Describe about aftercare and complication.

**Unit 4: Other Radiographic investigation using contrast media** **80 Hrs**

- 4.1 Sailogram, DCG, Myelogram, Arthrography, Mammography and Ward Radiography
  - 4.1.1 Explain the patient about other special investigation.
  - 4.1.2 Check for the patient preparation and necessary equipment.
  - 4.1.3 Check brief medical history of the patient.
  - 4.1.4 Look for any absolute contraindication.
  - 4.1.5 Take informed written consent for procedure.
  - 4.1.6 Prepare contrast media of different examination.
  - 4.1.7 Take the necessary exposures at accurate timing
  - 4.1.8 Describe about aftercare and complication.

**Note:**

- 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 examinations under the supervision of departmental staffs and may be allowed to perform examinations independently if the supervisor finds them perfect.
- Students should keep their practical record (log-book) signed periodically by their supervisor/ demonstrator at the end of the posting in each subject.

**Evaluation Scheme:**

- Under this scheme students will have to perform a prescribed number of examinations in each department and maintain a logbook duly signed by the supervisor.
- 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 and oral examination.

**Reference Books :**

- Thapa, N. *Radiographic photography & technique II*. Heritage Publication.
- Watson, N. *Chapman & Nakielny's guide to radiological procedures* (6th ed.).

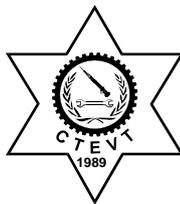
- Ballinger, P. W. *Merrill's atlas of radiographic positioning and diagnostic procedures* (Vols. I & II).
- Bhargava, S. K. *Textbook of radiology for residents & technicians* (5th ed.).
- Lakhkar, B. N. *Radiological procedures: A guideline*.

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5	Mr. Aroj Khadka	K.M.H.I.H.S, Kirtipur, Kathmandu.
6	Mr. Damodar Rokka	N. A. M. S., Mahavauddha, Kathmandu
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