

PROGRAM

MD RADIODIAGNOSIS

(Revised with effect from 2019-2020 onwards)

SUBJECT CONTENT

Physics:

1. Introduction to general properties of radiation and matter. Fundamentals of nuclear physics and radioactivity.
2. Production of x-rays.
3. X-ray generating apparatus, fluoroscopy.
4. Interactions of x-rays and gamma rays with matter and their effects on irradiated materials.
5. Measurement of X and gamma rays.
6. Interaction of X-rays with the patients.

7. The Radiological image.
8. The Image Receptor including CR and DR systems.
9. Radiation protection.
10. Quality assurance.
11. PACS.
12. Principles of conventional, spiral and MDCT.
13. Principles of Diagnostic Ultrasound and doppler.
14. Nuclear Magnetic Resonance and imaging.
15. Radionuclide imaging (Gamma camera, spect, PET).

Theoretical Knowledge:

The clinical features, imaging anatomy, imaging findings and management strategies of relevant diseases in the organ systems:

1. Bones and joints
2. Respiratory system
3. Cardiovascular system
4. Gastro intestinal tract
5. Urogenital tract
6. Head & Neck including orbits.
7. Imaging Obstetric and Gynecology
8. Teeth, soft tissue and breast
9. Endocrine system
10. Clinical (applied) radionuclide imaging.
11. Interventional radiology related to different systems of body.
12. Contrast agents: Contrast media, their types, formulation, mechanisms of action, dosage, routes of administration, adverse reactions and their management and recent developments.

Practical Experience:

1. Radiography of the chest.
 2. Radiography of the spine, extremities, abdomen, pelvic girdle and thorax.
 3. Radiography of the skull.
 4. Contrast techniques of GI tract, Biliary tract, GU tract.
 5. Portable radiography, emergency and pediatric radiography.
 6. Dark room technique.
 7. Positioning, performing and interpreting a CT study.
 8. Positioning, performing and interpreting an MR study.
 9. Performing a diagnostic angiogram and its pre and post procedure care.
 10. Performing USG / CT guided aspirations and catheter drainage.
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11. Performing and interpreting USG and Doppler studies.
12. Develop a systematic, lucid and clinically oriented reporting style.
13. Develop skills for workstation based reporting.
14. Develop ability to use Hospital information system to maximize diagnostic accuracy and reporting speed.
15. Develop specialised computer skills for creating high quality presentations.

Guidelines for Teaching and Learning Activities:

A candidate pursuing the course should work in the institution as a full time student. No candidate should be permitted to run a clinic/ laboratory/nursing home while studying postgraduate course. Each year should be taken as a unit for the purpose of calculating attendance.

Every student shall attend teaching and learning activities during each year as prescribed by the department and not absent himself/herself from work without valid reasons.

A list of teaching and learning activities designed to facilitate students acquire essential knowledge and skills outlined is given below.

1. **Lectures** : lectures are to be kept to a minimum. They may, however, be employed for teaching certain topics. Lectures may be didactic or integrated.

a. *dactic lectures:*

- 1) Bio-statistics.
 - 2) Use of library.
 - 3) Research Methods.
 - 4) Medical Code of Conduct and Medical Ethics.
 - 5) National health and Disease Control Programs.
 - 6) Communication Skills etc.
 - 7) Initial introductory lectures about the subject.
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b. *Integrated Lectures*: These are recommended to be taken by multidisciplinary teams for selected topics, e.g. Jaundice, Diabetes Mellitus, Thyroid etc.

2. **Journal Club** : Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in logbook relevant details. Further every candidate must make a presentation from the allotted journal(s) of selected articles at least four times a year and a total of 12 presentations in three years. The presentations would be evaluated using checklists and would carry weightage for internal assessment (evaluation sheet 1). A timetable with names of students and moderator should be announced at the beginning of every year.
 3. **Subject seminar** : Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the logbook relevant details. Further every candidate must present selected topics at least four times a year and a total of 12 seminar presentations in three years. The presentations should be evaluated using checklists and would carry weightage for internal assessment (evaluation sheet 1). A timetable with names of students and moderator should be announced at the beginning of every year.
 4. **Student Symposium** : Recommended as an optional multi disciplinary programme. The evaluation may be similar to that described for subject seminar.
 5. **Inter Departmental Meetings** : Strongly recommended particularly with departments of Surgery, Orthopedics and Medicine at least once a month. These meetings should be attended by postgraduate students and relevant entries must be made in the Logbook.
 6. **Teaching Skills** : Postgraduate students must teach Undergraduate students (e.g. Medical, Nursing) by taking demonstrations, bed side clinics, tutorials, lectures etc. Assessment is made using a checklist by faculty. Record of their participation should be kept in Logbook. Training of postgraduate students in Educational Technology is recommended.
 7. Department internal audit meetings: Once a month internal meetings to audit patient care, reporting and other operational issues.
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8. **Continuing Medical Education Programmes (CME)** : At least 2 state / national level CME programmes should be attended by each student in 3 years.
9. **Conferences** : Attending conferences is optional. However participation & presentation of scientific paper should be encouraged.

Courses:

Paper 1 (Basic Sciences, Radiological anatomy, Contrast Media, Imaging technology and Physics of radiation relevant to medical imaging) – Course 1 (U15MDRD01)

- CO 1 Detailed knowledge of Human anatomy and imaging (radiological) anatomy and the principles of radiographic positioning.
- CO 2 Knowledge of the physics of ionising radiation, the principles of its use for imaging, risk of radiation, safety measures for personnel and patient protection and regulations controlling its use.
- CO 3 Knowledge of the Physical principles of ultrasound, CT, PET and MRI, biosafety, and basic concepts of digital imaging and image quality.
- CO 4 Knowledge of the chemistry, pharmacokinetics, pharmacodynamics, dosage and toxicity of Imaging contrast media. Knowledge of contrast media reactions, their prevention and emergent management.

Introduction to general properties of radiation and matter. Fundamentals of nuclear physics and radioactivity.

Production of x-rays.

X-ray generating apparatus, fluoroscopy.

Interactions of x-rays and gamma rays with matter and their effects on irradiated materials.

Measurement of X and gamma rays.

Interaction of X-rays with the patients.

The Radiological image.

The Image Receptor including CR and DR systems.

Radiation protection.

Quality assurance.

PACS.

Principles of conventional, spiral and MDCT.

Principles of Diagnostic Ultrasound and doppler.

Nuclear Magnetic Resonance and imaging.

Radionuclide imaging (Gamma camera, spect, PET).

Paper 2 (Radiology of CVS, Respiratory, GIT (including Hepatobiliary and Endocrine systems)) – Course 2 (U15MDRD02)

- CO 1 Knowledge of Cardiovascular system pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, Conventional angiography, CT ,MRI and PET.
- CO 2 Knowledge of Respiratory system pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, CT and MRI and PET.
- CO 3 Knowledge of GI and hepatobiliary system pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, CT and MRI and PET.
- CO 4 Knowledge of Endocrine system pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, CT and MRI and PET.

**The gross and multiplanar anatomy of CNS, CVS, respiratory, GIT
Correlation of gross pathology of disease with imaging features.**

Indications, diagnostic features and limitation of plain radiography, contrast radiography, fluoroscopy, ultrasonography, CT, MRI and catheter angiography in the imaging of various organ systems.

Cardiac CT and its application

Radioimaging in pregnancy

Minimalising the radiation exposure among health care professionals

Overall diagnostic strategies (including non radiological tests) and management options in major clinical syndromes.

Paper 3 (Radiology of Genitourinary system, Obst. & Gynae, Musculoskeletal system, Central Nervous system and Head and Neck region)) – Course 3 (U15MDRD03)

- CO 1 Knowledge of Genitourinary system pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, CT and MRI and PET.
 - CO 2 Knowledge of Obst & Gynae pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, CT and MRI and PET.
 - CO 3 Knowledge of Musculoskeletal system pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, CT and MRI and PET.
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CO 4 Knowledge of Central Nervous system pathology, pathophysiology and the imaging approach and features of these diseases on X-rays, Ultrasound, conventional angiography, CT and MRI and PET.

CO 5 Knowledge of Head and Neck region pathology, pathophysiology and the imaging approach and features of diseases on X-rays, Ultrasound, CT and MRI and PET.

The gross and multiplanar anatomy of Genitourinary System, Obs and Gynae, Musculoskeletal system , CNS and head and neck region

Correlation of gross pathology of disease with imaging

Indications, diagnostic features and limitation of plain radiography, contrast radiography, fluoroscopy, USG, CT, MRI and catheter angiography in the imaging of various organ systems.

Overall diagnostic strategies (including non radiological tests) and management options

Paper 4 (Recent advances in the imaging sciences, molecular imaging and Interventional radiology) – Course 4 (U15MDRD04)

CO 1 Knowledge of pharmacology of radionucleotides, indications for their use, radiation safety, and the imaging features in various clinical conditions.

CO 2 Knowledge of recent advances and trends in imaging sciences and related fields, their potential clinical value and limitations.

CO 3 Knowledge of the common Interventional radiology procedures (Indications, techniques, materials, patient selection, intra and post procedure patient care, complications and their management)

Knowledge about Current developments and future trends in imaging technology and practice in the international setting as well the use of pharmacological techniques in RadioDiagnosis

Radionucleotide pharmacology

Limitations in radiology

Recent advances in interventional radiology

Non interpretative knowledge and skills – Course 5 (U15MDRD05) – Elective Course

CO 1 Knowledge of guidelines, regulations and statutory requirements for imaging of pregnant women and safe radiation practice.

CO 2 Knowledge of ethical and medico-legal issues related to radiology practice, the critical importance of documentation and the skill to share information and communicate empathetically with patients.



Knowledge and skill to obtain an informed consent which is legally and ethically valid.

- CO 3 Interpersonal skills to be an effective team member both in radiology and multi-speciality groups. The skills to communicate findings to referring physicians promptly and accurately, both orally and in written form and contribute usefully in discussions of complex clinical problems.
- CO 4 Knowledge of appropriate and rational use of imaging modalities in situations where resources are limited.
- CO 5 Knowledge of bio statistics to critically evaluate studies in the radiology literature and apply the knowledge to clinical practice. Be able to ask a research question, plan and conduct a statistically and ethically sound study and be able to write a good research paper.

Guidelines for Monitoring Learning Progress

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps the teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching learning activities. It may be structured and assessment be done using checklists that assesses various aspects.

The learning out comes to be assessed should include: (a) Personal Attitudes (b) Acquisition of Knowledge, (c) Clinical and operative skills, (d) Teaching skills and (e) Dissertation.

a) **Personal Attitudes.** The essential items are:

- Caring attitudes
 - Initiative
 - Organisational ability
 - Potential to cope with stressful situations and undertake responsibility.
 - Trust worthiness and reliability
 - To understand and communicate intelligibly with patients and others
 - To behave in a manner which establishes professional relationships with patients and colleagues.
 - Ability to work in team.
 - A critical enquiring approach to the acquisition of knowledge.
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The methods used mainly consist of observation. It is appreciated that these items require a degree of subjective assessment by the guide, supervisors and peers.

- b) **Acquisition of Knowledge** : The methods used comprise of 'Log Book' which records participation in various teaching / learning activities by the students. The number of activities, attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors. Some of the activities are listed. The list is not complete. Institutions may include additional activities, if so, desired.

Journal Review Meeting (Journal Club) : The ability to do literature search , in depth study, presentation skills and use of audio-visual aids are to be assessed.

Seminars / Symposia : The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio-visual aids are to be assessed using a checklist.

Clinico-pathological conferences : This should be multidisciplinary case study of an interesting case to train the candidate to solve diagnostic and therapeutic problems by using an analytical approach. The presenter(s) are to be assessed using a checklist similar to that used for a seminar.

Medical audit : Periodic morbidity and mortality meetings be held. Attendance and participation in these must be insisted upon. This may not be included in assessment.

c) Clinical skills

Day to Day work : Skills in outpatient and ward work should be assessed periodically. The assessment should include the candidates' punctuality, analytical ability and communication skills.

Clinical Meetings : Candidates should periodically present cases to his peers and faculty members. This should be assessed using a checklist.

Clinical and Procedural skills : The candidate should be given graded responsibility to enable learning by apprenticeship. The performance is assessed by the guide by direct observation. Particulars are recorded by the student in the logbook.

- d) **Teaching skills** : Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any..
- e) **Dissertation in the Department** : Periodic presentations are to be made in the department. Initially the topic selected is to be presented before submission to the University for registration, again before finalisation for critical evaluation and another before final submission of the completed work (evaluation sheet 2).
- f) **Periodic tests** : The departments may conduct three tests, two of them be annual tests, one at the end of first year and other in the second year. The third test may be held three months before the final examination. The tests may include written papers, practicals / clinicals and viva voce.
- g) **Work diary / Log Book** : Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the candidate.
- h) **Records** : Records. Logbooks and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University or MCI.

Log book

The logbook is a month wise record of the important activities of the candidates during his / her training. Internal assessment should be based on the evaluation of the logbook. Collectively, logbooks are a tool for the evaluation of the training programme of the institution by external agencies. The record includes academic activities as well as the presentations and procedures carried out by the candidate.

Final Assessment

All the papers to be set by 3 internal examiners jointly and moderated by one external examiner.

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| a) Theory | 50% |
| Paper I | Basic sciences & radiation physics. |
| Paper II | CVS Resp.G IT (including Hepato biliary), Endocrine. |
| Paper III | Genitourinary Retro peritoneum, CNS, Musculoskeletal system, Obst.&Gynae, ENT & Eye. |
| Paper IVs | Recent advances & nuclear medicine. |

All papers would consist of short answer question covering all aspects of the course.

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| b) Practical | 50% | |
| 1. | One long & two short cases | 50% |
| 2. | Film Quiz 40-50 spots | 25% |
| 3. | Radiation Physics | 5% |
| 4. | Equipment & accessory related to Radiology and contrast | 5% |
| 5. | Radiological & imaging procedure | 10% |
| 6. | Gross pathology | 5% |

THESIS FOR MD RADIO DIAGNOSIS AND IMAGING:

Objectives

1. The student would be able to demonstrate capability in research by planning, conducting systematic scientific inquiry, data analysis and derive conclusions.
2. Understand statistical methods used for evaluating an imaging modality and comparing two or more imaging modalities.

Dissertation

1. Every candidate pursuing MD/MS degree course is required to carry out work on a selected research project under the guidance of a recognized post graduate teacher. The results of such a work shall be submitted in the form of a dissertation.
 2. The dissertation is aimed to train a postgraduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of research study, collection of data, critical analysis, comparison of results and drawing conclusions.
 3. Every candidate shall submit to the Registrar (Academic) of the University in the prescribed proforma, a synopsis containing particulars of proposed dissertation work six months from the date of commencement of the course on or before the dates notified by the University. The synopsis shall be sent through the proper channel.
 4. Such synopsis shall be reviewed and the dissertation topic will be registered by the University. No change in the dissertation topic or guide shall be made without prior approval of the University.
 5. The study should be approved by the Institution Ethics Committee.
 6. The dissertation should be written under the following headings:
 - a) Introduction
 - b) Aims or Objectives of study
 - c) Review of Literature
 - d) Material and Methods
 - e) Results
 - f) Discussion
 - g) Conclusion
 - h) Summary
 - i) References (Vancouver style)
 - j) Tables
 - k) Annexures
 7. The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and
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other annexures. It should be neatly typed in double line spacing on one side of the paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. The dissertation shall be certified by the guide, head of the department and head of the institution.

8. Four copies of dissertation thus prepared shall be submitted to the Registrar (Evaluation), six months before final examination on or before the dates notified by the University.
9. The dissertation shall be valued by examiners appointed by the University. Approval of dissertation work is an essential precondition for a candidate to appear in the University examination.