RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Programme Structure and Course Details of B.Sc. (Hons) in Medical Radiology and Imaging Technology 2022-2026

Programme Code: 401

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M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

Faculty of Life and Allied Health Sciences
Department of AHS

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Dean - Academics
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Bangalore - 560 054

UNIVERSITY'S VISION, MISSION, AND OBJECTIVES

The M. S. Ramaiah University of Applied Sciences (MSRUAS) will focus on student-centric professional education and motivates its staff and students to contribute significantly to the growth of technology, science, economy, and society through their imaginative, creative and innovative pursuits. Hence, the University has articulated the following vision and objectives.

Vision

MSRUAS aspires to be the premier university of choice in Asia for student-centric professional education and services with a strong focus on applied research whilst maintaining the highest academic and ethical standards in a creative and innovative environment

Mission

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation, and excellence in our teaching and research. We value integrity, quality, and teamworkin all our endeavors. We inspire critical thinking, personal development, and a passion for lifelong learning. We serve the technical, scientific and economic needs of our Society.

Objectives

1. To disseminate knowledge and skills through instructions, teaching, training, seminars, workshops and symposia in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to equip students and scholars to meet the needs of industries, business and society
2. To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to meet the challenges that arise in industry, business and society
3. To promote health, and human well-being and provide holistic healthcare
4. To provide technical and scientific solutions to real-life problems posed by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences
5. To instill the spirit of entrepreneurship in our youth to help create more career opportunities in the society by incubating and nurturing technology product ideas and supporting technology-backed business
6. To identify and nurture leadership skills in students and help in the development of our future leaders to enrich the society we live in
7. To develop partnerships with universities, industries, businesses, research establishments, NGOs, international organizations, and governmental organizations in India and abroad to enrich the experiences of faculties and students through research and developmental programs

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PROGRAMME SPECIFICATIONS: B.Sc. (Hons)- Medical Radiology and Imaging Technology

Faculty	Faculty of Life and Allied Health Sciences
Department	Allied health Sciences
Programme	B.Sc. (Hons)- Medical Radiology and Imaging Technology
HOD	Dr Tushar Shaw
Dean of the faculty	Dr. Krishnamurthy Jayanna

1. **Title of the Award**
   B.Sc. (Hons) – Medical Radiology and Imaging Technology
2. **Mode of Study**
   Full-Time
3. **Awarding Institution/Body**
   M.S. Ramaiah University of Applied Sciences, Bangalore (India)
4. **Joint Award**
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5. **Teaching Institution**
   Faculty of Life and Allied Health Sciences
   M.S. Ramaiah University of Applied Sciences, Bangalore (India)
6. **Date of Programme Specifications**
   May 2022
7. **Date of Programme Approval by the Academic Council of MSRUAS**
   --
8. **Next Review Date**
   --
9. **Programme Approving Regulatory Body and Date of Approval**
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10. **Programme Accrediting Body and Date of Accreditation**
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11. **Grade Awarded by the Accreditation Body**
    --
12. **Programme Accreditation Validity**
13. **Programme Benchmark**

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14. Rationale for the Programme

Advances in science and technology have made a paradigm shift in health care over the past decade resulting in wider appreciation of the fact that health service delivery should go beyond just physicians and nurses and involve teamwork among clinicians and non-clinicians or allied health professionals. India is fast emerging on a global medical tourism hub with international patient base growing in double digits every year. This rising trend has resulted in an increase in investment by health care providers by installing best in class equipment upgrading medical technology and quality accreditation. In the current scenario physician's dependent on sophisticated machinery and technology, to arrive at an appropriate diagnosis. Allied healthcare professional (AHP) who can handle this equipment form an indispensable member of the team for successful management of patients.

Medical Radiology and imaging technology deals with radiation to diagnose and treat diseases. Many specialties are entirely dependent on radiology technologists to produce highly accurate images for precise detection of injuries, diseases and monitor treatment and progression or relapse of many diseases in a minimally invasive and anatomically precise manner. Medical Imaging technology has advanced in the last twenty years and includes now both invasive and non-invasive procedures which are highly specialized and sophisticated techniques requiring handling of advanced equipment by well-trained technologists. Thus, al trained medical radiology and imaging technologist becomes an essential member in both diagnostic and interventional radiology team.

A thorough knowledge of radiation protection and safety, structure and function of the body, effects of injury and diseases on the body are essential for a successful radiographic technologist. A wide range of imaging technologies which are being currently used such as CT, MRI, DEXA. Ultra-sound, angiography, and mammography require skilled professionals to handle the advance imaging equipment. They are also expected to have good communication, patient care, and monitoring skills.

This innovative competency-based curriculum is adopted from the guidelines published by Ministry of Health and Family Welfare, allied health Section 2015- 2016.

A competency-based program focuses on blend of skills and knowledge based on the needs of the community. The main competencies that have been identified as essential in an allied health care professional are clinical knowledge, patient care, and communication approaches, which is then developed to teach relevant content across a range of courses and settings.

The curriculum is outcome based and focuses on required theoretical concepts and practical skills in the domain. By undergoing this Programme, students develop critical, analytical thinking and problem-solving abilities for a smooth transition from academic to real-life work environment. Students do one year internship in the hospitals for skill development abilities to work in a team to enhance practical skills and problem-solving abilities. The students are required to submit a well written project report as partial fulfilment for the award of the degree, which will help develop skills of documenting scientific work. In addition, students are trained in communication skills and interdisciplinary topics to enhance their scope. The various new features such as foundation courses, early clinical exposure, bioengineering courses, major specialization, open electives and one year of internship make the students more versatile generating wide range of opportunities including registering for master's in medical Radiology and Imaging Technology. Advanced teaching and learning resources, and experience of the faculty members with them

strong connections with health care industry and research organizations makes this Programme unique.

For global mobility and acceptability of the graduates, the current curriculum structure is divided into smaller sections with focus on hours of studying that are converted into credit hours as per the international norms followed by various countries.

Integrated structure of the curriculum
This competency-based curriculum follows horizontal and vertical integration between disciplines; and bridges the gaps between both theory and practice, and between hospital-based practice and community practice.

15. Programme Mission

The purpose of the Programme is creation of knowledgeable human resources to work in government, semi-government, private and public sector owned hospitals and health care organizations and also to assume administrative positions. With further progression in education, graduates should be able to undertake teaching and research in colleges and universities as well as in scientific organizations.

16. Graduate Attributes

The courses have been designed with a focus on performance-based outcomes pertaining to Medical Radiology and Imaging Technology. The learning goals and objectives of the undergraduate education program is based on the performance expectations. They are articulated as learning goals (why we teach this) and learning objectives (what the students will learn). Using the framework, students will learn to integrate their knowledge, skills and abilities in a hands-on manner in a professional healthcare setting. The learning goals are divided into nine key areas,

1. Clinical care
2. Communication
3. Member of a multidisciplinary health care team
4. Ethics and accountability at all levels (clinical, professional, personal, and social)
5. Commitment to professional excellence
6. Leadership and mentorship
7. Social accountability and responsibility
8. Scientific attitude
9. Lifelong learning

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The curriculum aims to produce medical radiology and imaging Technologists who are.

1. technically and clinically competent
2. aware of safety issues and the importance of quality assurance
3. understand the theoretical basis for evidence-based practice.
4. effective members of the multidisciplinary team

17. Programme Goal

The Programme acts as a specialized course and helps to develop critical, analytical, and problem-solving skills at the first level. This foundation degree makes the graduates employable in health care organizations and to assume administrative positions in various types of organizations. The studentscan progress to pursue a career in academics or the health care industry or as a researcher.

18. Programme Outcomes (PO's)/ Programme objectives:

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The courses have been designed with a focus on performance-based outcomes about the specialty. The learning goals and objectives of the undergraduate education program are based on the performance expectations. They are articulated as learning goals (why we teach this) and learning objectives (what the students will learn). Using the framework, students will learn to integrate their knowledge, skills, and abilities in a hands-on manner in a professional healthcare setting. These learninggoals are divided into nine key areas, though the degree of required involvement may differ across various specialties:

PO 1- Clinical care: Appraise the evidence-based practice in medical imaging and construct an appropriatediagnostic care regime
PO 2- Communication: Discuss the findings with the colleagues and radiologists to plan the procedure and imagesto be acquired
PO 3- Membership of a multidisciplinary health team: Discuss and communicate with and summarize relevant information to, other stakeholders including members of the healthcare team
PO 4- Ethics and accountability at all levels: Describe and apply the basic concepts of clinical ethics to actual casesand situations
PO 5- Commitment to professional excellence: Demonstrate respect for each patient's rights of autonomy,privacy, and confidentiality
PO 6- Leadership and mentorship: Develop leadership in quality improvement and diagnostic service delivery toenhance the well-being of the society and enrich healthcare experience
PO 7- Social accountability and responsibility: Assess the appropriate technical factors for exposure related to the positioning and modality as per the requirement
PO 8- Lifelong learning: Evaluate the need and prioritize lifelong learning as an important outcome across theprofessional career

19. Programme Education Objectives

PEO 1- Graduates will develop profound knowledge to pursue successful industrial, academic, and researchcareers in specialized fields of radiological and imaging technology

PEO 2- Graduates will be engaged in ongoing learning and professional development through self-study, andcontinuing education in medical imaging and also in other allied fields.
PEO 3- Graduates will apply their technical skills, exhibiting critical thinking and problem-solving skills in professional clinical imaging practices or tackle social and technical challenges.
PEO 4- Graduates will adopt the ethical attitude and exhibit effective skills in communication, management,teamwork, and leadership qualities.

20. Programme Specific Outcomes (POs)

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At the end of the BSc (Hons) medical radiology and imaging Technology Programme the graduate will be able to:

PSO-1. Apply the knowledge in instrumentation and patient care to develop innovative and safe solutions tochallenges in medical radiology and imaging.
PSO-2. Adapt to technological advancement in imaging and diagnostics by upgrading to the latest design processes in medical radiology and imaging.
PSO-3. Demonstrate the leadership qualities and strive for the betterment of the organization, environment, and society.
PSO-4. Demonstrate an understanding of the importance of life-long learning through professional development,practical training, and specialized certifications.

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21. Programme Structure:

Course code	Course	T (H/W/S)	Tut (H/W/S)	P (H/W/S)	Total credits	Marks
Semester 1						
AHD101A	General Anatomy	2	0	2	3	100
AHD102A	General Physiology	2	0	2	3	100
AHD103A	HCDS	2	0	0	2	50
AHD104A	General Microbiology	2	0	2	3	100
AHD105A	Applied Physics	2	0	2	3	100
AHD106A	Basic electrical and electronics	2	0	2	3	100
AHN101A	Language-1(1)	3	0	0	3	100
AHM101A	Digital fluency	1	0	2	2	50
	TOTAL	16	0	12	22	700
	Total number of contact hours per week	**28 Hrs**				
Semester 2		T (H/W/S)	Tut (H/W/S)	P (H/W/S)	Total credits	Marks
AHD107A	General Biochemistry	2	0	0	2	50
AHD108A	General Pharmacology	2	0	0	2	50
AHD109A	Concepts of Hospital infection prevention	2	0	0	2	50
AHD110A	General Pathology	2	0	2	3	100
AHD111A	Environmental Science and Health	2	0	0	2	50
AHM102A	Health and Wellness/Social and Emotional Learning	1	0	2	2	50
AHD112A	Early clinical education	0	0	20	10	100
	TOTAL	11	0	24	23	450
	Total number of contact hours per week	**35 Hrs**				
Semester 3		T (H/W/S)	Tut (H/W/S)	P (H/W/S)	Total credits	Marks
MRC201A	Basic Radiological Physics	1	1	2	3	100
MRC202A	Basic Radiological equipment	1	1	2	3	100
AHN202A	Language-2 (3)	3	0	0	3	100
	Open Elective – 1	2	0	0	2	50
AHM203A	AI	1	0	2	2	50
AHM204A	Entrepreneurship	1	0	4	3	100
MRC203A	Studentship (Directed Clinical Education) I	0	0	16	8	100
	TOTAL	9	2	26	24	600

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	Total number of contact hours	37 Hrs				
	per week					
Semester 4		T (H/W/S)	Tut (H/W/S)	P (H/W/S)	Total credits	Marks
MRC204A	Radiographic positioning	1	1	2	3	100
MRC205A	Radiographic contrast procedures	1	1	2	3	100
MRC206A	Radiographic Image Processing Techniques	1	1	2	3	100
	Open Elective – 2	2	0	0	2	50
AHN203A	Constitution of India and human rights	2	0	0	2	50
AHN204A	Professional communication	1	0	2	2	50
AHN307A	Ethics & self-awareness	1	0	2	2	50
MRC207A	Studentship (Directed Clinical Education) II	0	0	14	7	100
		9	3	24	24	600
	Total number of contact hours per week	**36 Hrs**				
Semester 5		T (H/W/S)	Tut (H/W/S)	P (H/W/S)	Total credits	Marks
MRC308A	Basic to advanced Computed Tomography	1	1	2	3	100
MRC309A	Basic to advanced Ultrasound	1	1	2	3	100
MRC310A	Quality assurance and Regulatory requirements in radiology	1	1	2	3	100
AHM305A	Project management	2	0	0	2	50
AHN306A	SEC-4: Cyber Security	1	0	2	2	50
AHN205A	Sports/Yoga/NCC/NSS/R&R(S&G)/ Cultural	1	0	2	2	50
MRC311A	Studentship (Directed Clinical Education) 3	0	0	18	9	100
	TOTAL	7	3	28	24	550
	Total number of contact hours per week	**38HRS**				
Semester 6		T (H/W/S)	Tut (H/W/S)	P (H/W/S)	Total credits	Marks
MRC312A	Basic to advanced Magnetic Resonance Imaging	1	1	2	3	100
MRC313A	Basic concepts of Interventional radiology and Nuclear Medicine	1	1	2	3	100
AHC308A	Research methodology and Biostatistics	3	0	0	3	100
AHN307A	Personality development and soft skills	0	0	2	2	50

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MRC314A	Studentship (Directed Clinical Education) 4	0	0	24	12	100
	TOTAL	5	2	30	23	450
	Total number of contact hours	**37 Hrs**				
	per week					
Semester 7		**T (H/W/S)**	**Tut (H/W/S)**	**P (H/W/S)**	**Total credits**	**Marks**
MRP415A	Research project	0	0	20	10	100
MRC416A	Internship	0	0	20	10	100
		0	0	40	20	200
	Total number of contact hours per week	**40 Hrs**				
Semester 8		**T (H/W/S)**	**Tut (H/W/S)**	**P (H/W/S)**	**Total credits**	**Marks**
MRP417A	Research project	0	0	20	10	100
MRC418A	Internship	0	0	20	10	100
		0	0	40	20	200
	Total number of contact hours per week	**40 Hrs**				

Maximum Marks	**3750 (700+450+600+600+550+450+200+200)**
Total Credits	**180 (22+23+24+24+24+23+20+20)**

Note: The Vacations and other activities shall be as per the Timetable for the corresponding batch.

Open Elective Courses: Several open elective courses from the Faculty of Mathematical and Physical Sciences, Engineering, Management and Commerce, Art and Design, Hospitality Management and Catering Technology, Pharmacy, and Dental Sciences will be announced one semester before the scheduled semester. The students can also register through online mode via digital platforms such as NPTEL, Swayam, Coursera etc., as per the regulations.

22. Programme Delivery

As per the Time-Table.

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23. Teaching and Learning Methods

The module delivery comprises a combination of a few or all the following:

1. Face-to-face lectures using audio-visuals.
2. Workshops-group discussions, debates, presentations
3. Demonstrations

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4. Guest lectures
5. Laboratory-work/Fieldwork/Workshop
6. Hospital postings
7. Seminars
8. Group Exercises
9. Project Work

24. **Learning methodologies**

With a focus on self-directed learning, the curriculum will include a foundation course that focuses on communication, basic computer skills, professionalism, ethics and law. It also incorporates early clinical exposure and directed clinical education during specialty training. It is envisaged that the AHPs should have sufficient clinical exposure integrated with the learning of basic and laboratory sciences. There is an emphasis on the introduction of case scenarios for classroom discussion/case-based learning.

It is well documented in the literature that teaching and learning of clinical skills occur at the patient's bedside or other clinical areas supplemented by didactic teaching in classrooms and lecture theatres. Our institute has instituted clinical skill centers, laboratories and high-fidelity simulation laboratories to enhance the practice and training for allied and healthcare students and professionals. The skills training center overcomes the shortcoming of patients being used to learn and practice the necessary skills. The use of simulators addresses many issues such as lack of confidence and inadequate skills in handling the equipment. Practice on simulators and with corrective measures students can hone the skills and gain confidence to perform in real life situations.

Teaching and Learning Methods

1. Team teaching/ Integrated teaching
2. Face to Face lectures using audio-visuals.
3. Seminars/journal clubs/e-lectures
4. Case based discussions.
5. Group discussions, debates, presentations
6. Demonstrations on videos, computers, and models
7. Hospital based learning.
8. Laboratory work
9. Dissertation/ Group project work
10. School visits/Outreach centre visits
11. Interdepartmental meets
12. Continuing medical education

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programs/symposiums/workshops

state/national/international conferences and conventions

26. Assessment and Grading

26.1 Components of Grading

There shall be **two components** of grading in the assessment of each course:

Component 1, Continuous Evaluation (CE): This component involves multiple subcomponents (SC1, SC2, etc.) of learning and experiential assessment. The assessment of the subcomponentsof CE is conducted during the semester at regular intervals. This subcomponent represents the formative assessment of students' learning.

Component 2, Semester-end Examination (SEE): This component represents the summative assessment carried out in the form an examination conducted at the end of the semester.

Marks obtained CE and SEE components have 60:40 weightage (CE: 60% and SEE: 40%) in determining the final marks obtained by a student in a Course.

The complete details of Grading are given in the Academic Regulations.

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26.2 Continuous Evaluation Policies

Continuous evaluation depends on the type of the course as discussed below:

26.2 Theory Courses

The following is the CE components:

Theory Course CE			**Theory Course SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	40 marks
20 marks	20 Marks	20 Marks	

In CE there shall be three subcomponents of CE (SC1, SC2, and SC3), namely Mid Term; Written Assignment; Innovative assignments. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the followingtypes:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports

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g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the three subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. The Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% in case of theory courses. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative(Semester End Examination-SEE) should be 60:40.

26.2.1 Theory + Laboratory Courses

The following is the CE components:

Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

p) Online Test
q) Assignments/Problem Solving
r) Field Assignment
s) Open Book Test
t) Portfolio
u) Reports
v) Case Study
w) Group Task
x) Laboratory / Clinical Work Record
y) Computer Simulations
z) Creative Submission aa) Virtual Labs
bb) Viva / Oral Exam cc) Lab Manual Report
dd) Any other

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After the four subcomponents are evaluated, the CE component marks are consolidated to attain

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60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

26. Attendance

A minimum of 80 % attendance is compulsory to appear for semester end examinations.

27. Award of degree

As per the Academic Regulations for B.Sc. (Hons) MRIT Programme

28. Student Support for Learning

Student are given the following support:

a) Reference Books in the Library
b) Pre-reads and handouts
c) Cases/ Case Study and Case lets
d) Magazines and Journals
e) Internet Facility
f) Computing Facility
g) Laboratory Facility
h) Workshop Facility
i) Staff Support
j) Lounges for Discussions
k) Any other support that enhances their learning

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29. Quality Control Measures

The following are the Quality Control Measures:

1. Review of question papers and assignment at the Department Level
2. Student feedback
3. Opportunities for the students to see their assessed work.
4. Review by External Examiners and External Examiners Reports
5. Staff Student Consultative Committee Meetings
6. Student Exit Feedback
7. Subject Assessment Board
8. Programme Assessment Board

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30. Programme Map (Course-PO-PSO Map)

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Sem	Course Title	PO-1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO-8	PSO-1	PSO-2	PSO-3	PSO-4
1	General Anatomy	3	1	2			1					3	3
1	General Physiology	2		1	1	1				2			
1	HCDS	1	1	1	2	1		2	1	2			1
1	General Microbiology		2	1		2	2	2	1	2		1	1
1	Applied physics						3	2	1	1		2	
1	Basic electrical and electronics							3		2		3	
1	Language – 1 (1)	2	3	1			2						3
1	Digital fluency	2	1	1	2	1				2			
2	General Biochemistry	3			2	2				3			1
2	General Pharmacology	1	1	2	2	2	1	2	1	2		1	1
2	Concepts of Hospital infection prevention	2		1	1	2			1	2		1	
2	General Pathology	3	1	1		3	1		1	3		1	
2	Environmental Studies				3								2
2	Health & wellness	3	1	1		2				3			
2	Early clinical education	2	1	2	2						2		2
3	Basic radiological physics	1			2		2	3	2	2	2	3	
3	Basic Radiological equipment	1						3	2	2		2	1
3	Open elective -1												
3	Language – 2 (3)	3	2		1	1	1	1	2	3	2		1
3	SEC-2: AI	3			2	2			2	3	2	2	2

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3	Entrepreneurship					2	2	2	3		2		2
3	Studentship (Directed Clinical Education) 1	3	3	2	2	3	3	3	3	3	3	3	3
4	Radiographic positioning	3	3	3	2	2	2	3	3	2	2	3	3
4	Radiographic contrast procedures	3	3	3	2	2	2	3	3	2	2	3	3
4	Radiographic image processing techniques					2			1	1		3	
4	Open Elective – 2	3	1	1	1				3	3	2		3
4	Constitution of India	2		1	1		1	3	1	2	1	3	1
4	Professional communication	2	3	3			2						3
4	Sports	1	3				1					1	
4	Studentship (Directed Clinical Education) 2	3	3	2	2	3	3	3	3	3	3	3	3
5	Basic to advanced computed tomography	2	2	1	2	3	2	3	3	2	2	3	3
5	Basic to advanced ultrasound	2	2	1	2	3			2	2			2
5	Quality assurance and regulatory requirements in radiology	2			2		3		3	3	3	3	3
5	Project management		2	1							1		2
5	SEC-3: Cyber Security or some other SEC	3	1	3	2	3		3	2	3	2	2	2
6	Studentship (Directed Clinical Education) 3	3	3	2	2	3	3	3	3	3	3	3	3

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6	Basic to advanced MRI	2	2	2	2	3	3		2	3	2	3	3
6	Basic concepts of interventional radiology and Nuclear medicine	2	2	3	3	3	3	3	2	3	2	3	3
6	Research methodology				2	1	1	1	1				1
6	Personality development and soft skills		3		1		2	2	1	2	1	1	1
6	Studentship (Directed Clinical Education) 4	3	3	2	2	3	3	3	3	3	3	3	3
7	Research project		2		2		2	2		1		1	
7	Internship												
8	Research project	3	1	3		3	1	1		3	1		1
8	Internship		2	3	2	3		1	2	3	1	1	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

31. Co-curricular Activities

Student are encouraged to take part in co-curricular activities like seminars, conferences, symposium, paper writing, attending industry exhibitions, project competitions and related activities for them to enhance their knowledge and network

32. Cultural and Literary Activities

To unwind and ignite the creative endeavors annual cultural festivals are held and students are encouraged to plan and participate in cultural and literary activities.

33. Sports and Athletics

Students are encouraged develop to participate in out-door and in-door games onregular basis.

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Faculty of Life and Allied Health Sciences

Bachelor of Science. (Hons). Medical Radiology and Imaging Technology

Programme code: 401

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Course Specifications

Revised 2022

1st semester

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Course Specifications: General anatomy

Course Title	General Anatomy
Course Code	AHD101A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

I.Course Summary

1. Aim and Summary

The course aims to impart basic knowledge of general human anatomy which forms the basis for understanding other related subjects such as physiology, pathology and surgery. Emphasis will be placed on cell structure and functions. The various basic tissues of the body, their structure and functional co-relation will be taught. Formation of gametes and early development of the human foetus will be dealt with in short. Various organ systems, their components and basic functions will be covered under this course.

2. Course Size and Credits:

Number of credits	03
Total hours of classroom interactionduring the semester	30
Number of practical/tutorial hours	15
Number of semester weeks	16
Department responsible	Allied Health Sciences

Course evaluation	Total Marks: 100 As per the Academic Regulations
Pass requirement	As per the Academic Regulations
Attendance requirement	As per the Academic Regulations

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Teaching, Learning and Assessment

3.Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course outcome
1.	Describe the structure and functional organization of a basic human cell andthe normal anatomical positions and planes of the body
2.	Explain the structure and functions of basic tissues
3.	Explain the components of the organ systems and its basic functions
4.	Identify the parts of a compound microscope and differentiate microscopyof basic tissues
5.	Demonstrate the parts and position of bones in the human body and earlydevelopment of fetus
6.	Demonstrate the surface anatomy of structures and interpret data obtainedfrom various imaging techniques.

4. Course Contents:

Introduction

- Introduction to the human body as a whole
- Anatomical terms, planes and positions
- The cell: Structure, function and multiplication

Tissues

- Types, structure, characteristics, functions
- Simple and Compound Epithelium
- Connective tissue
- Cells, fibers and types
- Cartilage, Blood vessels, Muscle, Bone, Nervous tissue, Skin and SalivaryGlands

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Embryology • Fertilization and General embryology
Osteology • Axial skeleton (Skull: Cranium, air sinuses, Vertebral column: regions, movements, and characteristics, Sternum, Ribs) Appendicular skeleton (Bones involving Shoulder girdle and Upper limb, Pelvic girdle and lower limb, healing of bones: cellular activity, Factors that delay healing, Diseases of bones and joints) • Development of bone and stages of ossification
Organ systems • Musculoskeletal system • Digestive system • Respiratory system • Circulatory system • Excretory system • Nervous system
• Integumentary system • Endocrine system • Lymphoid system

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Practical

- Histology of epithelium
- Histology of Connective tissue
- Histology of cartilage
- Histology of bone
- Histology of muscle
- Histology of nervous tissue
- Histology of blood vessels
- Histology of skin
- Histology of Salivary glands
- Demonstration of embryology models
- Demonstration of bones Surface anatomy of all organ system
- Interpretation of Radio images

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1		1	2			1										
CO-2		1	2			1										
CO-3	3	1	2			1									3	3

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CO-4		1	2			1										
CO-5		1	2			1										
CO-6	3	1	2			1									3	3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face-to-Face Lectures		30
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/ Systems		
3. Demonstration on a Computer		
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory		
3. Engineering Workshop/Course		
4. Clinical Laboratory	10	
5. Hospital		10
6. Model Studio		
Others		
1. Case Study Presentation		
2. Guest Lecture		
3. Industry/Field Visit		
4. Brain Storming Sessions		
5. Group Discussions		
6. Discussing Possible Innovations		
Written Examination (Mid-Term tests and SEE)		5
Total Duration in Hours		45

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7. Method of Assessment

Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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After the four subcomponents are evaluated, the CE component marks are consolidated to attain60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part ofCE will have external examiner evaluation and marks listed separately for industry requirements.For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the rati

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of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl .No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

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a. Essential Reading

BD Chaurasia; 2015; **Handbook of General Anatomy**, 5th Edition; CBS Publishing.

IB Singh; 2016; **Textbook of Human Histology**, 8th Edition; Jaypee Brothers Medical Publishers. IB Singh; 2017; **Human Embryology**, 11thEdition; Jaypee Brothers Medical Publishers.

General Anatomy and Physiology – by DrVenkatesh

Surface and Radiological Anatomy- with a Clinical Perspective- by DrAshwini C A, 1st Edition, Jaypee

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Publishers, New Delhi

b. Recommended Reading

Anne Waugh, Allison Grant; 2018; Ross & Wilson **Anatomy and Physiology in Health and Illness**, 13th edition; Elsevier Churchill Livingstone.

Adam W.M. Mitchell, Richard Drake, A. Wayne Vogl; **Gray's anatomy for Students**; 3rd edition; Elsevier Churchill Livingstone.

10. Course Organization

Course Title		General Anatomy
Course Code		AHD101A
Course Leader/s Name		
Course Leader Contact Details	**Phone:**	080 – 49065555
	E- mail:	
Course Specifications Approval		June 2022
Next Course Specifications Review		June 2026

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Course Specifications: General Physiology

Course Title	General Physiology
Course Code	AHD102A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

1. Course Summary

The course aims to impart basic knowledge and sufficient exposure to the physiological concepts and principles with emphasis on applied aspects of organ systems in the body, and to provide the foundations needed for further studies in pharmacology, pathology, pathophysiology, and medicine.

The mechanisms of deranged function will be appreciated with an in-depth understanding of basic biophysical and physiological mechanisms. The purpose of developing these core competency criteria is to provide guidelines for the breadth and depth of knowledge in the physiological principles and concepts that are considered minimal and essential for further progress in understanding mechanisms of disease and body defenses.

2. Course Size and Credits:

Number of credits	03
Total hours of classroom interactionduring the semester	30
Number of practical/tutorial hours	15
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100 As per the Academic Regulations

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Pass requirement	As per the Academic Regulations
Attendance requirement	As per the Academic Regulations

Teaching, Learning and Assessment

3.Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course outcomes
1.	Describe the functions of the organ systems in the body
2.	Explain the mechanisms for the execution of these functions for homeostasisthrough the secretions of chemical and humoral factors
3.	Explain the regulatory mechanisms in the control of blood pressure, urineformation maintenance of extracellular and intracellular volume
4.	Perform to assess the normal values and parameters of the bodily functionindicators such as blood indices, blood gases
5.	Demonstrate the tests to assess the functional integrity of the respiratory and cardiovascular system
6.	Correlate the disease condition with physiological aspects of bodily functions

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4.Course Contents:

Course Content
Blood Composition and function of blood, blood bank, blood transfusion, erythrocytesedimentation rate (ESR) and packed cell volume, anemia, body fluids.
Cardiovascular System Heart and its muscles, cardiac output, heart sounds, blood pressure, hypertension,

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ECG.
Digestive System Physiological anatomy of gastro intestinal tract, functions of digestive system, salivary glands structure and functions, deglutition, stomach, gastric secretion, pancreas, functions of liver, gall bladder, intestine and lipids.
Respiratory System Functions of respiratory system, physiological anatomy of respiratory system. Mechanism of normal and rigorous respiration. Intra pulmonary pleural pressure, surface tension, recoil tendency of the wall. Transportation of respiratory gases lungvolumes and capacities, regulation of respiration.
Endocrine System Definition classification of endocrine glands & physiological, anatomy, hormone secreted, physiological function, and their hormones functions of endocrine glands regulation of secretion. Disorders - hypo and hyper secretion of hormone.
Nervous system Functions of nervous system, neuron structure, classification and properties. Neuroglia, nerve fiber, classification, conduction of impulses continuous and saltatory. Velocity of impulse. Synapse - Structure, types, properties. Receptors and synapses - Definition, classification, properties. Reflex action - Unconditioned properties of reflex action. Babinski's sign. Spinal cord nerve tracts. Ascending tracts, descending tracts - pyramidal tracts - extrapyramidal tracts. Functions of brain EEG. Cerebro spinal fluid (CSF): Formation, circulation, properties, composition and functions lumbar puncture. Autonomic nervous system: sympathetic and parasympathetic distribution and functions and comparison of functions.

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Excretory System Functions of kidneys structural and functional unit nephron, vasarecta, cortical and juxtamedullary nephrons: sites of reabsorption, substance reabsorbed, mechanisms of reabsorption glucose, urea.h + Cl amino acids etc. Tmg, tubular lead, renal threshold % of reabsorption of different substances, selective secretion. Properties and composition of normal urine, urine output. Abnormal constituents in urine, mechanism of urine concentration. Counter - current mechanisms: micturition, innervation of bladder, cystometrogram. Diuretics: water, diuretics, osmotic diuretics, artificial kidney renal function tests - plasma clearance actions of Adh,
aldosterone and Pth on kidneys. Renal function tests
Reproductive System Function of reproductive system, puberty, male reproductive system. Functions of testes, spermatogenesis site, stages, factors influencing semen. Endocrine functions of testes. Androgens - testosterone structure and functions. Female reproductive system. Ovulation, menstrual cycle. Physiological changes during pregnancy,pregnancy test. Lactation: composition of milk factors controlling lactation.
Muscle Nerve Physiology Classification of muscle, structure of skeletal muscle, sarcomere contractile proteins, neuromuscular junction. Transmission across, neuromuscular junction. Excitation contraction coupling. Mechanism of muscle contraction muscle tone, fatigue rigor mortis

Laboratory:

1. White Blood Cell Count
2. Red Blood Cell Count
3. Blood Pressure Recording SL
4. Auscultation of Heart Sounds
5. Artificial Respiration SL
6. Pulmonary Function Tests

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)	Programme Specific Outcomes (PSOs)

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	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PSO-1	PSO-2	PSO-3	PSO-4
CO-1	2			1					2			
CO-2	2								2			
CO-3	2				1				2			
CO-4	2		1		1				2			
CO-5	2								1			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution												

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		20
Demonstrations		2
1. Demonstration using Videos	2	
2. Demonstration using Physical	-	
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems	-	
Practical Work		30
1. Course Laboratory	25	
2. Computer Laboratory	-	
3. Engineering Workshop/Course	-	
4. Clinical Laboratory	5	
5. Hospital	-	
6. Model Studio	-	
Others		8
1. Case Study Presentation/ Case Studies	3	
2. Guest Lecture	-	
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	6	
5. Small Group Discussions	10	
6. Discussing Possible Innovations	-	
Term Test, Laboratory Examination and Written Examination		10

Total Duration in Hours	70

7. Method of Assessment

Continuous Evaluation Policies: Continuous evaluation depends on the type of the course as discussed below:

Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60%

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Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teachingand learning methods:

S.No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resource

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c. Essential Reading

Gerard J. Tortora, Bryan H. Derrickson (2013) Principles of Anatomy and Physiology 14th Edition. Wile publications

Sujit Kumar Chaudhuri (2011) Concise Medical New Central Book

Chatterjee CC(2005) Human Physiology Volume 1 and 2 11th edition CBS publishers

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D. Venkatesh, H.H. Sudhakar(2015)Textbook of Medical Physiology. Lippincott Williams & Wilkins

d. Recommended Reading

Guyton and Hall (2016) Textbook of Medical Physiology, 13edition Elsevier's publications

ParveenKumar and Michel Clark (2016) Kumar and Clark's Clinical Medicine Ninth edition

Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) 24th Edition

e. Magazines and Journals

f. Websites

10.Course Organization

Course name		General Physiology
Course code		AHD102A
Course Leader/s Name		
Course Leader Contact Details	**Phone:**	080 – 49065555
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Course Specifications: Health care delivery systems of India

Course Title	Health Care Delivery Systems of India
Course Code	AHD103A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

1. Course Summary

The aim of the course is to introduce students to the Indian system of health care, health status of the population and initiatives taken at the national level towards improving health status of the population.

The students are oriented to importance of demography and vital statistics and concept of health and disease. The students are exposed to health care delivery systems such as- Siddha, Unani, Homeopathy, Ayurveda and Yoga and Naturopathy. Students are also introduced to concept of integrating health care system to achieve health, measures taken at National level for improving health status of population including National Health programmes.

2. Course Size and Credits:

Number of credits	02
Total hours of class room interactionduring the semester	30
Number of practical/tutorial hours	0
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 50
Pass requirement	As per academic regulation
Attendance requirement	As per academic regulation

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Teaching, Learning and Assessment

3. Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course outcome
1.	Describe the Health Care delivery system in India at primary, secondary andtertiary level and identify their role in the health care team
2.	Explain the AYUSH system of medicine
3.	Explain the National Health programmes in terms of operation, achievements, and constraints
4.	Explain the importance of Demography and Vital statistics in planning healthpolicy
5.	Discuss role of epidemiology and epidemiological methods in health

4. Course Contents:

Introduction to healthcare delivery system • Healthcare delivery system in India at primary, secondaryand tertiary care Community participation in healthcare delivery system • Health system in developed countries Private Sector National Health Mission; National Health Policy and issuesin health care delivery system in India
National Health Programme • Background objectives, action plan, targets, operations, achievements, andconstraints in various National Heath Programme
Introduction to AYUSH system of medicine • Introduction to Ayurveda Yoga, naturopathy, unani, siddha and homeopathy Need for integration of various system of medicine

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Health scenario of India- past, present, and future

Demography & Vital Statistics • Demography – its concept. Vital events of life & its impact on demography • Significance and recording of vital statistics. Census & its impact on healthpolicy
Epidemiology • Principles of Epidemiology. Natural history of disease • Methods of epidemiological studies Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1		1		2	1		2						2			1
CO-2	1		1										2			
CO-3			1	2	1			1					2			
CO-4		1		1	1		2						2			
CO-5	1			1									2			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		25
Demonstrations		
2. Demonstration using Videos		
2. Demonstration using Physical Models/ Systems		
3. Demonstration on a Computer		
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory		
3. Engineering Workshop/Course		
4. Clinical Laboratory		
5. Hospital		
6. Model Studio		
Others		05
1. Case Study Presentation		
2. Guest Lecture		
3. Industry/Field Visit		
4. Brain Storming Sessions		
5. Group Discussions	05	
6. Discussing Possible Innovations		
Written Examination (Mid-Term tests and SEE)		05
Total Duration in Hours		35

7. Method of Assessment

Continuous evaluation depends on the type of the course as discussed below

Theory Course CE			Theory Course SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	40 marks
20 marks	20 Marks	20 Marks	

In CE there shall be three subcomponents of CE (SC1, SC2, and SC3), namely Mid Term; Written

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Assignment; Innovative assignments. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the three subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. The Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% in case of theory courses. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl .No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions

11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

g. Essential Reading

Community Medicine with recent advances - AH Suryakantha - 4th Edition - Jaypee Publishers

Review in Community Medicine - VVR SeshuBabu - 2nd Edition - Paras Medical Books

Epidemiology for Undergraduates - Marina Rajan Joseph - Jaypee Publishers

h. Recommended Reading

Park's Textbook of Preventive and Social Medicine - K. Park - 22nd Edition - Bhanot Publishers

Oxford Textbook of Public Health - Roger Detels - 5th Edition - Oxford University Press

National Health Programs of India - J Kishore - 12th Edition - Century Publications

i. Magazines and Journals

j. Websites

10. Course Organization

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Course Title		Health Care Delivery Systems of India
Course Code		AHD103A
Course Leader/s Name		
Course Leader Contact Details	**Phone:**	080 – 49065555
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Course Specifications: General microbiology

Course Title	General Microbiology
Course Code	AHD104A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

1. Aim and Summary

This course introduces the principles of Microbiology with emphasis on applied aspects of Microbiology of infectious diseases particularly in the principles & practice of sterilization methods, collection and despatch of specimens for routine microbiological investigations, interpretation of commonly done bacteriological and serological investigations, and control of hospital infections. This will help the students to maintain sterile working environment and appropriate sample collection.

2. Course Size and Credits

Number of credits	03
Total hours of class room interaction during the semester	30
Number of practical hours	30
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the Academic Regulations
Attendance requirement	As per the Academic Regulations

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Teaching, Learning and Assessment

3. Course Outcomes

After undergoing this course students will be able to:

No.	Course Outcome
1	Describe the morphology, physiology and characteristics of microorganisms
2	Describe the principles and practice of sterilization and disinfection
3	Discuss immunology, and immunity
4	Demonstrate sterilization procedures and use of sterilization equipment
5.	Demonstrate Collection and transport of specimens to the laboratory

4. Course Contents

Course Content
Introduction to Microbiology History, introduction, scope, aims and objectives. Morphology and physiology of bacteria. Detail account of sterilisation and disinfection. Brief account of culture mediaand culture techniques. Basic knowledge of selection, collection, transport, processing of clinical specimens and identification of bacteria and drug resistance in bacteria
Immunology Infection - Definition, Classification, Source, Mode of transmission andtypes of Infectious disease.Immunity. Structure and functions of Immune system. The Complement System. Antigen. Immunoglobulins - Antibodies - General structure and the role playedin defence mechanism of the body.Immune response. Antigen - Antibody reactions - with reference to clinical utility. And hHypersensitivity reactions.

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Systematic bacteriology

Pyogenic cocci - Staphylococcus, Streptococcus, Pneumococcus, Gonococcus, Meningococcus – brief account of each coccus– detailed account of mode of spread, laboratory diagnosis.

Mycobacteria - Tuberculosis and Leprosy.

Clostridium - Gas gangrene, food poisoning and tetanus.

Non-sporing Anaerobes - in brief about classification and morphology,in detail aboutViruses:

HIV and Hepatitis- Pathogenesis, Lab Diagnosis and management

Laboratory:

Demonstration of sterilization equipment's: hot air oven, autoclave, bacterial filters.

Demonstration of commonly used culture media, nutrient broth, nutrient agar, bloodagar, chocolate agar, MacConkey medium, L J media, Robertson cooked meat media.

Anaerobic culture methods.Antibiotic

susceptibility test.

Demonstration of common serological tests: ELISA.

Demonstration of Grams staining. Demonstration of

Acid fast staining.

Sample collection methods, storage and transport.

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5. Course mapping

	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)			
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PSO-1	PSO-2	PSO-3	PSO-4
CO-1	1								2			

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CO-2	2		1		1				2			
CO-3	1		1						2			
CO-4	2				1				2			
CO-5	2	1		2					2			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution												

6.Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		24
Demonstrations		
1. Demonstration using Videos	-	
2. Demonstration using Physical	00	
3. Demonstration on a Computer	-	00
Numeracy		00
1. Solving Numerical Problems	-	
Practical Work		
1. Course Laboratory	16	
2. Computer Laboratory	-	
3. Engineering Workshop/Course	-	26
4. Clinical Laboratory	05	
5. Hospital	05	
6. Model Studio	-	
Others		
1. Case Study Presentation	02	
2. Guest Lecture	-	
3. Industry/Field Visit	-	02
4. Brain Storming Sessions	-	
5. Group Discussions	00	
6. Discussing Possible Innovations	-	
Term Test, laboratory and Written Examination		08
Total Duration in Hours		60

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7.Method of Assessment

Theory Component CE	Laboratory Component CE	SEE

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SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities Skills	How imparted during the course

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1.	Knowledge	Lecture
2.	Understanding	lecture

3.	Critical Skills	Assignments, case study discussion, small group discussion
4.	Analytical Skills	Assignments, case study discussion, small group discussion
5.	Problem Solving Skills	Assignments
6.	Practical Skills	-OSPE
7.	Group Work	Assignments
8.	Self-Learning	Assignment, OSPE
9.	Written Communication Skills	Assignment, Examination
10.	Verbal Communication Skills	Small group discussion
11.	Presentation Skills	Small group discussion
12.	Behavioral Skills	-
13.	Information Management	Assignment
14.	Personal Management	-
15.	Leadership Skills	-

9.Course Resources

Essential Reading

- Class notes
- Ananthnarayan, R. &Panicker, C.K.J., 2009. Textbook of Microbiology. 8th ed. Hyderabad: Universities Press (India) Pvt. Ltd.
- Evan Roitt et al,Immunology. 3rd ed. USA: McGraw Hill Companies Inc.

Recommended Reading

- Apurba S. Sastry&SandhyaBhat K; Essentials of medical Microbiology.Jaypee. The health Sciences

Publisher

Magazines and Journals

Websites

Other Electronic Resource

10. Course Organization

Course Code	AHD104A	
Course Title	General Microbiology	
Course Leader/sName	Dr. Tushar Shaw	
Course Leader Contact Details	Pho	
	E-	
Course Specifications Approval	June 2022	
Next Course	June 2026	

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Course Specifications: Applied Physics

Course Title	Applied Physics
Course Code	AHD105A
Department	Applied Physics
Faculty	Life and Applied Health Sciences

Course Summary

1. Aim and Summary

The aim of this course is to impart basic concepts of Physics and its application to solve medical problems. The students are taught the basic topics in physics which include electromagnetic theory, electricity and magnetism, lasers and fiber optics. Interaction of radiation with matter will be discussed.

2. Course Size and Credits

Numberofcredits	3
Total hours of class room interactionduring the semester	30
Number of Laboratory hours	15
Number of semester weeks	16
Department responsible	Faculty of Mathematical & Physical Sciences
Course marks	Total marks: 100
Pass requirement	As per the Academic Regulations
Attendance requirement	As per the Academic Regulations

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Teaching, Learning and Assessment

3. Course Outcomes

After undergoing this course students will be able to:

No.	Course Outcome
1	Explain the basic concepts in sound, electricity and magnetism, laser physics and electromagnetic radiation
2	Describe concepts in optical fibres
3	Describe basic properties of fluids
4	Conduct experiments as per the standard procedures and tabulate the measuredvalues
5	Calculate the required parameters and plot the results
6	Interpret, compare with standard results and draw conclusions

4. Course Contents

Course Content
Basic Physics: Sound -The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction, Doppler effect, Applications of Dopplereffect
Optical fibre: Basic working principle of optical fibres: Types and structure of Optical fibers, modes ofpropagation, Refractive index profiles of step index and graded index fibers, Attenuation, Different types of loss mechanisms, Fiber optic application in medical field.
Electricity and Magnetism: A.C. and D.C. power supply with examples, single phase and poly phase power supply, switches, fuses, circuit breakers, earthing etc. main voltage drop: causes and remedy,cables; low tension, high tension. Magnets and magnetic field, force on an electric

current in a magnetic field, force on electric charge moving in a magnetic field, Ampere's law, electromagnet and solenoids
Electromagnetic radiation: Electromagnetic radiation spectrum, common properties of electromagnetic radiation;relationship between energy, frequency, wavelength and velocity e.g. X-rays and gamma rays. Transmission through matter, law of exponential attenuation- practical aspects of radiation absorption and transmission through body tissues.
Characteristics of laser light, Absorption, spontaneous emission and stimulatedemission, Requisite conditions for production of a laser beam, Nd-YAG Laser, Semiconductor laser, Applications of laser to medical field
Fluid mechanics: Rate of flow —lines and tubes of flow—Streamline and turbulent flow— Bernoulli's theorem and its applications-Reynold's number- viscosity —Derivation of Poiseuille's equation –Experimental determination of viscosity of a liquid, Surface tension—capillary rise Diffusion—Fick's law—Graham's law for diffusion of gases, biomedical applications
Basic Physics Laboratory: Study with charts, models & power point presentations- Perform experiments on electricity& magnetism, waves and light radiation. Carry out experiments related to wave properties of light and particle nature of light using laser source. Effect of radiation on matter-inverse square law.

5. Course Mapping

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	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)			
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PSO-1	PSO-2	PSO-3	PSO-4
CO-1			2		2			1	2			1
CO-2			2		1				2			

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CO-3					2				2			
CO-4			2		1				1			
CO-5					1				1			
CO-6					2				2			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution												

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		25
Demonstrations		0
1. Demonstration using Videos	3	3
2. Demonstration using Physical	-	
3. Demonstration on a Computer	-	
Numeracy		0
1. Solving Numerical Problems	-	0
Practical Work		
1. Course Laboratory	18	
2. Computer Laboratory		
3. Engineering Workshop/Course	-	18
4. Clinical Laboratory	-	
5. Hospital	-	
6. Model Studio	-	
Others		
1. Case Study Presentation	-	
2. Guest Lecture	-	
3. Industry/Field Visit	-	6
4. Brain Storming Sessions	-	
5. Group Discussions	6	
6. Discussing Possible Innovations		
Term Tests and Written Examination		08
Total Duration in Hours		60

7. Method of Assessment

Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

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8. Achieving learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S.No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures
2.	Understanding	Class room lectures,
3.	Critical Skills	Assignment
4.	Analytical Skills	Class room, assignment
5.	Problem Solving Skills	Class room, assignment
6.	Practical Skills	Class room, assignment
7.	Group Work	Classroom
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, examination
10.	Verbal Communication Skills	--
11.	Presentation Skills	--
12.	Behavioral Skills	Course work
13.	Information Management	Assignment, examination
14.	Personal Management	Assignment, examination
15.	Leadership Skills	--

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9. Course Resources

Essential Reading

- Class notes
- David Halliday, Robert Resnick and Jearl Walker, (2013) *Fundamentals of Physics*, New York, John Wiley & Sons.
- Murugeshan, R., (2008) *Electricity and Magnetism*, 7th Edition, S. Chand and Company
- Arora, C. L., (2007) *B.Sc. Practical Physics*, S. Chand and Company Ltd.
- William E. J McKinneyRadiographic latent image processing –American Society for Nondestructive Testing (1982)
- W. J. Meredith & J.B. Massey. Fundamental Physics of Radiology 1992(Varghese Publishing House).
- Robin J. Wilks, Principles of Radiological Physics, 2nd Revised edition (Oct. 1 1987)Churchill Livingstone;
- George A. Hay , Donald J. Hughes First-year Physics for Radiographers 3rd Revised edition (1997) BailliereTindall;

Recommended reading

- Basic Medical Radiation physics – by L Stanton Stanton 1963 (Butterworth)
- Thomas S. Curry III James E. Dowdey, Robert E. Murry Jr. Christensen's Physics of Diagnostic Radiology Fourth EditionLWW (August 1, 1990)
- Thayalan, K., (2003) Basic Radiological Physics,New Delhi, Jayapee Brothers Medical Publishing Pvt. Ltd.
- Bushberg, Seibert, Leidholdt and Boone,(2002)The essential physics of Medical Imaging,North America, Lippincot Williams and Wilkins.

Magazines and

JournalsWebsites

- www.ocw.mit.edu/courses/physics

Other Electronic Resources

- http://nptel.ac.in/

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10. Course Organization

Course Code	AHD105A	
Course Title	Applied Physics	
Course Leader/s Name	As per time table	
Course Leader Contact Details	Phone:	080 4906 5555
	E-mail:	hod.pi.mp@msruas.ac.in
Course Specifications Approval Date	May 2019	
Next Course Specifications ReviewDate:	May 2023	

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Course Specifications: Basic Electrical & Electronics

Course Title	Basic Electrical & Electronics
Course Code	AHD106A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

1. Course Summary

Aim and Summary:

This course deals with basic principles and concepts of Elements of Electrical and Electronics as applied to biomedical instrumentation. Students are taught the fundamentals of circuit analysis, magnetic circuits, DC machines and transformers. In addition, principles of PN junction diode, Zener diode, semiconductor devices such as transistors, amplifiers and power supplies.

2. Course Size and Credits

Number of credits	03
Total hours of class room interaction during the semester	30
Number of tutorial hours	15
Number of semester weeks	16
Department responsible	Electrical and Electronic Engineering
Course marks	Total Marks : 100
Pass requirement	As per the Academic Regulations
Attendance requirement	As per the Academic Regulations

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Teaching, Learning and Assessment

3. Course Outcomes

After undergoing this course students will be able to:

No.	Course Outcome
1	State various laws of electric and magnetic circuits and explain their significance in biomedical instrumentation
2	Explain DC machines, transformers and their applications
3	Solve simple numerical problems on electric circuits and magnetic circuits,
4	Explain working principles of PN junction diode, Zener diode, transistors and amplifier configurations
5	demonstrate electrical and electronic circuits for hardware modules using standard EDA tool

4. Course Contents

Course Content
DC and AC Fundamentals: Circuit elements, Voltage and Current Division, Ohm's Law and Kirchhoff's Laws, Sinusoidal voltage and currents, concept of cycle period, frequency, peak factor and form factor, phase difference, lagging, leading and in phase quantities. Study of AC circuits of pure R, L and C.
Magnetic Circuits: Magnetic effect of electrical current, Faraday's law of electromagnetic induction, statically and dynamically induced EMF's, self and mutual inductance, concepts of MMF, flux, flux density, reluctance, permeability and field strength, their units and relationship. Simple series and parallel magnetic circuits. Basic analogy between electric and magnetic circuits.

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DC Machines and Transformers:

Constructional details, working principle and methods of excitation of DC machine as a generator and a motor. Necessity of transformer, Constructional Details (core and shell types), Principle of operation, Ideal Transformer and Practical Transformer. Applications of DC machines and transformers in medical instrumentation.

Basic concepts in Electronics:

Semiconductor: p-type, n-type; p-n junction diode, its characteristics, half wave, full wave and bridge type rectifiers, basic filter circuits, Zener diode characteristics, Zener diode as a voltage regulator.

Transistors:

Transistor configurations: CB, CE and CC; Transistor parameters: alpha, beta and gamma, working of transistor as a switch, Amplifier, Characteristics of JFET,.

Amplifiers:

Differential amplifiers and their transfer characteristics, IC Op-Amps, their ideal and practical characteristics, Op-Amp in different modes as inverting amplifier, non-inverting amplifier, summing amplifier, scale changer, differentiator and integrator.

Lab course

Design and simulate following circuits using standard EDA tool

1. Verification of Ohms Law.
2. Verification of KVL and KCL
3. Verification of series circuit
4. Verification of parallel circuits
5. Characteristics of p-n junction diode
6. Characteristics of Zener diode
7. Half wave rectifier
8. Full wave rectifier

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5. Course Mapping

	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)			
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PSO-1	PSO-2	PSO-3	PSO-4
CO-1			2		2			1	2			1
CO-2			2		1				2			
CO-3					2				2			
CO-4			2		1				1			
CO-5					1				1			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution												

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures	24	
Demonstrations	04	
1. Demonstration using Videos	04	
2. Demonstration using Physical	-	
3. Demonstration on a Computer	-	
Numeracy	04	
1. Solving Numerical Problems	4	
Practical Work	20	
1. Course Laboratory	20	
2. Computer Laboratory	-	
3. Engineering Workshop / Course		
4. Clinical Laboratory	-	

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5. Hospital	-	
6. Model Studio	-	
Others	00	
1. Case Study Presentation	-	
2. Guest Lecture	-	
3. Industry / Field Visit	-	

4. Brain Storming Sessions	-	
5. Group Discussions	0	
6. Discussing Possible Innovations	-	
Term Tests, Laboratory Examination / Written Examination,		8
Total Duration in Hours		60

7. Method of Assessment

Theory Component CE			**Laboratory Component CE**	**SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

p) Online Test
q) Assignments/Problem Solving
r) Field Assignment
s) Open Book Test
t) Portfolio
u) Reports
v) Case Study
w) Group Task

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x) Laboratory / Clinical Work Record
y) Computer Simulations
z) Creative Submission
aa) Virtual Labs
bb) Viva / Oral Exam cc) Lab Manual Reportdd) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S.No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Class room lectures, Assignments
2.	Understanding	Class room lectures, Assignments
3.	Critical Skills	Class room lectures, Assignments
4.	Analytical Skills	Class room lectures, Assignments
5.	Problem Solving Skills	Class room lectures, Assignments
6.	Practical Skills	
7.	Group Work	Assignment
8.	Self-Learning	Assignment
9.	Written Communication	Assignment, Examination
10.	Verbal Communication	
11.	Presentation Skills	
12.	Behavioral Skills	Course work

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13.	Information Management	Assignment, Examination
14.	Personal Management	Course work
15.	Leadership Skills	

9. Course Resources

Essential Reading

- Class Notes
- Edward Hughes, (2002), Electrical and Electronics Technology, ELBS, 6th edition
- Millman and Halkias, (2001) Integrated Electronics, Tata McGraw-Hill Education

Recommended Reading

- Mittle, V.N., (2007) Basic Electrical and Electronics Engineering, Tata McGraw Hill Edition, New Delhi, 1st edition
- Delton Horn T., (1993) Abraham Pallas, Basic Electricity and Electronics, Europe, McGraw-Hill Limited

Websites

- Basic Electrical Technology (2013) http://freevideolectures.com/Course/2335/Basic- Electrical-Technology/23
- IITM Lectures (2013) http://www.nptel.iitm.ac.in/courses/108105017/

Other Electronic Resources

- Electronic resources on the course area are available on MSRUAS library

10. Course organization

Course Code	AHD106A	
Course Title	Basic Electrical and Electronics	
Course Leader/s Name	As per Time - table	
Course Leader Contact Details	**Phone:**	49065555
	E-mail:	< hod.ee.et@msruas.ac.in>
Course Specifications Approval	2019	
Next Course SpecificationsReview Date	2023	

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Bachelors (Hons).

Medical Radiology and Imaging Technology

Programme code - 401

Course Specifications Revised 2022

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2nd Semester

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Course Specifications: General Biochemistry

Course Title	General Biochemistry
Course Code	AHD107A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

I. Course Summary

1. Aim and Summary

The course aims to impart basic knowledge on biochemistry and its role in health and diseases, emphasizing on the diagnostic aspect of the subject. The course is designed to provide an understanding of the basic process of life in molecular terms. The students are oriented to chemistry of carbohydrates, proteins, lipids, and various metabolic pathways to understand and utilize different biomolecules, nutrition, and nutritional support with special emphasis on parental nutrition. Students learn about specimen collection, and different laboratory apparatus used and reparation of solutions. They are exposed to the concept of quality control. They will perform routine urine and blood investigations and interpret and diagnose abnormalities.

2. Course Size and Credits:

Number of credits	02
Total hours of class room interaction during the semester	30
Number of practical/tutorial hours	00
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 50
Pass requirement	As per academic regulations
Attendance requirement	As per academic regulations

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3.Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course outcome
1.	Describe the various laboratory apparatus used, the steps in specimen collection and safety measurements to be taken in biochemistry laboratory
2.	Explain different models of atomic structure, acids, bases, buffers and disturbances in acid base balance
3.	Explain quality control, precision, specificity, sensitivity when conducting special investigations
4.	Demonstrate qualitative and quantitative estimations of various analyses (urine, blood)
5.	Interpret the various biochemical parameters in health and disease

4.Course Contents:

Specimen collection Pre-analytical variables. Collection of blood. Collection of CSF & other fluids. Urine collection. Use of preservatives. Anticoagulants.
Introduction to laboratory apparatus Pipettes: different types (graduated, volumetric, Pasteur, automatic etc.).Calibration of glass pipettes. Burettes, beakers, petri dishes, depression plates. Flasks: different types (volumetric, round bottomed, Erlenmeyer conical etc.).Funnels: different types (conical, Buchner etc.).Bottles: reagent bottles – graduated and common, wash bottles different type specimen bottles
Instruments Use, care and maintenance of: water bath, oven & incubators, water distillation plant, water deionizers, refrigerators, cold box, deep freezers, reflux condenser, centrifuge, balances, colorimeter, spectrophotometer, pH meter and electrodes.

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Centrifuges: definition, principles, Svedberg unit, centrifugal force, centrifugal field, RPM, conversion of G to RPM and vice versa, different types of centrifuges. Manual balances: single pan, double pan, triple balance, direct read out electrical balances.
Safety of measurements & Conventional and SI units
Dilutions
Acids & Bases
Acid- base indicator Theory
Quality control

5.Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1		1	1		2								2			
CO-2					2								2			
CO-3	1				2								2			
CO-4	2				2								3			
CO-5	2				2								2			
CO-6	3				2								2			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

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6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		25
Demonstrations		
3. Demonstration using Videos	05	
2. Demonstration using Physical Models/ Systems		
3. Demonstration on a Computer		0
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory		
3. Engineering Workshop/Course		
4. Clinical Laboratory		
5. Hospital		
6. Model Studio		
Others		
1. Case Study Presentation		
2. Guest Lecture		
3. Industry/Field Visit		
4. Brain Storming Sessions		
5. Group Discussions		
6. Discussing Possible Innovations		
Written Examination (Mid-Term tests and SEE)		05
Total Duration in Hours		35

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7. Method of Assessment

Theory Course CE			**Theory Course SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	40 marks
20 marks	20 Marks	20 Marks	

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In CE there shall be three subcomponents of CE (SC1, SC2, and SC3), namely Mid Term; Written Assignment; Innovative assignments. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the three subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. The Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% in case of theory courses. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

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S.No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions

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12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9.Course Resources

Essential Reading

- Vasudevan, D.M., Sreekumari, S., Vaidyanathan, K. Textbook of Biochemistry for Medical Students, Jaypee Brothers Medical Publishers, New Delhi, 8th Ed, 2016
- Satyanarayana U, Chakrapani U. Biochemistry. Books & Allied (P) Ltd, Kolkata 4th Ed, 2013

Recommended Reading

- Murray Rk, GrannerDk, RochwellVw. Harper's Illustrated Biochemistry, Lange McGraw Hill, New York, 30th Ed, 2015
- Champe Pc, Harvey Ra, Ferrier Dr. Lippincott's Illustrated Reviews Biochemistry, Wolters Kluwer Health, Lippincotts Williams & Wilkins, New Delhi, 6th Ed, 2013
- DasDebjyoti, Fundamentals of Biochemistry books & allied, Kolkata 14th Ed, 2012
- Varley , Clinical chemistry 4th edition
- Teitz , Fundamentals of clinical chemistry 6th edition

Magazines and Journals

- Journal of clinical chemistry and laboratory medicine
- Indian journal of medical biochemistry

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10.Course Organization

Course Title		General Biochemistry
Course Code		AHD107A
Course Leader/s Name		
Course Leader Contact Details	**Phone:**	080 – 49065555
	E- mail:	
Course Specifications Approval		June 2022
Next Course Specifications Review		June 2026

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Course Specifications: General pharmacology

Course Title	General Pharmacology
Course Code	AHD108A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

I. Course Summary

1. Aim and Summary

The aim of the course is to introduce students of allied health sciences to the Pharmacological basis of therapeutics. This should help them to understand therapeutics in management of various diseases. Pharmacology, the science of drugs, has special reference to the students of allied health sciences. Practice of various technologies involves use of pharmacological agents both for diagnosis and treatment. The students are oriented to importance of pharmacological basis of therapeutic intervention. Broad understanding of pharmacology with emphasis on how the human bodyhandles a drug is imperative to these students.

2. Course Size and Credits:

Number of credits	02
Total hours of class room interaction during the semester	30
Number of practical/tutorial hours	00
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 50
Pass requirement	As per academic regulations
Attendance requirement	As per academic regulations

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Teaching, Learning and Assessment

3.Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course Outcome
1.	Describe pharmacokinetic principles in relation to drug administration
2.	Explain the concept of pharmacodynamics in relation to drug utilization in therapeutics
3.	Explain the concept of chemotherapy in relation to infectious diseases
4.	Explain the importance of adverse effects in therapeutics of various drug usage
5.	Identify drugs dosage forms and posology in management of diseases and calculate doses in various age groups
6.	Interpret the importance of drug combinations with reference to therapeutic index and drug utilization

4.Course Contents:

General Pharmacology Introduction to pharmacology-various terminologies-sources & routes of drug administration – Absorption & Factors modifying drug absorption – Distribution of drugs – Metabolism: Phase II, - Excretion: routes, modes & kinetics of elimination – Excretion – Mechanism of drug action in brief, synergism & antagonism and Factors modifying drug action – Adverse drug reactions – ADR reporting & monitoring – Drug interactions
Pharmacokinetics Pharmacokinetics and dynamics of drugs acting on Central Nervous System & Respiratory System Introduction to CNS and Neurotransmitters, drugs used in insomnia, Sedatives and hypnotics
Safety and efficacy of drugs acting on Cardio vascular system & blood. Drugs used in Ischemic Heart Disease-nitrates-Calcium channel, immunomodulators, hormones
Drug use in children and geriatric population with reference to antimicrobials.

5.Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	2			2	2								2			
CO-2	2			1	2								2			
CO-3	2				2								2			
CO-4	3				2			1					3			1
CO-5	2				2			1					2			1
	2			1	1								2			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6.Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		25
Demonstrations		0
1. Demonstration using Videos	05	5
2. Demonstration using Physical Models/ Systems		
3. Demonstration on a Computer		
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory		
3. Engineering Workshop/Course		
4. Clinical Laboratory		
5. Hospital		
6. Model Studio		
Others		
1. Case Study Presentation		
2. Guest Lecture		
3. Industry/Field Visit		
4. Brain Storming Sessions		
5. Group Discussions		

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6. Discussing Possible Innovations		
7. Journal club		
Written Examination (Mid-Term tests and SEE)		05
Total Duration in Hours		35

7.Method of Assessment

Theory Course CE			**Theory Course SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	40 marks
20 marks	20 Marks	20 Marks	

In CE there shall be three subcomponents of CE (SC1, SC2, and SC3), namely Mid Term; Written Assignment; Innovative assignments. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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After the three subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. The Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% in case of theory courses. In summary, the ratio of Formative

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(Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S.No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading

- Essentials of Medical Pharmacology: K.D. Tripathi, 6th edition, Jaypee Publishers
- Medical Pharmacology. S K Shrivastava. Avichal publishing NewDelhi
- Manual of Practical Pharmacology. Avichal Publications.

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Recommended Reading

- Lippincott's Illustrated Reviews: Pharmacology, 5th edition, by Richard A. Harvey and Pamela C. Champe, Lippincott Williams & Wilkins Publisher
- Katzung's Basic and Clinical Pharmacology 13th edition. Lange Publication.

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Magazines and Journals

10.Course Organization

Course		General Pharmacology
Course		AHD108A
Course Leader/s Name		
Course Leader Contact Details	**Phone:**	080 – 49065555
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Course Specifications: Concepts of Hospital Infection prevention

Course Title	Concepts of Hospital Infection Prevention
Course Code	AHD109A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

The aim of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement prevention of infection spreading in the health system. The students will be introduced to aspects such as Bio medical waste management and environment safety, Infection prevention and control, Antibiotic Resistance and Disaster preparedness and management.

2. Course Size and Credits:

Number of credits	2
Total hours of classroom interaction during the semester	30
Number of practical hours	-
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course marks	Total Marks: 50
Pass requirement	As per academic regulations
Attendance requirement	As per academic regulations

3. Course Outcomes

After undergoing this course students will be able to:

CO-1: Explain the steps involved in infection prevention and control

CO-2: Understand the working and application of CSSD

CO-3: Explain the importance of antibiotic resistance in the patient care and ways to prevent it.

CO-4: Apply the concepts of biomedical waste management to ensure clean and hazard free hospital environment

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4. Course Contents

Bio medical waste management and environment safety Definition of Biomedical Waste. Waste minimization. BMW – Segregation, collection, transportation, treatment and disposal (including color coding). Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste. BMW Management & methodsof disinfection. Modern technology for handling BMW. Use of personal protective equipment (PPE). Monitoring & controlling of cross infection (Protective devices)
Infection prevention and control Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)]. Prevention & control of common healthcare associated infections. Components of aneffective infection control program and Guidelines (NABH and JCI) for HospitalInfection Control. Spill management
Antibiotic Resistance History of antibiotics. How resistance happens and spreads. Types of resistance- Intrinsic, acquired, passive. Trends in drug resistance. Actions to fight resistance. Bacterial persistence. Antibiotic sensitivity. Consequences of antibiotic resistance. Antimicrobial stewardship- Barriers and opportunities. Tools and models in hospitals.
Working of CSSD: Understand the concepts of sterilization, disinfection in CSSD, Structure and workingof CSSD

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5. Course Mapping

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8					PSO-1	PSO-2	PSO-3	PSO-4
CO-1				3			3						3		1	
CO-2				1	3		1						3			
CO-3				1	3		1						3			
CO-4					3		1						3			
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
FacetoFaceLectures		20
Demonstrations		
1. Demonstration using Videos	-	
2. Demonstration using Physical	-	
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems	-	
Practical Work		
1. Course Laboratory	5	
2. Computer Laboratory	-	
3. Engineering Workshop/Course	-	05
4. Clinical Laboratory	-	
5. Hospital	-	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture	-	
3. Industry/Field Visit	-	00
4. Brain Storming Sessions/ Seminar	-	
5. Small Group Discussions(SGD)	-	
6. Discussing Possible Innovations	-	

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Term Test, Laboratory Examination and Written Examination	5
Total Duration in Hours	30

7. Method of Assessment

Theory Course CE			**Theory Course SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	40 marks
20 marks	20 Marks	20 Marks	

In CE there shall be three subcomponents of CE (SC1, SC2, and SC3), namely Mid Term; Written Assignment; Innovative assignments. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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After the three subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. The Semester End Examination shall be a 2-hour theory paper of 50 marks with a

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weightage of 40% in case of theory courses. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in thefollowing teaching and learning methods:

Sl.No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Lectures
2.	Understanding	Practical. Tutorials and lectures
3.	Critical Skills	Tutorials SGD
4.	Analytical Skills	Practical
5.	Problem Solving Skills	Case studies SGD
6.	Practical Skills	Practicals, OSPE
7.	Group Work	Seminar SGD
8.	Self-Learning	SDL SGD assignment
9.	Written Communication Skills	Semester exams ,test and assignment
10.	Verbal Communication Skills	Seminar and SGD
11.	Presentation Skills	Seminar
12.	Behavioral Skills	practical
13.	Information Management	assignment
14.	Personal Management	
15.	Leadership Skills	Group discussion

9. **Course Resources**

Essential Reading:

- Class notes
- Essentials of Hospital Infection Control by Apurba Shastry

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10. Course Organization

Course Code	AHD109A		
Course Title	Concepts of Infection Prevention		
Course Leader/Name		As per time table	
Course Leader Contact Details		Phone:	080-45366666
		E-mail:	
Course Specifications Approval Date		10/5/2019	
Next Course Specifications Review Date:		10/5/2023	

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Course Specifications: General pathology

Course Title	General Pathology
Course Code	AHD110A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

I. Course Summary

1. Aim and Summary

The aim of the course is to introduce students of allied health sciences to concepts of general Pathology. This should help them to build a foundation for understandingpathological basis of various diseases with special reference to radiation technology anddialysis technology. The course would help integrate knowledge of basic concepts of pathology and clinical medicine into allied sciences. At the end of the course, the student will learn fundamental aspects of cellular injury, inflammation, tissue repair, immunology, neoplasia, histopathology, hematology, and blood banking.

2. Course Size and Credits:

Number of credits	03
Total hours of classroom interaction during the semester	30
Number of practical/tutorial hours	15
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per academic regulations
Attendance requirement	As per academic regulations

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Teaching, Learning and Assessment

3.Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course Outcome
1.	Describe basic facts and concepts of pathology
2.	Explain fundamental aspects of hematology and blood banking
3.	Explain the various clinical pathology tests
4.	Perform laboratory tests related to hematology and clinical pathology
5.	Interpret the results of laboratory tests
6.	Apply concepts of general pathology to understand pathological basis of disease

4.Course Contents:

General Pathology

General Pathology Adaptations, Cell Injury and Repair: Hyperplasia, atrophy, metaplasia, necrosis and apoptosis - Differences between apoptosis and necrosis.

Acute and Chronic inflammation: Five cardinal signs of inflammation- Outcomes of acute inflammation- Chronic inflammation-Granulomatous inflammation-Acute phaseproteins.

Tissue repair, regeneration and hemodynamic disorders: Cutaneous wound healing-Pathologic aspects of repair-Hyperaemia and congestion-Thrombosis and Virchow triad-Embolism-Infarction Shock; Bronchial asthma, COPD.

Diseases of immune system: Hypersensitivity reaction-Type I, II, III, and IV hypersensitivity reactions.

Neoplasia: Definition of neoplasia. Differences between benign and malignant tumors ; Metastasis ; Carcinogenesis – Causes ; Carcinoma of oral cavity –

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Etiology of Carcinoma cervix – type of virus implicated, high risk sero-types, Screening investigations; Breast carcinoma – Risk factors

Histopathology

Introduction to histopathology. Receiving of specimen in the laboratory. Grossing techniques. Mounting techniques: various mountants. Maintenance of records and filing of the slides. Use& care of microscope. Various fixatives, mode of action, preparation and indication. Sectioncutting. Tissue processing for routine paraffin sections. Decalcification of tissues. Staining of tissues: H & E Staining. Bio-medical waste management. Frozen section cutting and staining.

Blood Bank

Introduction. Blood grouping and Rh types. Cross matching

Laboratory

ine Examination: physical, chemical, microscopic.

Blood grouping Rh typing. Cross matching (Observation), how to send samples for cross matching, PT, APTT and Hb, packed cell volume (PCV), erythrocyte sedimentation rate (ESR), bleeding tome, clotting time

Frozen section cutting and H &E staining.

Collection, transport, and preservation, of various clinical specimens.(Urine, CSF, sputum and other body fluids)

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	1				1								2			
CO-2	1		1	1									2			
CO-3	2				2								2			
CO-4	2		1		2								2			
CO-5	2			1									2			
CO-6	2		1		2			1					2		1	
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		22
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical	03	
3. Demonstration on a Computer		
Practical Work		
Conducting demo interviews and focus	5	
Computer lab (software demonstration)		
Demonstrating analysis using a case study		
Others		
1. Case Study Presentation		

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2. Brain Storming Sessions		
3. Group Discussions		
4. Discussing Possible Innovations		
Written Examination		10
Total Duration in Hours		45

7. Method of Assessment

Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam

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n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S.No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Case study and group discussions
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	Case study and group discussions
8.	Self-Learning	Assignments/Reports
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
14.	Leadership Skills	Group discussions

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9.Course Resources

1. **Essential Reading**

Sood R, (1996), Laboratory Technology- Methods and interpretation, 4th Ed. J.P. Bros, New Delhi.

Nayak R, (2017), Textbook of Pathology for Allied Health sciences, Jaypee brothers Medical Publishers, New Delhi.

MdTahmiunur Rahman Sajal et al, (2013), A Short Textbook of Pathology, 2nd Ed, Jaypee, New Delhi

2. Recommended Reading

Gupta S, (1998) Short text book of Medical Laboratory for technician, J.P. Bros, New Delhi.

Satish M Kawthalkar, (2010), Essentials of Clinical Pathology, Jaypee brothers Medical Publishers, New Delhi.

Harsh Mohan, (2005), Textbook of Pathology, 5th Ed, Jaypee brothers Medical Publishers, New Delhi.

3. **Magazines and Journals**

10.Course Organization

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Course		General Pathology
Course		AHD110A
Course Leader/s Name		
Course Leader Contact Details	**Phone:**	080 – 49065555
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Bachelors (Hons)

Medical Radiology and Imaging Technology

Programme code - 401

Course Specifications

Revised 2022

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3rd Semester

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Course Specifications: Basic Radiological Physics

Course Title	Basic Radiological Physics
Course Code	MRC201A
Department	Allied Health sciences
Faculty	Life and Allied Health Sciences

1. Aim and Summary:

The course aims to impart basic knowledge and provide the foundations needed for further understanding the concepts and principles in radiographic and imaging techniques.

Radiological physics is an applied branch of physics. It is concerned with the application of physical energy to the diagnosis and treatment of human disease. It encompasses of general physics, and radiation physics, physics of diagnostic radiology, and radiological health and safety.

2.Course Size and Credits:

Number of credits	03
Total hours of class room interactionduring the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. **Course Outcomes (CO)**

After undergoing this course students will be able to:

No.	Course Outcome
1	Comprehend the fundamental physics of diagnostic radiology
2	Understand the basic functioning of all x-ray equipment and follow radiation safety guidelines.
3	Explain the detection and measurement of radiation
4	Explain the various radiographic methods and keep up to date on technological advancements in the diagnostic field

4. Course Contents

Course Content (indicative content):

1. X-rays: Discovery of x-rays-X-ray production and properties: Bremsstrahlung Radiations-Characteristics X-Rays, factors affecting X-ray emission spectra, X- ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets.

2. Interaction of ionizing radiation with matter-Types of interactions of X- and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation.

3. Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.

4. Radiation intensity and exposure, photon flux and energy flux density.

5. LET, range of energy relationship for alpha, beta particles with X-Rays.

6. X-ray tube: historical aspects, requirements for X- ray production, tube

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voltage, current, space charge, , X-ray production efficiency, anode angulation and rotating tubes-line focus principle-space charge effect, tube cooling, grid-controlled X-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube Rating-Quality and intensity of x-rays-factors influencing them.

7. Heat dissipation methods, tube rating, heat units, operating conditions and maintenance and Q.A procedures.

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

9. X-ray generator circuits: Vacuum tube diodes-semi-conductor diodes-transistor-Rectification-half and full wave-self rectification-X-ray generator; filament circuit-kilo Voltage circuit-single phase generator-three phase generator-constant potential generator-Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthing.

10. Physical quantity, its unit and measurement: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVp, mA, mAS, Heat unit (HU.

11. Radiation quantities and units: Radiation intensity-exposure, roentgen, its limitations-kerma and absorbed dose-electronic equilibrium-rad, gray, conversion factor for roentgen to rad-quality factor-dose equivalent-rem, Sievert. Quality factor, dose equivalent, relationship between absorbed dose and equivalent dose.

12. Radiation detection and measurements: Principle of radiation detection-Basic principles of ionization chambers, proportional counters, G.M counters and scintillation detectors. Measuring system: free ionization chamber-thimble ion chamber-condenser chamber-secondary standard dosimeter-film dosimeter- chemical dosimeter-Thermo Luminescent Dosimeter-Pocket dosimeter

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5.Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1				2		2	3	2					2	2	3	
CO-2	1		2			3	3	2					2	2	3	
CO-3	2			2		3	3	2					3	2	3	3
CO-4								3					2	2		2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		

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2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		60

7. Method of Assessment

The following is the CE components:

Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

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In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

p) Online Test
q) Assignments/Problem Solving
r) Field Assignment
s) Open Book Test
t) Portfolio
u) Reports
v) Case Study
w) Group Task
x) Laboratory / Clinical Work Record
y) Computer Simulations
z) Creative Submission
aa) Virtual Labs
bb) Viva / Oral Exam
cc) Lab Manual Report
dd) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

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8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures

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2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading

a. **Class notes**

b. **Text Books:**

1. Christensen"s Physics of Diagnostic Radiology – 4 th edition, Thomas S. Curry, 1990.
2. Chesney & Chesney"s X-ray Equipment's for Student Radiographers, 1987.
3. Chesney"s Radiographic Imaging – 4 th edition, Wiley-Blackwell, 1994
4. Radiologic Science for Technologists- 9 th edition, Stewart Carlyle Bushong, Mosby Elsevier, 2008.
5. Principles of Imaging Science & Protection, Michael A. Thompson, W.B. Saunders Company, 1994.
6. Radiographic Imaging & Exposure, Terri L. Fauber, Mosby Elsevier, 2009

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10. Course Organization

Course Code	MRC201A		
Course Title	Basic Radiological Physics		
Course Leader/s Name		As per time table	
Course Leader Contact Details		Phone:	
		E-mail:	
Course Specifications Approval Date			
Next Course Specifications Review Date:			

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Course Specifications: Basic Radiological Equipment

Course Title	Basic Radiological Equipment
Course Code	MRC202A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

The course aims to impart basic knowledge and sufficient exposure to conventional and modern radiography such as X ray and fluoroscopy, computed radiography, DEXA and Vascular imaging equipment. The students learn the working of the equipment, care and maintenance.

2. Course Size and Credits:

Number of credits	03
Total hours of class room interaction during the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcome
1.	Understand the basic working principle and equipment of the various modalities
2.	Explain the safe handling of the equipment
3.	Explain the applications of various equipment's in diagnostic radiology
4.	practical learning and training in operating the equipment and stay abreast of the latest technology advancements

4. Course contents

Course Content
<u>X-ray equipment</u> 1. Meters and exposure timers: Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber-based timers, integrated timer. 2. Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements. 3. Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of

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fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualizing intensified image

4. Portable and mobile x-ray units, dental x-ray machine, Mammographic device -; Dual energy x-ray absorptiometry (DEXA) scan.

5. Computed radiography- its principle, physics & equipment. Digital Radiography, Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications.

6. Vascular Imaging Equipment: Introduction, historical developments, Principle, digital subtraction angiography.

7. Tele Radiology: LAN (Local area network), WAN (wide area network), DICOM (Digital Imaging and Communications in Medicine), HIS (Hospital information system), RIS (Radiology information system), Picture archiving and communication system (PACS).

5.Course Map (CO-PO-PSO Map)

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	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	1	1			2	3	2	2					1	2	3	
CO-2	2				3	1	2						2		3	
CO-3				2		2	1	2					2		3	3

* Approved by the Academic Council at its 26 th meeting held on 14 July 2022

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CO-4	1	2	1	2	3	1	3	2					3	2	3	3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		

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3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		60

7. Method of Assessment

The following is the CE components:

Theory Component CE			**Laboratory Component CE**	**SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study

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h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions

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13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading

a. **Class notes**

b. Text Books:

1. Christensen"s Physics of Diagnostic Radiology – 4 th edition, Thomas S. Curry, 1990.
2. Chesney & Chesney"s X-ray Equipment's for Student Radiographers, 1987.
3. Chesney"s Radiographic Imaging – 4 th edition, Wiley-Blackwell, 1994
4. Radiologic Science for Technologists- 9 th edition, Stewart Carlyle Bushong, Mosby Elsevier, 2008.
5. Principles of Imaging Science & Protection, Michael A. Thompson, W.B. Saunders Company, 1994.
6. Radiographic Imaging & Exposure, Terri L. Fauber, Mosby Elsevier, 2009

10. Course Organization

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Course Code	MRC202A	
Course Title	Basic radiological equipment	
Course Leader/s Name	As per time table	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Course Specifications: Entrepreneurship Development

Course Title	Entrepreneurship Development
Course Code	AHM203A
Course Type	Core Theory Course
Department	Management Studies
Faculty	Management and Commerce

1. Course Summary

The open elective common course on Entrepreneurship Development has been introduced across all the undergraduate programs with an aim to impart comprehensive knowledge of an entrepreneurial ecosystem. Further, the course enables to develop entrepreneurial skills by building entrepreneurial intentions among students. The students also gain knowledge on competencies to provide with necessary inputs for creation of new ventures and scaling up existing startups. The students are also introduced to design thinking process to nurture entrepreneurial way of thinking.

2. Course Size and Credits:

Number of Credits	03
Credit Structure (Lecture: Tutorial: Practical)	1:1:1
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Respective Department of the Faculty
Total Course Marks	100
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

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3. Course Outcomes (COs)

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

CO-1. Discuss the concepts and process of entrepreneurship
CO-2. Construct and apply the idea generation techniques
CO-3. Examine the opportunities for launching of new venture and various entry strategies
CO-4. Acquire the skills for creation and management of entrepreneurial venture
CO-5. Present a viable business plan, for business success

4. Course Contents

Unit 1: Introduction to Entrepreneurship

Introduction to entrepreneurship, Evolution of the concept, Entrepreneurial process, Types of Entrepreneurship - Social entrepreneurship, rural entrepreneurship. Ccharacteristics of an entrepreneur, incorporation of a company, managing a family business, corporate intrapreneurship

Unit 2:

Creativity and the Business idea): Key elements in an entrepreneur's background. Types of Innovations. Identify various sources of ideas for new ventures- methods available for generating new venture ideas- creativity, design thinking and the techniques for creative problem solving. Aspects of the product planning and development process

Unit 3

New Venture:

Creating opportunities, resources, role of new ventures and small businesses in the economy, types of entry strategies, launch a new venture and the generic strategies

Unit 4

Strategies to Sustain and Grow

Strategies for expansion, joint ventures, acquisitions, merges, franchising, public issues, rights issues, bonus issues, growth strategy, exit strategy.

Unit 5 Business Plan

Business plan, scope and value of the business plan, step-by-step explanation of the business plan, marketing plan, Organizational plan, financial plan (source of capital), entrepreneurship models

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)			
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2	PSO-3	PSO-4
CO-1	2	2	2									2			3
CO-2	3	2	2	2	3								3	2	
CO-3	3	3	2	2								2		2	
CO-4	3	2	2	2	2	3			3	3			2		3
CO-5	2	3		2							3		2	3	
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution															

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		20
Demonstrations		02
1. Demonstration using Videos	02	
2. Demonstration using Physical Models / Posters	00	
3. Demonstration on a Computer	00	
Numeracy		00
1. Solving Numerical Problems	00	
Practical Work		03
1. Course Laboratory	00	
2. Computer Laboratory	00	
3. Engineering Workshop / Course/Workshop / Kitchen	03	

4. Clinical Laboratory	00	
5. Hospital	00	
6. Model Studio	00	
Others		
1. Case Study Presentation	05	
2. Guest Lecture	01	
3. Industry / Field Visit	02	15
4. Brain Storming Sessions	02	
5. Group Discussions	04	
6. Discussing Possible Innovations	01	
Term Tests, Laboratory Examination/Written Examination, Presentations		05
Total Duration in Hours		**45**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Program Specifications document pertaining to the UG Program. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation			
	Component 1: CE (50% Weightage)		**Component 2: SEE – Group Task/Activity (50% Weightage)**
Subcomponent ▶	**SC1**	**SC2**	
Subcomponent Type ▶	**Mid Term Test**	**Assignment/Presentation Deck of Innovative Ideas**	**50 Marks**
Maximum Marks ▶	**25**	**25**	

CO-2			
CO-3			
CO-4			
CO-5			
The details of SC1 and SC2 are presented in the Programme Specifications Document.			

The Course Leader assigned to the course, shall provide the focus of COs in each component of assessment in the beginning of the semester to capture the Group Task evaluation parameters such as: field visit, presentation of business plan, case study presentation on success and failure companies. Ideating and running the business for a day inside the campus.

Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Assignment
4.	Analytical Skills	Class room, assignment,examination
5.	Problem Solving Skills	Assignment, Field visit andpresentation
6.	Practical Skills	Assignment
7.	Group Work	Case study Presentation
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, examination
10.	Verbal Communication Skills	Case study and group discussions
11.	Presentation Skills	Case study and group discussions
12.	Behavioral Skills	Group discussions

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13.	Information Management	Assignment
14.	Personal Management	Assignment and Group Discussion
15.	Leadership Skills	Group discussions and Case study

9. Course Resources

a. Essential Reading

1. Course notes
2. Rajeev Roy, (2011), *Entrepreneurship*, Oxford University Press, 2nd Edition
3. Robert D. Hisrich, Michael P. Peters, *Entrepreneurship (2017)* Dean A. Shepherd. Tenth edition. New York, NY : McGraw-Hill Education

b. Recommended Reading

1. Poornima. M. Charantimath, *Entrepreneurship Development* (2006) Small Business Enterprises, Pearson Education

c. Magazines and Journals

1. Business World: ABP Group - Fortnightly business magazine
2. Journal of small business management , Blackwell publishing- yearly
3. Business Strategy: PwC Strategy& Inc. - Quarterly issue

d. Websites

1. www. startup India.org
2. www. allsharktankproducts .com

e. Other Electronic Resources

NA

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10. Course Organization

Course Code	AHM203A		
Course Title	Entrepreneurship Development and Startups		
Course Leader's Name		As per Timetable	
Course Leader's Contact Details		**Phone:**	+91-80-4536-6666
		E-mail:	
Course Specifications Approval Date		17 June 2022	
Next Course Specifications Review Date		June 2024	

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Course Specifications: Directed Clinical Education I

Course Title	Directed Clinical Education - I
Course Code	MRC203A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

I. Course Summary

Students will gain skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from clinical learning experience under the supervision of a radiologist or senior technologist Students are tested on intermediate clinical radiological skills. Students will observe the basic operations of the radiology equipment while interacting with the multidisciplinary team members involved in providing optimal care to the patients. The student will be introduced to various terminology, equipment, and techniques used in radiology.

2. Course Size and Credits:

Number of credits	8
Total hours of class room interaction during the semester	00
Number of tutorial/ Laboratory/hospital posting hours	240
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course marks	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Intended Learning Outcome
1	Assist in setting up conventional and modern radiologic equipment for indicative radiographs
2	Assist in developing good quality X-ray films in the dark room
3	Assist senior technician in general care and performing functional tests of the equipment
4	Assist in processing the cassettes manually and using automatic film processor.

4. Course Contents

Course Content
Orientation to hospital and department, procedures carried out in the department. X-ray tubes, high tension circuits, Meters and exposure timers, Beam limiting devices Fluoroscopy, general care and functional tests, radiographic films, types of cassettes, manual and automatic film processors. Dark room processing.
Introduction to different radiological procedures and techniques

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	3	3			3		3						2		3	
CO-2			2		3			2						2		2
CO-3	3			3		2		2						2		2
CO-4	3	3		3		3	3							3		1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		
Demonstrations		
1. Demonstration using Videos	-	
2. Demonstration using Physical Models/Systems	-	
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory/ Radiology department	200	

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2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	200
4. Clinical Laboratory	-	
5. Hospital	-	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	10	
2. Guest Lecture	-	
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	24	
5. Small Group Discussions	-	
6. Discussing Possible Innovations	-	
Work Place Based Assessment, Portfolio Presentation, and Viva		6
Total Duration in Hours		240

7. Method of Assessment

Theory Component CE	Laboratory Component CE
SC1 (Logbook)	SC2 (Internal viva voice & practical's)
50 marks	50 Marks

The following is the CE components:

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

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a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

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Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination

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10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading

Clinical manuals

10. Course Organization

Course Code	MRC203A	
Course Title	Direct clinical education -1	
Course Leader/s Name	As per time table	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Bachelors (Hons)

Medical Radiology and Imaging Technology

Programme code - 401

Course Specifications

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4th Semester

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Course Specifications: Radiographic Positioning

Course Title	Radiographic positioning
Course Code	MRC204A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

The purpose of this course is to familiarize, understand, and apply the knowledge of positioning of the patient and the factors related to getting the best image quality with the least amount of radiation dose and to justify each and every exposure and to gain expertise with basic and complex positioning radiography by critical thinking and analyzing each and every individual case in the department while adhering to radiation safety and protection norms.

2. Course Size and Credits:

Number of credits	03
Total hours of class room interactionduring the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcomes
1	Explain the proper positioning techniques
2	Learn how to independently confirm and check the image quality and post-processing techniques.
3	Understand and follow the norms of radiation safety
4	Handle complex cases by using critical thinking and reasoning.

4. Course Contents

Course Content
Unit 1-General Considerations Basic Radiographic anatomy, subject types, age and sex, anatomical landmarks-postural variations-erect and horizontal technique respiratory movement and diaphragm level-regional densities-preparations-and immobilization of patient –pathological conditions-injuries, fractures and dislocations congenital, localized views-periodic examinations-use of dry bones-positioning terminology identification systems. UNIT-2- POSITIONING A. Upper Limb Techniques for hand-fingers-thumb-wrist joint-forearm-elbow joint-humerus- shoulder joint and sternoclavicular joint. B. Lower Limb Techniques for foot-calcaneum-ankle joint-leg-knee joint-patella-and femur (lower two thirds) UNIT C. Thorax: Techniques for sternum, ribs (upper and lower). D. Pelvic Girdle Techniques for pelvic-iliac fossa-ischium-and sacro iliac joint. E. Vertebral Column Techniques for Atlanto-occipital articulation, cervical vertebrae, cervico-thoracic junction, thoracic vertebrae, lumbar vertebrae, lumbosacral

articulation, sacrum, coccyx.

F. Skull Techniques for cranium, facial bones, Sella turcica, temporal Bone and optic foraminae, sinuses, mandible and temporo mandible joint. Abdomen Routine and radiographs on acute condition.

3.UNIT-3-Dental Radiography

Technique for intra oral full mouth. -Occlusal projections. - Extra oral projections including orthopantomography. - Supplementary techniques.

4.Microradiography: Principle, advantage, technique and applications.

5.High KV techniques principle and its applications.

6. Soft tissue Radiography including Mammography - its techniques, equipment, advancements and applications.

7. Localization of foreign bodies. Various techniques

8. Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.

9. Trauma radiography/Emergency radiography

10. Neonatal and Pediatric Radiography,

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	2	2		2	3		3	1						2	3	2
CO-2					3	3		2					2		3	
CO-3	2			3			3								3	3
CO-4	3			2			2	2						3	3	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory	-	

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3. Engineering Workshop/Course	-
Workshop/Kitchen/ OSPE	
4. Clinical Laboratory	-
5. Hospital	25
6. Model Studio	-
Others	
1. Case Study Presentation/ Case Studies	-
2. Guest Lecture	
3. Industry/Field Visit	-
4. Brain Storming Sessions/ Seminar	10
5. Group Discussions	3
6. Discussing Possible Innovations	
Term Test, Laboratory Examination and Written Examination	7
Total Duration in Hours	60

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7. Method of Assessment

The following is the CE components:

Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

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8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course

ResourcesEssential

Reading:

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1. Class notes
2. Atlas of Radiographic Positioning and Radiological Procedures. Mosby)
3. Bruce W. Long ,Jeannean Hall Rollins , Barbara J. Smith Merrill's Atlas of Radiographic Positions and Radiologic Procedures, 3-Volume Set, 13e 13th Edition Mosby; 2015)
4. Phillip W. Ballinger Merrill's Atlas of Radiographic Positions and Radiologic Procedures 1982 (5th Edition, Mosby
5. Philip W. Ballinger, Eugene D. Frank, Radiographic Anatomy,Positioning Proceedlm 1999 Eleventh

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edition Mosby,

6. K C Clark R A Swallow E Naylor E J Roebuck Whitley. Clarks Positioning In Radiography Mosby, 1999 Eleventh edition

Recommended Reading

1. Kathleen Clara Clark; R A Swallow; E Naylor; E J Roebuck; A S Whitley Clarks Positioning In Radiography 1989, Oxford : Heinemann medical Books,

2. Sante, L. R., Manual of RoentgenologicalTechniquePublished by Edwards brothers, Incorporated, Ann Arbor, Michigan, U.S.A. (1943)

3. David Cope Myer Goldman , A Radiographic Index, 8Rev Ed edition (1987)

   a. Butterworth-Heinemann LTD.

4. Merrill's atlas of radiographic positioning and radiologic procedures, 1,2 & 3 Volume

10. Course Organization

Course Code	MRC204A	
Course Title	Radiographic positioning	
Course Leader/s Name	As per timetable	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Course Specifications: Radiographic Contrast Procedures

Course Title	Radiographic contrast procedures
Course Code	MRC205A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

The purpose of this course is to understand radiographic anatomy, the importance of radiographic contrast pharmacology, and their application in diagnostic radiology, as well as to apply the knowledge on cases through hands-on training in the radiology department and be able to handle complex cases such as adversity reactions of contrast media through critical thinking while adhering to radiation safety and protection norms.

2. Course Size and Credits:

Number of credits	03
Total hours of class room interactionduring the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcomes
1	Understand the pharmacology of the contrast media and its administration forvarious procedures
2	Gain knowledge regarding patient preparation, procedure, and post-procedurecare for all radiological contrast procedures.
3	Explain and handle complex cases using modified techniques and positioning whileadhering to radiation safety regulations.
4	Handle the practical issues that arise when using contrast agents and the ways toresolve them.

4. Course Contents

	Course Content
	General considerations: 1. Responsibility of Radiographer during Radiological Procedures. 2. Preparation of Patient for Different Procedures. 3. Contrast Media - Positive and Negative, Ionic & Non – Ionic 4. Adverse Reactions to Contrast Media and Patient Management 5. Emergency Drugs in the Radiology Department 6. Emergency Equipment in the Radiology Department 7. Aseptic technique 8. Indications, contraindications, basic techniques and relationship to other techniques of the following special procedures • **Gastrointestinal Tract:** • Fluoroscopy, general considerations, responsibility of radiographers

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- Barium swallow
- Barium meal and follow through
- Hypotonic duodenography
- Small bowel enema
- Barium Enema
- colostomy.

- **Salivary glands:** Routine technique, procedure–sialography
- **Biliary system:**
  - Intravenous cholangiography
  - Percutaneous cholangiography
  - Endoscopic retrograde cholangio-pancreatography (ERCP)
  - Operative cholangiography
  - Post-Operative cholangiography (T - tube Cholangiography)
- **Urinary system:**
  - Intravenous urography
  - Retrograde pyelography
  - Antegrade pyelography
  - Cystography and micturating cystourethrography
  - Urethrography (ascending)
  - Renal puncture
- **Female reproductive system:** Hysterosalpingography.
- **Sinogram**
- **Dacrocystography**

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	2	2		2	3		3	1						2	3	2
CO-2					3	3		2					2		3	
CO-3	2			3			3								3	3
CO-4	3			2			2	2						3	3	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		16
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer		
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		

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2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	30	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	25	
5. Group Discussions	2	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		

7. Method of Assessment

The following is the CE components:

Theory Component CE			**Laboratory Component CE**	**SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

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assignment subcomponents can be of any of the following types:

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c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars

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9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. **CourseResources**

EssentialReading:

1. Class notes

2. Patesson: Printed Notes For Radiographers In India (Cmai)

3. Achwaz: Unit-step Radiography: Simplification of Medical Radiography through Manual and Automatic Use of an Exposure Value Scale (XVS) System and Standardization, Gerhart Steven Schwarz, Thomas, 1961

Recommended Reading:

1. John A. Ross , R.W. Galloway , Handbook of Radiography Hardcover
   i. H. K. Lewis & Co Ltd; 3rd Revised edition (1963)
2. Glenda J. Bryan, Diagnostic Radiography, Churchill Livingstone, 01-Jan-1987
3. Charles A. Jacobi, Don Q. Paris : Textbook of Radiological Technology (Mosby) C. V. Mosby Co., 1968
4. Scarrow: Contrast Radiography (Schering Chemicals)
5. Marianne R. Tortorici , Hiram M. Hunt,Concepts in Medical Radiographic Imaging –1992, Elsevier Science Health Science div
6. Derrick P. Roberts, Radiographic Imaging: A Practical Approach, Churchill Livingstone (July 1, 1988)

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10. Course Organization

Course Code	**MRC205A**		
Course Title	Radiographic contrast Procedures		
Course Leader/s Name		As per time table	
Course Leader Contact Details		Phone:	
		E-mail:	
Course Specifications Approval Date			
Next Course Specifications Review Date:			

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Course Specifications: Radiographic image processing techniques

Course Title	Radiographic Image processing techniques
Course Code	MRC206A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

Aim and Summary:

The course aims to provide students with hands-on training in the workstation so that they can appreciate and apply their knowledge to produce high-quality radiographic images with low radiation doses by utilizing the most recent technologies and focusing on the factors that affect image quality as well as the importance of processing equipment in the diagnostic imaging department. The lectures are interspersed with practical demonstrations to emphasize the significance of image processing techniques

2. Course Size and Credits:

Number of credits	03
Total hours of class room interaction during the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. **Course Outcomes (CO)**

After undergoing this course students will be able to:

No.	Course Outcome
1	Get oriented to the work flow in the image processing rooms and equipmentworking principle
2	Explain the factors influencing image quality and ways to improve it using technical processing factors.
3	Receive hands-on training in the safe handling of processing equipment, as wellas its care and importance.
4	Stay abreast of the latest and emerging technologies in the field of diagnosticimaging post-processing software.

4. Course contents:

	Course Content
	1. Radiographic Film: Structure of film emulsion-film characteristics (speed, base + fog, gamma, latitude)-effect of grain size on film response to exposure, interpretation of characteristics curve-Grain Technology-Gelatin-Basic film types-Film formats and packing-Direct exposure duplitised films-Single coated emulsions-Films for specialized use-manufacturing process. Structure, properties of different parts. Handling of exposed and unexposed films. Types, applications, advantages/limitations of different types, safe light requirements. 2. Sensitometer: Photographic density-characteristic curve-information from the characteristic curve-speed Vs definition. Storage of X-ray film. 3. Intensifying screens: Structure and functions, common phosphors used-types, screen mounting, care and maintenance of film screen contact. Intensifying factor-speed and detail-crossover effect-resolution-mottle-reciprocity-screen asymmetry-cleaning. New phosphor technology-influence of kilo voltage. Photo-stimulable phosphor Imaging. 4. Cassettes: Structure and function-Types-single, gridded, film holder-Design features and consideration with loading/unloading-Care and maintenance

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(cleaning).

5. Photochemistry: Principles, Acidity, alkalinity, pH, the processing cycle, development, developer solution. Fixing, fixer solution, washing, drying replenishment, checking and adjusting-latent image formation--nature of development-constitution of developer-development time-factors in the use of developer. Fixers-constitution of fixing solution-factors affecting the fixer-replenishment of fixer-silver conservation-Drying-developer and fixer for automatic film processor-rinsing-washing and drying. Replenishment rates in manual and automatic processing-silver recovery-Auto and manual chemicals.
6. Processing: manual processing-care of processing equipment-automatic processor-manual VS automatic processing-principles and typical equipment Microprocessor controlled-Cine Processing-Daylight Systems-Processing faults-maintenance.
7. Automatic Film Processor-components, working principle, film feed system, care and maintenance
8. Factors affecting radiographic Image Quality: Image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur.
9. Presentation of radiographs-opaque letters and markers-Identification of dental films-preparation of stereo radiographs-viewing conditions.
10. Monitor images-Characteristics of the video image-television camera-imaging camera. Laser-light and laser-laser imaging-laser imagers-imaging plates-Dry cameras.
11. Dark Room: planning, construction, room storage, safe lights, film loading, dispensing, cleaning and maintenance

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5. Course Map (CO-PO-PSO Map):

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CO-1					3	3	2	1					2		3	

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CO-2	2			1		3	3	1							3	
CO-3	1			2	3	2	3						2		3	3
CO-4	1					2		2					2	2		3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

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Teaching and Learning Methods	Duration in hours	Total Duration in Hours
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2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		

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3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		60

7. Method of Assessment

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j) Computer Simulations
k) Creative Submission

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l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

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8. Achieving learning outcomes:

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Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

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9.Course Resources

Essential Reading

a.**Class notes**

b.**Text Books:**

1. Christensen"s Physics of Diagnostic Radiology – 4 th edition, Thomas S. Curry, 1990.

2. Chesney & Chesney"s X-ray Equipment's for Student Radiographers, 1987.

3. Chesney"s Radiographic Imaging – 4 th edition, Wiley-Blackwell, 1994

4.Piles: Medical Radiographic Technique (Thoms), Dark room, developers

Recommended Reading

5. Radiologic Science for Technologists- 9 th edition, Stewart Carlyle Bushong, Mosby Elsevier, 2008.

6. Principles of Imaging Science & Protection, Michael A. Thompson, W.B. Saunders Company, 1994.

7. Radiographic Imaging & Exposure, Terri L. Fauber, Mosby Elsevier, 2009

10.Course Organization

Course Code	**MRC206A**	
Course Title	Radiographic Image processing techniques	
Course Leader/s Name	As per time table	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Course Specifications: Directed Clinical Education II

Course Title	Directed Clinical Education - II
Course Code	MRC207A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

I. Course Summary

The course aims at preparing the students to produce X-ray films of good quality and diagnostic value. Students will be introduced to radiographic techniques of CT, Ultrasonography / Doppler and MRI scanners. This will help them position the patient and utilize image processing facilities to guide the clinician. Students will be familiarized with special positioning of patients as related to cranial, facial and dental radiography. They will also be exposed to principles, advantages and applications of advance techniques such as macro – radiography, mammography, mobile radiography, stereography, tomography and forensic radiography. The student will also gain basic knowledge and about radiological procedures of the respiratory genitourinary, gastrointestinal systems macro radiography, soft tissue radiography and localization of foreign bodies, emphasizing the use of radiological contrast media, and the equipment used during these procedures. It also focuses on the indication, contraindications, associated risks and precautions in performing contrast investigation.

2. **Course Size and Credits**:

Number of credits	7
Total hours of class room interaction during the semester	00
Number of tutorial/ Laboratory/hospital posting hours	210
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course marks	Total Marks: 100

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Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Intended Learning Outcome
1	Assist in Developing of radiographic films.
2	Have basic knowledge and understanding of the principles of ultrasound,Doppler and MRI scanners.
3	Assist in preparing and managing patients for radiological and imaging procedures
4	Have basic understanding of Macro radiography, mammography, mobile radiography, stereography, tomography and forensic radiography.

4. Course Contents

Should be able to independently process radiographic films

Should be able to undertake Mammography, CT scan and MRI procedures under supervision.

Assist in specialized radiological procedures such as Mammography, macro radiographyand bed side radiography.

Should be able to handle all radiological and imaging equipment under supervision.Should ensure radiation protection and quality assurance

Undertake care and maintenance of all radiological and imaging equipment

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	3	3			3		3						2		3	
CO-2			2		3			2						2		2
CO-3	3			3		2		2						2		2
CO-4	3	3		3		3	3							3		1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		-
Demonstrations		
1. Demonstration using Videos	-	
2. Demonstration using Physical Models/Systems	-	
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory/ Radiology department	150	

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2. Computer Laboratory	-	
3. Engineering Workshop/CourseWorkshop/Kitchen/ OSPE	-	15 0
4. Clinical Laboratory	-	
5. Hospital	-	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	20	
2. Guest Lecture	-	
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	30	
5. Small Group Discussions	-	
6. Discussing Possible Innovations	-	
Work Place Based Assessment, Portfolio Presentation and Viva		10
Total Duration in Hours		210

7. Method of Assessment

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Theory Component CE	Laboratory Component CE
SC1 (Logbook)	SC2 (Internal viva voice & practical's)
50 marks	50 Marks

The following is the CE components:

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

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a) Online Test

b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions

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12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading

Clinical manuals

10. Course Organization

Course Code	**MRC207A**	
Course Title	Direct clinical education -II	
Course Leader/s Name	As per time table	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Bachelors (Hons)

Medical Radiology and Imaging Technology

Programme code - 401

Course Specifications

Revised 2022

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5th Semester

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Course Specifications: Basic to advanced Computed Tomography

Course Title	Basic to advanced Computed Tomography
Course Code	MRC308A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

The aim of the course is to understand the basic working principles and equipment of computed tomography and its application in diagnostic radiology, as well as the imaging protocols in CT and the required patient preparation and post procedural cares in computed tomography modality through hands-on training and exposure to the machine and modify the techniques for complex cases through critical thinking and analysis while maintaining radiation safety.

2. Course Size and Credits:

Number of credits	03
Total hours of class room interactionduring the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

3. Course Outcomes (CO)

After undergoing this course students will be able to:

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No.	Course Outcome
1	comprehend the CT working principles, instrumentation and physics
2	Familiarized with cross-sectional grey scale anatomy and radiation safety
3	Safe handling the equipment by receiving hands-on training and staying up to date on the latest technological advancements in the field
4	Evaluate image quality, carry out the necessary post-processing, annotations, image archiving, and documentation

4.Course Contents

Course Content
1. Historical aspects of CT, working principle of Computed Tomography, Comparison of CT with Conventional Radiography and Tomography, generations of computed tomography 2. CT equipment: Gantry, Patient couch, X-ray tube, Filters, Collimators, Detectors, Data Acquisition System (DAS). 3. Image Formation in CT, CT Image Reconstruction, Hounsfield Unit, Windowing, CT image display 4. CT Image quality and artifacts: Factors influencing CT Image Quality, CT Dose, Causes, manifestation and rectification of CT artifacts. 5. Advancements: Multi Detector CT, spiral CT scan: Slip ring technology, CBCT-geometry, Reconstruction of CT images, 4D CT, HRCT, Post Processing Techniques: MPR, MIP, Min IP, Rendering software's -SSD and VR 6. CT Protocols: Patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography: Selective angiogram head, neck and peripheral, Image documentation: Filing, Maintenance.

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5. **Course Map (CO-PO-PSO Map)**

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1				3	2	2	2	1					2	2		
CO-2	2	2			3	3	2							2		
CO-3	2					1	2	1					2		2	
CO-4			2		2			1					2	2	3	
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6.Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory	-	
3. Engineering Workshop/Course	-	

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Workshop/Kitchen/ OSPE		
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		60

7. Method of Assessment

The following is the CE components:

Theory Component CE			**Laboratory Component CE**	**SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent

is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions

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8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading:

1. Class notes
2. Christensen's Physics of Diagnostic Radiology – 4 th edition, Thomas S. Curry, 1990.
3. Euclid Seeram Computed Tomography – Physical principles, Clinical applications and Quality Control, 3rd edition, Saunders Elsevier, 2009.
4. A Practical Guide to CT Technologist, C. Ramamohan, Paras Publishing, 2002.
5. High Resolution CT of the Lung – 4 th edition, W. Richard Webb., Nestor L. Muller & David P. Naidich, Lippincott Williams & Wilkins, 2009.

10. Course Organization

Course Code	**MRC308A**	
Course Title	Basic to advanced Computed Tomography	
Course Leader/s Name	As per timetable	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Course Specifications: Basic to advanced Ultrasound

Course Title	Basic to advanced Ultrasound
Course Code	MRC309A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

The aim of the course is to understand the basic working principles and equipment of ultrasound and their application in diagnostic radiology, as well as the factors that affect ultrasound image quality and how to improve it, as well as the patient preparation for the various ultrasound procedures.

2. Course Size and Credits:

Number of credits	03
Total hours of class room interactionduring the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcome
1	comprehend the Ultrasound working principles, instrumentation and physics

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2	Familiarized with cross-sectional grey scale anatomy in ultrasound
3	Safe handling the equipment by receiving hands-on training and staying up todate on the latest technological advancements in the field
4	Evaluate image quality, carry out the necessary post-processing, annotations,image archiving, and documentation

4. Course Contents

Course Content
1. Historical aspects of ultrasound, Generations and Properties of Ultrasound: Basic Acoustic principles 2.Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed,frequency, dB notation: relative acoustic pressure and relative acoustic intensity. 3.Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, Construction and Working, Characteristics of US beam. 4. Interaction of Ultrasound with matter: Reflection, transmission, scattering, refraction and absorption, Attenuation and attenuation coefficients. 5.Types of transducers: linear, curvilinear, sector, transvaginal, transrectal, trans oesophageal, intra vascular probe ,3D & 4D transducers and working principles 6.Image Formation, Display and Quality: Ultrasound display modes: A, B, M, T-M mode, B-scan, Scan-converters: Analog and Digital, Image Quality: Axial, Lateral and Elevational resolutions, US Machine Controls, US focusing. Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, Ultrasound Artifacts. 7. Techniques: Techniques for imaging different anatomic areas, Patientpreparation for various ultrasound imaging. 8. Doppler Ultrasound: Doppler Effect, Doppler ultrasound techniques:Continuous Wave Doppler, Pulsed Doppler, Duplex scanning, Doppler spectrum,

Color Doppler, Power Doppler, stress and shear wave doppler, B-flow imaging

9. Harmonic imaging Extended FOV imaging 3D US imaging: acquisition methods& reconstruction 4D & 5D US imaging.

10. PRACTICALS: Basic ultrasound techniques, practical based on theory.

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1				2	1	2	1	1					2		2	
CO-2	1			2				1						2	2	1
CO-3				2			2	1					3		3	3
CO-4					3	2		2					2		2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer		

Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		60

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7. Method of Assessment

The following is the CE components:

Theory Component CE			**Laboratory Component CE**	**SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE

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20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion

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5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading:

1. Christensen"s Physics of Diagnostic Radiology – 4 th edition, Thomas S. Curry, 1990.
2. The Essential Physics of Medical Imaging – 2 nd edition, Jerrold T. Bushberg, 2001
3. Doppler Ultrasound: Principles & Instruments – 2 nd edition, Frederick W. Kremkav, 1995.
4. Text book of Color Doppler Imaging – 2 nd edition, Satish K. Bhargava, Jaypee Brothers Medical Publishers (P) Ltd., 2010. 5. Essentials of Ultrasound Physics, James A Zagzebski, Mosby, 1996.
5. Three-Dimensional Ultrasound, Thomas R. Nelson, Donal B. Downey, Dolores H. Pretorius, Aaron Fenster, Lippincott Williams & Wilkins, 2009.

10. Course Organization

Course Code	**MRC309A**	
Course Title	Basic to advanced Ultrasound	
Course Leader/s Name	As per timetable	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

Course Specifications: Quality assurance and regulatory requirements in radiology

Course Title	Quality assurance and Regulatory requirements in radiology
Course Code	MRC310A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary:

The course aims to familiarize the students regarding the quality assurance procedures and radiation safety in diagnostic radiology. Students will understand the significance of quality assurance activity and programs at different levels. They will learn regarding maintenance and safe operations of equipment. Biological effects of radiation, its detection, measurement and protection including radiation hazard and control will be covered in this course.

2.Course Size and Credits:

Number of credits	03
Total hours of class room interactionduring the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcome
1	Understand the importance of quality assurance tests in the department
2	To get oriented to quality assurance program at different levels
3	Explain the biological effects of radiation, along with ways to keep within safeexposure limits.
4	Explain the requirements and guidelines for diagnostic radiology regulatorybodies at the national and international levels.

4. Course Contents

Course Content
1. Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance. 2. Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance. 3. Quality assurance Programme tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. 4.Light beam alignment; X-ray out-put and beam quality check; Focal spot size and angle measurement; Grid alignment test; High and low contrast resolutions; Proper screen-film contact test; Safe light test

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5. Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipment's; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis Programme.

Radiation safety and regulatory requirements in diagnostic Radiology

1. Units of radiation - Occupational Exposure Limits - Dose limits to public-CT dosimetry

2. Biological Effects of radiation-Stochastic effects -Deterministic effects -Dose limitations

3.Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation andradiation survey – ALARA

4.Radiation Hazard evaluation and control: Calculation of Work load, weekly calculated dose to radiation worker & General public. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.

5. Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements.

6. AERB specifications for site planning and mandatory guidelines – Planning of X-ray rooms, dark rooms – Inspection of X-Ray installations - Registration of X-Ray equipment installation-Certification WHO guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDT Act

and guidelines

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO	PO	PO	PO	PO	PO	PO	PO					PSO	PSO	PSO	PSO

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	-1	-2	-3	-4	-5	-6	-7	-8					-1	-2	-3	-4
CO-1	1			2	2		2	1					2	2		
CO-2				2	3	3	2						2			
CO-3	2	1		2	3	1	2	2					2		3	
CO-4		1	2	2	2	2	3	3					2		3	3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6.Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	

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Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		60

7. Method of Assessment

The following is the CE components:

Theory Component CE			**Laboratory Component CE**	**SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

p) Online Test
q) Assignments/Problem Solving
r) Field Assignment
s) Open Book Test
t) Portfolio
u) Reports

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v) Case Study
w) Group Task
x) Laboratory / Clinical Work Record
y) Computer Simulations
z) Creative Submission
aa) Virtual Labs
bb) Viva / Oral Exam
cc) Lab Manual Report
dd) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions

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13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading:

Class notes

1. J. E. Gray, N. T. Winkler, J. Stears, and E. D. Frank, *Quality Control in Diagnostic Imaging*, James S. Whiting November 1983

2. MM Rehani, Diagnostic Imaging: Quality Assurance, Jaypee Brothers Medical Publishers (1995)

3. J.M. Mcolemore Quality assurance in Diagnostic Radiology" By (Year book of Medical Publishers) Quality Control in diagnostic imagine" By J.E. Gray (University ParkPress)

4. William E.J. Mckinney Processing and Quality Control (J.B. Lippincott Company)

5. Marianne Tortoic Concepts in Medical Radiographic imagine" By: (W.B. Saunders Company)

6. G.E. Hayes Quality assurance Management " By (Charger production) Diagnostic Imaging M.M.Rehani:Quality Assurance By: (Jaypee Bros Medical Publishers)

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10. Course Organization

Course Code	MRC310A		
Course Title	Quality assurance and regulatory requirements in radiology		
Course Leader/s Name		As per timetable	
Course Leader Contact Details		Phone:	
		E-mail:	
Course Specifications Approval Date			
Next Course Specifications Review Date:			

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Course Specifications: Project Management

Course Title	Project Management
Course Code	AHM305A
Department	Directorate of Transferable Skills and Leadership Development
Faculty / School	All Faculties / Schools of RUAS

I. Course Summary

1. Aim and Summary

With the advent of technology, changing business environments, varying economic conditions and prevailing political situations, a varied types of projects are being undertaken. This is seen in different segments such as infrastructure, construction, Information Technology, Manufacturing, Engineering, Health Care, Hospitality, Logistics and Services. Along with these, there is a big need for manpower with competencies in Managing different types and sizes of projects. A Project Management Professional equipped with,

- appropriate tools and techniques,
- an ability to apply appropriate methods and processes
- appropriate project leadership skills and
- a structured approach to manage a project in its entiretywill be in a better position to ensure a project's defined success.

The course aims at imparting knowledge and developing competencies on various aspects of Project Management as per International Project Management Association's framework. This course also provides a glimpse of tools, techniques, methods and process for managing a project effectively. This course offers a structured approach which are derived from the experiences of a large number of successful global organizations.

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2. Course Size and Credits:

Number of credits	03
Total hours of teaching and learningactivities during the semester	45
Number of practical/tutorial hours	15
Number of semester week(s)	15
Department responsible	Directorate of Transferable Skills and Leadership Development
Course evaluation	Total Marks: 100
Pass requirement	As per the Academic Regulations
Attendance requirement	As per the Academic Regulations

Teaching, Learning and Assessment

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3. Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	course Outcomes
1.	Explain the characteristics of projects, Operations and principles of Project Management
2.	Discuss the Project Management Competency Elements as per PMA's Individual Competence Baseline Ver 4.0
3.	Discuss the tools for Project Execution, Monitoring and control
4.	Apply the tools for project planning and Create a Project Management Plan covering Project Charter, Work Breakdown Structure, Project Organisation, Time Management Plan and Risk Management Plan

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4. Course Contents:

Section 1

Introduction to Project, Programmes, Portfolio and Operations

Project Organization and Permanent Organization

Project Management Success

- KRAs

Creation of project

- Need analysis
- Business Case
- Project Charter

Section 2

Requirements, Objectives & Benefits

Scope

- WBS
- Scope baseline
- Change Management

Time Management

- Lifecycle
- AOA (ADM)
- AON (PDM)
- CPM
- Floats
- Network Exercises
- Gantt Charts
- Bar Charts

Resources

- Resource Calendar

Section 3

Controlling

Handling Changes

Phase end and Close out

Earned Value Management System

- Variances, SPI & CPI

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- Numerical Exercises

Quality Management

- Quality Planning
- Quality Assurance
- Quality Control
- Quality Tools
    - Pareto Chart
    - Control Chart
    - Inspections
    - Benchmarking

Risk & Opportunity

- Risk categories
- Identification
- Risk Analysis

Section 4

Organization and Information

Stakeholder Management

Power and Interest

Culture and Values

Personal integrity and reliability

Personal communication

- Communication Planning
- Communication methods
- Communication barriers

Conflict and crisis

Resourcefulness

Result Orientation

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5. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		20
Demonstrations		
1. Demonstration using Videos		

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2. Demonstration using Physical		
3. Demonstration on a Computer		
Numeracy		
1. Solving Numerical Problems		
PracticalWork		
1. Course Laboratory		
2. Computer Laboratory		
3. Engineering Workshop/Course		
4. Clinical Laboratory		
5. Hospital		
6. Model Studio		
Others		
1. Case Study Presentation	05	
2. Guest Lecture		
3. Industry/Field Visit		25
4. Brain Storming Sessions		
5. Group Discussions	20	
6. Discussing Possible Innovations		
Written Examination (Term tests and SEE)		05
Total Duration in Hours		50

6. Method of Assessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the respective Undergraduate Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1 or SC2), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation			
	Component 1: CE (50% Weightage)		Component 2: SEE (50% Weightage)
Subcomponent ▶	SC1	SC2	
Subcomponent Type ▶	Mid Term Exam	Assignment	50 Marks
Maximum Marks ▶	25	25	

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CO-1	Explain the characteristics of projects, Operations and principles of Project Management	X		X
CO-2	Discuss the Project Management Competency Elements as per PMA's Individual Competence Baseline Ver 4.0	X		X
CO-3	Discuss the tools for Project Execution, Monitoring and control	X	X	X
CO-4	Apply the tools for project planning and Create a Project Management Plan covering Project Charter, Work Breakdown Structure, Project Organisation, Time Management Plan and Risk Management Plan		X	X

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The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

7. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods

S.No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures

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3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions / Group Discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

a. Essential Readings

- Course Notes
- Pinto Jeffrey K. (2019) Project Management: Achieving Competitive Advantage, 5th Edition, Pearson

b. Recommended Readings

- Meredith, J.R. and Mantel, S.J. (2005) Project Management – a managerial approach, 6th edition, Wiley
- Ghattas, R. G. and Sandra L. Mckee (2001) Practical Project Management, New Jersey, Prentice Hall

c. Magazines and Journals

- Project Manager Today
- PM network
- International Journal of Project and Operation Research, Inderscience
- Journal of Operation Management, Project and Operation Research, INFORMS

d. Websites

- http://www.providence.edu/mcs/rbg/mba.htm
- http://library.kent.ac.uk/library/exampapers/deptcourses.php?dept=Business%20Studies
- http://homepages.stmartin.edu/fac_staff/dstout/MBA631/lecture_notes.htm

10. Course Organisation

Course Title		Project Management
Course Code		**AHM305A**
Course Leader/s Name		Mr. Jyothi Shankar G
Course Leader Contact Details	**Phone:**	080 – 4536 6666
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Course Specifications: Directed Clinical Education III

Course Title	Directed Clinical Education - III
Course Code	MRC311A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1.Course Summary

The student will gain basic knowledge and sufficient exposure to principles and working of the newer imaging techniques including interventional radiology. The basic principles underlying newer imaging techniques such as angiography, venography, cerebral interventional studies, and arthrography, positioning of the patient and care of patient will be discussed in this course.The will learn about the hospital procedures, patient care, record keeping, drug management and principles of asepsis. Student will be attached to the wards and accident and emergency department so that they learn about cooperation between the teams that manage the patient.The students will learn the basics regarding the quality assurance procedures and radiation safety in diagnostic radiology. Students will understand the significance of quality assurance activity and programs at different levels. They will learn regarding maintenance and safe operations of equipment. Biological effects of radiation, its detection, measurement and protection including radiation hazard and control will be covered in this course.

2.Course Size and Credits:

Number of credits	9
Total hours of class room interaction during the semester	00
Number of tutorial/ Laboratory/hospital posting hours	270
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course marks	Total Marks: 100

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Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

3.Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Intended Learning Outcome
1	Assist in Newer imaging techniques such as angiography and venography.
2	Check, identify and prepare the radiological equipment needed for the procedures
3	Assist in preparing and managing patients for radiological and imaging procedures
4	Will have basic knowledge in hospital procedures, patient care, record keeping, drug management and principles of asepsis.
5	Ensure that radiation safety procedures are adhered and followed
6	Conduct routine quality checks on a day to day and weekly basis.

4.Course Contents

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Course Content

1. Should be able to undertake Angiography and Venography under supervision.
2. Will perform cerebral interventional studies under supervision.
3. Will be skilled in hospital procedures, patient care, record keeping, drug management and principles of asepsis.
4. Will be able to cooperate between the teams that manage the patient in emergency situations.
5. Student will be able to understand the significance of quality assurance

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	3	3			3		3						2		3	
CO-2			2		3			2						2		2
CO-3	3			3		2		2						2		2
CO-4	3	3		3		3	3							3		1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6.Course Teaching and Learning Method

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		-
Demonstrations		
1. Demonstration using Videos	-	
2. Demonstration using Physical Models/Systems	-	
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory/ Radiology department	214	
2. Computer Laboratory	-	

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3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	214
4. Clinical Laboratory	-	
5. Hospital	-	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	20	
2. Guest Lecture	-	
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	30	
5. Small Group Discussions	-	
6. Discussing Possible Innovations	-	
Work Place Based Assessment, Portfolio Presentation and Viva		6
Total Duration in Hours		270

7. Method of Assessment

Theory Component CE	Laboratory Component CE
SC1 (Logbook)	SC2 (Internal viva voice & practical's)
50 marks	50 Marks

The following is the CE components:

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

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a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions

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12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading

Clinical manuals

10. Course Organization

Course Code	**MRC311A**	
Course Title	Direct clinical education -III	
Course Leader/s Name	As per time table	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Bachelors (Hons)

Medical Radiology and Imaging Technology

Programme code – 401

Course Specifications

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6th Semester

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Course Specifications: ~~Directed Clinical Education IH~~

Course Title	Basic to advanced Magnetic Resonance Imaging
Course Code	MRC312A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

The aim of the course is to understand the basic working principles and equipment MRI, image formation, MR safety and their application in diagnostic radiology, safe handling of the equipment and maintenance, and the factors that affect MR image quality and how to improve it, as well as the patient preparation for the various MR protocols and how to modify the technique based on the patient's history through hands-on training and exposure.

2. Course Size and Credits:

Number of credits	03
Total hours of class room interactionduring the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcome
1	comprehend the MRI working principles, instrumentation and physics
2	Familiarized with cross-sectional grey scale anatomy in MRI
3	Safe handling the equipment by receiving hands-on training and staying up todate on the latest technological advancements in the field and MR Safety
4	Evaluate image quality, carry out the necessary post-processing, annotations,image archiving, and documentation

4. Course Contents

Course Content
1. Historical aspects of MRI, Basic working principle of MRI, Role of hydrogen in MR Imaging, Precession, Resonance, MR Signal, T1 Relaxation and T2 Relaxation, Image weighting and Contrast Advantages and disadvantages of MRI 2. Equipment: MR architecture, magnet system and gradient system, types of RF coils, RF Shielding 3. MR safety -zones of MRI, Patient preparation, instructions, patient safety, MR professional responsibilities. 4. Image Formation: Data Collection and Image formation in MRI, K space description and filling, Fourier transformation 5. Pulse Sequences: Introduction, Spin echo pulse sequences, Inversion Recovery Sequences, Gradient echo Pulse sequences and Parallel Imaging techniques 6. Imaging Protocols: Protocols in MRI for whole Body, Contrast agents in MRI, Artefacts and their remedies, Parameters influencing MR Image Quality, MRI Safety

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7.Advanced MRI: MR Angiography, (TOF, phase contrast and dynamic contrast MR angiography), Functional MRI, MR Spectroscopy, Recent advancement in MRI andopen MRI

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1				3	2	2	2	1					2	2		
CO-2	2	2			3	3	2							2		
CO-3	2					1	2	1					2		2	
CO-4			2		2			1					2	2	3	
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6.Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using PhysicalModels/Systems		
3. Demonstration on a Computer		
Numeracy		
1. Solving Numerical Problems		
Practical Work		

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1. Course Laboratory		
2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7
Total Duration in Hours		60

7. Method of Assessment

The following is the CE components:

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Theory Component CE			Laboratory Component CE	SEE
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE

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20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

p) Online Test
- q) Assignments/Problem Solving
- r) Field Assignment
- s) Open Book Test
- t) Portfolio
- u) Reports
- v) Case Study
- w) Group Task
- x) Laboratory / Clinical Work Record
- y) Computer Simulations
- z) Creative Submission
- aa) Virtual Labs
- bb) Viva / Oral Exam
- cc) Lab Manual Report
- dd) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative (Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

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8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion

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5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

Essential Reading:

1. MRI in Practice by Catherine Westbrook
2. MRI Physics for Radiologist by Alfred Horowitz

10. Course Organization

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Course Code	MRC312A	
Course Title	Basic to advanced Magnetic Resonance Imaging	
Course Leader/s Name	As per timetable	
Course Leader Contact Details	Phone:	
	E-mail:	
Course Specifications Approval Date		
Next Course Specifications Review Date:		

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Course Specifications: Basic concepts of interventional radiology and nuclear medicine

Course Title	Basic concepts of Interventional radiology and nuclear medicine
Course Code	MRC313A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1.Course Summary

The aim of the course is to understand the basic working principles and equipment of nuclear medicine and interventional radiology departments, as well as their diagnostic and minimal therapeutic applications in the medical field, as well as safe handling of the equipment, radio isotopes and maintenance, and the factors that influence image quality and how to improve it, as well as patient preparation for the various NM and IR protocols and how to modify the technique based on the patient's condition. Adhere to the radiation safety norms in the working place.

2.Course Size and Credits:

Number of credits	03
Total hours of class room interaction during the semester	15
Number of practical/tutorial hours	45
Number of semester weeks	60
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcome
1	Understand the basics of nuclear medicine and interventional radiology equipment.
2	Explain radiation safety and radioisotope handling in the department.
3	Hands-on training in the department ensures safe equipment handling.
4	Evaluate image quality, carry out the necessary post-processing, annotations, image archiving, and documentation

4. Course Contents

	Course Content
	Interventional radiology: 1. Instrumentation -historical aspects of interventional radiology, Digital Subtraction Angiography: working principle, Various Digital Subtraction Techniques, types of catheters, stents, stent grafts, embolic agents. 2. Emergency drugs and equipment in interventional radiology department. 3. Invasive procedures- Seldinger technique, Angiography and venography 4. Invasive monitoring - NIBP, Pulseoximetery, Cardiac resuscitation measures, IBP, ECG, Management of shock 5. Neuro interventional procedures: Embolization, GDC, Glue embolization, Vertebroplasty 6. Non-Neuro interventional procedures: PTBD, Stenting, PTA + stenting, stent graft, Embolization TIPS, drainage procedure.

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7. Radiation safety – patient safety, personnel safety, DAP

Nuclear medicine

1. Basic atomic and nuclear physics -Radioactivity, Modes of radioactive decay, parent isotope, daughter isotope, production of Radionuclides radiopharmaceuticals.

2. Instrumentation and physics-Basic working principles of Gamma camera, PET, Fusion imaging and system components

3. Imaging techniques-static and dynamic studies

4. Image quality: spatial and contrast resolution, noise

5. Radiation safety: safe handling of radioisotopes, measurements and storage, radioactive spill management, survey meters, personnel monitoring and area monitoring devices

5. Course Map (CO-PO-PSO Map)

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	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	1			2	2		2	1					2	2		
CO-2				2	3	3	2						2			
CO-3	2	1		2	3	1	2	2					2		3	
CO-4		1	2	2	2	2	3	3					2		3	3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

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6.Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		15
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models/Systems		
3. Demonstration on a Computer	-	
Numeracy		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	25	
6. Model Studio	-	
Others		
1. Case Study Presentation/ Case Studies	-	
2. Guest Lecture		
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	10	
5. Group Discussions	3	
6. Discussing Possible Innovations		
Term Test, Laboratory Examination and Written Examination		7

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Total Duration in Hours	60

7. Method of Assessment

The following is the CE components:

Theory Component CE			**Laboratory Component CE**	**SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	SC4 (Formative laboratory performance assessment)	SEE
20 Marks	20 Marks	20 Marks	30 Marks	60 (40 written exam; 20 Viva-voce)

In CE there shall be four subcomponents of CE (SC1, SC2, SC3, and SC4), namely Mid Term; Written Assignment; Innovative assignments; and Laboratory performance assessment. Each subcomponent is evaluated individually accounting to 60% Weightage as indicated in Course Specifications. The innovative assignment subcomponents can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Laboratory / Clinical Work Record
j) Computer Simulations
k) Creative Submission
l) Virtual Labs
m) Viva / Oral Exam
n) Lab Manual Report
o) Any other

After the four subcomponents are evaluated, the CE component marks are consolidated to attain 60% Weightage. Laboratory/Practical shall be shifted as part of CE. The lab component as part of CE will have external examiner evaluation and marks listed separately for industry requirements. For a theory + laboratory course, the Semester End Examination shall be a 2-hour theory paper of 50 marks with a weightage of 40% and there will be a 20 marks Viva-Voce. In summary, the ratio of Formative

(Continuous Evaluation-CE) Vs Summative (Semester End Examination-SEE) should be 60:40.

8. Achieving learningoutcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

9. Course Resources

1. Essential Reading:

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Interventional radiology

1. Christensen's Physics of Diagnostic Radiology – 4 th edition, Thomas S. Curry, 1990.

2. Applied Angiography for Radiographers, Laudicina & Wean, W.B. Saunders Company, 1994.

3. The Requisites: Vascular & Interventional Radiology, John A. Kaufman, Michael J. Lee, Mosby, 2004.

Nuclear medicine

1.Physcis in Nuclear medicine -Sorenson

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2.physics of nuclear medicine -powsner

10. Course Organization

Course Code	MRC313A		
Course Title	Basic concepts of Interventional radiology and Nuclear medicine		
Course Leader/s Name		As per timetable	
Course Leader Contact Details		Phone:	
		E-mail:	
Course Specifications Approval Date			
Next Course Specifications Review Date:			

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Course Specifications: Directed Clinical Education -IV

Course Title	Directed Clinical Education - IV
Course Code	MRC314A
Department	Allied Health Sciences
Faculty	Life and Allied Health Sciences

1. Course Summary

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. In addition students are tested on intermediate clinical radio diagnosis skills. Exposure gives the students to improve their skills in clinical procedures. Progressive interaction with patients and professional personnel are monitored in a supervised setting. Additional areas include problem solving, identifying machine components and basic side effect management. Students will demonstrate competence in beginning and intermediate procedures. During the course the students will participate in patient care in the department, follow the quality assurance procedures in radiology and radiation safety and followregulatory requirements.

2. Course Size and Credits:

Number of credits	12
Total hours of class room interaction during the semester	00
Number of tutorial/ Laboratory/hospital posting hours	360
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course marks	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

After undergoing this course students will be able to:

No.	Course Outcome
1	Assist in radio diagnostic procedures
2	Check the radiological equipment under supervision
3	Assist in preparing and managing patients for radiological and imaging procedures
4	Evaluate quality of images for diagnosis
5	Ensure that radiation safety procedures are adhered and followed
6	Conduct routine quality checks on a day to day and weekly basis under supervision

4. Course Contents

Course Content
1. Should be able to undertake Mammography, CT scan and MRI procedures independently. 2. Assist in specialized radiological procedures. 3. Able to do the image processing. 4. Should be able to handle all radiological and imaging equipment independently. 5. Should ensure radiation protection and quality assurance 6. Undertake care and maintenance of all radiological and imaging equipment 7. Able to evaluate images for technical quality 8. Able to identify and manage emergency situations. 9. Able to receive and document verbal, written and electronic orders in the patient's medical record.

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10. Implements health and safety procedures Demonstrates ability to interpret, apply and disseminate information as a member of the medical imaging team 12. Ensures radiation protection legislation is adhered to 13. Demonstrates knowledge and skills to carry out the daily/weekly Quality Control (QC) checks Participates in research activities

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8					PSO -1	PSO -2	PSO -3	PSO -4
CO-1	3	3			3		3						2		3	
CO-2			2		3			2						2		2
CO-3	3			3		2		2						2		2
CO-4	3	3		3		3	3							3		1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution																

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		
Demonstrations		
1. Demonstration using Videos	-	

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2. Demonstration using Physical Models/Systems	-	
3. Demonstration on a Computer	-	

Numeracy		
1. Solving Numerical Problems		
Practical Work		280
1. Course Laboratory/ Radiology department	280	
2. Computer Laboratory	-	
3. Engineering Workshop/Course Workshop/Kitchen/ OSPE	-	
4. Clinical Laboratory	-	
5. Hospital	-	
6. Model Studio	-	
Others		70
1. Case Study Presentation/ Case Studies	30	
2. Guest Lecture	-	
3. Industry/Field Visit	-	
4. Brain Storming Sessions/ Seminar	30	
5. Small Group Discussions	10	
6. Discussing Possible Innovations	-	
Work Place Based Assessment, Portfolio Presentation and Viva		10
Total Duration in Hours		360

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7. Method of Assessment:

Theory Component CE	Laboratory Component CE
SC1 (Logbook)	SC2 (Internal viva voice & practical's)
50 marks	50 Marks

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following

Teaching and learning methods:

Sl. No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Class room lectures
2.	Understanding	Class room lectures
3.	Critical Skills	Class room lectures
4.	Analytical Skills	Group discussion
5.	Problem Solving Skills	Case discussions
6.	Practical Skills	Case discussions
7.	Group Work	case study and group discussions
8.	Self-Learning	Seminars
9.	Written Communication Skills	Examination
10.	Verbal Communication Skills	Group discussions
11.	Presentation Skills	Seminars, Case discussions
12.	Behavioral Skills	Group discussion, Case discussions
13.	Information Management	Case discussions
15.	Leadership Skills	Group discussions

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9. Course Resources

Essential Reading

- Clinical manuals

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10. Course Organization

Course Code	MRC314A		
Course Title	Direct clinical education - IV		
Course Leader/s Name		As per time table	
Course Leader Contact Details		Phone:	
		E-mail:	
Course Specifications Approval Date			
Next Course Specifications Review Date:			

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Bachelors (Hons)
Medical Radiology and Imaging Technology

Programme code – 401

Course Specifications
Revised 2022

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7th Semester

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Course Specifications: Research Project

Course Title	Research Project
Course Code	MRP415A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

I. Course Summary

1. Aim and Summary

The aim of this course is to give students an experience of addressing a real time problem in Radiology. The students are expected to work in a team of not more than 4 members and are required to develop an appropriate solution by identifying a problem for which a better or new solution is required. The team need to propose a solution / develop a physical product and write a project report.

2. Course Size and Credits:

Number of credits	10
Total hours of class room interaction during the semester	00
Number of practical/tutorial hours	300
Number of semester weeks	16
Department responsible	Allied Health Sciences
Course evaluation	Total Marks: 100
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

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3. Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course outcomes

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1.	Refine the problem in Allied Health Science
2.	Identify appropriate methodology to solve the problem
3.	Propose solutions to the problem identified
4.	Prepare a project report as per the specified guidelines
5.	Presentation of the research finding in an appropriate forum

4.Course Contents:

• Identifying a problem for which a better or new solution is required, through literature review or as defined by Biotechnology experts from Industry
• Defining the scope of the problem followed by aim and objectives
• Identifying the methodology to meet the objectives
• Data collection, analysis and interpretation
• Propose solution based on data analysis and interpretation (Can be a physical product as well)
• Preparing/ writing a project report and presentation in appropriate forum

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5.Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PSO -1	PSO -2	PSO -3	PSO -4
CO-1	3	2						3			2	3
CO-2					3			3				3
CO-3						2		3	1		2	3
CO-4				3			2	3	1			3
CO-5								3				3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution												

6.Course Teaching and Learning Methods

	Teaching and Learning Methods	Duration in hours
1.	Refining Problem, Aim, Objective & Methodology in oncurrence with academic guide	02
2.	Review Plan, design and execution of experiments	20
3.	Data collection, Analysis and Interpretation	20
4.	Discussion with supervisor	06
5.	Propose solution	10
6.	Report presentation	02
Total Duration in Hours		60

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7.Method of Assessment

Components of Grading

There shall be **two components** of grading in the assessment of each course:

The following is the CE components:

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Laboratory component CE	SEE
SC1(Protocol presentation, Data collection, Analysis)	SEE
60 marks	40 (Thesis presentation)

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl .No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Project Work
2.	Understanding	Project Work\Interaction with Supervisor
3.	Critical Skills	Project Work
4.	Analytical Skills	Project Work
5.	Problem Solving Skills	Project Work
6.	Practical Skills	Project Work
7.	Group Work	Project Work
8.	Self-Learning	Project Work
9.	Written Communication Skills	Project Report
10.	Verbal Communication Skills	Examination, Viva-Voce
11.	Presentation Skills	Presentation, Viva-Voce
12.	Behavioral Skills	Project Work
13.	Information Management	Project Report
15.	Leadership Skills	Group discussions

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9.Course

Resources

Essential

Reading

Gurumani, N., 2006, Research methodology for biological sciences, MJP Publishers.

10.Course Organization

Course Title		Research Project
Course Code		MRP415A
Course Leader/s Name		As per time table
Course Leader Contact Details	**Phone:**	
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Course Specifications: Internship

Course Title	Internship
Course Code	MRP416A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

1. Course Summary

This internship training deals with postings in various modalities of the Radiology dept. The students are trained to acquire skills for the actual conduct of all the clinical services entrusted to them in those specialized modalities leading to the emergence of fully trained Radiology technologist.

2. Course Size and Credits:

Number of credits	10
Total hours of Internship in an academic year	-
Number of practical/tutorial hours	300
Number of weeks per year	16
Department responsible	Radiology
Pass requirement	As per the new academic regulations
Attendance requirement	As per the academic regulations

Teaching, Learning and assessment

3. Course Outcomes (CO)

Upon completion of this course students will be able to:

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No.	Course outcome
1.	Demonstrate ability to perform routine radiographic views with while observing adequate patient and personnel radiation safety
2.	Assist in special radiographic procedures with respect to Urological, Gastro Intestinal and Gynecological studies.
3.	To understand the various aspects of image distribution over a local and wide area network
4.	To observe routine Ultrasound and Doppler scans and to be able assist in special procedures and intervention as part of the therapeutic team.
5.	For female interns to demonstrate ability to perform routine mammographic procedures
6.	Demonstrate ability to perform routine CT and MRI scans with while observing adequate patient and personnel safety

4. Course Contents:

Internship:

(1) Internship is a phase of training wherein a student is expected to conduct actual practice and acquires skills under supervision so that he or she may become capable of functioning independently.

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(2) Intern will rotate in the following areas for the duration mentioned in the following table.

• Hands on experience with respect to X-ray machines, imaging plates, Digitizers and workstations. Routine X-ray views of the whole body. Specialized views. Image Acquisition. Image transfer. Post processing. Filming. Basic dark room techniques. Emergency and Bedside radiography. Intra operating radiography.
• Hands on experience with image intensifier, fluoroscopy, C arm, Cath laboratory equipment. Exposure to special investigations with respect to urology, gastro Enterology, Gynecology and vascular procedures. Observe biopsy and drainage procedures.
• Observe and assist radiological DICOM image export, transfer, networking, post processing and retrieval. HIS, RIS, Electronic medical records and workflow.

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• Observe handling of radio pharmaceuticals and nuclear image acquisition
• Observe routine ultrasound and Doppler workflow. Assist special procedures. Patient care. PCPNDT act. Knobology and ultra sound machine care.
• Hands on experience with respect to CT and MRI machines, Pressure injectors, Coils and workstations. Routine scans of the whole body. Specialized procedures; diagnostic and therapeutic.3D Post processing. Filming.

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PSO -1	PSO -2	PSO -3	PSO -4
CO-1	2	1							1		2	
CO-2	3	1	3						2	1	2	2
CO-3			2								2	
CO-4	2							2		2	2	
CO-5	2						3		3		2	
CO-6	2			2	3		2		3		2	
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution												

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6. Course Teaching and Learning Methods

Teaching and Learning Methods		Duration in Hours
Face to Face Lectures		
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical		
3. Demonstration on a Computer		
Numeracy or Tutorials		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory		
3. Engineering Workshop/Course		
4. Clinical Laboratory		
5. Hospital	X	
6. Model Studio		
Others		
1. Case Study Presentation	X	
2. Guest Lecture		
3. Industry/Field Visit		
4. Brain Storming Sessions		
5. Group Discussions		
6. Discussing Possible Innovations		
Total Duration in Hours		300

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7. Method of Assessment

Components of Grading

There shall be **two components** of grading in the assessment of each course:

The following is the CE components:

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Laboratory component CE	SEE
SC1(Formative laboratory performance assessment/logbook)	SEE
60 marks	40 (OSPE/OSCE)

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl .No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	
2.	Understanding	Clinical postings
3.	Critical Skills	Clinical postings
4.	Analytical Skills	Clinical postings
5.	Problem Solving Skills	Clinical postings
6.	Practical Skills	Clinical postings
7.	Group Work	Clinical postings
8.	Self-Learning	Clinical postings
9.	Written Communication Skills	Patient orders
10.	Verbal Communication Skills	Clinical postings
11.	Presentation Skills	
12.	Behavioral Skills	Clinical postings
13.	Information Management	
15.	Leadership Skills	Clinical postings

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9. Course Resources

k. Essential Reading

Class Notes

Patesson: Printed Notes For Radiographers In India (Cmai)

Manual and Automatic Use of an Exposure Value Scale (XVS) System and Standardization, Gerhart Steve Schwarz, Thomas, 1961

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I. Recommended Reading

John A. Ross , R.W. Galloway , Handbook of Radiography Hardcover
H. K. Lewis & Co Ltd; 3rd Revised edition (1963)

Glenda J. Bryan, Diagnostic Radiography, Churchill Livingstone, 01-Jan-1987

Charles A. Jacobi, Don Q. Paris : Textbook of Radiological Technology (Mosby) C. V. Mosby Co., 1968

Scarrow: Contrast Radiography (Schering Chemicals)

Marianne R. Tortorici , Hiram M. Hunt, Concepts in Medical Radiographic Imaging –1992, Elsevier Science Health Science div

Derrick P. Roberts, Radiographic Imaging: A Practical Approach, Churchill Livingstone (July 1, 1988)

10. Course Organization

Course Title		Internship
Course Code		MRP416A
Course Leader/s Name		As per time table
Course Leader Contact Details	**Phone:**	
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Bachelors (Hons)

Medical Radiology and Imaging Technology

Programme code -401

Course Specifications

Revised 2022

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8th Semester

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Course Specifications: Research Project

Course Title	Research Project
Course Code	MRP417A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

1.Aim and Summary

The aim of this course is to give students an experience of addressing a real time problem in Radiology. The students are expected to work in a team of not more than 4 members and are required to develop an appropriate solution by identifying a problem for which a better or new solution is required. The team need to propose a solution / develop a physical product and write a project report.

2.Course Size and Credits:

Number of credits	10
Total hours of class room interaction during the semester	00
Number of practical/tutorial hours	300
Number of semester weeks	16
Department responsible	Allied Health Science

Course evaluation	Total Mark: 100
Pass requirement	As per the new academic regulations
Attendance requirement	As per the new academic regulations

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3. Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course outcome
1.	Refine the problem in Allied Health Science
2.	Identify appropriate methodology to solve the problem
3.	Propose solutions to the problem identified
4.	Prepare a project report as per the specified guidelines
5.	Presentation of the research finding in an appropriate forum

4. Course Contents:

• Identifying a problem for which a better or new solution is required, through literature review or as defined by Biotechnology experts from Industry
• Defining the scope of the problem followed by aim and objectives
• Identifying the methodology to meet the objectives

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• Data collection, analysis and interpretation
• Propose solution based on data analysis and interpretation (Can be a physical product as well)
• Preparing/ writing a project report and presentation in appropriate forum

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PSO -1	PSO -2	PSO -3	PSO -4
CO-1	3	2						3			2	3
CO-2					3			3				3
CO-3						2		3	1		2	3
CO-4				3			2	3	1			3
CO-5								3				3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution												

6. Course Teaching and Learning Methods

	Teaching and Learning Methods	Duration in hours
7.	Refining Problem, Aim, Objective & Methodology in incurrence with academic guide	02
8.	Review Plan, design and execution of experiments	20
9.	Data collection, Analysis and Interpretation	20

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10.	Discussion with supervisor	06
11.	Propose solution	10
12.	Report presentation	02
Total Duration in Hours		60

7. Method of Assessment:

The following is the CE components

Laboratory component CE	**SEE**
SC1(Protocol presentation, Data collection, Analysis)	SEE
60 marks	40 (Thesis presentation)

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl .No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	Project Work
2.	Understanding	Project Work\Interaction with Supervisor
3.	Critical Skills	Project Work
4.	Analytical Skills	Project Work
5.	Problem Solving Skills	Project Work
6.	Practical Skills	Project Work
7.	Group Work	Project Work
8.	Self-Learning	Project Work
9.	Written Communication Skills	Project Report
10.	Verbal Communication Skills	Examination, Viva-Voce
11.	Presentation Skills	Presentation, Viva-Voce
12.	Behavioral Skills	Project Work

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13.	Information Management	Project Report
15.	Leadership Skills	Group discussions

9.Course Resources

m. Essential Reading

Gurumani, N., 2006, Research methodology for biological sciences, MJP Publishers

n. Recommended Reading

Gurumani, N., 2010, Scientific Thesis Writing and Paper Presentation, 1st Edition, MJP Publishers.

10. Course Organization

Course Title		Research Project
Course Code		MRP417A
Course Leader/s Name		As per time table
Course Leader Contact Details	**Phone:**	
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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Course Specifications: Internship

Course Title	Internship
Course Code	MRC418A
Department	Allied Health Science
Faculty	Faculty of Life and Allied Health Sciences

1. Course Summary

This internship training deals with postings in various modalities of the Radiology dept. The students are trained to acquire skills for the actual conduct of all the clinical services entrusted to them in those specialized modalities leading to the emergence of fully trained Radiology technologist.

2. Course Size and Credits:

Number of credits	10
Total hours of Internship in an academic year	300
Number of practical/tutorial hours	-
Number of weeks per year	16
Pass requirement	As per the academic regulations
Attendance requirement	As per the academic regulations

3. Course Outcomes (CO)

Upon completion of this course students will be able to:

No.	Course outcome
1.	Demonstrate ability to perform routine radiographic views with while observing adequate patient and personnel radiation safety

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2.	Assist in special radiographic procedures with respect to Urological, Gastro Intestinal and Gynecological studies.
3.	To understand the various aspects of image distribution over a local and wide area network
4.	To observe routine Ultrasound and Doppler scans and to be able assist in special procedures and intervention as part of the therapeutic team.
5.	For female interns to demonstrate ability to perform routine mammographic procedures
6.	Demonstrate ability to perform routine CT and MRI scans with while observing adequate patient and personnel safety

4. Course Contents:

1. Internship is a phase of training wherein a student is expected to conduct actual practice and acquires skills under supervision so that he or she may become capable of functioning independently.
2. Intern will rotate in the following areas for the duration mentioned in the following table.

• Hands on experience with respect to X-ray machines, imaging plates, Digitizers and workstations. Routine X-ray views of the whole body. Specialized views. Image Acquisition. Image transfer. Post processing. Filming. Basic dark room techniques. Emergency and Bedside radiography. Intra operating radiography.
• Hands on experience with image intensifier, fluoroscopy, C arm, Cath laboratory equipment. Exposure to special investigations with respect to urology, gastro Enterology, Gynecology and vascular procedures. Observe biopsy and drainage procedures.
• Observe and assist radiological DICOM image export, transfer, networking, post processing and retrieval. HIS, RIS, Electronic medical records and workflow.
• Observe handling of radio pharmaceuticals and nuclear image acquisition
• Observe routine ultrasound and Doppler workflow. Assist special procedures. Patient care. PCPNDT act. Knobology and ultra sound machine care.

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- Hands on experience with respect to CT and MRI machines, Pressure injectors, Coils and workstations. Routine scans of the whole body. Specialized procedures; diagnostic and therapeutic.3D Post processing. Filming.

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)			
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PSO -1	PSO -2	PSO -3	PSO -4
CO-1	2	1							1		2	
CO-2	3	1	3						2	1	2	2
CO-3			2								2	
CO-4	2							2		2	2	
CO-5	2						3		3		2	
CO-6	2			2	3		2		3		2	

3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution

6. Course Teaching and Learning Methods

Teaching and Learning Methods		Duration in Hours
Face to Face Lectures		
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using		
3. Demonstration on a Computer		
Numeracy or Tutorials		
1. Solving Numerical Problems		
Practical Work		
1. Course Laboratory		
2. Computer Laboratory		
3. Engineering		
4. Clinical Laboratory		
5. Hospital	X	
6. Model Studio		

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Others		
1. Case Study Presentation	X	
2. Guest Lecture		
3. Industry/Field Visit		
4. Brain Storming Sessions		
5. Group Discussions		
6. Discussing Possible Innovations		
Total Duration in Hours		580

7. Method of Assessment

The following is the CE components:

Theory Course CE			**Theory Course SEE**
SC1 (Written Assignment)	SC2 (Innovative assignment)	SC3 (Mid-term test)	40 marks
20 marks	20 Marks	20 Marks	

8. Achieving learning outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

Sl .No	Curriculum and Capabilities	How imparted during the course
1.	Knowledge	
2.	Understanding	Clinical postings
3.	Critical Skills	Clinical postings
4.	Analytical Skills	Clinical postings
5.	Problem Solving Skills	Clinical postings
6.	Practical Skills	Clinical postings
7.	Group Work	Clinical postings
8.	Self-Learning	Clinical postings
9.	Written Communication Skills	Patient orders

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10.	Verbal Communication Skills	Clinical postings
11.	Presentation Skills	
12.	Behavioral Skills	Clinical postings
13.	Information Management	
15.	Leadership Skills	Clinical postings

9. Course Resources

a. Essential Reading

Patesson: Printed Notes For Radiographers In India (Cmai)
Manual and Automatic Use of an Exposure Value Scale (XVS) System and Standardization, Gerhart Steven Schwarz, Thomas, 1961

Recommended Reading

John A. Ross , R.W. Galloway , Handbook of Radiography Hardcover
H. K. Lewis & Co Ltd; 3rd Revised edition (1963)
Glenda J. Bryan, Diagnostic Radiography, Churchill Livingstone, 01-Jan-1987
Charles A. Jacobi, Don Q. Paris : Textbook of Radiological Technology (Mosby) C. V. Mosby Co., 1968
Scarrow: Contrast Radiography (Schering Chemicals)
Marianne R. Tortorici , Hiram M. Hunt, Concepts in Medical Radiographic Imaging –1992, Elsevier Science Health Science div
Derrick P. Roberts, Radiographic Imaging: A Practical Approach, Churchill Livingstone (July 1, 1988)

10. Course Organization

Course Title		Internship
Course Code		MRC418A
Course Leader/s Name		As per time table
Course Leader Contact Details	**Phone:**	
	E- mail:	
Course Specifications Approval		
Next Course Specifications Review		

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