



DEPARTMENT OF PARAMEDICAL SCIENCES
Subharti Medical College

Recognized by Govt. of India, Ministry of Health & Family Welfare, Govt. Letter No. U.12012/69/96-ME(P)
Website: medical.subharti.org, e-mail: paramedical@subharti.org, Ph: 0121-3055000 (Extn: 2118), Telefax: 0121-2435127, 2439067
A constituent college of

SWAMI VIVEKANAND SUBHARTI UNIVERSITY

(Established under U.P. Govt. Act no. 29 of 2008 and approved under section 2(f) of UGC Act 1956)



Ref. No-SVSU/PMS/2025/963(b)

Date: 16/04/2025


To
The Registrar,
Swami Vivekanand Subharti University, Meerut

Subject: Minutes of Meeting of Board of Studies (BOS) conducted on 15.04.2025

Dear Sir,

A meeting of Board of Studies of the Department of Paramedical Sciences was conducted on 15.04.2025 and following agenda item was discussed in the meeting and forwarded for the upcoming Academic Council for approval and necessary action.

Agenda: 1. Syllabus and Ordinance of B.Sc. Nuclear Medicine Technology


D C Saxena
Director (General)
DC SAXENA
Dir. (Gen.), SVSU


Dr. Pankaj Kishor Mishra
Prof. & Head

Enclosure:

1. Minutes of Meeting
2. Ordinance and Syllabus of B.Sc. Nuclear Medicine Technology
3. Notice of BOS Meeting



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Ref. No./SVSU/PMS/2025/963 (a)

Dated: 16.04.2025

Minutes of Meeting

A BOS meeting was conducted on 15th April, 2025 at 03:00 PM in Departmental Conference Hall under the guidance of Prof. (Dr.) Pankaj Kishor Mishra, Head, Department of Paramedical Sciences, SMC, Meerut.

The following members have attended the meeting-

1. Prof. (Dr.) Pankaj Kishor Mishra	Chairperson
2. Dr. Umesh Kumar	Member
3. Dr. Anshu Kumar Singh	Member
4. Dr. Meenakshi Mishra	Member
5. Dr. Ravindra Kumar Manik	Member
6. Mr. Akash Kumar	Member
7. Mrs. Hiba	Member
8. Mr. Rahul	Member
9. Mr. Pushpendra Rajput	Member
10. Mr. Ankit	Member
11. Ms. Shmruti	Member
12. Mr. Viswanath Pratap Singh	Member
13. Ms. Zeba Naaj	Member
14. Mr. Sumit Kumar Sagar	Member
15. Ms. Khushi Kansal	Member
16. Mr. Navdeep Singh	Member
17. Mr. Muhammad Zubair	Member

External Expert: Dr. Saloni Mehta-, Department of Nuclear Medicine, Subharti Medical College, SVSU

Alumni Member: Mr. Anuj- Student of BMLT batch 2019


All the participants were welcomed by Prof. (Dr.) Pankaj Kishor Mishra, Chairperson.

The following agenda item was discussed in the meeting:-

Agenda 1: Proposal of Ordinance and Syllabus of B.Sc. Nuclear Medicine Technology

Resolution: The BOS committee has recommended the Ordinance and Syllabus of B.Sc. Nuclear Medicine Technology to be approved by upcoming academic council.

Chairperson of the BOS meeting has concluded the meeting with the vote of thanks.


D C Saxena
Director (General)


Dr. Pankaj Kishor Mishra
Prof. & Head



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Ref. No.SVSU/PMS/2025/959

Date-15-04-2025

BOARD OF STUDIES (BOS)
ATTENDANCE SHEET

S.No	Faculty Name	Designation	Signature
1.	Prof. (Dr.) Pankaj Kishor Mishra	Chairperson	
2.	Dr. Saloni Mehta	External Expert	
3.	Dr. Umesh Kumar	Member	
4.	Dr. Anshu Kumar Singh	Member	
5.	Dr. Meenakshi Mishra	Member	
6.	Dr. Ravindra Kumar Manik	Member	
7.	Mr. Akash Kumar	Member	
8.	Mrs. Hiba	Member	
9.	Mr. Rahul	Member	
10.	Mr. Pushpendra Rajput	Member	Absent
11.	Mr. Ankit	Member	Absent
12.	Ms. Shmriti	Member	
13.	Mr. Viswanath Pratap Singh	Member	
14.	Ms. Zeba Naaj	Member	
15.	Mr. Sumit Kumar Sagar	Member	
16.	Ms. Khushi Kansal	Member	
17.	Mr. Navdeep Singh	Member	
18.	Mr. Muhammad Zubair	Member	
19.	Mr. Anuj	Almuni	



Prof. (Dr.) Pankaj Kishor Mishra
Head of Department



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Ref. No-/SVSU/PMS/2025/..... 944

Date: 12/04/2025

NOTICE

A meeting of Board of Studies (BOS) of Department of Paramedical Sciences is scheduled to be held on 15th April, 2025 (Tuesday) at 02:00 PM in the departmental conference room. External member, all faculty members and alumni are requested to attend the meeting.

Agenda to be discussed:

Agenda: 1. Syllabus and Ordinance of B.Sc. Nuclear Medicine Technology

Agenda 2: If any.

Thanking you.


Dr. Pankaj Kishor Mishra
Prof. & Head
Meerut

Copy to:

1. External Member
2. All Faculty Members
3. Alumni Member
4. Notice Board

Ordinance No. (.....A)

BACHELOR OF SCIENCE

(B.Sc.)

(Discipline- Nuclear Medicine Technology)



Faculty of Medicine

Department of Paramedical Sciences,

Subharti Medical College,

Swami Vivekanand Subharti University

**Subhartipuram, NH-58, Delhi-Haridwar Bypass Road, Meerut-250005, Uttar
Pradesh, India**

I. GENERAL PROVISIONS

1. The Programme of study leading to B.Sc. NMT of SVSU shall be of three years in Addition to 1 year Internship duration.
2. The Programme of study leading to B.Sc. NMT of the SVSU shall be conducted in the department of Paramedical Sciences of Faculty of Medicine.
3. The admission to B.Sc. NMT programme shall be deal with by the director Admission Cell and HOD, the last date for the receipt of the application form shall be fixed by the Director admission Cell.
4. The candidate seeking Admission will have to apply on a prescribed format available from the University on payment of prescribed fee.

A. Eligibility

1. For the admission of B.Sc. NMT course an applicant should be Intermediate (10+2) or its equivalent from a recognized board with minimum 50% marks in PCM/PCB with English as a subject of the course.
2. The students who are foreign Nationals/Non –Resident Indians /Persons of Indian origin have passed an examination, which is equivalent to the intermediate (10+2) examination in India.
3. Admission to the course shall be made on the basis of eligibility and merit in the aptitude test (preferably online), followed by an interview.
4. Successful candidates on the basis of the test will be called for the interview & shall have to face an interview conducted by board, constituent in the Department of Paramedical Sciences, Subharti Medical College.

B. Intake

1. The intake to B.Sc. NMT programme shall be 05.

C. Admission of Foreign Nationals

1. Admission of Foreign Nationals nominated by the Government of India under scholarship schemes and self-financing Foreign Nationals shall be entertained for the aforesaid programme. They shall not be subject to the Entrance Test provided they have passed the equivalent qualifying examination and satisfy the minimum eligibility requirements with relaxation in maximum age for admission.
2. The International Students Advisor shall get examined the eligibility etc. of each applicant and shall issue the eligibility letter to the concerned foreign national, if found eligible. Further details of the process etc. shall be available from the office of the International Students Advisor, SVSU.

II. CONDUCT OF THE PROGRAMME

1. A candidate admitted to the B.Sc. NMT programme shall be permitted to appear at University Examinations only when he/she has been enrolled as a student of the SVSU and has submitted the migration certificate and paid the enrollment fee prescribed herein after by the Ordinances.
2. To qualify for the B.Sc. NMT programme, the candidate must earn the prescribed number of credit as contained in the Course structure / syllabus detailed herein after.
3. A student of the B.Sc. NMT programme shall not be permitted to seek admission concurrently to any other equivalent or higher degree examination in the University.
4. The maximum period allowed to complete the course will be normally 06 years.
5. Inter-University Ordinances i) Notwithstanding anything contained in these Ordinances a student who is qualified under the foregoing Ordinances for admission to the University, and who is a member of some other Indian University, shall not be admitted to the University or any constituent College/Faculty thereof without the production of:
 - a. A leaving or transfer certificate signed by the Principal of the last college attended and certifying to the satisfactory conduct of the student mentioning the highest examination he/she has passed.
 - b. A certified copy of all the entries against his/her name in the Enrollment Register of the University if such a copy is obtainable.
6. A student of some other Indian University shall in any case be admitted only at the beginning of the particular course which he/she proposes to take in the University.

III. ATTENDANCE RULES

1. A student is required to have full, i.e., 100%, attendance and condonation upto 30% can be considered for specific cogent reasons. Out of this 30%, only 10% condonation will be permitted without taking any application from the student. Rest 20% condonation may be given by the Dean. Further, a student shall be deemed to have minimum percentage of attendance only if, apart from the above, he/she has attended at least 50% of the classes in each subject.
2. The attendance of a newly admitted candidate shall be counted from the date of his/her admission, or date of beginning of classes whichever is later, while in the case of promoted candidates, attendance shall be counted from the date on which respective class begins. However, in case of promotion after declaration of results of supplementary examination (if any), the attendance will be counted from the date of admission in the respective case.

IV. COURSE STRUCTURE AND SCHEME OF EXAMINATION OF B.Sc. NMT PROGRAMME

Candidates for the three and one -years B.Sc. NMT Examination shall be examined in the following subjects in accordance with the syllabi or course prescribed in the following Ordinances.

1. Course Structure:

A. The B.Sc. NMT programme shall be of three and one year's duration. A student is required to offer compulsory courses of 112 credits in three years as per the details given below. The various courses to be offered in these three years are given below.

**Distribution of Marks, Teaching subjects and Examination Evaluation Scheme
Program: Bachelor of Science in Nuclear Medicine Technology
Course Structure**

Year	Course	Code	Credit (L+T+P)*
1 st	Human Anatomy and Physiology	BNMT-101	3+1+4
1 st	Basics of Nuclear Physics	BNMT-102	3+1+4
1 st	Medical Biochemistry	BNMT-103	3+1+4
1 st	Community Healthcare	BNMT-104	3+1+0
1 st	Computational Skills and Biostatistics	BNMT-105	3+1+4
1 st	General English and Communication Skills	AEC-1	2+0+2
1 st	Hospital Posting	BNMT-155P	0+0+4
2 nd	Pathology and Microbiology	BNMT-201	3+1+4
2 nd	Radiochemistry & radio Pharmacy	BNMT-202	3+1+4
2 nd	Radiobiology *	BNMT-203	3+1+0
2 nd	Nuclear medicine Instrumentation & Quality assurance	BNMT-204	3+1+4
2 nd	Applied Mathematics	BNMT-205	3+1+0
2 nd	Hospital Posting	BNMT-254P	0+0+4
3 rd	Therapeutic Nuclear Medicine and Radiation Dosimetry	BNMT-301	3+1+4
3 rd	Diagnostic Nuclear Medicine Techniques	BNMT-302	3+1+4
3 rd	Recent Advances, Planning and Regulatory Requirements	BNMT-303	3+1+0
3 rd	Radiation Protection in Nuclear Medicine	BNMT-304	3+1+0
3 rd	Medical Ethics and Patient care	BNMT-305	3+1+0
3 rd	Hospital Posting	BNMT-353P	0+0+4

*L- Lecture, T-Tutorial, P- Practical

SUMMARY OF CREDIT SYSTEM
FOR BACHELOR OF NUCLEAR MEDICINE TECHNOLOGY

S. No.	Year	NO. OF CREDIT
1	1 st	44
2	2 nd	36
3	3 rd	32
GRAND TOTAL		112

2. Examination System:

Each theory and practical course shall be of 100 marks. For evaluation, the overall structure of the distribution of marks in a course shall be such that 30 marks are allotted to various assessments during the year, while 70 marks shall be allotted for the annual examinations.

A. Sessional:

- I. The assessment (sessional) in theory courses will comprise of class test/test(s) and seminars/assignments and regularity in each of the courses offered by them.
- II. Such class tests, seminars and/or assignments in each paper shall carry 30 marks, of which 20 marks will be for class tests and quizzes and 10 marks for seminars (s) and/or assignment(s) and regularity. (The marks of best class tests/quizzes be considered out of 2 class tests/quizzes)
- III. The seminar report(s) and/or assignment(s) shall be submitted by the students to the teachers concerned, by a date fixed by the Head of the Department of Paramedical Sciences studies. After evaluation of the seminar report(s) and/or assignment(s), the teacher concerned shall submit the result to the Head of the Department of Paramedical Sciences who shall forward the same to the Controller of Examinations.
- IV. The marks obtained in seminar report(s) and/or assignment(s) will be displayed on the notice board.
- V. Where candidate fails to take examination in any one or more papers or having taken the examination, has but failed to secure the minimum pass marks in any one or more papers or in the aggregate, his marks in the class tests, seminar reports and/or assignments will be carried forward to the subsequent examination.

B. Annual Examination and evaluation (for 70 marks):

The question papers shall be set and the answer-scripts shall be evaluated by the teachers of the as per Board of Examiners.

C. Compulsory Internship:

Internship is a phase of training wherein a graduate is expected to conduct actual practice of Nuclear Medicine Technology and acquire skills under supervision so that he/she may become capable of functioning independently. It will be of ONE year duration.

3. Script and Duration of Examinations:

- I. Except when otherwise directed by the Ordinances or by the examiner in the examination paper, every candidate shall answer question in English language in the examination in all the subjects.
 - II. Each individual paper shall be of three-hour duration and practicals, if any, shall also be of three hour duration.
- 4. Evaluation Pattern:**
- a) Examination result shall be prepared at the end of each academic year by taking into account the marks obtained in all the year till date.
 - b) A candidate shall be declared as passed at the end of an academic year if he/she secures minimum 50% marks in each paper and practical separately.
 - c) The university shall issue a provisional B.Sc. NMT degree certificate on passing the final examination.
 - d) The final result at the end of the course shall be prepared as below by aggregating the marks obtained in all the years.

AGGREGATE	DIVISION
60% and above in aggregate	1 st
50% or above but below 60% in aggregate	2 nd
Below 50% in aggregate	FAIL

- c) The Degree B.Sc. Nuclear Medicine Technology (B.Sc. NMT) shall be awarded to a candidate, indicating Division and the grading, after the candidate has successfully completed the following:
 - He/she has passed all the three annual examinations and completes the ONE year internship.
 - Candidate work and conduct during the period of training have been satisfactory.

Ranking to the candidates:

- I. Ranking shall be given to only those candidates who pass all the courses of the programme in one attempt.
- II. Notwithstanding any provision in the ordinances to the contrary, the following category of examinee is also eligible for ranking.
- III. The student who, having been duly admitted to a regular examination of the course, was unable to take that examination in full or in part due to some disruption of examination, and took the next following examination of that course and passed the course.
- IV. The marks obtained by him/her at the examination shall be considered as the basis for the University Ranking, Scholarships and other distinctions.
- V. In order to get the benefit of this provision, the student should claim that he/she is eligible for this benefit and get a decision in writing after proving his/her eligibility there for.

5. Admit Card (for Annual Examination):

A candidate may not be admitted into examination room unless he/she produces his/her Admit Card to the officer conducting the examination or satisfies such officer that it shall be subsequently produced.

The Controller of Examinations may, if satisfied that an examinee's admit card has been lost or Destroyed, grant duplicate admit card on payment of a requisite fee.

Ordinance No. (.....B)

BACHELOR OF SCIENCE

(B.Sc.)

(Discipline- Nuclear Medicine Technology)



Ordinance Relating to Bachelor of Science in Nuclear medicine Technology (B.Sc. NMT) Course Curriculum and Syllabus

1. This ordinance may be called the "Ordinance Relating to Bachelor of Science in Nuclear Medicine Technology (B.Sc. NMT) Curriculum and Syllabus".
2. It shall come into force with Academic session.....

**Curriculum outline/ Syllabus
(Paper code and subject title)**

COURSE CURRICULUM

Bachelor of Science in Nuclear Medicine Technology (B.Sc. NMT)
Distribution of Marks, Teaching subjects and Examination evaluation scheme
Program: Bachelor of Science in Nuclear Medicine Technology 1st year

S. N O.	Subject Code	Subject Name	Hours Per Week				Examination Scheme				Grand total
			L	T	P	C	Theory Marks		Practical Marks		
							UE	CCE	UE	CCE	
1.	BNMT-101	Human Anatomy and Physiology	3	1	-	4	70	30	-	-	100
2.	BNMT-102	Basics of Nuclear Physics	3	1	-	4	70	30	-	-	100
3.	BNMT-103	Medical Biochemistry	3	1	-	4	70	30	-	-	100
4.	BNMT-104	Community Healthcare	3	1	-	4	70	30	-	-	100
5.	BNMT-105	Computational Skills and Biostatistics	3	1	-	4	70	30	-	-	100
6.	AEC-1	General English and Communication Skills	2	-	-	2	35	15	-	-	50
7.	BNMT151P	Human Anatomy and Physiology (Practical)	-	-	4	4	-	-	50	50	100
8.	BNMT-152P	Basics of Nuclear Physics (Practical)	-	-	4	4	-	-	50	50	100
9.	BNMT153P	Medical Biochemistry (Practical)	-	-	4	4	-	-	50	50	100
10.	BNMT154P	Computational Skills and Biostatistics (Practical)	-	-	4	4	-	-	50	50	100
11.	AEC-1P	General English and Communication Skills (Practical)	-	-	2	2			35	15	50
12.	BNMT155P	Hospital Posting	-	-	4	4	-	-	50	50	100
Total Credit			14	5	22	44	385	165	285	265	1100

*L- Lecture, T-Tutorial, P- Practical, C- Credit, CCE- Continuous Comprehensive Evaluation, UE- University External

Distribution of Marks, Teaching subjects and Examination evaluation scheme
Program: Bachelor of Science in Nuclear Medicine Technology 2nd year

S. N. O.	Subject Code	Subject Name	Hours Per Week				Examination Scheme				Grand total
			L	T	P	C	Theory Marks		Practical Marks		
							UE	CCE	UE	CCE	
1.	BNMT-201	Pathology and Microbiology	3	1	-	4	70	30	-	-	100
2.	BNMT-202	Radiochemistry & radio Pharmacy	3	1	-	4	70	30	-	-	100
3.	BNMT-203	Radiobiology	3	1	-	4	70	30	-	-	100
4.	BNMT-204	Nuclear Medicine Instrumentation and Quality Assurance	3	1	-	4	70	30	-	-	100
5.	BNMT-205	Applied mathematics	3	1	-	4	70	30	-	-	100
6.	BNMT-251P	Pathology and Microbiology (Practical)	-	-	4	4	-	-	50	50	100
7.	BNMT-252P	Radiochemistry & radio Pharmacy (Practical)	-	-	4	4	-	-	50	50	100
8.	BNMT-253P	Nuclear Medicine Instrumentation & Quality Assurance (Practical)	-	-	4	4	-	-	50	50	100
9.	BNMT-254P	Hospital Posting	-	-	4	4	-	-	50	50	100
Total Credits			15	5	16	36	350	150	200	200	900

*L- Lecture, T-Tutorial, P- Practical, C- Credit, CCE- Continuous Comprehensive Evaluation, UE-
University External

Distribution of Marks, Teaching subjects and Examination evaluation scheme
Program: Bachelor of Science in Nuclear Medicine Technology 3rd year

S. N O.	Subject Code	Subject Name	Hours Per Week				Examination Scheme				
			L	T	P	C	Theory Marks		Practical Marks		Grand total
							UE	CCE	UE	CCE	
1.	BNMT-301	Therapeutic Nuclear Medicine and Radiation Dosimetry	3	1	-	4	70	30	-	-	100
2.	BNMT-302	Diagnostic Nuclear Medicine Techniques	3	1	-	4	70	30	-	-	100
3.	BNMT-303	Recent Advances, Planning and Regulatory Requirements	3	1	-	4	70	30	-	-	100
4.	BNMT-304	Radiation Protection in Nuclear Medicine	3	1	-	4	70	30	-	-	100
5.	BNMT-305	Medical Ethics and Patient Care	3	1	-	4	70	30	-	-	100
6.	BNMT-351P	Therapeutic Nuclear Medicine and Radiation Dosimetry (Practical)	-	-	4	4	-	-	50	50	100
7.	BNMT-352P	Diagnostic Nuclear Medicine Techniques (Practical)	-	-	4	4	-	-	50	50	100
8.	BNMT-353P	Hospital Posting	-	-	4	4	-	-	50	50	100
9.	Total Credits		15	5	12	32	350	150	150	150	800

*L- Lecture, T-Tutorial, P- Practical, C- Credit, CCE- Continuous Comprehensive Evaluation, UE- University External

SUMMARY OF CREDIT SYSTEM
FOR BACHELOR OF NUCLEAR MEDICINE TECHNOLOGY

S. No.	Year	NO. OF CREDIT
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Grand Total		112

(B.Sc. NMT)

INTRODUCTION

B.Sc. in Nuclear Medicine Technology is a specialized undergraduate program that focuses on the use of radioactive substances for diagnosing and treating various diseases, especially cancer. The course combines knowledge of physics, chemistry, biology, and medicine to train students in handling sophisticated imaging equipment like PET and SPECT scanners. Students learn how to prepare radiopharmaceuticals, conduct imaging procedures, and ensure patient safety during radioactive exposure. This program plays a crucial role in modern healthcare by helping detect conditions at an early stage with high accuracy. The future scope of B.Sc. NMT is promising due to the growing demand for advanced diagnostic tools and personalized treatment. Graduates can work in hospitals, diagnostic centers, research labs, and pharmaceutical companies, or pursue higher education and specialization. With continuous advancements in medical technology and an increasing focus on precision medicine, nuclear medicine professionals are expected to be in high demand in both India and abroad.

PROGRAM OBJECTIVES

Upon successful completion of the bachelor degree in Nuclear Medicine Technology, the student should be able to:

- PO1-** Conceptualise and apply the theories of applied sciences such as Physics, Chemistry, Anatomy, Physiology, Biochemistry, and Pathology relevant to Nuclear Medicine Technology.
- PO2-** Know the ethics and organization of Nuclear Medicine Department.
- PO3-** Perform various diagnostic and Prognostic Procedures of Nuclear Medicine Technology.
- PO4-** Do work efficiently with latest sophisticated modern Nuclear Medicine Technology modalities.
- PO5-** Students will be aware about radiation safety, various national and international regulatory bodies, applying quality assurance measures, safety procedures & care and maintenance of Nuclear Medicine Technology Equipments.
- PO6-** Analyzing the protocols in Nuclear Medicine Technology Procedures and evaluating various pathological conditions.

(B.Sc. NMT)

1st YEAR

PAPER-1: Human Anatomy and Physiology

Theory	Subject Code- BNMT-101
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

Students get to know in depth about human anatomy and physiology. In this subject students learn about basics of human anatomy, blood, parts and function of different body systems. Practices and demonstrations are also associated with this subject.

Course Outcomes (COs)

CO1: Classify bones (axial and appendicular), describe bone structure, formation, growth, and identify common bone-related conditions.

CO2: Understand the basic anatomy of the endocrine and nervous systems, sense organs, and surface landmarks used in radiographic positioning

CO3: Understand the composition and functions of blood.

CO4: Understand the structure and basic functions of major physiological systems including respiratory, cardiovascular, lymphatic, and reticulo-endothelial systems.

CO5: Identify the location and functions of major endocrine glands and parts of the nervous system.

Unit	Contents	Credit Hours
1	<p>Part-A (Anatomy)</p> <p>Anatomy of Human body: Structure of cell and tissues of body: Epithelial tissue, connective tissue, muscle tissue and nervous tissue</p> <p>Classification of bones: Axial skeleton, Appendicular skeleton, Bones - Structure and functions, formation of bone, growth of skeleton, centres of ossification, fracture and dislocation, diseases of the bones , Radiological and Surface Anatomy.</p> <p>Joints: Classification of joints with examples, anatomy of various joints of head and neck, trunk and limbs</p> <p>Cardiovascular system: Anatomy of pericardium and heart, blood vessels, types of blood circulation</p>	30

2	<p>Muscular system: Types of muscles, Position and actions of chief muscles of the body</p> <p>Respiratory system: Nasal passages and para -nasal sinuses, pharynx and larynx, trachea, bronchi, lungs and pleura</p> <p>Gastrointestinal system: Parts of GIT, oral cavity, salivary glands, oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas,</p> <p>Urinary system: Kidney, Ureters, urinary bladder and urethra</p> <p>Reproductive system: Parts of male and female reproductive system, location, functions, mammary gland</p> <p>Endocrine system: Location, structure and functions of Pituitary, Thyroid, Parathyroid, Suprarenal and Pancreas</p> <p>Nervous system and sense organs: Structure and function of Neuron, subdivisions of nervous system: central and autonomic nervous system- Parts, structure and functions, ventricles of the Brain, CSF circulation, spinal cord. Cranial nerve, Brachial plexus.</p> <p>Sense Organs: Structure and function of the eye, ear, tongue, nose, skin. Surface landmarks and topography of organs on the surface of body for radiographic positioning</p>	30
3	<p>Part-B (Physiology)</p> <p>Blood: Its composition and function – nerve tissue- muscular tissue and types.</p>	10
4	<p>Respiratory system: Nasal passages and Para nasal sinuses- pharynx and larynx- Trachea, Bronchus and lungs. The pleura- nature and functions of respiration.</p> <p>Lymphatic system: Lymph and tissue fluid- main glands and drainage areas in the lymphatic system- Lymphoid tissue and the tonsils.</p> <p>Cardiovascular system: General arrange, heart, arteries, veins and capillaries, heart structure and function, cardiac cycle, heart sounds, heart rate, blood pressure, mechanism of circulation, definition of hypertension and shock</p> <p>Reticulo-endothelial system: Liver and spleen- bone marrow, Life cycle of red and white corpuscles of the blood,</p> <p>Alimentary systems: Function of mouth, tongue and teeth, salivary glands- pharynx and esophagus- Stomach – small intestine (jejunum)- large intestine (colon)- Liver and Biliary tract- pancreas- functions of</p>	30

	<p>the alimentary system – digestion and absorption of food- metabolism- common terms used in connection with abnormalities of this system.</p> <p>Urinary tract: kidney, Ureters and bladder, urethra, urinary Excretion.</p> <p>Reproductive system: Male genitalia, Female genitalia, Mammary glands, Menstruation, pregnancy and lactation, common terms related to abnormalities of this system.</p>	
5	<p>Ductless glands (Endocrine system): Anatomical location of pituitary, thyroid, parathyroid, adrenal, thymus, pancreas and gonads – there function, common terms related to this system.</p> <p>Nervous system: Main subdivisions, lobes and ventricles of the brain- spinal cord- meninges and cerebro- spinal fluid- common terms used in abnormalities of this system.</p> <p>Organs of senses: Structure and function of the eye, Structure and function of the ear.</p>	20

Reference Books:

1. Guyton, Arthur, Text Book of Physiology, Prism Publishers
2. Chatterjee, C C, Human Physiology, Medical Allied Agency
3. A.K Jain, Human Physiology
4. Anatomy and Physiology, Ross and Wilson
5. Human Anatomy, B D Chaurasia

Human Anatomy and Physiology Practical

Practical	Subject Code- BNMT-151P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Human Anatomy

S.No.	List of Experiment	Credit Hours
1.	<p>Histology of types of epithelium, serous, mucous and mixed salivary gland</p> <p>Demonstration of the glands, Histology of pituitary, thyroid, parathyroid, suprarenal glands</p>	120

2.	<p>Histology of the 3 types of cartilage, Demo of all bones showing parts, radiographs of normal bones and joints, Histology of compact bone (TS and LS)</p> <p>Demonstration of heart and vessels in the body, Histology of large artery, medium sized artery and vein, large vein, Microscopic appearance of large artery, medium sized artery and vein, large vein, pericardium,</p>
3.	<p>Demonstration of parts of respiratory system, Normal radiographs of chest, Histology of lung and trachea</p> <p>Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder,</p> <p>Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vasdeferens, epididymis, prostate, uterus, fallopian tubes, ovary</p>
4.	<p>Demonstration of all part of brain, Histology of cerebrum, cerebellum and spinal cord, peripheral nerve and optic nerve. Histology of thin and thick skin</p> <p>Demonstration and histology of eyeball, Histology of cornea and retina</p>
5.	<p>Haemoglobinometry, Determination of Blood Groups ,White Blood Cell Count and Red Blood Count</p> <p>Leishman's staining and Differential WBC count, Determination of packed cell Volume</p>
6.	<p>Erythrocyte sedimentation rate [ESR] and Calculation of blood indices</p> <p>Determination of Clotting Time, Bleeding Time</p>
7.	<p>Blood pressure Recording and Determination of vital capacity.</p> <p>Auscultation for Heart Sounds and Artificial Respiration</p>

Reference Books:

1. William Davis, Understanding Human Anatomy and Physiology, McGraw Hill.
2. B.D. Chaurasia's, Practical of Human Anatomy.
3. Principles of Anatomy and Physiology, Gerard J. Tortora and Bryan H. Derrickso.

PAPER-2: Basics of Nuclear Physics

Theory	Subject Code- BNMT-102
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

Students get to know in depth about Basics of medical Physics. In this subject students learn about structure of matter, electromagnetism, production of X-Rays, Production of Radionuclide.

Course Outcomes (COs)

CO1: Understand the structure of atoms, atomic energy levels, and electromagnetic radiation.

CO2: Understand basic concepts of electricity and magnetism, including Coulomb's law, electric current, resistance, and magnetic effects.

CO3: Understand the construction, working principles, and components of X-ray tubes and circuits, the interaction of radiation with matter and the characteristics of different X-ray beams in clinical applications.

CO4: Understand nuclear transformations, including radioactivity, decay processes, and nuclear reactions.

CO5: Understand the production of radionuclides using reactors, accelerators, and radionuclide generators.

Unit	Contents	Credit Hours
1	<p>Structure of Matter: Constituents of atoms, atomic and mass energy, units, electron shells, atomic energy levels, Nuclear forces, Nuclear energy levels. Atomic structure Nucleus, Electromagnetic spectrum, Energy quantization, Relationship between wavelengths, Frequency, Energy.</p> <p>Physics Units and measurements Force, Work, Power, energy temperature and heat SI units of above parameters. Atomic Number, Mass No., electron orbit and energy levels Periodic table Ionization and excitation. Electromagnetic radiation</p>	30
2	<p>Electricity and magnetism: Electric charges, Coulomb's law Unit of charge Electric potential, unit of potential Electric induction, capacitance and capacitors, series and parallel connection electric current, unit, resistance, ohm's law, electric power, Joule's law</p> <p>Magnetism: Magnetic induction magnetic properties Hysteresis magnetic effect of current Electrical instruments, Galvanometer, voltmeter, ammeter and multi meter</p> <p>Electronic: Introduction to Semiconductors- Extrinsic and Intrinsic Semiconductors- Formation of p-n Junction, p-n Junction diode-Half wave and Full wave rectifiers using diodes, Efficiency: Bipolar Junction Transistor-Forward and reverse bias characteristics, Amplifiers; Types of</p>	30

	Amplifiers	
3	<p>Production of X-rays: X-ray tube, anode, cathode construction, and working principles of transformers and autotransformers used in x-ray circuits, voltage rectification, and measurements in x-ray circuits. Physics of x-ray production (Bremsstrahlung and Characteristic x-rays)</p> <p>Interaction of radiation with matter: ionization and excitation, various types of interaction processes (photoelectric effect, Compton scattering, pair production etc.) Interaction of charged particles and neutrons with matter. Comparative beam characteristics. Orthovoltage and megavoltage beam, their interactions and clinical applications</p>	30
4	<p>Nuclear Transformations : Radioactivity, decay constant, activity half life, mean life, radioactive series, radioactive equilibrium, modes of decay : α-decay, β-decay, γ- decay , Isobars, Isotopes, Isotones, Isomers, electron capture, internal conversion, isomeric transition. Nuclear reactions: (α, p) reaction, (α, n) reaction, proton bombardment, deuteron bombardment, neutron bombardment, photodisintegration, fission, fusion, activation of nuclides, nuclear reactors.</p>	18
5	<p>Production of Radio nuclides: Reactor produced radionuclide, Reactor principles; Accelerator produced radionuclide, Radionuclide generators.</p>	12

Reference Books

1. K.Thalayan, Basic of Radiological Physics.
2. They physics of radiation therapy, Faiz M. Khan, 4th edition (2010), Lippincott, Williams.
3. Fundamental of Xray and Radium Physics Joseph Selman.
4. Basic Medical Radiation Physics – Stanton.

Basics of Nuclear Physics Practical

Practical	Subject Code- BNMT-152P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S. No.	List of Experiment	Credit Hours
1.	Atomic theory	

2.	Radioactivity	120
3.	Production of Radionuclide	
4.	Interaction of Radiation with Matter	
5.	Demonstration Nuclear Medicine Technology Equipments.	
6.	Production of X-rays	

Reference Books:

1. The physics of radiation therapy, Faiz M. Khan, 5th edition.
2. Christensen's Physics of Diagnostic Radiology – Christensen & Christensen.
3. Fundamental of Xray Fundamental of Xray and Radium Physics Joseph.
4. Basic Medical Radiation Physics – Stanton.

PAPER-3: Medical Biochemistry

Theory	Subject Code- BNMT-103
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

Students get to know in depth about Medical Biochemistry. In this subject students learn about chemistry of carbohydrates, lipids, enzymes, function and structure of cell. Practices and demonstrations are also associated with this subject.

Course Outcomes (COs)

CO1: Understand the structure and function of cells, including prokaryotic and eukaryotic organization, transport mechanisms, and acid-base balance.

CO2: Summarizing the chemistry of carbohydrates, proteins, lipids and amino acids.

CO3: Understand the composition, metabolism, and transport of lipids, including fatty acids, cholesterol, lipoproteins, and their role in health.

CO4: Knowing the biochemical testing and analyzing the test result.

CO5: Understand the principles of radioactivity and the use of various analytical techniques like GM Counter, colorimetry, chromatography, and immunoassays.

Unit	Contents	Credit Hours
1	Structure and Function OF Cell: Structure and function of cell, Prokaryote and Eukaryote cell organization, Fluid Mosaic Model of cell membrane, Transport Mechanism, Acid Base Balance-maintenance, PH Buffers, Henderson – Hasselbalch equation and its applications.	20
2	Composition and Metabolism of Carbohydrate: Types, structure, composition and function, Monosaccharides, Disaccharides, Oligosaccharides, Polysaccharides, Metabolism, Glycolysis, Gluconeogenesis, Tricarboxylic acid (TCA) cycle, Pentose phosphate pathways (HMP), Regulation of blood glucose level, Glucose investigations and their interpretations	20
3	Composition and Metabolism of Lipids: Types, Structure, Composition and function of fatty acids, Nomenclature, Roles and Prostaglandins, Triacylglycerols, phospholipids, Cholesterol. Metabolism of fatty acid: Breakdown, Synthesis Biosynthesis & its regulation: Bile salts & bilirubin, Vitamin D Lipoproteins and their functions, Transport of lipids, VLDLs, LDLs, HDLs, Atherosclerosis, Investigations and their interpretations	30

4	<p>Composition and Function of Amino Acids and Proteins: Types , structure, composition and function of amino acid, Structural organization of proteins (basic understanding only), Classification and functions of proteins, Denaturation and Coagulation, Metabolism of Nitrogen, Fixation and Assimilation, Urea cycle</p> <p>Enzymes and Hormones: Enzymes and Co-enzymes, Classification and function, Factors effecting enzyme action, Coenzyme and Cofactor</p> <p>Glands: Exocrine and Endocrine, Hormones, Investigations and their interpretations</p>	30
5	<p>Radioactivity: Radioactivity, Radioisotopes, GM Counter, Colorimeter and Spectrophotometer, Chromatography, Electrophoresis, RIA, ELISA</p>	20

Reference Books:

1. U. Satyanarayana, Text book for Biochemistry.
2. D.M Vasudevan, Text book for Biochemistry.
3. Illustrated Biochemistry by HARPER.
4. Lehninger Principles of Biochemistry.
5. Biochemistry by Stryer.
6. Biochemistry by Voet and Voet.

Medical Biochemistry Practical

Practical	Subject Code- BNMT-153P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S.No.	List of Experiments	Credit Hours
1.	Analysis of Normal Urine	120
2.	Liver Function tests	
3.	Lipid Profile	
4.	Renal Function test	
5.	Blood gas and Electrolytes	
6.	Demonstration of Glucometer with strips	

Reference Books:

1. Das, Debajyothi, Biochemistry, Academic Publishers, Calcutta.
2. Chatterjee, A Text book of Medical Biochemistry.
3. Satyanarayan, U., Medical Biochemistry.

PAPER-4: Community Healthcare

Theory	Subject Code- BNMT-104
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

Students get to know in depth about Community healthcare. In this subject students learn about health, different types of family, hospital acquired infection, infection types and its treatment.

Course Outcomes (COs)

- CO1:** Understand and Remembering the Concept of Health.
CO2: Understand the concept of family, its types, functions, and its influence on individual health, nutrition, and psychosomatic diseases in physiotherapy.
CO3: Understand the concepts of community-acquired and hospital-acquired infections, including their control measures.
CO4: Understand lifestyle disorders and nosocomial infections, including their causes and prevention.
CO5: Understand the features of rural and urban communities, including health hazards specific to each.

Unit	Contents	Credit Hours
1	Health: Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept. National Health Policy: National Health Programmers (Briefly Objectives and Scope) Population of India and Family welfare programme in India.	25
2	Family: The family, meaning and definitions, Functions of types of family, Changing family patterns, Influence of family on Individuals Health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their Importance to physiotherapy.	25
3	Community acquired infection: Control of infection, Hospital acquired infection. (HAI)	20
4	Hygiene: Life style disorder, Nosocomial infection	20

5	Community: Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community, Urban community – Meaning and features – Health hazards of urbanities	30
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Reference Books:

1. K. Perks ,Textbook of Preventive Social Medicine.
2. Sunder Lal, Adarsh, Pandey, Textbook of community health.
3. Park & Park, Textbook of Social Medicine.
4. Harshmohan, Textbook of Pathology

PAPER-5: COMPUTATIONAL SKILLS AND BIostatISTICS

Theory	Subject Code- BNMT-105
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

Students get to know in depth about Computer and biostatistics. In this subject students learn about basic computer fundamentals, use of network terminology and calculate the central tendency and use different test of significance.

Course Outcomes (COs)

- CO1- Understand the basic fundamentals of computers, computer organization and representation of data
CO2- Understand the network terminology and application of multimedia
CO3- Apply the stepwise methodology of developing an algorithm and general awareness in information technology.
CO4- To demonstrate the central tendency and calculate the measure of dispersion in biostatistics.
CO5- To Apply the use of different types of test of significance.

Unit	Contents	Credit Hours
1	Part A: COMPUTATIONAL SKILLS Computer Fundamentals: Introduction to Computers: Characteristics of Computers, Uses of computers, Types and generations of Computers. Basic Computer Organization - Units of a computer, CPU, ALU, memory hierarchy, registers, I/O devices. User Interface with the Operating System, System Tools Data Representation: Binary representation of integers and real numbers, 1's Complement, 2's Complement, Addition and subtraction of binary numbers, BCD, ASCII, Unicode	30
2	Networks terminology: Types of networks, router, switch, server-client architecture Multimedia: Introduction, Characteristics, Elements, Applications	20
3	Problem Solving: Notion of algorithms, stepwise methodology of developing an algorithm, developing macros in spread sheet, M.S. Office: word, excel, power point, Internet, e-mail, search engine, General Awareness: IT Act, System Security (virus/firewall etc.), I-	25

	Tax, Reservations, Banking.	
4	Part B: Biostatistics Measure of central tendency: Mean, median and mode and their relationship. Measure of dispersion: quantitative deviations, mean deviation, standard deviation, coefficient of variations. Concept of Standard errors.	25
5	Tests of significance: Hypothesis testing (null and alternative hypothesis) Tests of significance (non-parametric): T- test and Chi-square test for independence; P-value of the statistic; Confidence limits	20

Reference Books:

1. Wayne W. Daniel, Biostatistics: A foundation for Analysis in the Health Sciences, 8th Edition, Wiley, 2004.
2. Prem S. Mann, Introductory Statistics, 6th Edition, Wiley, 2006.
3. John A. Rice, Mathematical Statistics and Data Analysis, 3rd Edition, John A. Rice, Duxbury Press, 2006.

COMPUTATIONAL SKILLS AND BIostatISTICS PRACTICAL

Practical	Subject Code: BNMT-154P	
Total Marks for Evaluation:100	No. of Credit Hours: 120, Credits:4	
S.No.	List of Experiments	Credit Hours
1	Collection and tabulation of data	120
2	Graphical representation of data	
3	Correlation and regression analysis	
4	Student's 't' test	
5	Chi-square test	
6	ANOVA	
7	Use of MS EXCEL	
8	Use of in-built statistical functions for computations Mean, S.D., Correlation, regression coefficients	
9	Use of bar diagram, histogram, scatter plots, etc.	
10	Graphical tools in EXCEL for presentation of data	

Reference Books:

- i. Fundamentals of Biostatistics Bernard Rosner 5th Edition, Duxbury Thomson Learning, 8th, Ed, (2015)
- ii. Introductory Biostatistics, Chap T. Lee, Wiley, 1st Ed., (2003)
- iii. Comdex computer course kit, Vikas Gupta, Dreamtex press ND.
- iv. Introduction to computer, Pooja Jain and Neelam Kumari, Vikas publishing house Pvt Ltd.
- v. Biostatistics for medical students and research workers 9th Ed., Bratati Banerjee, Jaypee Brothers Medical Publishers.

PAPER-6: GENERAL ENGLISH AND COMMUNICATION SKILLS

Theory	Subject Code- AEC-1
Total Marks for Evaluation- 50	No. of Contact Hours- 60, Credits:2

Course Objective

Students get to know in depth about general English and communication. In this subject students learn about to basic of English grammar, vocabulary and enhance their communication skills from use of different types of skills.

Course Outcomes (COs)

CO1: Understand the essentials of grammar, including parts of speech, sentence transformation, tenses, and vocabulary skills.

CO2: Develop technical writing skills, including paragraph writing, scientific abstracts, reading comprehension, and effective communication.

CO3: Understand key interview tips, non-verbal communication, office etiquette, and effective participation in group discussions and role-plays.

CO4: Develop report writing, scientific writing, and presentation skills, including email strategies, PowerPoint use, and effective group discussions.

CO5: Understand the key elements of effective presentation skills, including voice modulation, body language, audience awareness, and use of visual aids.

Unit	Content	Credit Hours
1	Essentials of grammar: Part of speech, noun, pronoun, adjective, verb, preposition, articles, Sentences (kind) transformation of sentences, tense (present, past, future), Active and passive, Direct and indirect, Vocabulary, synonyms, antonyms, idioms and phrase, one word substitution.	10
2	Technical writing skills: Definition, requisites of good paragraph writing, scientific writing skills and forming abstracts, Reading comprehension skills, passage for communication (oral), Effective listening, importance of listening and hearing, Letter writing: official letters, business letters, personal letters.	15
3	Interview tips: what student is supposed to do before the interview, during the interview and after the interview and on, Importance of non-verbal communication, debates, role-plays, corporate behaviour, office etiquettes, Importance of body language, Group discussion (G.D.), G.D. tips.	12

4	Report writing skills: Types of reports, layout of formal report, scientific writing skills, problems while writing a scientific report/document. Plagiarism, element of scientific paper, abstract writing, Internet as a medium of interaction. Effective e-mail strategy using the right tone and conciseness, Presentation skills: Formal presentation skills, Preparing and presenting using Over Head Projector, Power Point presentation, Defending Interrogation; Scientific poster preparation and presentation; Participating in group discussions.	13
5	Presentation skills: Importance of Presentation Skills, Capturing Data, Voice and Picture Integration, Guidelines to make Presentation Interesting, Body Language, Voice Modulation, Audience Awareness, Presentation Plan, Visual Aids, Forms of Layout, Style of Presentation.	10

Reference Books:

1. Wren and Martin H- "High school grammar and composition" S. Chand and co
2. Robbins's "organization behavior"
3. Sharma R C and Krishan Mohan – Business correspondence and report writing. New Delhi Tata MCgrahill.
4. Banerji, Meera and krisan Mohan- Developing communication skills, Macmillan publishers India.
5. Raman, Meenakshi and ShasmeSangeeta- "Technical communication – principles and practices
6. "Oxford University Press.

General English and Communication Skills

Practical	Subject Code- AEC-1
Total Marks for Evaluation- 50	No. of Contact Hours- 60, Credits:2

S. No.	List of Experiment	Credit Hours
1.	Personal letter writing	120

2.	Business letter writing	
3.	Official letter writing	
4.	Interview	
5.	Report writing	
6.	Presentation skill	

Reference Books:

1. Wren and Martin H- "High school grammar and composition" S. Chand and co
2. Robbins's "organization behavior"
3. Sharma R C and Krishan Mohan – Business correspondence and report writing. New Delhi Tata mcgram hill
4. Banerji, Meera and krisan Mohan- Developing communication skills, Macmillan publishers India

Hospital Postings

Practical	Subject Code- BNMT-155P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S.No.	List of Experiments	Credit Hours
1.	Students shall be deputed to various labs of Nuclear Medicine department wherein they shall undergo practical	120
2.	Training of handling patients, Nuclear Medicine procedures, etc. and equipments.	
3.	Identification of patient's	
4.	Student will practice about Radionuclide's.	
5.	Process of performing various Nuclear Medicine Procedures from different equipments.	
6.	Each student is required to maintain a logbook of the various postings.	
7.	Evaluated on continuous basis by the faculty posted in various sections.	
8.	Assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.	

Bachelor of Science in Nuclear Medicine Technology (B.Sc. NMT)

YEAR-2

PAPER-1: Pathology and Microbiology

Theory	Subject Code- BNMT-201
Total marks for evaluation- 100	No. of contact hours- 120, Credits:4

Course Objective

In this subject students learn about the Pathology and Microbiology that is related to Nuclear Medicine Technology.

Course Outcomes (COs)

CO1: The end of the course, the students learn about basics of histopathology.

CO2: At course's conclusion, students gain knowledge of haematology. Histopathology as well as blood banking

CO3: The students learn about Infections caused by virus.

CO4: Understand the classification, morphology, and physiology of microbes, types of immunity, and methods of sterilization and disinfection.

CO5: By the end of the course, the students have gained knowledge about hospital infections, immunology, sterilization, disinfection, and microscopy.

Unit	Contents	Credit Hours
1	Histopathology Introduction to Histopathology, Receiving of Specimen in the laboratory, Use & care of Microscope, Various Fixatives, Mode of action, Preparation and Indication, Tissue processing for routine paraffin sections, Section Cutting, Staining of tissues - H& E Staining, Bio-Medical waste management .	20
2	Haematology Introduction to Haematology, Normal constituents of Blood, their structure and function, Collection of Blood samples Various Anticoagulants used in Haematology Laboratory safety guidelines , SI units and conventional units in Hospital Laboratory Hb, PCV,	25

	ESR Diseases of Esophagus, Stomach and Intestine , Diseases of Liver and Pancreas Blood Bank Introduction to blood bank, ABO and Rh blood grouping.	
3	Microscopy Working principle, techniques and application of various types of microscope (light microscope, dark field microscope, phase contract microscope, fluorescent microscope, confocal microscope and electron microscope).	20
4	Morphology & Classification Nomenclature and Classification of microbes (in brief), Size and Shape, morphology of bacteria: Structures of a bacterial cell and their functions, physiology of Bacteria: nutrition, gaseous requirement, temperature requirement and other growth requirements. Immunology Immunity and types of immunity, Infection: sources of infection, modes of transmission, factors predisposing to microbial , pathogenicity, types of infectious diseases types of vaccine and Immunization schedule Sterilization and Disinfection sterilization and Disinfection in detail, principles and use of equipments of sterilization (Namely Hot Air Oven, Autoclave, Inspissrator and Pasteurization) antiseptic and disinfectants	35
5	Hospital infection Causative agents, transmission methods, prevention and control hospital infection, blood born infections, virology viral infections with special mention of hepatitis, poliomyelitis, HIV and rabies, FLU (Influenza) , Dengue, Chikungunya, basics of parasitology.	20

Reference Books:

1. Text book of pathology by Harsh Mohan.
2. Practical Haematology by DACIE & LEWIS.
3. Monika Chesbrow District laboratory practice in Tropical countries II volume.
4. Baveja Medical Paracytology

Pathology and Microbiology Practical

Practical	Subject Code- BNMT-251P	
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4	
S.No.	List of Experiments	Credit Hours

1.	Blood Grouping Rh typing, Hb Estimation, Packed Cell Volume (PCV), Erythrocyte Sedimentation Rate (ESR).	120
2.	Bleeding Time, Clotting Time.	
3.	Parts of Microscope. Grams stain and Acid Fast staining.	
4.	Demonstration and sterilization of equipments – Hot Air oven, Autoclave, Bacterial filters , Demonstration of commonly used culture media, culture methods: Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, Mac-Conkey medium, LJ media, Robertson Cooked meat media.	
5.	Visit to hospital for demonstration of Biomedical waste management.	

Reference Books

1. Bancroft : Theory and Practical of Histology techniques.
2. Textbook of Clinical Blood Banking Science by Zmijewski.
3. Manual for Clinical Pathology by Sabitry Sanyal.
4. Practical Pathology by Dr.P.Chakraborty& Gargi Chakraborty.
5. Haematology for students and practitioners by Ramnik Sood.

PAPER-2: Radiochemistry & Radio Pharmacy

Theory	Subject Code- BNMT-202
Total marks for evaluation- 100	No. of contact hours- 120, Credits:4

Course Objective:

To provide foundational knowledge of radiochemistry and radiopharmacy, focusing on the preparation, handling, and application of radiopharmaceuticals in nuclear medicine.

Course Outcomes (COs)

CO1: Understand how radionuclides are produced using reactors and cyclotrons.

CO2: Explain how radionuclide generators work and their uses.

CO3: Understand the methods of radioiodination, chemistry of Tc-99m, and the preparation and labeling of radiopharmaceuticals for diagnosis and therapy.

CO4: Learn how to check the quality and safety of radiopharmaceuticals.

CO5: Know the rules, safety, and ethical use of radiopharmaceuticals.

Unit	Contents	Credit Hours
1	Production of Radionuclides: Construction and functioning of nuclear reactor, nuclear fission reactions, fission products, Nuclear activation, and cross sections, Methods of radionuclide separation and purification, Characteristics of reactor-produced radionuclides, Construction and functioning of medical cyclotrons, types of cyclotrons, Methods of radionuclide separation and purification, Characteristics of cyclotron-produced radionuclides, Production of some commonly available radionuclides such as F-18, C-11, O-15, N-13, Tl-201, Ga-67, In-111, I-123	20
2	Radionuclide Generator: Parent- daughter relationship, principles and construction of Generator System, Sterilization, commonly available generator system such as Mo-99/Tc-99m, Ge- 68/Ga-68, Sr-82/Rb-82, etc. Mo-99 and Aluminium breakthrough test. Radiopharmaceutical: Tracer concept, ideal characteristics of a	25

	<p>radiopharmaceutical Tracer concept, ideal characteristics of a radiopharmaceutical, factors influencing design of a radiopharmaceutical, Mechanism of localisation of radiopharmaceutical.</p> <p>Radiolabelling: Methods of radiolabelling, important factors in radiolabelling, Radiolabelling of cells and proteins</p>	
3	<p>Radiiodination: Methods and purification, commonly used radioiodinated compounds for diagnosis and therapy</p> <p>Labelling of radiopharmaceuticals chemistry of Tc-99m: Physical characteristics, Oxidation states, Chelation, ligand exchange reactions, Production of Cold kits for radiopharmaceutical preparation, Labelling of Tc-99m radiopharmaceuticals with coldkits such as DTPA, MIBI, DMSA, MDP, etc.</p>	20
4	<p>Labelling of PET Radiopharmaceuticals: Synthesis and purification of ^{18}F FDG, ^{68}Ga labelled radiopharmaceuticals, $^{13}\text{NH}_3$, etc.</p> <p>Labelling of therapeutic radiopharmaceuticals: Labelling chemistry of Lu-177, Re-188, etc., phase contract microscope, fluorescent microscope, confocal microscope and electron microscope.</p> <p>Qualitycontrol of radiopharmaceuticals: Physicochemical tests, radionuclidic purity, Radiochemical purity, Sterilisation of radiopharmaceuticals, biological tests such as Sterility, Toxicity & Apyrogenicity testing</p> <p>Dispensing of radiopharmaceuticals: Calculation of activity to be administered, routes of radiopharmaceutical administration, Specific activity</p>	35
5	<p>Tracer kinetic modelling: Basic concept of tracer kinetic modelling. Flow, Diffusion, Extraction, Kinetic modelling based on receptors, enzyme action, and metabolism.</p> <p>Drug interactions with radiopharmaceuticals: Known interactions of drugs with radiopharmaceuticals and their effects.</p> <p>Regulations, ethics, and registration of radiopharmaceuticals: Ethical use of radionuclides and radiopharmaceuticals in patient care and research. Regulatory authorities and procedures for registration of radiopharmaceuticals.</p>	20

Reference Books

1. Fundamentals of Nuclear Pharmacy-Gopal B.Saha, Springer-Verlag, NewYork.
2. The handbook of Radiopharmaceutical -MohanPatel & Samij Sadack,Chapman & Hall Medicals, London.
3. Nuclear Medicine Technology & Techniques-DonaldR. Bernier,PaulE.Christian & James K. Langan Mosby.
4. Radiopharmaceuticals in Nuclear Pharmacy and Nuclear Medicine by Richard J. Kowalsky, American Pharmacists Association, USA

Practical		Subject Code- BNMT-252P
Total Marks for Evaluation- 100		No. of Contact Hours- 120, Credits:4
S.No.	List of Experiments	Credit Hours
1	Elution and calculation of yield of Molybdenum-99/Tc-99m generator.	120
2	Preparation of Tc-99m labelled radiopharmaceuticals and dispensing of radiopharmaceuticals based on weight.	
3	Determination of ^{99}Mo breakthrough in $^{99\text{m}}\text{Tc}$	
4	Measurement of radiochemical purity by paperchromatography.	
5	Radionuclied Generator	
6	Cyclotran	
7	Nuclear reactor	
8	Radiolabelling	

Reference Books

1. Fundamentals of Nuclear Pharmacy-Gopal B.Saha, Springer-Verlag, New York.
2. The handbook of Radiopharmaceutical -MohanPatel & Samij Sadack,Chapman & Hall Medicals, London.
3. Nuclear Medicine Technology & Techniques-DonaldR. Bernier,PaulE.Christian & James K. Langan Mosby.
4. Radiopharmaceuticals in Nuclear Pharmacy and Nuclear Medicine by Richard J. Kowalsky, American Pharmacists Association, USA

PAPER-3: Radiobiology

Theory	Subject Code- BNMT-203
Total marks for evaluation- 100	No. of contact hours- 120, Credits:4

Course Objective:

To provide a foundational understanding of the biological effects of ionizing radiation and essential principles of radiation protection to ensure safe and effective use in medical and industrial applications.

Course Outcomes (COs):

- CO1:** Understand how radiation affects cells and how cells repair the damage.
- CO2:** Understand cell survival curves, mechanisms of cell damage, and the acute effects of radiation on the body, including medical countermeasures.
- CO3:** Understand the heritable effects of radiation, including mechanisms, disorders, and the impact of radiation on embryos and fetuses.
- CO4:** Understand radiation risks in nuclear medicine, including patient doses, occupational exposure, and heritable effects on humans and embryos.
- CO5:** Understand the mechanisms of radiation carcinogenesis, types of radiation-induced cancers, and radiation risks in nuclear medicine procedures.

Unit	Contents	Credit Hours
1	General Cell Biology and mammalian cell-growth and replication cycles, interaction of radiation with cells, mechanism of damage, nature of damage Effect of radiation on cells: Directly and indirectly ionising radiation, Direct and Indirect action of radiation, Deterministic (Tissue reaction) and Stochastic effects of radiation, Mechanisms of chromosomal & DNA damage and repair	20
2	Cell survival curve: Linear quadratic and multi target models of cell damage mechanism of cell killing, Relationship of dose, dose rate, and cell age to radiosensitivity, Linear energy transfer and Relative Biological effectiveness of radiation Acute effects of radiation: Acute radiation syndrome, Prodromal, Cerebrovascular, Gastrointestinal, and Haematopoietic syndromes, Acute effects on lungs and skin; Medical countermeasures to radiation exposure	25

	(radioprotectors)	
3	<p>Heritable effects of radiation: Mechanisms of radiation-induced heritable effects (Mendelian disorders, Chromosomal aberrations, and multi factorial disorders), Examples of such disorders in human beings. Effects of radiation on the embryo and foetus: Radiation-induced death and disorders and their relation to the radiation dose & gestational time.</p>	20
4	<p>Radiation risks in diagnostic and therapeutic Nuclear Medicine procedures: Effective whole body and organ doses to patients during Nuclear Medicine and relevant radiological diagnostic procedures; Occupational exposures to radiation workers</p> <p>Heritable effects of radiation: Mechanisms of radiation-induced heritable effects (Mendelian disorders, Chromosomal aberrations, and multi factorial disorders), Examples of such disorders in human beings.</p> <p>Effects of radiation on the embryo and foetus: Radiation-induced death and disorders and their relation to the radiation dose & gestational time</p>	35
5	<p>Radiation carcinogenesis: Mechanism of carcinogenesis and the role of radiation, Types of radiation-induced cancers and their temporal relation to the exposure, Cancer risk estimate to radiation, Dose and Dose-rate effectiveness factor (DDREF)</p> <p>Radiation risks in diagnostic and therapeutic Nuclear Medicine procedures: Effective whole body and organ doses to patients during Nuclear Medicine and relevant radiological diagnostic procedures; Occupational exposures to radiation workers.</p>	20

Reference Books- Basic Clinical Radiobiology, Michael Joiner and Albert van der Kogel

PAPER-4: Nuclear Medicine Instrumentation & Quality assurance

Theory	Subject Code- BNMT-204
Total marks for evaluation- 100	No. of contact hours- 120, Credits:4

Course Objective:

To understand how nuclear medicine instruments work and learn how to check and maintain their quality for safe and accurate use.

Course Outcomes (COs):

CO1: Understand the construction, principles, and quality control of well counters, thyroid uptake probes, and intraoperative probes.

CO2: Understand the construction, working principles, and quality control of whole body counters, liquid scintillation counters, and neutron detectors.

CO3: Understand the construction, operation, and collimator types of gamma cameras and SPECT/CT systems.

CO4: Understand the parameters, image reconstruction techniques, and quality control of SPECT, along with the basics of ultrasound, MRI, ECG, and other medical monitoring systems.

CO5: Understand the construction, working principles, and quality control of PET, PET/CT, and CT systems, including acquisition protocols and dose parameters.

Unit	Contents	Credit Hours
1	Well counter: Construction and principles of operation, Crystal characteristics suited for detection of various radionuclides, Signal output, applications; Quality control of well counter. Thyroid uptake probe & Intraoperative Probes: Types, Construction, basic working principles. Quality control of thyroid uptake probe and intraoperative probe.	20
2	Whole body counters: Construction, basic working principles and quality control. Liquid Scintillation	25

	Counters: Construction, Quenching and quench corrections methods, Internal standard method, external standard method and channel ratio method Neutron detectors: Basic principles and applications.	
3	Gamma Camera and SPECT/CT: Construction and principles of operation: Collimators and practical considerations - parallel hole and its types (based on quality parameters: high resolution, high sensitivity, general purpose; based on energy of incident ray: high / medium / low energy, s), pinhole, diverging / converging, fan beam collimators.	20
4	SPECT: Parameters of acquisition (linear sampling, angular sampling, degrees of rotation, continuous / step & shoot, circular / elliptical), image reconstruction techniques, filters, artefacts in SPECT (attenuation correction, non-uniformity corrections, correction with combined SPECT-CT system), effect of scatter & scatter correction, partial volume effects, multi detector SPECT, coincidence, SPECT acquisition-step & shoot/continuous Quality control of gamma camera: Tuning, Uniformity, Linearity, Spatial resolution, Sensitivity, centre of rotation Introduction to Ultrasound and MRI, ECG monitor, Treadmill system, Infusion pump	35
5	Positron Emission Tomography (PET) and PET/CT: Construction and working principles, PET crystals, acquisition protocols, 3D PET acquisition, time of flight, Hybrid PET/CT. Quality control of PET: Calibration with dose calibrator, Uniformity Computed Tomography: Construction and working principles, CT detectors, helical CT, acquisition protocols, CT reconstruction, CT based attenuation correction. Dose parameters. Quality control of CT	20

Reference Books:

1. Physics in Nuclear Medicine, Simon R. Cherry, James A. Sorenson & Michael E. Phelps, Saunders Elsevier publications
2. Essentials of Nuclear Medicine Physics and Instrumentation, Rachel A. Powsner, Matthew R. Palmer, Edward R. Powsner, Wiley Blackwell Publications
3. Basics of PET Imaging, Gopal B. Saha, Springer

Nuclear medicine Instrumentation & Quality assurance Practical

Practical	Subject Code- BNMT-253P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S.No.	List of Experiments	Credit Hours
1	Calibration of spectrometer, finding energy resolution	120
2	Identification of an unknown radionuclide	
3	Quality control of Dose Calibrator: Dose linearity, Constancy, Accuracy, Geometric variation	
4	Quality control of gamma camera: Tuning, Uniformity, Linearity, Spatial resolution, Sensitivity, High count rate performance, Centre of rotation	
5	Quality control of PET	
6	Quality control of Computed Tomography	
7	Thyroid uptake probe: Iso-response curve	

Reference Books

1. Physics in Nuclear Medicine, Simon R Cherry, James A. Sorenson & Michael E. Phelps, Saunders Elsevier publications
2. Essentials of Nuclear Medicine Physics and Instrumentation, Rachel A. Powsner, Matthew R. Palmer, Edward R. Powsner, Wiley Blackwell Publications
3. Basics of PET Imaging, Gopal B. Saha, Springer

PAPER-5: Applied Mathematics

Theory	Subject Code- BNMT-205
Total marks for evaluation- 100	No. of contact hours- 120, Credits:4

Course Objective:

To apply basic mathematical concepts for calculations, data analysis, and interpretation in nuclear medicine procedures.

CO1: Understand the concepts of differentiation, including derivatives of various functions, successive differentiation, and Leibnitz theorem.

CO2: Understand the methods of integration, including substitution, parts, definite integrals, and simple cases of double integrals.

CO3: Understand the concepts of matrices, including adjoint, inverse, rank, determinant properties, and elementary transformations,

CO4: Understand vector operations, including dot and cross products, derivatives of vectors, and gradient of scalar point functions.

CO5: Understand numerical methods, including accuracy, errors, iteration techniques, and the Newton-Raphson method for solving equations.

Unit	Contents	Credit Hours
1	Differential calculus:- Differentiation-Derivative of a function of a real variable, derivatives of circular and inverse circular function, hyperbolic and inverse hyperbolic functions, successive differentiation, Leibnitz theorem (statement without proof) and simple problems.	20
2	Integration: Primitive, different methods of integration, integration by substitution and integration by parts, define integrals and its properties , double integrals (simple case only)	25
3	Linear algebra: Definition of a matrix, adjoint and inverse of a square matrix, orthogonal matrix, rank of a matrix, elementary transformation of a matrix-reduction of a matrix to normal . Determinant of square matrix of	20

	order n , its properties, multiplication of determinants.	
4	Vector analysis: Dot and cross product of vectors, products of three or more vectors, derivative of a vector with respect to scalar parameter, gradient of a scalar point function, solenoid and rotational vectors.	35
5	Numerical methods: Numerical methods, accuracy and errors on calculations, evaluation formulae. Iteration for solving $X = g(X)$, initial approximation and convergence criteria, Newton Raphson method	20

Reference Books

1. Calculus: Early Transcendentals

Hospital Postings

Practical	Subject Code- BNMT-254P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S.No.	List of Experiments	Credit Hours
1.	Students shall be deputed to various labs of Nuclear Medicine department wherein they shall undergo practical	120
2.	Training of handling patients, Nuclear Medicine procedures, etc. and equipments.	
3.	Identification of patient's	
4.	Student will practice about Radionuclide's.	
5.	Process of performing various Nuclear Medicine Procedures from different equipments.	
6.	Each student is required to maintain a logbook of the various postings.	
7.	Evaluated on continuous basis by the faculty posted in various sections.	
8.	Assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.	

Bachelor of Science in Nuclear Medicine Technology (B.Sc. NMT)

3rd YEAR

PAPER-1: Therapeutic Nuclear Medicine and Radiation Dosimetry

Theory	Subject Code- NMT-301
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

This course gives detailed knowledge and practical experience in using therapeutic radionuclides. Students will be trained to choose proper radionuclides according to their physical and biological characteristics, internal radiation dosimetry, and implementation of standardized treatment protocols. The course focuses on clinical procedures, radiation protection, and evidence-based follow-up care.

Course Outcomes (COs)

CO 1- Describe the ideal physical and biological characteristics of therapeutic radionuclides and apply criteria to select appropriate radionuclides based on disease pathology, target requirements, and radiation emission profiles.

CO 2- Explain the mechanism of radiation-induced cell killing, differentiating between the effects of alpha, beta, and Auger electron emitters at the cellular and molecular level.

CO 3- Apply the principles of internal radiation dosimetry, including the MIRD formalism, and use relevant software and phantoms to perform dose calculations for radionuclide therapy.

CO 4- Demonstrate comprehensive knowledge of clinical protocols for key radionuclide therapies, including I-131 therapy, mIBG therapy, PRRT, and treatments for bone pain, joint disorders, and liver tumors.

CO 5- Develop patient-centered treatment plans that include indications, patient preparation, radiopharmaceutical administration, radiation protection measures, post-treatment advice, and structured follow-up care across various radionuclide therapies.

Unit	Contents	Credit Hours
1	Ideal characteristics of therapeutic radionuclide. Choosing an appropriate radionuclide based on its physical characteristics and target requirements. Mechanism of cell killing. Radiation dosimetry: Basic concept of internal radiation dosimetry, MIRD method, Phantoms and software used for dosimetry, Quantitation of activity, Small scale dosimetry and microdosimetry, Dosimetry of various radionuclide therapies.	30

2	<p>Treatment of thyrotoxicosis: Indications, Patient preparation, dose calculations, administration of I-131 sodium iodide, post-treatment advice and follow up. Treatment of differentiated thyroid cancers of follicular origin: Indications, pre-requisites, patient preparation, dose calculation, administration of I-131 sodium iodide, need for isolation, post-therapy scan, post-treatment advice and follow up.</p>	30
3	<p>mIBG Therapy – Treatment of neuroblastoma and metastatic pheochromocytoma / paraganglioma</p> <p>Peptide receptor radionuclide therapy: Indications (Neuroendocrine tumours, Prostate cancer), choice of radionuclide and ligand, pre-requisites, patient preparation, dose calculation, administration of radiopharmaceutical, need for isolation, post-therapy scan, post-treatment advice and follow up</p>	10
4	<p>Bone pain palliation: Indications, choice of radiopharmaceutical, pre-requisites, patient preparation, post-therapy scan, post-treatment advice and follow up</p> <p>Radiation synovectomy: Indications, choice of radiopharmaceutical, pre-requisites, administration techniques, post-therapy scan, post-treatment advice and follow up</p>	30
5	<p>Radioimmunotherapy: Merits of radioimmunotherapy, monoclonal antibodies, tumour antigens, biotin-avidin system pretargeting, cancers suitable for radioimmunotherapy, choice of radiopharmaceutical, pre-requisites, patient preparation, post-therapy scan, post-treatment advice and follow up Treatment of liver tumours with microspheres: Indications, choice of radiopharmaceutical, pre-requisites, patient preparation, post-therapy scan, post-treatment advice and follow up. Miscellaneous: Treatment of polycythaemia vera, malignant ascites, skin lesions including basal cell carcinoma</p>	20

Reference Books:

1. Basic Science of Nuclear Medicine, Roy P Parker, Peter A S Smith & David Churchill Livingston, New York 35.
2. Essentials of Nuclear Medicine, M.V. Merrick.
3. Mosbys manual of Nuclear Medicine Procedures Bruce Sodee, Paul J. Early & Sharon Wikepry, Mosbey Company, London.
4. Essentials of Nuclear Medicine Imaging, Fred Ametter, Milton J.

Therapeutic Nuclear Medicine and Radiation Dosimetry Practical

Practical	Subject Code- BNMT-301P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S.No.	List of Experiment	Credit Hours
1	Patient preparation, administration, and post-administration care in nuclear medicine treatment procedures-thyrotoxicosis, thyroid cancer, neuro endocrine tumour therapy and other internal radiation therapy procedures.	120

Reference Books

1. Principles and practice of Nuclear Medicine, Bruce Sodee, Paul J. Early & Sharon Wikepry.
2. Basic Science of Nuclear Medicine, Roy P Parker, Peter A S Smith & David Churchill Livingston, New York 35.
3. Essentials of Nuclear Medicine, M.V. Merrick.
4. Mosbeys manual of Nuclear Medicine Procedures Bruce Sodee, Paul J. Early & Sharon Wikepry, Mosbey Company, London.
5. Nuclear Medicine Technology & Techniques -Donald R. Bernier, Paul E. Christian, & James K. Langan Mosby.

PAPER-2: Diagnostic Nuclear Medicine Technique

Theory	Subject Code- BNMT-302
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

This course is designed to provide students with in-depth knowledge and practical exposure to diagnostic nuclear medicine, including organ system-based imaging, in-vivo and in-vitro diagnostic tests, and emergency procedures. The course focuses on the principles of physiology, radiopharmaceutical methods, analysis of nuclear medicine scans, and correlation with clinical observations in a variety of medical conditions.

Course Outcomes (COs)

CO1- Understand and interpret the principles and clinical applications of nuclear medicine imaging across all major organ systems.

CO2- Perform and interpret a range of advanced nuclear medicine procedures for functional and anatomical evaluation across diverse clinical scenarios.

CO3- Apply non-imaging nuclear medicine techniques, including in-vivo functional tests and in-vitro assays for diagnostic evaluation.

CO4- Identify and manage specialized nuclear medicine investigations for lymphatic mapping, protein loss, and infection or inflammation detection.

CO5- Demonstrate readiness in emergency nuclear medicine procedures and contrast-enhanced CT, including agent selection, precautions, and multiphasic CT applications in hybrid imaging.

Unit	Contents	Credit Hours
1	<p>Renal system: Renogram, diuretic renogram, renogram to detect renovascular hypertension (ACE inhibitor, Angiotensin receptor antagonist, Aspirin and Exercise renograms), Vesico ureteric reflux study(Direct and Indirect), evaluation of donors and renal transplant recipients, and renal cortical imaging.</p> <p>Musculo skeletal system: Bone imaging-three phase, whole body and spot for various malignant and benign conditions (benign tumours, metabolic bone disease, trauma, vascular, infection and inflammation) F-18 Fluoride PET/CT, bone marrow imaging.</p>	30
2	<p>Liver and Hepatobiliary system: Liver-spleen study, bloodpool</p>	30

	<p>imaging, spleen imaging with denatured RBCs, Hepatobiliary imaging for function, bile leak, obstruction, neonatal cholestasis, biliary reflux, and Gall bladder functional evaluation.</p> <p>Gastrointestinal system: Salivary scintigraphy, Gastrointestinal motility studies (oesophageal transit, gastro-oesophageal reflux, gastric emptying, small & large bowel transit), Meckel's scan, and GI bleed study.</p> <p>Lung imaging system: Ventilation scan using Tc-99m DTPA aerosol, evaluation of aerosols generators, evaluation of COPD & Pulmonary permeability, lung perfusion imaging.</p>	
3	<p>Cardio vascular system: ERNA, First pass RNA, Stress-Rest myocardial perfusion imaging, myocardial viability studies (Tc-99m MIBI, Tl-201, F-18FDG), cardiac inflammation imaging, sympathetic innervation imaging, and infarct imaging.</p> <p>Central nervous system: Brain perfusion/metabolism/Dopamine transporter imaging, Evaluation of epilepsy, cerebrovascular accident, dementia, motor neuron disorders, etc. CSF cisternography for CSF leak, patency of ventriculoperitoneal shunt, Evaluation of brain tumours (GHA, FDG, etc) and brain death.</p> <p>Endocrinesystem: Thyroid imaging and uptake (99mTc and 131I), 131I whole-body imaging, Parathyroid imaging, insulinoma, adrenal cortical and medullary imaging</p>	30
4	<p>Oncology: lymphoma, cancers of breast / lung / gastrointestinal system / genitor urinary tract, bone tumours, neuroendocrine tumours, brain tumours, etc. (such as F-18 FDG, F-18 Fluoride PET/CT, Ga-68 DOTANOC, I-131 MIBG)</p> <p>Miscellaneous: gastrointestinal protein loss estimation, Lymphoscintigraphy, Sentinel Lymph Node Imaging, Radio immuno scintigraphy (RIS), Scrotal scintigraphy, pleuroperitoneal shunt, Hysterosalpingo scintigraphy, Scinti mammography, Dacryo scintigraphy, Infection and inflammation imaging (Ga-67 citrate, Tc-99m labelled WBCs, F-18 FDG, F-18 FDG WBCs)</p>	18
5	<p>Contrast-enhanced CT: Types of contrast and precautions, multi-phasic CT</p> <p>In-vivo diagnostic procedures: Thyroid uptake study and Perchloratedis charge test</p> <p>In-vitro diagnostic studies: Radioimmunoassay (RIA) and Immunoradiometric assay (IRMA), Renal clearance measurements (GFR, ERPF), Urea breath analysis, Blood volume measurement, red blood cell lifespan, Intrinsic factor assay, Ferro kinetic studies</p> <p>Emergency nuclear medicine procedures.</p>	12

Reference Books

1. Principles and Practice of Nuclear Medicine. Paul J. Early, D., Bruce Sodee
2. Mosbey's manual of Nuclear Medicine Procedures Bruce Sodee, Paul J. Early & Sharon Wikeptry, Mosbey Company, London.
3. Essentials of Nuclear Medicine, M. V. Merrick
4. Basic Science of Nuclear Medicine, Roy P Parker, Peter A S Smith & David Churchill Livingston, New York 35
5. Essentials of Nuclear Medicine Imaging, Fred A Metter, Milton J

Diagnostic Nuclear Medicine Technique Practical

Practical	Subject Code- BNMT-302 IP
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S. No.	List of Experiment	Credit Hours
7.	Patient preparation, Acquisition protocol, Data processing of planar, SPECT and SPECT/CT, and PET/CT images- musculoskeletal, cardiac, endocrine, hepatobiliary, gastrointestinal, genitourinary, infection, brain, and oncological imaging procedures	120
8.	Patient preparation, performance, and display of results of non-imaging in-vivo and in-vitro nuclear medicine procedures	

Reference Books:

1. Principles and Practice of Nuclear Medicine. Paul J. Early, D., Bruce Sodee
2. Mosbey's manual of Nuclear Medicine Procedures Bruce Sodee, Paul J. Early & Sharon Wikeptry, Mosbey Company, London.
3. Essentials of Nuclear Medicine, M. V. Merrick
4. Basic Science of Nuclear Medicine, Roy P Parker, Peter A S Smith & David Churchill Livingston, New York 35

PAPER-3: Recent advances, Planning and Regulatory Requirements

Theory	Subject Code- BNMT-303
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

To provide students with advanced knowledge of cutting-edge technologies, innovations in imaging and therapy, quality assurance protocols, and regulatory and infrastructural requirements for modern nuclear medicine practice.

Course Outcomes (COs)

CO 1- Explore the latest tools and techniques in nuclear medicine—like digital PET, total body PET/CT, PET/MRI, the agnostics, and advanced radiopharmaceuticals—to stay current with technological progress.

CO 2- Use emerging methods such as artificial intelligence, dynamic and 4D PET imaging, and PET-guided biopsy to enhance clinical decision-making and precision in patient care.

CO 3- Understand how to plan and design safe, efficient nuclear medicine facilities, including proper shielding, layout, and safety measures for both staff and patients.

CO 4- Navigate the key regulatory requirements from AERB and other agencies for setting up and operating nuclear medicine services, including record-keeping, waste management, and equipment calibration.

CO 5- Maintain high standards of quality by performing regular equipment checks, following quality control protocols, and ensuring all nuclear medicine procedures meet safety and performance benchmarks.

Unit	Contents	Credit Hours
1	Recent advances in instrumentation: Digital PET systems, Total body PET/CT, PET/MRI, Breast-specific gamma cameras, Positron Emission Mammography, Cardiac-specific gamma cameras, small animal imaging systems, PET-guided biopsy Recent advances in image processing techniques: Introduction to newer reconstruction algorithms, partial-volume correction, and collimator-detector response recovery.	20
2	PET: List mode, Dynamic PET, 4D imaging (Respiratory gating methods) Image-guided radiotherapy: Principles and applications Artificial intelligence in Nuclear Imaging: Basic concept of artificial intelligence, classification, and applications in nuclear imaging, processing, and analysis	20

3	<p>Recent advances in radionuclide therapy: Theragnostics, personalised nuclear medicine, patient-specific dosimetry, alpha therapy</p> <p>Recent advances in Radiopharmacy: Newer radiopharmaceuticals, liposome-labelling, nanotechnology, etc.</p>	30
4	<p>Planning of Nuclear Medicine (NM) facilities: Classification and general features of NM laboratories (site, typical floor plan, ventilation, surface walls, floor and ceiling); Planning of radiation installation (Radiopharmacy, gammacamera, SPECT/CT, PET/CT, radionuclide therapy wards): protection from primary, leakage, and scattered radiation. Concepts of workload use factor, occupancy factor & distance.</p> <p>Barrier design: barrier materials-concrete, brick and lead, Primary & secondary barrier design calculations, design of doors, control of radiation-effects of time, distance and shielding.</p> <p>Regulatory requirements: AERB safety code and ethics, No Objection Certificates for facilities, radionuclides, and radiation equipment; Procedure for Commissioning, Operation, and Decommissioning of equipment, Calibration of radiation detection equipment (survey meters, area zone monitors, dose calibrators)</p>	30
5	<p>Operational safety, Radiation protection programme, Personnel requirements and responsibilities, Annual report submission to AERB.</p> <p>Record keeping for radionuclide storage, waste disposal, survey, spills, misadministration, personnel dosimeter recordings, quality control of equipment</p> <p>Quality in Nuclear Medicine: Principles of quality, standards, measures to maintain quality</p> <p>Quality assurance of equipment: Acceptance test during installation - Routine daily checking the power line - Air conditioning efficiency - dust free atmosphere - Making the availability of service then and there - Routine quality control study of different equipment periodically without delay - Maintenance of service record.</p>	20

Reference Books:

1. Basic radiological physics. Jaypee Brothers Private limited, New Delhi.
2. An Introduction to Radiation Protection. Allen Martin & Samuel.
3. Radiation safety in Medical practice. M.M. Rehani.

PAPER-4: Radiation Protection in Nuclear Medicine

Theory	Subject Code- BNMT-304
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

This course is designed to help students fully understand how to work safely with radioactive materials by covering key principles of radiation protection and regulations. It also prepares them to confidently manage monitoring tools, waste disposal, and emergencies in nuclear medicine settings.

Course Outcomes (COs)

- CO 1-** Understand the principles of radiation protection and regulatory guidelines from ICRP, NCRP, IAEA, and AERB.
- CO 2-** Apply appropriate radiation safety measures using shielding, PPE, and monitoring devices in clinical settings.
- CO 3-** Demonstrate radiation monitoring procedures such as wipe tests and area surveys in nuclear medicine facilities.
- CO 4-** Manage the safe handling, transport, and record-keeping of radioactive materials as per regulatory norms.
- CO 5-** Evaluate radioactive waste disposal methods and response strategies for misadministration and radiation emergencies.

Unit	Contents	Credit Hours
1	Radiation Protection Principles of radiation protection: The need for radiation protection Safe handling of radioactive materials Recommendations (ICRP, NCRP) and regulatory requirements (IAEA, AERB) Negligible individual dose Radiation detriment ALARA, Dose limits to radiation workers, caregivers, and public Annual limit of intake Derived air concentration	25
2	Radiation Protective Equipment Shielding: lead barriers, syringe shields, lead aprons, lead gloves Radiation monitoring devices: Personnel monitoring systems: pocket dosimeters, film badges, and thermos luminescent dosimeters (chest, wrist, ring, eye, etc.) Survey meters Contamination monitors Zone monitors Phantoms	25

3	Radiation Monitoring Procedures Wipe test Area monitoring and radiation survey of nuclear medicine lab Radioactive materials: Types of radioactive material packaging and testing Transport of radioactive materials (Categories and Transport Index), TREMCARD Receipt of radioactive material – procedure and test for contamination Maintenance of records	20
4	Procedure for Handling Spills & Emergencies Handling of minor and major spills Measures for containment Decontamination procedure of personnel, equipment, and work area Decontamination kit Radiation emergencies and preparedness Wipe test of nuclear medicine facility	20
5	Radioactive Waste Management & Misadministration Solid, liquid, and gaseous wastes, Principles of waste management Disposal of corpses containing therapeutic doses of radionuclides Misadministration: Definition Procedure for reporting Measures to minimize such events	30

Reference Books:

1. 1. Radiobiology for the Radiologist – Eric J. Hall, Amato J. Giaccia, Wolters Kluwer
2. AERB Safety Code for Nuclear Medicine
3. IAEA Safety Manuals

PAPER-5: Medical Ethics and Patient care

Theory	Subject Code- BNMT-305
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

Course Objective

In this subject students will study about values of life, history of medical ethics and preparation of patient for radiotherapy procedure.

Course Outcomes (COs)

- CO 1-** After the completion of the course students able to use code of ethics.
- CO 2-** Demonstrate understanding of medical ethics, confidentiality, and legal responsibilities, including professional duties towards patients, colleagues, society, and oneself.
- CO 3-** Explain and demonstrate proper patient preparation techniques for general radiotherapy procedures, including premedication, special care considerations, and setup for various examinations.
- CO 4-** Demonstrate the ability to observe, report, and manage patient responses to treatment, including changes in symptoms, blood counts, local/systemic reactions, and provide compassionate terminal care.
- CO 5-** Understand the organizational practices of a radiotherapy department and identify commonly used drugs in radiotherapy procedures.

Unit	Contents	Credit Hours
1	Values of life (Philosophy) in clinical practice & Definition of medical ethics. History of Medical Ethics: Indian perspectives charaka, susruta, the Hippocratic Oath, declaration of Helsinki , WHO declaration of Geneva, International code of Medical Ethics Ethical problems of life: Right to life, prenatal screening / sex selection ,abortion, feticide ,assisted reproductive technologies, genetic testing ,genetic engineering, cloning, care of terminally ill, death and dying, euthanasia, etiquette and mannerism, good communication skill, truthfulness, building trust, honesty with patients, communication with colleagues, seniors and subordinates.	30
2	Confidentiality : Malpractice, negligence, Medical ethics and law Code of ethics: (Please refer Annexure for elaborations) Duties to patients, duties to colleagues and other professionals, duties to yourself, duties to society, duties to your profession, specific issues.	20

3	<p>Preparation of patients for general radiotherapy procedures: Departmental instructions to outpatients or ward staff- use of aperients; enemas and colonic irrigations flatulence and flatus, causes and methods of relief principles of catheterization and intubation, premedication. Its uses and methods; anesthetized patients; diabetic patients' special attention to food hazards of trauma. Preparation of the patients of biopsy and trolley set up; trolley set up for ENT examination, preparation of the patients for pelvic examination and trolley set up, general welfare of the patients during and after the treatment including the care of any inter current diseases (diabetes, tuberculosis, arthritis), diet and fluid intake.</p>	25
4.	<p>The observation and reporting any change in the signs and symptoms of patients receiving treatment, the use of blood count in the control of certain treatment, the care of blood counts, the care of local and systematic reaction, local reaction showed include those in the ear, nose, throat and eye and those arising from treatment given to the pelvis, instrumentation the absolute necessity for accuracy in every aspects of each individual treatment, the terminal care of dying patients.</p>	25
4	<p>Organization of radiotherapy: Department practice, appointment organization in the planning room, treatment area. Management of waiting patients. Drugs used in Radiotherapy: Basic knowledge on drugs used in the department.</p>	20

Reference Books:

1. Nursing foundation by Anuradha
2. Medical Surgical nursing by Javed Ansari and Lewis 3- Stewart C B., MRI Physics and Biological Principle

Hospital Postings

Practical	Subject Code- BNMT-353P
Total Marks for Evaluation- 100	No. of Contact Hours- 120, Credits:4

S.No.	List of Experiments	Credit Hours
1.	Students shall be deputed to various labs of Nuclear Medicine department wherein they shall undergo practical	120
2.	Thyroid uptake	
3.	Bone scan	
4.	Gastric reflux	
5.	Gastric emptying.	
6.	Each student is required to maintain a logbook of the various postings	
7.	Respiratory imaging, GIT Imaging, Renal imaging, Cardiovascular imaging	
8.	Assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.	