



**MANIPAL**

ACADEMY of HIGHER EDUCATION

*(Deemed to be University under Section 3 of the UGC Act, 1956)*

## **Manipal College of Health Professions**

**Manipal Academy of Higher Education, Manipal**

*Outcome-Based Education (OBE) Framework*

**Four years Full time**

**Undergraduate Program**

**Bachelor of Science in**

**Nuclear Medicine Technology**

**(B.Sc. NMT)**

*With effect from July 2020*

## 2. PROGRAM EDUCATION OBJECTIVES (PEOs)

The overall objective of the learning outcome-based curriculum framework (LOCF) for B.Sc. NMT Program are as follows:

PEO No.	Education Objective
<b>PEO 1</b>	Students will be able to use their fundamental knowledge and clinical competence in Nuclear Medicine Science and Technology as and when required to achieve professional excellence.
<b>PEO 2</b>	Students will demonstrate strong and well defined clinical and practical skills in Nuclear medicine diagnostic and therapeutic procedures, radiation safety, Nuclear medicine instrumentation, Radiochemistry and Radiopharmacy
<b>PEO 3</b>	Students will be able to practice the profession with highly professional and ethical attitude, strong communication skills, and effective professional skills to work in a inter-disciplinary team.
<b>PEO 4</b>	Students will be able to use interpersonal and collaborative skills to identify, assess and formulate problems and execute the solution.
<b>PEO 5</b>	Students will be able to imbibe the culture of research, innovation, entrepreneurship and incubation.
<b>PEO 6</b>	Students will be able to participate in lifelong learning process for a highly productive career and will be able to relate the concepts of Medicine, Biology, Radiobiology, Nuclear Physics and Radiochemistry towards serving the cause of the society.

### 3. GRADUATE ATTRIBUTES

S No.	Attribute	Description
1	<b>Professional Knowledge</b>	Demonstrate <b>scientific knowledge and understanding</b> to work as a health care professional
2	<b>Clinical / technical / Laboratory / practical skills</b>	Demonstrate <b>Clinical, technical and practical skills</b> in order to implement the preventive, assessment and management plans for quality health care services
3.	<b>Communication</b>	Ability to communicate effectively and appropriately in writing and orally to patients/clients, care-givers, other health professionals and other members of the community
4.	<b>Cooperation/Team work</b>	Ability to work effectively and respectfully with interdisciplinary team members to achieve coordinated, high quality health care
5.	<b>Professional ethics</b>	Ability to identify ethical issues and apply the ethical values in the professional life
6.	<b>Research / Innovation-related Skills</b>	A sense of inquiry and investigation for raising relevant and contemporary questions, synthesizing and articulating.
7.	<b>Critical thinking and problem solving</b>	Ability to think critically and apply once learning to real-life situations
8.	<b>Reflective thinking</b>	Ability to employ reflective thinking along with the ability to create the sense of awareness of one self and society
9.	<b>Information/digital literacy</b>	Ability to use ICT in a variety of learning situations
10.	<b>Multi-cultural competence</b>	Ability to effectively engage in a multicultural society and interact respectfully
11.	<b>Leadership readiness/qualities</b>	Ability to respond in an autonomous and confident manner to planned and uncertain situations, and should be able to manage themselves and others effectively
12.	<b>Lifelong Learning</b>	Every graduate to be converted into lifelong learner and consistently update himself or herself with current knowledge, skills and technologies. Acquiring Knowledge and creating the understanding in learners that learning will continue throughout life.

## 5. PROGRAM OUTCOMES (POs):

After successful completion of B.Sc.Nuclear Medicine Technology (B.Sc.NMT) program, students will be able to:

PO No.	Attribute	Competency
PO 1	<b>Professional knowledge</b>	Possess and acquire <b>scientific knowledge</b> to work as a health care professional
PO 2	<b>Clinical/ Technical skills</b>	Demonstrate and possess <b>clinical skills</b> to provide quality health care services
PO 3	<b>Team work</b>	Demonstrate <b>team work skills</b> to support shared goals with the interdisciplinary health care team to improve societal health
PO 4	<b>Ethical value &amp; professionalism</b>	Possess and demonstrate <b>ethical values and professionalism</b> within the legal framework of the society
PO 5	<b>Communication</b>	<b>Communicate effectively</b> and appropriately with the interdisciplinary health care team and the society
PO 6	<b>Evidence based practice</b>	Demonstrate high quality <b>evidence based practice</b> that leads to excellence in professional practice
PO 7	<b>Life-long learning</b>	Enhance knowledge and skills with the use of advancing technology for the <b>continual improvement</b> of professional practice
PO 8	<b>Entrepreneurship, leadership and mentorship</b>	Display <b>entrepreneurship, leadership and mentorship</b> skills to practice independently as well as in collaboration with the interdisciplinary health care team

## 6. COURSE STRUCTURE, COURSE WISE LEARNING OBJECTIVE, COURSE OUTCOMES (COs)

### SEMESTER I

Course Code	Course title	Credit distribution (L,T,P, CL are hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
ANA1103	Anatomy	3	-	-	-	3	30	70	100
PHY1101	Physiology - I	2	-	-	-	2	30	70	100
NMT1101	Fundamentals of Electronics	2	1	-	-	3	50	50	100
NMT1102	Radiation Physics	3	1	-	-	4	50	50	100
NMT1111	Practicum - I	-	1	6	-	4	50	50	100
NMT1112	Lab Practice	-	1	6	-	4	100	-	100
	<b>Total</b>	<b>10</b>	<b>4</b>	<b>12</b>	<b>-</b>	<b>20</b>	<b>310</b>	<b>290</b>	<b>600</b>

Note: ESE for

- ANA1103 & PHY1101 will be conducted for 50 marks and normalized to 70 marks for grading.
- NMT1101, NMT1102 and NMT1111 will be conducted for 100 marks and scaled to 50 marks for grading.

### SEMESTER II

Course Code	Course title	Credit distribution (L,T,P, CL are hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
PHY1201	Physiology-II	2	-	-	-	2	30	70	100
BIC1201	Biochemistry	3	-	-	-	3	30	70	100
EIC1001	Environmental Science and Indian Constitution	2	-	-	-	2	100	-	100
CSK1001	Communication Skill	2	-	-	-	2	100	-	100
NMT1201	Cell and Molecular Biology	3	1	-	-	4	50	50	100
NMT1202	Bioethics and Patient Care	2	1	-	-	3	50	50	100
NMT1211	Practicum - II	-	1	4	-	3	50	50	100
NMT1231	Clinical Practice	-	-	-	3	1	100	-	100
	<b>Total</b>	<b>14</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>20</b>	<b>510</b>	<b>290</b>	<b>800</b>

Note: ESE for

- PHY1201 & BIC1201, will be conducted for 50 marks and normalized to 70 marks for grading.
- NMT1201, NMT1202 and NMT1211 will be conducted for 100 marks and scaled to 50 marks for grading.
- IAC for NMT1221, EIC1001 & CSK1001 will be conducted for 50 marks and normalized to 100 marks for grading.

**SEMESTER III**

Course Code	Course title	Credit distribution (L,T,P, CL are hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
NMT2101	Introduction to Radiopharmacy	3	1	-	-	4	50	50	100
NMT2102	Nuclear Medicine Instrumentation Physics	3	1	-	-	4	50	50	100
NMT2103	Mathematics in Nuclear Medicine	2	1	-	-	3	50	50	100
NMT2111	Practicum - III	-	1	6	-	4	50	50	100
NMT2131	Clinical Practice	-	1	-	3	2	100	-	100
*** ****	Open Elective - I	2	1	-	-	3	S/NS		
	<b>Total</b>	<b>10</b>	<b>6</b>	<b>6</b>	<b>3</b>	<b>20</b>	<b>300</b>	<b>200</b>	<b>500</b>

Note: ESE for

- NMT2101, NMT2102, NMT2103 and NMT2111 will be conducted for 100 marks normalized to 50 marks for grading.
- IAC for, NMT2121 will be conducted for 50 marks and normalized to 100 marks for grading.

**SEMESTER IV**

Course Code	Course title	Credit distribution (L,T,P, CL are hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
BST3201	Biostatistics and Research methodology	3	-	-	-	3	30	70	100
NMT2201	Radiobiology	2	1	-	-	3	50	50	100
NMT2202	Health Physics	2	1	-	-	3	50	50	100
NMT2211	Practicum –IV	-	1	4	-	3	50	50	100
NMT2231	Clinical Practice	-	1	-	12	5	100	-	100
NMT****	Program Elective -I	2	1	-	-	3	50	50	100
	<b>Total</b>	<b>10</b>	<b>4</b>	<b>4</b>	<b>12</b>	<b>20</b>	<b>330</b>	<b>270</b>	<b>600</b>

Note:ESE for

- BST3201 will be conducted for 100 marks and normalized to 70 marks for grading.
- NMT2201, NMT2202 and NMT2211 will be conducted for 100 marks and scaled to 50 marks for grading.

**SEMESTER V**

Course Code	Course title	Credit distribution (L,T,P, CL are hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
NMT3101	Radiopharmacy in Nuclear Medicine	3	1	-	-	4	50	50	100
NMT3102	Therapeutic Nuclear Medicine	2	1	-	-	3	50	50	100
NMT3103	Clinical Nuclear Medicine - I	3	1	-	-	4	50	50	100
NMT3111	Practicum - V	-	1	4	-	3	50	50	100
NMT3131	Clinical Practice	-	1	-	6	3	100	-	100
*** ****	Open Elective - II	-	-	-	-	3	S/NS		
	<b>Total</b>	<b>8</b>	<b>5</b>	<b>4</b>	<b>6</b>	<b>20</b>	<b>300</b>	<b>200</b>	<b>500</b>

Note: ESE for

- NMT3101, NMT3102, NMT3103 and NMT3111 will be conducted for 100 marks and normalized to 50 marks for grading.

**SEMESTER VI**

Course Code	Course title	Credit distribution (L,T,P,CL are hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
NMT3201	Tomography and hybrid imaging	3	1	-	-	4	50	50	100
NMT3202	Clinical Nuclear Medicine - II	3	1	-	-	4	50	50	100
NMT3211	Practicum - VI	-	2	4	-	4	50	50	100
NMT3231	Clinical Practice	-	1	-	12	5	100	-	100
NMT ****	Program Elective - II	2	1	-	-	3	50	50	100
	<b>Total</b>	<b>8</b>	<b>6</b>	<b>4</b>	<b>12</b>	<b>20</b>	<b>300</b>	<b>200</b>	<b>500</b>

Note: ESE for

- NMT3201, NMT3202 and NMT3211 will be conducted for 100 marks and normalized to 50 marks for grading

### Open Electives

Open elective is credited, choice-based and is graded as satisfactory / not satisfactory (S/NS). Students make a choice from pool of electives offered by MAHE institution / Online courses as approved by the department

### Program Electives

Program elective is credited and choice-based. The students make a choice from pool of electives offered by the department. The ESE is conducted for 50 marks.

Semester	Course Code	Course Title	Credit (s) Distribution (L,T,P,CL are hours/week)				
			L	T	P	CL	CR
IV Semester	NMT2241	Non Imaging Nuclear Medicine Techniques	2	1	-	-	3
	NMT2242	Radioimmunology	2	1	-	-	3
VI Semester	NMT3241	Principles and Techniques in Radiopharmaceutical Development	2	1	-	-	3
	NMT3242	Principles and Techniques in Nuclear Medicine Image Analysis	2	1	-	-	3

### SEMESTER - VII and VIII Internship (1 year, 48 hours/week)

SEMESTER VII		SEMESTER VIII	
Course	Duration	Course	Duration
Internship	6 months	Internship	6 months
<b>Total</b>	<b>12 months ( CL = 48 hours / week)</b>		

### TOTAL DEGREE CREDIT DISTRIBUTION

Semester	Credit distribution (L,T,P, CL are hours/week)					Marks Distribution		
	L	T	P	CL	C	IAC	ESE	Total
Semester - I	10	4	12	-	20	310	290	600
Semester - II	14	3	4	3	20	510	290	800
Semester - III	10	6	6	3	20	300	200	500
Semester - IV	10	4	4	12	20	330	270	600
Semester - V	8	5	4	6	20	300	200	500
Semester - VI	8	6	4	12	20	300	200	500
Semester - VII (Internship)	-	-	-	48	-	-	-	-
Semester - VIII (Internship)	-	-	-	48	-	-	-	-
<b>Total</b>					<b>120</b>	<b>2050</b>	<b>1450</b>	<b>3500</b>