Guidelines for M.Tech(IT) & M.Tech-PhD(IT) Specialization NEP-2020 Based PG Curriculum 2023-24

This document supersedes all prior documents in this regard

1. The Department of Information Technology (IT) offers 7 Specializations as shown in Table 2.
2. Students are selected through CCMT (CENTRALIZED COUNSELLING FOR M.TECH. / M.ARCH. / M.PLAN. ADMISSIONS: *https://ccmt.nic.in/WebInfo21/Page/Page?PageId=1&LangId=P*

Table 1.

OPEN	OPEN-PwD	EWS	EWS-PwD	SC	SC-PwD	ST	ST-PwD	OBC	OBC-PwD	Total
48	3	11	1	18	1	9	0	32	2	125

3. Apart from CCMT selection the Department of IT takes admission of limited students through Direct Admission of Students Abroad (DASA): DASA PG 2021

4. The IT Department is offering the following specializations in each group:

Table 2.

Si. No.	Groups	Specialization	M. Tech. Seats per Group	M.Tech-PhD Seats
1.	Machine Learning, Robotics and Human Computer Interaction Group.	Machine Learning and Intelligent Systems (MLIS)	48	5
		Robotics and Machine Intelligence (RMI)		
		Human Computer Interaction (HCI)		
2.	Software and Data Engineering Group	Software Engineering (SE)	32	4
		Data Engineering (DE)		
3.	Network and Security Group	Wireless Communication and Computing (WCC)	32	4
		Cyber Laws and Information Security (CLIS)		
		Total Seats	**112**	**13**

Every student will be allocated a specialization after the completion of the first semester. For example, if a student opts for **Machine Learning, Robotics and Human Computer Interaction Group**, he/she will get a chance to opt for

Machine Learning and Intelligent Systems (MLIS) or

Robotics and Machine Intelligence (RMI) or

Human-Computer Interaction (HCI).

The student may get any of the three specializations mentioned above based on his/her performance (GPA points) in the first semester. Please note that every specialization has an equal number of seats.

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For M.Tech.-Ph.D. Programme; 5+4+4 =13 seats (Table 2) have been kept reserved. This is in tune with the spirit of **NEP 2020**. It is envisaged with a target towards research leading to a PhD programme with a minimum duration of 04 years, and with a possible exit for the award of MTech degree and/or PG Diploma in case of exigency.

The credits for all courses are given in LTP format. L stands for Lecture, T for Tutorial, P for Practice/Practical. L=3 signifies 3 hours of Lectures per week, T=1 signifies 1 hour of Tutorial per week, and P=1 corresponds to 2 hours Practice/Practical per week. The Practice/Practical component of the course could also be a Term paper or Term Paper along with the lab.

Please refer to the M.Tech. and Ph.D. Ordinance for the other details of the M. Tech. and Ph.D. programmes that is available at the following link: https://aaa.iiita.ac.in/

1. First semester subjects for all the candidates admitted in M.Tech. (IT) Group shall be common within the Group.

2. **Seat Allocation**
   a. Every student will be allocated a specialization from within the Group based on his/her choice and performance in the 1st Semester.
   b. After the completion of the first semester, the students will be asked to select the specializations within the Group, offered by the Department in that academic session as per the procedures laid down by the Department of IT.
   c. The following procedure will be followed for allocation of the specializations
      i. The students will be asked to submit their preferences for all the specializations within the group. It will be mandatory for the students to fill all the preferences relevant to the Group. Specializations from other groups will not be allowed.
      ii. The department will allocate the specializations to the students in accordance with
         a. Students' preferences
         b. The 1st semester's SGPI.
         c. Total number of the seats in each specialization will be the same within the group.

3. The Department reserves the right to offer or not a particular specialization. It is possible that all specializations given in Table 2 may not run. **Minimum number of seats for a specialization to run shall be decided by the Department at the end of the first semester.** The specializations that will be offered shall be announced before the commencement of the 2nd Semester.

4. It is expected that the student will work on M.Tech. Project/Thesis in tune with the specialization assigned to him/her. So, the selection of project Mentor(s)/Supervisor(s) has to be made before the commencement of the second semester.

5. Students will have to register their Project Mentor/Supervisor, for the **2nd Semester** Project, as soon as their specialization is decided. ***The department will ensure a procedure for the number of students to be Supervised by a Faculty.*** In normal circumstances, the Project Mentor/Supervisor will not be changed for the **3rd** and **4th** semester Thesis work. It shall be the endeavor to see the three semester Projects/Thesis to

be connected, which will enable the students to go deep into the specialization and at the end students will be able to have a good research outcome in the form of publication/ patent out of their M.Tech. Thesis work.

6. Under extraordinary circumstances the change of supervisor will be with the approval of the DPGC.

The Institute reserves the right to take appropriate decisions in regard to the implementation of the "**Guidelines for choosing M. Tech (IT) Specialization 2023-24**", which shall be binding to all concerned.

For any other Details regarding the M.Tech. Course :
The M.Tech Ordinance of IIIT-Allahabad may please be referred to:
https://egazette. 73046.pdf
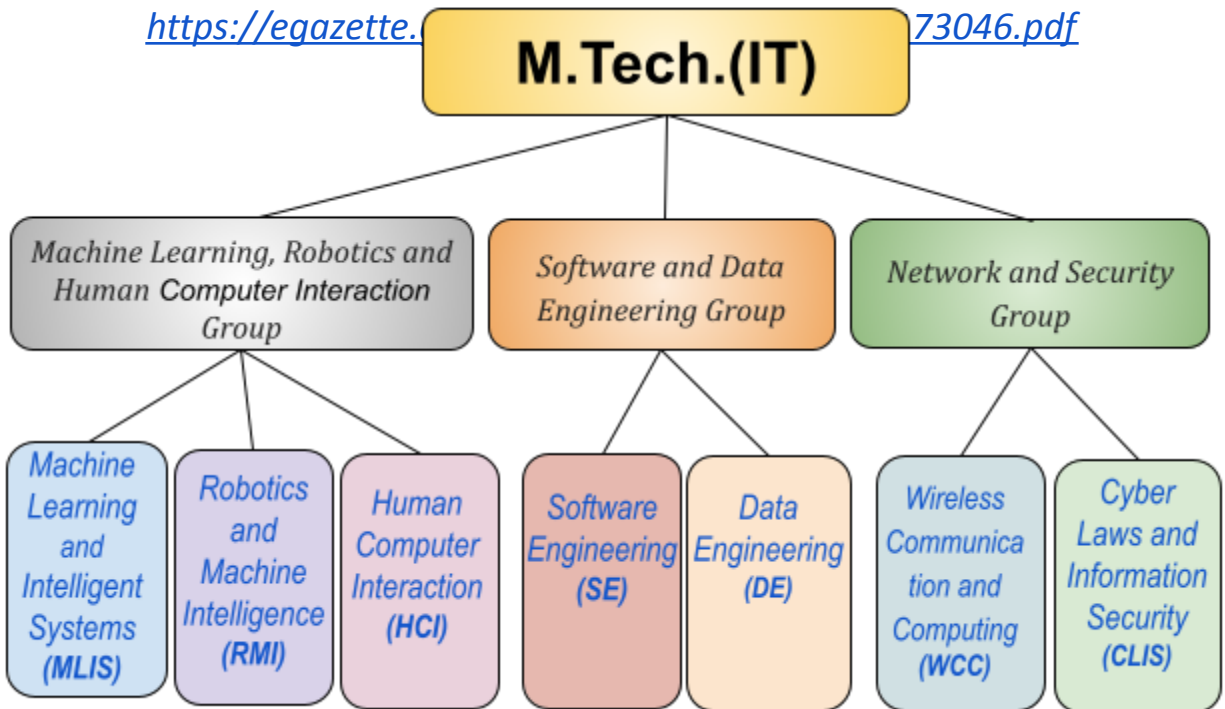
MTech-PhD program

Salient features

1. *Degree:* MTech-PhD degree shall be given upon successful completion of the programme, when the student defends his Ph.D. Thesis. Provisional MTech degree shall be given after submission of the PhD thesis.

2. *Seats:* The total number of M.Tech.-Ph.D. Seats (5+4+4=13) (Table-2) is taken from the present sanctioned MTech programme seats such that the overall seat matrix will remain unchanged.

3. *Duration:* The minimum duration of the program will be 4 years, including the M.Tech portion.

4. *Scholarship:* Scholarship will be paid for a maximum period of 05 years. Scholarship will be paid only to those students who complete the M.Tech-PhD programme.
   - First year MTech Scholarship
   - Second and Third year Ph.D.'s Junior Research Fellowship (JRF)
   - Fourth year Senior Research Fellowship (SRF). The student will move SRF only after only after an assessment of his research work by the prescribed committee defined for the purpose (Doctoral Committee of the student which should include an external examiner). If the work by the student is not to the marks and unsatisfactory, the assessment committee may recommend the continuation of JRF or terminate the Fellowship.
   - Financial support may further be extended to a maximum of 1 year. This will depend on the (i) strict assessment of the students research performance, with a final approval of the Chairman Senate.

5. *Exit Options:* The exit with MTech will be considered only after completion of the first 2+ years. This exit shall not be a voluntary exit and will happen only if a student has outstanding dropped courses at the beginning of the third semester. In such cases, the student will be required to complete the requirements of MTech programmes (credits and thesis). The exit with PG Diploma will be considered only after 1+ year upon completion of at least 32 credits. Such students would be considered for lateral admission to complete an MTech degree. However, they will not be considered for the PhD program, nor will they be paid any fellowship to complete the remaining credits required for their exit degree of M.Tech/ PG Diploma.

6. *Course Fee:* M.Tech-PhD students will pay fees like the regular M.Tech Students, an M.Tech Fee for the 1st 4 Semesters. From the 5th Semester They will pay the fees on par with the regular PhD students. The students who have been given an exit option will pay the regular M.Tech Fees for the semester.

7. *Supervisor:* To be fixed before the commencement of the 2nd semester in accordance with the provisions of the PhD ordinance.

8. *Doctoral Committee:* To be constituted before the commencement of the 2nd semester in accordance with the provisions of the PhD ordinance

Justification: Benefits of the MTech-PhD programme:

1. Early start of research work and publication – *Students will embrace the research and innovation culture of the institute. He/she will start contributing towards research activity from start and well in advance*

2. Programme in line to respect the spirit of NEP – *To encourage research culture, students will be motivated to join the MTech-PhD program. However, PG diploma and M.Tech. will be given an exit option as per NEP 2020 will be applicable. Details of the credit table with Exit Scheme are tabulated below.*

3. From past experience, the M.Tech. - Ph.D. programme has produced extremely good Ph.D. research for the institute.

Sem	I	II	Summer	III	IV	V	VI	VII	VIII
Year	1			2		3		4	
Credits	16+4=20	16+4=20	8	12+4=16	12	12	12	12	12
	PG Diploma								
	Regular M.Tech								
	MTech-PhD Exit with M.Tech								
	MTech Fellowship		*J.R.F.*						
							S.R.F.		

M.Tech (IT) Course Structure with Different Specializations
M.Tech Credit Distribution

Table 4.

| Semester Number	Mandatory Credit Required for M.Tech	Mandatory Credit Required for M.Tech-PhD	Maximum Credit Allowed *MTech/ MTech-PhD*
1	18	20	20
2	17	20	20
Summer Semester	(5 for Exit)	8	8
3	18	19	20
4	16	16	20
5	–	12	12
6	–	12	12
7	–	12	12
8	–	12	12
Cumulative Degree Credits:	66	130	80/136

The **M.Tech students** may also take the additional credits offered to the **M.Tech-PhD students** as an Add-On Course. If they decide after 2 Semesters to move into the **M.Tech-PhD Programme**, depending on their performance, they will be allowed to do so.

M.Tech-IT Credit Distribution

M.Tech-IT		I	II	III	IV	Total Credits	
Profe ssion al	MTech-IT Core	13	0	0	0	13	19.7%
	Group Core	4	0	0	0	4	6.1%
	Specialization Core	0	8	4	0	12	18.2%
	Professional Elective	0	3	3	0	6	9.1%
	Open Elective	0	0	3	0	3	4.5%
	Thesis/Project	0	4	8	16	28	42.4%
	Total Credits	**17**	**15**	**18**	**16**	**66**	*100.0%*

MTech-IT Course Credit Distribution

M.Tech-IT Core 19.7%

Thesis/Project 42.4%

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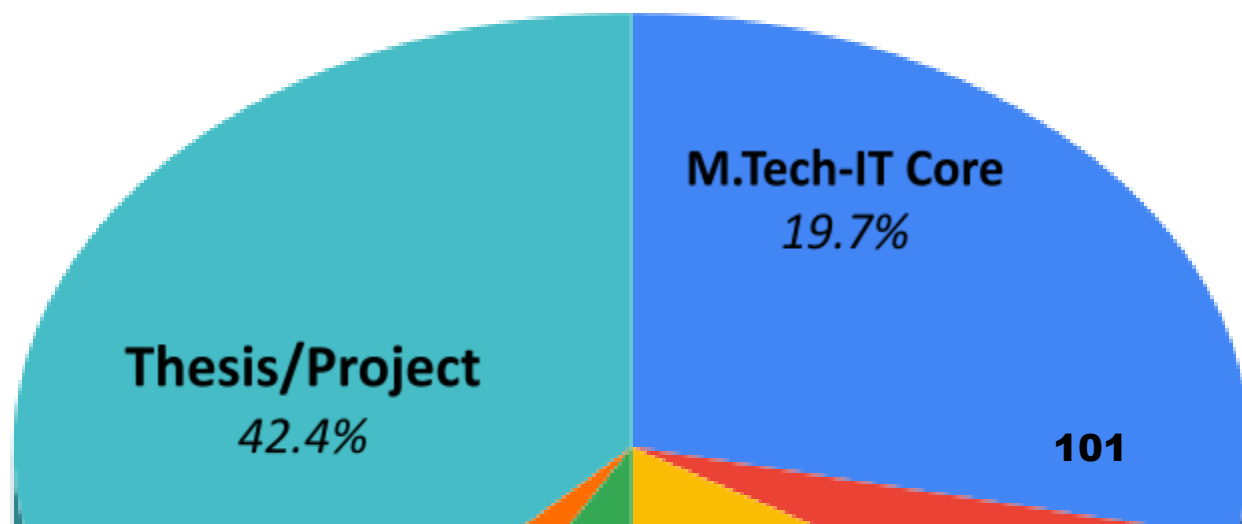
M.Tech-Ph.D, Credit Distribution

	I	II	Summer	III	IV	V	VI	VII	VIII	Total Credits	
MTech-PhD Core	16	0	0	0	0	0	0	0	0	16	12.3%
Group Core	4	0	0	0	0	0	0	0	0	4	3.1%
Specialization Core	0	8	0	0	0	0	0	0	0	8	6.2%
Elective	0	3	0	8	4	0	0	0	0	15	11.5%
Independent Study	0	4	0	0	0	0	0	0	0	4	3.1%
Open Elective	0	0	0	3	0	0	0	0	0	3	2.3%
Thesis/Project/ Research Credits	0	4	8	8	12	12	12	12	12	80	61.5%
Total Credits	20	19	8	19	16	12	12	12	12	130	100.0%

MTech-PhD Credit Distribution
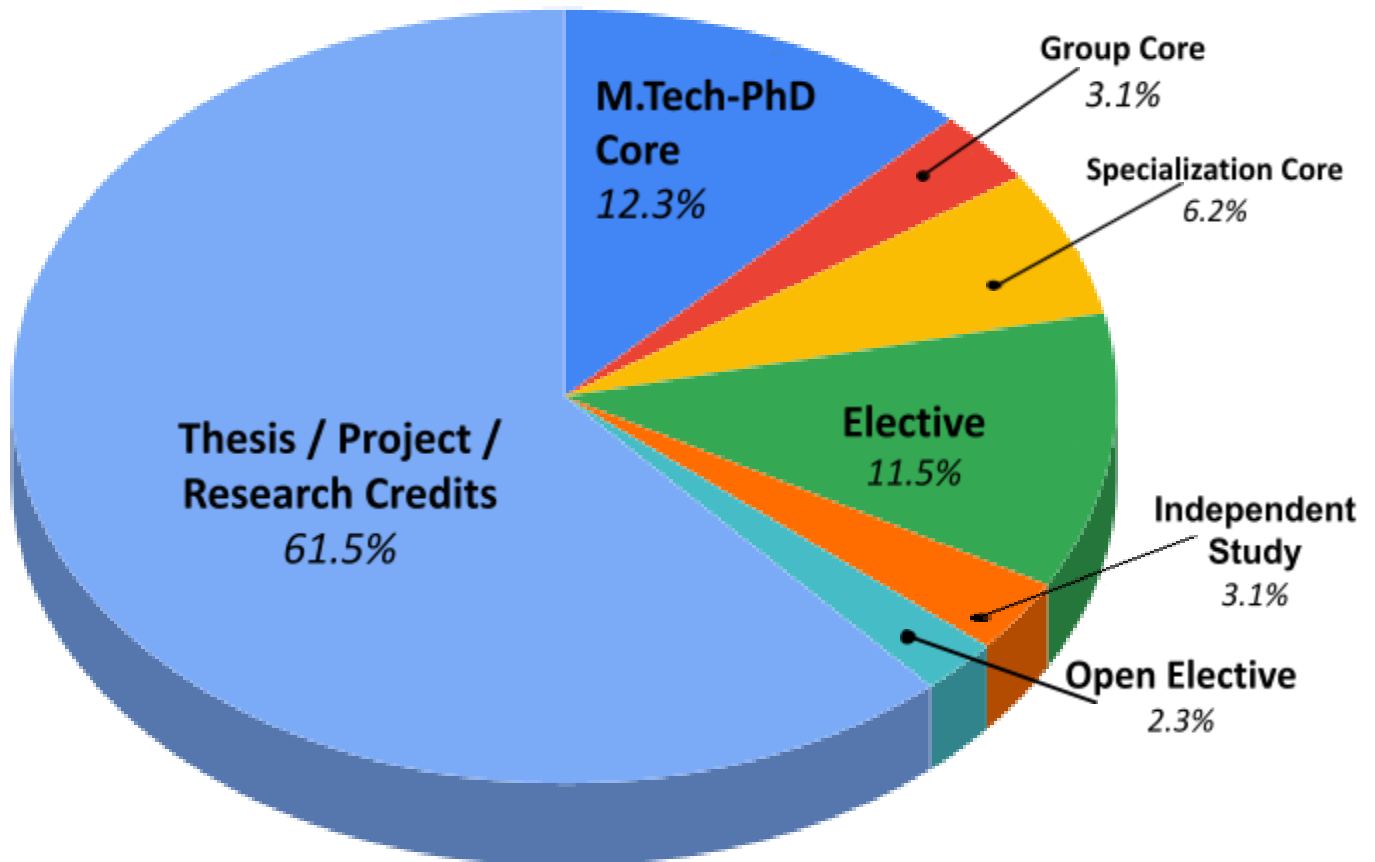
Machine Learning, Robotics and Human Computer Interaction Group.

In the proposed Curriculum, the 1st Semester courses for the **Machine Learning, Robotics and Human Computer Interaction Group** is Common for

- **Machine Learning and Intelligent Systems (MLIS)**
- **Robotics and Machine Intelligence (RMI)**
- **Human-Computer Interaction (HCI)**.

Table 5: First Semester

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Mathematics for IT	**PC-IT-MIT501**	PCC	4	3–0–2-0
2.	Advanced Programming Practices	**PC-IT-APP502**	PCC	4	2–0–4-0
3.	Introduction to Machine Learning	**PC-IT-IML503**	PCC	4	3–0–2-0
4.	Image and Video Processing	**PC-IT-IVP504**	PCC	4	3–0–2-0
5.	**Research Methodology & IPR -1** *(For MTech, MTech-PhD and PhD)*	**PC-IT-RMA505**	ELC	2	2–0–0-0
6.	**Research Methodology-2** *(For MTech-PhD and PhD only)*	**PC-PH-RMB701**	ELC	2	2–0–0-0
Total Semester Credit:				**18/20**	**13-0-10-0** **15-0-10-0** 23 Hrs./week 25 Hrs./week

M. Tech. (IT) with Specialization in

Machine Learning and Intelligent Systems *(MLIS)*

The Laboratory/ Centers offering the Specialization:
Machine Learning & Optimization Lab (MLO Lab), Computer Vision & Biometrics Lab (CVB Lab), Speech Image and Language Processing Lab (SILP Lab).
Some other labs, also, from the Department.

Note: This course has been running successfully at IIITA since 2007. Strong group of faculty members exist in the department.

Objective:

MLIS, M.Tech. Program provides the foundation and advanced skills in the principles and technologies that underlie, Machine Learning, Deep Learning, probabilistic models and Convex & Non convex optimization. Students can pursue advanced research topics in areas such as cognition, vision, natural language processing and representation Learning.

(Please Note 1ˢᵗ Sem. common for all M.Tech.(IT) Specializations within the Group: Table 5.)

<p align="center">Table 6:   Second Semester</p>

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Deep Learning	**PC-IT-DEL506**	PCC	4	3-0-2-0
2.	Probabilistic Machine Learning and Graphical Model	**PC-IT-PGM507**	PCC	4	3-0-2-0
3.	Elective - 1	**PE-IT-xxx601**	PEC	3	3-0-0-0
4.	Project	**PC-IT-PRJ508**	ELC	4	0-1-6-0
5.	HSMC-1	**HC-IT-**	HSMC	2	2-0-0-0
6.	*Independent Study as advised by the Supervisor (MTech-PhD)* *This will be an **Area Specific Depth Paper**. Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	*PC-IT-ins702*	PEC	3	3-0-0-0
Cumulative of 18/20 Credits +Total Semester Credit:				**17/20**	**11-1-10-0** **14-1-10-0** 22 Hrs./week 25 Hrs./week

Exit: After successful completion of one year (first two semesters), students may get *PG Diploma.* They need to earn 6 credits additional, in summer, before exit.

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a* **Summer Semester** *between II and III Semester. (Please refer to* **Annexure-4***)*

<p align="center">Table 7:   Third Semester (for M.Tech)</p>

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Optimization	**PC-IT-OPT601**	PCC	4	3-0-2-0
2.	Elective - 2	**PE-IT-xxx602**	PEC	3	3-0-0-0
3.	Elective - 3 (Open Elective)	**OE-XX-xxx603**	OEC	3	3-0-0-0
3.	Thesis – Part -I	**PC-IT-THA604**	ELC	6	0-2-8-0
Cumulative of 35 Credits +Total Semester Credit:				**16**	**9-2-10-0** 21 Hrs./week

<p align="center">Table 8:   Fourth Semester (for M.Tech)</p>

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Thesis – Part-II	**PC-IT-THB605**	ELC	15	0-2-26-0
Cumulative of 51 Credits +Total Semester Credit:				**15**	**0-2-26--0** 28 Hrs./week
Cumulative Degree Credits				**66**	

Table 9.: List of Electives:

	Course Name	Code PE-IT-xxx60x	Type	Credit	Hours L-T-P-S
1.	Computer Vision	PE-IT-COV60x	PEC	3	3-0-0-0
2.	Cognition and Cognitive Process Modeling	PE-IT-CCP60x	PEC	3	3-0-0-0
3.	Information Retrieval	PE-IT-INR60x	PEC	3	3-0-0-0
4.	Cyber Physical System Security	PE-IT-CPS602	PEC	3	3-0-0-0
5.	Natural Language Processing	PE-IT-NLP60x	PEC	3	3-0-0-0
6.	Humanoid and Collaborative Robots	PE-IT-HCR60x	PEC	3	3-0-0-0
7.	Social Network Analysis	PE-IT-SNA60x	PEC	3	3-0-0-0
8.	Visual Recognition	PE-IT-VRE60x	PEC	3	3-0-0-0
9.	Big Data Analytics (2nd Sem)	PE-IT-BDA601	PEC	3	3-0-0-0
10.	*Independent Study*	PE-IT-ins60x	PEC	3	3-0-0-0

Please Note: **x** could be **1** or **2** dependinding in which semester it is offered. If offered in the II Semester **x=1**. If offered in the III Semester **x=2**.

M. Tech. (IT) with Specialization in
Robotics and Machine Intelligence (RMI)

The Laboratory/ Centers offering the Specialization: Robotics and Machine Intelligence Lab, Analytics and Application Lab.

Motivation:

During the two years Robotics and Machine Intelligence program, we are committed to provide a stimulating environment to the deserving candidates so that they can showcase their talents and build up an illustrious career in this niche area of robotics.

(Please Note 1ˢᵗ Sem. common for all M.Tech.(IT) Specializations within the Group: **Table 5.** *)*

Table 10:   Second Semester

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Deep Learning	**PC-IT-DEL506**	PCC	4	3-0-2-0
2.	Robot Motion Control	**PC-IT-RMC507**	PCC	4	3-0-2-0
3.	Elective - 1	**PE-IT-xxx601**	PEC	3	3-0-0-0
4.	Project	**PC-IT-PRJ508**	ELC	4	0-1-6-0
5.	HSMC-1	**HC-IT-**		2	2-0-0-0
6.	*Independent Study as advised by the Supervisor (MTech-PhD) This will be an **Area Specific Depth Paper**. Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	***PC-IT-ins702***	PEC	3	3-0-0-0
Cumulative of 18/20 Credits +Total Semester Credit:				**17/20**	11-1-10-0 14-1-10-0 22 Hrs./week 25 Hrs./week

Exit: After successful completion of one year (first two semesters), students may get **PG Diploma.** They need to earn 6 credits additional, in summer, before exit.

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a* **Summer Semester** *between II and III Semester. (Please refer to* **Annexure-4***)*

Table 11:   Third Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Foundations of Robotics	**PC-IT-FOR601**	PCC	4	3-0-2-0
2.	Elective - 2	**PE-IT-xxx602**	PEC	3	3-0-0-0
3.	Elective - 3 (Open Elective)	**OE-XX-xxx603**	OEC	3	3-0-0-0
3.	Thesis – Part -I	**PC-IT-THA604**	ELC	6	0-2-8-0
Cumulative of 35 Credits +Total Semester Credit:				**16**	9-2-10-0 21 Hrs./week

Table 12:   Fourth Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours
					L-T-P-S
1.	Thesis – Part-II	PC-IT-THB605	ELC	15	0-2-26-0
	Cumulative of 51 Credits +Total Semester Credit:			**15**	**0-2-26--0** 28 Hrs./week
	Cumulative Degree Credits			**66**	

Table 13.:   List of Electives:

	Course Name	Code PE-IT-xxx60x	Type	Credit	Hours
					L-T-P-S
1.	Swarm and Evolutionary Robotics	PE-IT-SER60x	PEC	3	3-0-0-0
2.	Computer Vision	PE-IT-COV60x	PEC	3	3-0-0-0
3.	Cognition and Cognitive Process Modeling	PE-IT-CCP60x	PEC	3	3-0-0-0
4.	Information Retrieval	PE-IT-INR60x	PEC	3	3-0-0-0
5.	Natural Language Processing	PE-IT-NLP60x	PEC	3	3-0-0-0
6.	Humanoid and Collaborative Robots	PE-IT-HCR60x	PEC	3	3-0-0-0
7.	Virtual Reality (3rd Sem)	PE-IT-VIR602	PEC	3	3-0-0-0
8.	Social Network Analysis	PE-IT-SNA60x	PEC	3	3-0-0-0
9.	Visual Recognition (3 Sem)	PE-IT-VRE602	PEC	3	3-0-0-0
10.	Advanced Robotics Perception and Control	PE-IT-RPC60x	PEC	3	3-0-0-0
11.	Advanced Graphics & Animation (2 Sem)	PE-IT-AGA601	PEC	3	3-0-0-0
12.	*Independent Study*	PE-IT-ins60x	PEC	3	3-0-0-0

Please Note: **x** could be **1** or **2** dependinding in which semester it is offered. If offered in the II Semester **x=1**. If offered in the III Semester **x=2**..

M. Tech. (IT) with Specialization in
Human-Computer Interaction (HCI)

The Laboratory/ Centers offer the Specialization: *Interactive Technologies and Multimedia Research (ITMR) Lab, Speech Image and Language Processing (SILP) Lab, Software Engineering Research Lab, Analytics & Application Lab, Computer Vision and Biometrics Lab.*

Motivation

- ***Research Intensive & Industry Oriented*** *M.Tech. program.*
- *HCI is the study of designing computers and machines so that they best serve their **users (i.e. humans)**. HCI is closely related to the field of User Experience (UX) design.*
- *The MTech IT (HCI) course aims to provide the practical skills and theoretical understandings needed to become leaders in the design, implementation and evaluation of the **next generation** of human-computer or human-machine interfaces.*
- *HCI students learn how to identify areas of improvement and then create **better services and products**. In today's highly competitive digital markets, HCI design can be the difference between success and failure.*

(Please Note 1ˢᵗ Sem. common for all M.Tech.(IT) Specializations within the Group: Table 5.)

Table 14.: Second Semester

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Deep Learning	**PC-IT-DEL506**	PCC	4	3-0-2-0
2.	Advanced Graphics & Animation	**PC-IT-AGA507**	PCC	4	3-0-2-0
3.	Elective - 1	**PE-IT-xxx601**	PEC	3	3-0-0-0
4.	Project	**PC-IT-PRJ508**	ELC	4	0-1-6-0
5.	HSMC-1	**HC-IT-**		2	2-0-0-0
6.	*Independent Study as advised by the Supervisor (MTech-PhD) This will be an **Area Specific Depth Paper**. Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	**PC-IT-ins702**	PEC	3	3-0-0-0
Cumulative of 18/20 Credits +Total Semester Credit:				**17/20**	**11-1-10-0** **14-1-10-0** 22 Hrs./week 25 Hrs./week

Exit: After successful completion of one year (first two semesters), students may get ***PG Diploma.*** They need to earn 6 credits additional, in summer, before exit.

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a **Summer Semester** between II and III Semester.* (Please refer to **Annexure-4**)

Table 15: Third Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Virtual Reality	**PC-IT-VIR601**	PCC	4	3-0-2-0
2.	Elective - 2	**PE-IT-xxx602**	PEC	3	3-0-0-0
3.	Elective - 3 (Open Elective)	**OE-XX-xxx603**	OEC	3	3-0-0-0
3.	Thesis – Part -I	**PC-IT-THA604**	ELC	6	0-2-8-0
Cumulative of 35 Credits +Total Semester Credit:				**16**	**9-2-10-0** 21 Hrs./week

Table 16: Fourth Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Thesis – Part-II	**PC-IT-THB605**	ELC	15	0-2-26-0
Cumulative of 51 Credits +Total Semester Credit:				**15**	**0-2-26--0** 28 Hrs./week
Cumulative Degree Credits				**66**	

Table 17.:   List of Electives:

	Course Name	Code PE-IT-xxx60x	Type	Credit	Hours L-T-P-S
1.	Visual Recognition	PE-IT-VRE60x	PEC	3	3-0-0-0
2.	Computer Vision	PE-IT-COV60x	PEC	3	3-0-0-0
3.	Pattern Recognition	PE-IT-PAR60x	PEC	3	3-0-0-0
4.	Medical Image Processing	PE-IT-MIP60x	PEC	3	3-0-0-0
5.	Remote Sensing & GIS	PE-IT-RSG60x	PEC	3	3-0-0-0
6.	Soft Computing	PE-IT-SOC60x	PEC	3	3-0-0-0
7.	Information Retrieval	PE-IT-INR60x	PEC	3	3-0-0-0
8.	Usability Engineering	PE-IT-USE60x	PEC	3	3-0-0-0
9.	Social Network Analysis	PE-IT-SNA60x	PEC	3	3-0-0-0
10.	Natural Language Processing	PE-IT-NLP60x	PEC	3	3-0-0-0
11.	Speech and Dialog	PE-IT-SPD60x	PEC	3	3-0-0-0
12.	Affective Computing	PE-IT-AFC60x	PEC	3	3-0-0-0
13.	Principles of Interaction Design	PE-IT-PID60x	PEC	3	3-0-0-0
14.	Brain-Computer Interface	PE-IT-BCI60x	PEC	3	3-0-0-0
15.	Cognition and Cognitive Process Modeling	PE-IT-CCP60x	PEC	3	3-0-0-0
16.	Game Design & Development	PE-IT-GDD60x	PEC	3	3-0-0-0
17.	Swarm and Evolutionary Robotics	PE-IT-SER60x	PEC	3	3-0-0-0
18.	Humanoid and Collaborative Robots	PE-IT-HCR60x	PEC	3	3-0-0-0
19.	Advanced Robotics Perception and Control	PE-IT-RPC60x	PEC	3	3-0-0-0
20.	Big Data Analytics (2nd Sem)	PE-IT-BDA601	PEC	3	3-0-0-0
21.	*Independent Study*	PE-IT-ins60x	PEC	3	3-0-0-0

Please Note: **x** could be **1** or **2** dependinding in which semester it is offered. If offered in the II Semester **x=1**. If offered in the III Semester **x=2**.

2. Software and Data Engineering Group

In the proposed Curriculum, the 1st Semester courses for the **Software and Data Engineering Group** is Common for
- **Software Engineering**
- **Data Engineering**

Table 18.:   First Semester

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Mathematics for IT	PC-IT-MIT501	PCC	4	3–0–2-0
2.	Advanced Programming Practices	PC-IT-APP502	PCC	4	2–0–4-0
3.	Introduction to Machine Learning	PC-IT-IML503	PCC	4	3–0–2-0
4.	Data Analytics	PC-IT-DAA504	PCC	4	3–0–2-0
5.	**Research Methodology & IPR -1** *(For MTech, MTech-PhD and PhD)*	PC-IT-RMA505	ELC	2	2–0–0-0
6.	**Research Methodology-2** *(For MTech-PhD and PhD only)*	PC-PH-RMB701	ELC	2	2–0–0-0
	Total Semester Credit:			18/20	13-0-10-0 15-0-10-0 23 Hrs./week 25 Hrs./week

Annexure-2.1

M. Tech. (IT) with Specialization in

Software Engineering (SE)

The Laboratory/ Centers offering the Specialization: Software Engineering Research Lab (SER Lab), Big Data Analytics Lab, Analytics and Application Lab.

- *Research Intensive & Industry Oriented M.Tech. program(s)*
- *Strong group of faculty members and researchers with well-equipped research labs.*
- *Suitable to get successful professional careers in industry, government and academia.*
- *Helpful to take up entrepreneurship for the growth of the economy and to generate employment.*
- *Develop ability to analyze and evaluate problems and draw on the theoretical and technical knowledge to develop solutions and systems*
- *To establish awareness on the current research in software development, the analytical skills and research techniques for their critical and independent evaluation and their application to new problems.*

(Please Note 1st Sem. common for all M.Tech.(IT) Specializations within the Group: Table 18.)

Table 19.: **Second Semester**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Software Design & Architecture	PC-IT-SDA501	PCC	4	3-0-2-0
2.	Software Requirements and Estimation	PC-IT-SRE502	PCC	4	3-0-2-0
3.	Elective - 1	PE-IT-xxx601	PEC	3	3-0-0-0
4.	Project	PC-IT-PRJ508	ELC	4	0-1-6-0
5.	HSMC-1	HC-IT-		2	2-0-0-0
6.	*Independent Study* as advised by the Supervisor (MTech-PhD) *This will be an* **Area Specific Depth Paper**. *Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	*PC-IT-ins702*	PEC	3	3-0-0-0
	Cumulative of 18/20 Credits +Total Semester Credit:			17/20	**11-1-10-0** **14-1-10-0** 22 Hrs./week 25 Hrs./week

Exit: After successful completion of one year (first two semesters), students may get *PG Diploma.* They need to earn 6 credits additional, in summer, before exit.

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a* **Summer Semester** *between II and III Semester. (Please refer to* **Annexure-4***)*

Table 20: **Third Semester** *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Software Testing and Quality Management	PC-IT-STQ601	PCC	4	3-0-2-0
2.	Elective - 2	PE-IT-xxx602	PEC	3	3-0-0-0
3.	Elective - 3 (Open Elective)	OE-XX-xxx603	OEC	3	3-0-0-0
3.	Thesis – Part -I	PC-IT-THA604	ELC	6	0-2-8-0
	Cumulative of 35 Credits +Total Semester Credit:			16	**9-2-10-0** 21 Hrs./week

Table 21: **Fourth Semester** *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Thesis – Part-II	PC-IT-THB605	ELC	15	0-2-26-0
	Cumulative of 51 Credits +Total Semester Credit:			15	**0-2-26--0** 28 Hrs./week
	Cumulative Degree Credits			66	

Table 22.:   List of Electives:

	Course Name	Code PE-IT-xxx60x	Type	Credit	Hours L-T-P-S
1.	Software Metrics	PE-IT-SOM60x	PEC	3	3-0-0-0
2.	Mobile Software Engineering	PE-IT-MSE60x	PEC	3	3-0-0-0
3.	Software Process Management	PE-IT-SPM60x	PEC	3	3-0-0-0
4.	Business Analytics	PE-IT-BUA60x	PEC	3	3-0-0-0
5.	Deep Learning (2nd Sem)	PE-IT-DEL601	PEC	3	3-0-0-0
6.	Big Data Analytics (2nd Sem)	PE-IT-BDA601	PEC	3	3-0-0-0
7.	Data Visualization (2nd Sem)	PE-IT-DVI601	PEC	3	3-0-0-0
8.	Soft Computing	PE-IT-SOC60x	PEC	3	3-0-0-0
9.	Information Retrieval	PE-IT-INR60x	PEC	3	3-0-0-0
10.	Usability Engineering	PE-IT-USE60x	PEC	3	3-0-0-0
11.	Social Network Analysis	PE-IT-SNA60x	PEC	3	3-0-0-0
12.	Time Series Data Analytics	PE-IT-TSD60x	PEC	3	3-0-0-0
13.	Natural Language Processing	PE-IT-NLP60x	PEC	3	3-0-0-0
14.	Affective Computing	PE-IT-AFC60x	PEC	3	3-0-0-0
15.	Principles of Interaction Design	PE-IT-PID60x	PEC	3	3-0-0-0
16.	Cyber Security and Digital Forensics	PE-IT-CSD60x	PEC	3	3-0-0-0
17.	Cognition and Cognitive Process Modeling	PE-IT-CCP60x	PEC	3	3-0-0-0
18.	Game Design & Development	PE-IT-GDD60x	PEC	3	3-0-0-0
19.	Advanced Robotics Perception and Control	PE-IT-RPC60x	PEC	3	3-0-0-0
20.	*Independent Study*	PE-IT-ins60x	PEC	3	3-0-0-0

Please Note: **x** could be **1** or **2** dependinding in which semester it is offered. If offered in the II Semester **x=1**. If offered in the III Semester **x=2**.

M. Tech. (IT) with Specialization in

Data Engineering (DE)

The Laboratory/ Centers offering the Specialization: *Data Analytics Lab (DAL), Big Data Analytics Lab(BDAL), Analytics and Application Lab(AAL)*
Note: Faculties from all other labs of IIITA are also associated.

Motivation

- *Research Intensive & Industry Oriented M.Tech. program.*
- *Strong group of faculty members exist in the department.*
- *Demanded by students and the IT industry.*
- *Importance of Data analytics at present. It is one of the current trends in the academia & industry.*
- *This course consists of varied subjects covering various aspects of Data storage, preprocessing, analytics and related topics which prepares students for research and Industry as well.*
- *Many Ph.D thesis going on in this area by current students. M.tech students may be benefitted also.*

Course Structure

(Please Note 1ˢᵗ Sem. common for all M.Tech.(IT) Specializations within the Group: **Table 18.** *)*

Table 23.: **Second Semester**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Data Visualization	**PC-IT-DVI506**	PCC	4	3-0-2-0
2.	Big Data Analytics	**PC-IT-BDA507**	PCC	4	3-0-2-0
3.	Elective - 1	**PE-IT-xxx601**	PEC	3	3-0-0-0
4.	Project	**PC-IT-PRJ508**	ELC	4	0-1-6-0
5.	HSMC-1	**HC-IT-**		2	2-0-0-0
6.	*Independent Study as advised by the Supervisor (MTech-PhD)* *This will be an Area Specific Depth Paper. Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	*PC-IT-ins702*	PEC	3	3-0-0-0
	Cumulative of 18/20 Credits +Total Semester Credit:			**17/20**	**11-1-10-0** **14-1-10-0** 22 Hrs./week 25 Hrs./week

Exit: After successful completion of one year (first two semesters), students may get *PG Diploma.* They need to earn 6 credits additional, in summer, before exit.

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a* **Summer Semester** *between II and III Semester. (Please refer to* **Annexure-4***).*

Table 24: Third Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Parallel and Distributed Computing	**PC-IT-PDC601**	PCC	4	3-0-2-0
2.	Elective - 2	**PE-IT-xxx602**	PEC	3	3-0-0-0
3.	Elective - 3 (Open Elective)	**OE-XX-xxx603**	OEC	3	3-0-0-0
3.	Thesis – Part -I	**PC-IT-THA604**	ELC	6	0-2-8-0
Cumulative of 35 Credits +Total Semester Credit:				**16**	**9-2-10-0** 21 Hrs./week

Table 25: Fourth Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Thesis – Part-II	**PC-IT-THB605**	ELC	15	0-2-26-0
Cumulative of 51 Credits +Total Semester Credit:				**15**	**0-2-26--0** 28 Hrs./week
Cumulative Degree Credits				**66**	

Table 26.: **List of Electives:**

	Course Name	Code PE-IT-xxx60x	Type	Credit	Hours L-T-P-S
1.	Deep Learning (2nd Sem)	PE-IT-DEL601	PEC	3	3-0-0-0
2.	Time Series Data Analytics	PE-IT-TSD60x	PEC	3	3-0-0-0
3.	Business Analytics	PE-IT-BUA60x	PEC	3	3-0-0-0
4.	Semantic Data Analytics	PE-IT-SED60x	PEC	3	3-0-0-0
5.	Social Network Analysis	PE-IT-SNA60x	PEC	3	3-0-0-0
6.	Information Retrieval	PE-IT-INR60x	PEC	3	3-0-0-0
7.	Probabilistic Machine Learning and Graphical Model (2nd Sem)	PE-IT-PGM601	PEC	3	3-0-0-0
8.	Soft Computing	PE-IT-SOC60x	PEC	3	3-0-0-0
9.	Database Security	PE-IT-DSE60x	PEC	3	3-0-0-0
10.	Blockchain Technology	PE-IT-BCT60x	PEC	3	3-0-0-0
11.	Natural Language Processing	PE-IT-NLP60x	PEC	3	3-0-0-0
12.	Usability Engineering	PE-IT-USE60x	PEC	3	3-0-0-0
13.	Optimization	PE-IT-COO60x	PEC	3	3-0-0-0
14.	Data Management in Mobile and Sensor Networks	PE-IT-DMS60x	PEC	3	3-0-0-0
15.	Affective Computing	PE-IT-AFC60x	PEC	3	3-0-0-0
16.	Principles of Interaction Design	PE-IT-PID60x	PEC	3	3-0-0-0
17.	Cyber Security and Digital Forensics	PE-IT-CSD60x	PEC	3	3-0-0-0
18.	Cognition and Cognitive Process Modeling	PE-IT-CCP60x	PEC	3	3-0-0-0
19.	Game Design & Development	PE-IT-GDD60x	PEC	3	3-0-0-0
20.	*Independent Study*	PE-IT-ins60x	PEC	3	3-0-0-0

Please Note: **x** could be **1** or **2** dependinding in which semester it is offered. If offered in the II Semester **x=1**. If offered in the III Semester **x=2**.

3.   Network and Security Group

In the proposed Curriculum, the 1st Semester courses for the **Network and Security Group** is Common for

- **Wireless Communication and Computing (WCC).**
- **Cyber Laws and Information Security (CLIS)**.

Table 25.:   First Semester

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Mathematics for IT	**PC-IT-MIT501**	PCC	4	3–0–2-0
2.	Advanced Programming Practices	**PC-IT-APP502**	PCC	4	2–0–4-0
3.	Introduction to Cryptography	**PC-IT-ICR503**	PCC	4	3–0–2-0
4.	Networking Concepts	**PC-IT-NEC504**	PCC	4	3–0–2-0
5.	**Research Methodology & IPR -1** *(For MTech, MTech-PhD and PhD)*	**PC-IT-RMA505**	ELC	2	2–0–0-0
6.	**Research Methodology-2** *(For MTech-PhD and PhD only)*	**PC-PH-RMB701**	ELC	2	2–0–0-0
	Total Semester Credit:			18/20	**13-0-10-0** **15-0-10-0** 23 Hrs./week 25 Hrs./week

Annexure-3.1

M. Tech. (IT) with Specialization in

Wireless Communication and Computing (WCC)

The Laboratory/ Centers offering the Specialization: Center of Research and Development for IoT Lab, Systems Lab, Wireless sensor lab.

Motivation: Wireless Communication and Computing is one of the oldest specializations in IIIT Allahabad. The specialization is offered with the support of many research and academic enthusiastic faculties of the institute. The courses in this specialization are designed to equip students with theoretical and practical knowledge of Wireless Communication, Wireless and Mobile Networks, IoT, and their applications. The courses are supported by state-of-the-art laboratory infrastructure which includes multiple sensor motes, sensors, IoT kits, and software to simulate various aspects of wireless communication. The main focus of this specialization is to make students Industry and research-ready in the domain of Wireless Communication and Computing.

(Please Note 1st Sem. common for all M.Tech.(IT) Specializations within the Group: **Table 25.** *)*

Table 26.:   Second Semester

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Principles of Wireless Communications	**PC-IT-PWC501**	PCC	4	3-0-2-0
2.	Cloud and Edge Computing	**PC-IT-CEC502**	PCC	4	3-0-2-0
3.	Elective - 1	**PE-IT-xxx601**	PEC	3	3-0-0-0
4.	Project	**PC-IT-PRJ508**	ELC	4	0-1-6-0
5.	HSMC-1	**HC-IT-**		2	2-0-0-0
6.	*Independent Study as advised by the Supervisor (MTech-PhD) This will be an **Area Specific Depth Paper**. Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	*PC-IT-ins702*	PEC	3	3-0-0-0
	Cumulative of 18/20 Credits +Total Semester Credit:			**17/20**	**11-1-10-0** **14-1-10-0** 22 Hrs./week 25 Hrs./week

Exit: After successful completion of one year (first two semesters), students may get **PG Diploma.** They need to earn 6 credits additional, in summer, before exit.

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a* **Summer Semester** *between II and III Semester.* (Please refer to **Annexure-4**)

Table 27:   Third Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Embedded Systems and IoT	**PC-IT-IOT601**	PCC	4	3-0-2-0
2.	Elective - 2	**PE-IT-xxx602**	PEC	3	3-0-0-0
3.	Elective - 3 (Open Elective)	**OE-XX-xxx603**	OEC	3	3-0-0-0
3.	Thesis – Part -I	**PC-IT-THA604**	ELC	6	0-2-8-0
	Cumulative of 35 Credits +Total Semester Credit:			**16**	**9-2-10-0** 21 Hrs./week

Table 28:   Fourth Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Thesis – Part-II	**PC-IT-THB605**	ELC	15	0-2-26-0
	Cumulative of 51 Credits +Total Semester Credit:			**15**	**0-2-26--0** 28 Hrs./week
	Cumulative Degree Credits			**66**	

Table 29.:   List of Electives:

	Course Name	Code PE-IT-xxx60x	Type	Credit	Hours L-T-P-S
1.	Introduction to Machine Learning (Sem-3)	PE-IT-IML602	PEC	3	3-0-0-0
2.	Embedded System Security	PE-IT-ESS60x	PEC	3	3-0-0-0
3.	Detection and Estimation Theory	PE-IT-DET60x	PEC	3	3-0-0-0
4.	Mobile and Wireless Security	PE-IT-MWS60x	PEC	3	3-0-0-0
5.	Parallel and Distributed Computing (Sem-3)	PE-IT-PDC602	PEC	3	3-0-0-0
6.	Digital Signal Processing	PE-IT-DSP60x	PEC	3	3-0-0-0
7.	Blockchain and Cryptocurrency	PE-IT-BCC60x	PEC	3	3-0-0-0
8.	Energy Harvesting in Wireless Sensor Networks	PE-IT-EHN60x	PEC	3	3-0-0-0
9.	Data Management in Mobile and Sensor Networks	PE-IT-DMS60x	PEC	3	3-0-0-0
10.	Time Series Data Analytics	PE-IT-TSD60x	PEC	3	3-0-0-0
11.	Social Network Analysis	PE-IT-SNA60x	PEC	3	3-0-0-0
12.	Information Retrieval	PE-IT-INR60x	PEC	3	3-0-0-0
13.	Database Security	PE-IT-DSE60x	PEC	3	3-0-0-0
14.	Blockchain Technology	PE-IT-BCT60x	PEC	3	3-0-0-0
15.	Data Management in Mobile and Sensor Networks	PE-IT-DMS60x	PEC	3	3-0-0-0
16.	Affective Computing	PE-IT-AFC60x	PEC	3	3-0-0-0
17.	Cyber Security and Digital Forensics	PE-IT-CSD60x	PEC	3	3-0-0-0
18.	*Independent Study*	PE-IT-ins60x	PEC	3	3-0-0-0

Please Note: **x** could be **1** or **2** dependinding in which semester it is offered. If offered in the II Semester **x=1**. If offered in the III Semester **x=2**

<u>M. Tech. (IT) with specialization in</u>

Cyber Laws and Information Security (CLIS)

The Laboratory/ Centers offering the Specialization: *Network Security and Cryptography (NSC) Lab*

Motivation

- *The needs of cyber security professionals are increasing exponentially to counter the various cyber-attacks in the world.*
- *Research, Practical and Industry oriented teaching of the courses by our strong Faculty group.*
- *This course consists of varied subjects covering various aspects of Cyber laws and Information Security related topics which are essential to create a successful cyber security workforce for organizations.*
- *On demand and competitive Research oriented thesis by our students.*
- *Laboratories are made with necessary infrastructure.*

(Please Note 1ˢᵗ Sem. common for all M.Tech.(IT) Specializations within the Group: **Table 25.** *)*

Table 30.: **Second Semester**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Information Security Laws and Regulations	**PC-IT-SLR506**	PCC	4	3-0-2-0
2.	Network Security	**PC-IT-NES507**	PCC	4	3-0-2-0
3.	Elective - 1	**PE-IT-xxx601**	PEC	3	3-0-0-0
4.	Project	**PC-IT-PRJ508**	ELC	4	0-1-6-0
5.	HSMC-1	**HC-IT-**		2	2-0-0-0
6.	*Independent Study as advised by the Supervisor (MTech-PhD) This will be an **Area Specific Depth Paper**. Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	***PC-IT-ins702***	PEC	3	3-0-0-0
	Cumulative of 18/20 Credits +Total Semester Credit:			**17/20**	**11-1-10-0** **14-1-10-0** 22 Hrs./week 25 Hrs./week

Exit: After successful completion of one year (first two semesters), students may get *PG Diploma.* They need to earn 6 credits additional, in summer, before exit.

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a **Summer Semester** between II and III Semester. (Please refer to **Annexure-4***)

Table 31:   Third Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Cyber Physical System Security	PC-IT-CPS601	PCC	4	3-0-2-0
2.	Elective - 2	PE-IT-xxx602	PEC	3	3-0-0-0
3.	Elective - 3 (Open Elective)	OE-XX-xxx603	OEC	3	3-0-0-0
3.	Thesis – Part -I	PC-IT-THA604	ELC	6	0-2-8-0
	Cumulative of 35 Credits +Total Semester Credit:			**16**	**9-2-10-0** 21 Hrs./week

Table 32:   Fourth Semester *(for M.Tech)*

	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Thesis – Part-II	PC-IT-THB605	ELC	15	0-2-26-0
	Cumulative of 51 Credits +Total Semester Credit:			**15**	**0-2-26--0** 28 Hrs./week
	Cumulative Degree Credits			**66**	

Table 33.:   List of Electives:

	Course Name	Code PE-IT-xxx60x	Type	Credit	Hours L-T-P-S
1.	Intrusion detection system	PE-IT-IDS60x	PEC	3	3-0-0-0
2.	Embedded System Security	PE-IT-ESS60x	PEC	3	3-0-0-0
3.	Information Security Risk Management	PE-IT-SRM60x	PEC	3	3-0-0-0
4.	Mobile and Wireless Security	PE-IT-MWS60x	PEC	3	3-0-0-0
5.	Advanced cryptography	PE-IT-ADC60x	PEC	3	3-0-0-0
6.	Blockchain and Cryptocurrency	PE-IT-BCC60x	PEC	3	3-0-0-0
7.	Blockchain Technology	PE-IT-BCT60x	PEC	3	3-0-0-0
8.	Post- Quantum Cryptography	PE-IT-PQC60x	PEC	3	3-0-0-0
9.	Information security audit	PE-IT-ISA60x	PEC	3	3-0-0-0
10.	Social Cyber Security	PE-IT-SCS60x	PEC	3	3-0-0-0
11.	Database Security	PE-IT-DSE60x	PEC	3	3-0-0-0
12.	Blockchain Technology	PE-IT-BCT60x	PEC	3	3-0-0-0
13.	Cyber Security and Digital Forensics	PE-IT-CSD60x	PEC	3	3-0-0-0
14.	*Independent Study*	PE-IT-ins60x	PEC	3	3-0-0-0

Please Note: **x** could be **1** or **2** dependinding in which semester it is offered. If offered in the II Semester **x=1**. If offered in the III Semester **x=2**.

Annexure-4

M. Tech.- Ph.D. (IT) the PhD Programme
as per Ph.D Ordinance

After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note the Summer Semester between II and III Semester.

Table 34: Summer Semester *(for M.Tech-PhD)*

Si. No.	Code	Subject Name	Total Credit
1.	PC-IT-REC703	**Registration Colloquium**: *For this Colloquium, candidates are expected to finalize the Topic of research and to generate a report covering the possible Statement of the problem, Related literature, Relevance, Importance followed by presenting and defending the same before the Doctoral committee.*	8
		Cumulative of 40 Credits + Total Semester Credit:	**8**

IV Sem: Prerequisite: *Successful completion of Registration Colloquium of **Summer Semester** and all course credits of Semester I & II).*

Table 35.: Third Semester *(for M.Tech-PhD)*

Si. No.	Code	Subject Name	Total Credit
3.	OE-XX-xxx603	Elective - 3 (Open Elective)	3
1.	PC-IT-RPS704	**Research Problem Specific Course 1:** *(May be a Self-study course)* *(Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes)*	4
2.	PC-IT-RPS705	**Research Problem Specific Course 2:** *(May be a Self-study course)* *(Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes)*	4
4.	PC-IT-RPC706	**Research Proposal Colloquium:** *(For this Colloquium, Candidate is expected to freeze the Title of the Thesis and to generate a report covering the Proposed Statement of the problem, State of the art Relevance/Importance, Proposed Methodology followed by presenting and defending the same before the Doctoral committee. The title of the thesis along with the abstract of the research plan, in about 300 words, shall then be communicated to the AAA section through Dean(A&R), under the approval of the Chairperson Doctoral Committee).* **(Imp -Research Area** - *is broadly the area identified for Research within the branch of study.* **Topic of Research** - *is the focused theme identified within the Research Area.* **Thesis Title** - *would refer to the statement of the Research problem, within the scope of the identified Research Topic.)*	8
		Cumulative of 48 Credits + Total Semester Credit:	**19**

IV Sem: Prerequisite: *Successful completion of Research Proposal Colloquium of III Semester together with all Course Credits up to the end of Semester III.*

Table 36.: Fourth Semester *(for M.Tech-PhD)*

Si. No.	Code	Subject Name	Total Credit
1.	PC-IT-RPS707	**Research Problem Specific Course 3:** *(May be a Self-study course)* *(Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes)*	4
2.	PC-IT-RRP801	**Research & Research Progress Colloquium I** *If the Thesis Title is required to be touched by way of alteration or modification, the same may be allowed by the Doctoral Committee provided the desired alteration/modification confirms to the requirement. This MUST however happen before the Progress Colloquium and duly certified in the Progress Colloquium. The same shall be required to be communicated to AAA Section through Dean (A&R) for recording.*	12
		Cumulative of 67 Credits + Total Semester Credit:	**16**

Table 37.: Fifth Semester *(for M.Tech-PhD)*

Si. No.	Code	Subject Name	Total Credit
1.	PC-IT-RRP802	**Research & Research Progress Colloquium II** *(Including authoring and presenting)*	12
		Cumulative of 83 Credits + Total Semester Credit:	**12**

Table 38.: Sixth Semester *(for M.Tech-PhD)*

Si. No.	Code	Subject Name	Total Credit
1.	PC-IT-RRP803	**Research & Research Progress Colloquium III** *(Including authoring and presenting)*	12
		Cumulative of 95 Credits + Total Semester Credit:	**12**

Table 39.: Seventh Semester *(for M.Tech-PhD)*

Si. No.	Code	Subject Name	Total Credit
1.	PC-IT-RRP804	**Research & Research Progress Colloquium IV** *(Including authoring and presenting)*	12
		Cumulative of 107 Credits + Total Semester Credit:	**12**

Along with the **12 credits Research & Research Progress** in the fifth, sixth and seventh semester, the student may take on recommendation of the supervisor additional courses not exceeding **4-credits/semester**.

VIII Sem Prerequisite: *Successful completion of all **119 Credits** till the end of VII Semester, as prescribed*

<p align="center"><strong style="color:red">Table 40.:   **Eighth Semester**   *(for M.Tech-PhD)*</p>

Si. No.	Code	Subject Name	Total Credit
2.	PC-IT-PTS805	**Pre-Thesis Submission Colloquium** *(Open to all in the institute)* *a) Upon the explicit request of the candidate / Supervisor, in case it is desired to touch the earlier frozen Thesis Title, the Doctoral committee may recommend the fresh title for acceptance to the Chairperson Senate, upon the payment of prescribed Fees which shall be 5% of the Tuition Fees for the Semester as prevailing. The brief of the abstract should be submitted to the Dean (A&R), before the conduct of the pre-thesis colloquium, which will be sent to the AAA section for the purpose of recording.* *b) No re-touching of any kind in the Thesis Title shall be allowed after successful completion of Pre-Thesis Submission Colloquium, which shall be Title Specific.* *c) The thesis should be submitted within a maximum of 150 days from the date of notification of successful completion of Pre-thesis submission Colloquium, failing which it is automatically treated as the candidate has dropped the Pre-thesis colloquium which compels him/her to register for Pre-thesis colloquium afresh.*	12
		Cumulative of 119 Credits + Total Semester Credit:	**12**
		Cumulative Minimum Degree Credits	**131**

Please Note if the Ph.D. Scholar is unable to complete his Prerequisite successfully in VII Semester; then the Ph.D. Scholar continues with **Research & Research Progress Colloquium V, VI, VII,.........**

The code will be **PC-IT-RRP805, PC-IT-RRP806, PC-IT-RRP807, ……….** with **12 credits** each semester.

Annexure-5

Ph.D. (IT) for M.Tech(IT) Graduands from IIIT-Allahabad

Some M.Tech(IT) graduates from the M.Tech programme at IIIT-Allahabad, have joined the Ph.D. Programme. The Full Time Doctoral Degree (Ph.D.) Program Ordinance 2018 of IIIT Allahabad allows such candidates with CGPI of more than 8.0 to be directly assessed through interaction/interview. The written examination is waived off. (*page 3 of the Full Time Doctoral Degree (Ph.D.) Program Ordinance 2018 of IIIT Allahabad*).

Such candidates selected through the regular Ph.D Selection interaction/interview; are already exposed to the research being conducted at IIITA and satisfy some prerequisites. This course structure will allow such students to come to par with the M.Tech.-Ph.D students in one Semester.

Table 41.: First Two Semester + Summer Semester

Si. No.	Code	Subject Name	Total Credit	L	T	P
1.	PC-PH-RMB701	**Research Methodology-2** *(For MTech-PhD only)*	3	3	0	0
2.	*PC-IT-ins702*	*Independent Study as advised by the Supervisor (MTech-PhD)* *This will be an Area Specific Depth Paper. Detailed Coursework appropriate to the chosen area of research. Suitable Title to be communicated by the Chairperson Doctoral Committee, for Grade Card purposes.*	3	-	-	-
3.	PC-IT-REC703	**Registration Colloquium**: *For this Colloquium, Candidate is expected to finalize the Topic of research and to generate a report covering the possible Statement of the problem, Related literature, Relevance, Importance followed by presenting and defending the same before the Doctoral committee*	8	-	-	-
		Total Semester Credit :	**15**			

The M.Tech(IT) student from IIIT-Allahabad, will complete all additional credits/courses done by the dual degree M.Tech-Ph.D students in their first 2 Semesters (1st Year). At the end of I Semester the student will have to clear the Registration Colloquium.

The student will move directly to the III Semester of the M.Tech-PhD programme **Table 35. Annexure-4.** However the student need not register for the **Open Elective (Code: OE-XX-xxx603)** since the student has cleared this course in his M.Tech Programme.

The student will have to clear a minimum 64 credits to complete the credit requirement for the Ph.D programme. Please note that the regular Ph.D. programme of the institute also requires the completion of 64 Credits.

The Minimum duration for the completion of the Ph.D. Programme will be 5 Semester (2.5 Years).

1. *Duration:* The minimum duration of the program will be 2.5 years (5 Semesters).
2. *Scholarship:* Scholarship will be paid for a maximum period of 05 years
   - First year and Second year Ph.D.'s Junior Research Fellowship (JRF)
   - Third year Senior Research Fellowship (SRF). The student will move SRF only after only after an assessment of his research work by the prescribed committee defined for the purpose (Doctoral Committee of the student which should include an external examiner). If the work by the student is not to the marks and unsatisfactory, the assessment committee may recommend the continuation of JRF or terminate the Fellowship.
   - Financial support may further be extended to a maximum of 1 year. This will depend on the (i) strict assessment of the students' research performance, with a final approval of the Chairman Senate.
3. *Course Fee:* Same as regular Ph.D. programmes of the institute.

4. *Supervisor:* To be fixed before the commencement of the first semester in accordance with the provisions of the PhD ordinance.

5. *Doctoral Committee:* To be constituted before the commencement of the first semester in accordance with the provisions of the PhD ordinance.

Please Note:

Electives: Table 9, 13, 17, 21, 25, 29 and **33**, provide a broad topic of Electives offered in each Specialization of all the 3 Groups. DPGC-IT can offer other approved courses as elective in any of the specializations. Every Elective has a minimum of **3 Credits**. A Core from different specializations can be offered as an elective. ~~If such a core course is of 4 Credits~~ then the elective ~~will be of 4 Credits.~~

The DPGC-IT's recommendation will be sent through the DPGC-IT Chairman (HoD-IT) and the DPGC Convener to the AAA section for consideration. It will be binding on AAA to accept the Elective course.

"*Independent Study*" has been included as an elective in each of the Specializations of M.Tech(IT). A student taking this course has to request the instructor to take a-priori approval of the DPGC-IT.

1) The request should justify the necessity why the offered electives will not be appropriate for the students M.Tech Research.
2) Broad Structure of the independent study (in 4 Units) as provided for each course syllabus.
3) Model of Assessment.

The DPGC-IT's decision will be communicated through the DPGC-IT Chairman (HoD-IT) and the DPGC Convener to the AAA section. The Suitable Title of the course will be communicated, for Grade Card purposes.

"*Independent Study – <Broad Title of the Topic>* "

This *<Broad Title of the Topic>* should be short enough to fit on the Grade Card.

Add-On Courses shall be floated as per rules

Cumulative Degree Credits: The Minimum Cumulative Degree Credits for M.Tech will be **66 Credits**; while for M.Tech-PhD will be of **130 Credits.** Please note that the Student may acquire additional credits above **66 Credits / 130 Credits.**

Indian Institute of Information Technology - Allahabad

Deoghat, Jhalwa- 211015, Prayagraj, Uttar Pradesh

Department of Electronics and Communication Engineering

Guidelines for M.Tech(ECE) & M.Tech-PhD(ECE)-2023-24

1. The seat matrix roster of Department of Electronics and Communication Engineering (ECE)) is given in Table-1.
2. Students are selected through CCMT (CENTRALIZED COUNSELLING FOR M.TECH. / M.ARCH. / M.PLAN. ADMISSIONS: *https://ccmt.nic.in/WebInfo21/Page/Page?PageId=1&LangId=P*

Table 1

OPEN	OPEN-PwD	EWS	EWS-PwD	SC	SC-PwD	ST	ST-PwD	OBC	OBC-PwD	Total
19	1	5	0	7	0	4	0	13	1	50

3. Apart from CCMT selection the Department of ECE takes admission of limited students through Direct Admission of Students Abroad (DASA).

4. The ECE Department is offering the following specializations:

Table 2

S. No.	Specialization	M. Tech. Seats per Group	M.Tech-PhD Seats
1.	Microelectronics	22	03
2.	Communication Engineering	23	02
	Total Seats	**45**	**05**

For M.Tech.-Ph.D. Programme; 3+2 =5 seats (Table 2) have been kept reserved. This is in tune with the spirit of **NEP 2020**. It is envisaged with a target towards research leading to a PhD programme with a minimum duration of 04 years, and with a possible exit for the award of M. Tech. degree and/or PG Diploma in case of exigency.

The credits for all courses are given in LTP format. L stands for Lecture, T for Tutorial, P for Practice/Practicle. L=3 signifies 3 hours of Lectures per week, T=1 signifies 1 hour of Tutorial per week, and P=1 corresponds to 2 hours Practice/Practical per week.

MTech-PhD Programme

Salient features

1. ***Degree:*** MTech-PhD degree shall be given upon successful completion of the programme, when the student defends his Ph.D. Thesis. Provisional MTech degree shall be given after submission of the PhD thesis.

2. ***Seats:*** The total number of M.Tech.-Ph.D. Seats (3+2=5) (Table-2) is taken from the present sanctioned MTech programme seats such that the overall seat matrix will remain unchanged.

3. ***Duration:*** The minimum duration of the program will be 4 years, including the M.Tech portion.

4. ***Scholarship:*** Scholarship will be paid for a maximum period of 05 years. Scholarship will be paid only to those students who complete the M.Tech-PhD programme.
   - First year MTech Scholarship
   - Second and Third year Ph.D.'s Junior Research Fellowship (JRF)
   - Fourth year Senior Research Fellowship (SRF). The student will move SRF only after an assessment of his research work by the prescribed committee defined for the purpose (Doctoral Committee of the student which should include an external examiner). If the work by the student is not to the marks and unsatisfactory, the assessment committee may recommend the continuation of JRF or terminate the Fellowship.
   - Financial support may further be extended to a maximum of 1 year. This will depend on the (i) strict assessment of the student's research performance, with a final approval of the Chairman Senate.

5. ***Exit Options:*** The exit with MTech will be considered only after completion of the first 2+ years. This exit shall not be a voluntary exit and will happen only if a student has outstanding dropped courses at the beginning of the third semester. In such cases, the student will be required to complete the requirements of MTech programmes (credits and thesis). The exit with PG Diploma will be considered only after 1+ year upon completion of at least 32 credits. Such students would be considered for lateral admission to complete an MTech degree. However, they will not be considered for the PhD program, nor will they be paid any fellowship to complete the remaining credits required for their exit degree of M.Tech/ PG Diploma.

6. ***Course Fee:*** M.Tech-PhD students will pay fees like the regular M.Tech Students, an M.Tech Fee for the 1st 4 Semesters. From the 5th Semester They will pay the fees on par with the regular PhD students. The students who have been given an exit option will pay the regular M.Tech Fees for the semester.

7. ***Supervisor:*** To be fixed before the commencement of the 2nd semester in accordance with the provisions of the PhD ordinance.

8. ***Doctoral Committee:*** To be constituted before the commencement of the 2nd semester in accordance with the provisions of the PhD ordinance

Justification: Benefits of the MTech-PhD programme:

1. Early start of research work and publication – *Students will embrace the research and innovation culture of the institute. He/she will start contributing towards research activity from start and well in advance*

2. Programme in line to respect the spirit of NEP – *To encourage research culture, students will be motivated to join the MTech-PhD program. However, PG diploma and M.Tech. will be given an exit option as per NEP 2020 will be applicable. Details of the credit table with Exit Scheme are tabulated below.*

3. From past experience, the M.Tech. - Ph.D. programme has produced extremely good Ph.D. research for the institute.

4. The complete semester wise credit distribution for M.Tech and M.Tech-PhD is given in Table-3 & 4.

Sem	I	II	Summer	III	IV	V	VI	VII	VIII
Year	1			2		3		4	
Credits	18+2=20	16+4=20	4+4=8	12+4=16	16	12	12	12	12
	PG Diploma								
	Regular M.Tech								
	MTech-PhD Exit with M.Tech								
	MTech Fellowship			*J.R.F.*					
							S.R.F.		

M.Tech and M.Tech-Ph.D Semester Wise Credit Distribution
Table 4.

Semester Number	Mandatory Credit Required for M.Tech	Mandatory Credit Required for M.Tech-PhD
1	18	20
2	16	20
Summer Semester		8
3	16	16
4	16	16
5		12
6		12
7	–	12
8	–	12
Cumulative Degree Credits:	**66**	**128**

- *The **M. Tech students** may also take the additional credits offered to the **M. Tech-PhD students** as an Add-On Course. If they decide after 2 Semesters to move into the **M. Tech-PhD Programme**, depending on their performance, they will be allowed to do so.*

Microelectronics.

Table 5: First Semester

Si. No	Code	Subject Name	Type	Total Credit	Hours/Week			
					L	T	P	S
1.	PC-MI-DSD501	Digital System Design	PCC	4	3	0	2	0
2.	PC-MI-VLT502	VLSI Technology	PCC	4	3	0	2	0
3.	PC-M-ISSD503	Solid State Devices	PCC	4	3	0	2	0
4.	PC-MI-ESD504	Embedded System Design	PCC	4	3	0	2	0
5.	HM-MS-RMI501	Research Methodology & IPR-1 *(For M Tech and MTech-PhD both)*	HSMC (AEC)	2	2	0	0	0
6.	PC-PH-RMB701	Research Methodology & IPR-II *(For MTech-PhD only)*	HSMC (AEC)	2	2	0	0	0
Total Semester Credit:				18/20	22 Hrs./week 24 Hrs./week			

Table 6:   Second Semester

Si. No.	Code	Subject Name	Type	Total Credit	Hours/Week			
					L	**T**	**P**	**S**
1.	PC-MI-TAV505	Testing and Verification	PCC	4	3	0	2	0
2.	PC-MI-AIC506	Analog Integrated Circuits	PCC	4	3	0	2	0
3.	PE-MI-XXX5XX	Program Elective-I	PEC	3	3	0	0	0
4.	PE-MI-XXX5XX	Program Elective-II	PEC	3	3	0	0	0
5	HM-MS-XXXXXX	Community Services	CEA	2	0	0	0	4
6.	*PC-ECE-INS702*	**Independent Study** as advised by the Supervisor (MTech-PhD) This will be an **Area Specific Depth Paper**. Detailed Coursework appropriate to the chosen area of research.		4	0	0	0	4
Cumulative of 18/20 Credits +Total Semester Credit:				**16/20**	20 Hrs./week 26 Hrs./week			

Exit option

After successful completion of one year (first two semesters), students may get M Tech ECE Certificate. They need to do two courses in summer before exit.

Table 7:

1	**M Tech Project**	ELC	4	0	0	8
2	**Programming for Microelectronics**	PCC	4	0	2	4

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a **Summer Semester** between II and III Semester.*

Table 8: Third Semester *(for M.Tech)*

Si. No.	Code	Subject Name	Type	Credit	Hours/Week			
					L	T	P	S
1.	PE-MI-XXX6XX	Program Elective-III	PEC	4	3	0	2	0
2.	PE-MI-XXX6XX	Program Elective-IV	PEC	4	3	0	2	0
3.	OE-XX-XXX60X	Open Elective	OEC	3	3	0	0	0
4	PC-MI-PRO604	M Tech Project	ELC	5	0	0	10	0
Cumulative of 34 Credits +Total Semester Credit:				16	23 Hrs./week			

Table 9: Fourth Semester *(for M.Tech)*

Si. No	Code	Subject Name	Type	Credit	Hours/Week			
					L	T	P	S
1.	**PC-EC-THB605**	Thesis	ELC	16	0	0	32	0
Cumulative of 50 Credits +Total Semester Credit:				**16**	32 Hrs./week			
Cumulative Degree Credits				**66**				

Table 10.: List of Electives:

S. No.	Code	Subject Name	Semester	Total Credit	Hours/Week			
					L	T	P	S
1.	PE-MI-HDM501	Hardware Design Methodology	II	4	3	0	2	0
2.	PE-MI-LPS502	Low Power Design	II	4	3	0	2	0
3.	PE-MI-RFI503	RFIC Design	II	4	3	0	2	0
4.	PE-MI-MEM504	MEMS	II	4	3	0	2	0
5.	PE-MI-RCS505	Reconfigurable Computing System	II	4	3	0	2	0
6.	PE-MI-PND601	Physics of Nanoscale Devices	III	3	3	0	0	0
7.	PE-MI-END603	Emerging Nano-Electronic Devices	III	3	3	0	0	0
8.	PE-MI-MSD604	Mixed Signal IC Design	III	3	3	0	0	0
9.	PE-MI-ACA605	Advanced Computer Architectures	III	3	3	0	0	0

Note :-Electives may be include/exclude with the approval of DPGC of the department.

M.Tech-ECE (MI) Credit Distribution

M.Tech	I	II	III	IV	Total Credits	
Program Core Course (PCC)	16	8	0	0	**24**	*36.36%*
Program Elective Course (PEC)	0	6	8	0	**14**	*21.21%*
Open Elective Course (OEC)	0	0	3	0	**03**	*4.54%*
HSMC	2	2	0	0	**04**	*6.06%*
Thesis/Project (ELC)	0	0	5	16	**21**	*31.81%*
Total Credits	**17**	**16**	**16**	**16**	**66**	*100.0%*

NEP-2020 Based M.Tech-ECE (MI) Curriculum, IITA
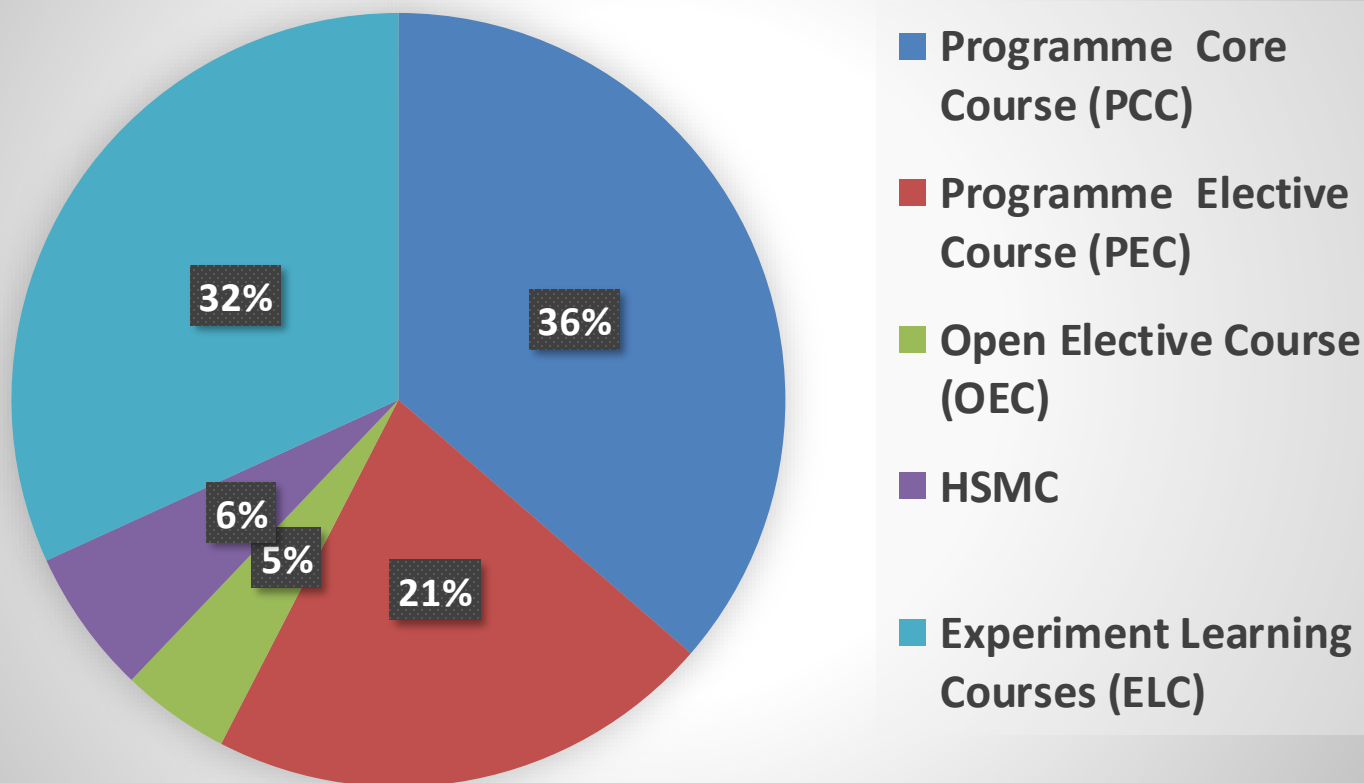
- Programme Core Course (PCC) — 36%
- Programme Elective Course (PEC) — 21%
- Open Elective Course (OEC) — 5%
- HSMC — 6%
- Experiment Learning Courses (ELC) — 32%

Communication Engineering

Table 11: **First Semester**

S. No.	Code	Subject Name	Type	Credit	Hours/Week			
					L	T	P	S
1.			PCC	4	3	0	2	0
2.	PC-CE-SSA502	Statistical Signal Analysis	PCC	4	3	0	2	0
3.	PC-CE-RSS503	Radiating Systems	PCC	4	3	0	2	0
4.	PC-CE-IML504	Introduction to Machine Learning	PCC	4	3	0	2	0
5.	HM-MS-RMI501	Research Methodology & IPR-1 *(For MTech and MTech-PhD both)*	HSMC (AEC)	2	2	0	0	0
6.	HM-XX-XXX502	Research Methodology & IPR-2 *(For MTech-PhD only)*	HSMC (AEC)	2	2	0	0	0
Total Semester Credits:				**18/20**	22 Hrs./week 24 Hrs./week			

Table 12:   Second Semester

S. No.	Code	Subject Name	Type	Credit	Hours/Week			
					L	T	P	S
1.	PC-CE-PWC505	Principles of Wireless Communications	PCC	4	3	0	2	0
2.	PC-CE-RML506	Recent Advances in Machine Learning	PCC	4	3	0	2	0
3.	PE-CE-XXX5XX	Program Elective-I	PEC	3	2	0	2	0
4.	PE-CE-XXX5XX	Program Elective-II	PEC	3	2	0	2	0
5.	HM-MS-XXXXXX	Community Services	CEA	2	0	0	0	40
6.	RS-CE-INT702	**Independent Study** as advised by the Supervisor (MTech-PhD) This will be an **Area Specific Depth Paper**. Detailed Coursework appropriate to the chosen area of research.		4	0	0	8	0
Cumulative of 18/20 Credits +Total Semester Credit:				**16/20**	20 Hrs./Week 28 Hrs./Week			

M.Tech-Ph.D : *After the end of II Semester the M.Tech-PhD student moves into the Ph.D Section of the Degree and will be henceforth governed by the Ph.D ordinance. Please note that there is a **Summer Semester** between II and III Semester.*

Exit option
After successful completion of one year (first two semesters), students may get M Tech ECE Certificate. They need to do two courses in summer before exit.

1	M Tech Project	ELC	4	0	0	8	
2	6G and Terahertz Communication	PCC	4	0	2	4	

Table 13: **Third Semester** *(for M.Tech)*

S. No.	Code	Subject Name	Type	Credit	Hours/Week			
					L	T	P	S
1.	PE-CE-XXX6XX	Program Elective-III	PEC	4	3	0	2	0
2.	PE-CE-XXX6XX	Program Elective-IV	PEC	4	3	0	2	0
3.	OE-XX-XXX601	Open Elective-I	OEC	3	3	0	0	0
3.	PI-CE-MPP601	M. Tech Project	ELC	5	0	0	10	0
Cumulative of 34 Credits +Total Semester Credit:				**16**	23 Hrs./Week			0

Table 14: **Fourth Semester** *(for M.Tech)*

S. No.	Code	Subject Name	Type	Credit	Hours/Week			
					L	T	P	S
1.	PI-CE-THE602	Thesis	ELC	16	0	0	32	0
Cumulative of 50 Credits +Total Semester Credit:				**16**	32Hrs./week			
Cumulative Degree Credits				**66**				

Indian Institute of Information Technology - Allahabad

Deoghat, Jhalwa- 211015, Prayagraj, Uttar Pradesh

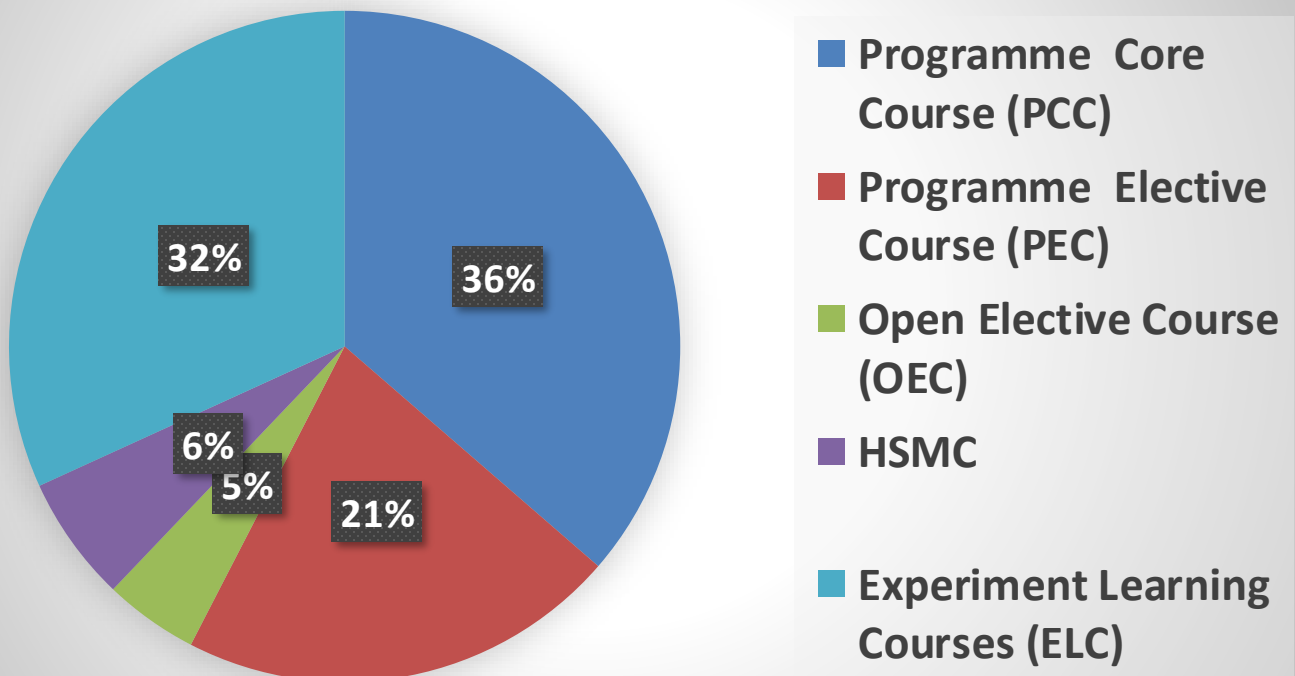## Department of Electronics and Communication Engineering

Table 15: List of Program Electives

S. No.	Code	Subject Name	Semester	Total Credit	Hours/Week			
					L	T	P	S
1.	PE-C-EMCD501	RF/Microwave Circuit Design Techniques	II	3	2	0	2	0
2.	PE-CE-RSP502	Radar Signal Processing	II	3	2	0	2	0
3.	PE-CE-ASP503	Advanced Digital Signal Processing	II	3	2	0	2	0
4.	PE-CE-OCS504	Optical Communications	II	3	2	0	2	0
5.	PE-CE-MIO601	MIMO Communications	III	3	3	0	0	0
6.	PE-CE-SSP603	Radar and Satellite Communication	III	3	3	0	0	0
7.	PE-MI-END603	Speech Signal Processing	III	3	3	0	0	0
8.	PE-CE-MRS604	Microwave Remote Sensing	III	3	3	0	0	0
9.	PE-CE-SAN605	Smart Antennas	III	3	3	0	0	0
10.	PE-CE-6TZ606	6G and Terahertz Communication	III	3	3	0	0	0
11.	PE-CE-DSP607	Introduction to Digital Signal Processors	III	3	3	0	0	0

Note :- Electives may be include/exclude with the approval of DPGC of the department.

M.Tech-CE Credit Distribution

Table 16

M.Tech	I	II	III	IV	Total Credits	
Program Core Course (PCC)	16	8	0	0	**24**	*36.36%*
Program Elective Course (PEC)	0	6	8	0	**14**	*21.21%*
Open Elective Course (OEC)	0	0	3	0	**03**	*4.54%*
HSMC	2	2	0	0	**04**	*6.06%*
Thesis/Project (ELC)	0	0	5	16	**21**	*31.81%*
Total Credits	**17**	**16**	**16**	**16**	**66**	*100.0%*

M.Tech-ECE(CE) Credit Distribution (Pi-Chart)

NEP-2020 Based M.Tech-ECE (CE) Curriculum, IITA

- Programme Core Course (PCC) — 36%
- Programme Elective Course (PEC) — 21%
- Open Elective Course (OEC) — 5%
- HSMC — 6%
- Experiment Learning Courses (ELC) — 32%

M.Tech Curriculum 2023-24

Department of Applied Science

(NEP based Curriculum)

Guidelines for M. Tech& Duel degree M. Tech-PhD 2023-24

PC- Programme Core, PE- Programme Elective, ES- Engineering Science, BS- Basic Science, OE- Open Elective, HM- Humanities and Management, MR- Minor, HR- Honor, AC- Audit Course

L-T-P (hr)

Lecture (L): 1 Credit = 1 hr/ week, Tutorial (T): 1 Credit = 1hr/week, Practical (P): 1 credit = 2 hr/week

The credits for all courses are given in LTP format. L stands for Lecture, T for Tutorial, P for Practice/Practical. L=3 signifies 3 hours of Lectures per week, T=1 signifies 1 hour of Tutorial per week, and P=1 corresponds to 2 hours Practice/Practical per week. For M. Tech. students, T and P need not be explicitly mentioned in the Time Table. The Practice/Practical component of the course could also be a Term paper or Term Paper along with the lab. The discretion is left to the Teacher teaching the course.

The dual degree M.Tech.-Ph.D. Programme has been kept reserved. This is in tune with the spirit of NEP 2020. It is envisaged with a target towards research leading to a PhD programme with a minimum duration of 04 years, and with a possible exit for the award of MTech degree and/or PG Diploma after securing required credits.

Please refer to the M.Tech. and Ph.D. Ordinance for the other details of the M. Tech. and Ph.D. programs that is available at the following link: https://aaa.iiita.ac.in/

The AS Department is offering the following specializations in each group:

M. Tech Biomedical Engineering

The M. Tech Biomedical Engineering program at IIIT-Allahabad is designed to provide students with a comprehensive understanding of the interdisciplinary field that combines principles of engineering, medicine, and biology. The mission of the Biomedical Engineering course at IIIT-A is to build up clinically adaptable solutions for human health by educating the next generation of biomedical engineers, cultivating leaders, and nurturing the amalgamation of science, engineering, and medicine in a discovery-focused environment. The main educational objective is to offer a systematic training in the fundamentals of engineering science, design, and biology. The curriculum is planned to endow with concepts essential to understanding living systems from the molecular and cellular levels. The curriculum further incorporates principles of straight up integration, leading to the choice of a technical area (biomedical imaging and instrumentation, cellular engineering, computational biomedical engineering, or biomechanics), and culminates in a biomedical device design experience. With state-of-the- art facilities and a team of experienced faculty members, IIIT-Allahabad is committed to offering students a stimulating and nurturing learning environment.

Total Credit Distribution

Semester	Semester I	Semester II	Summer Semester	Semester III	Semester IV	Total Credits
M. Tech	18	19	0	17	12	66
PG Diploma	18	19	5	-	-	42

M. Tech BME, Credit Distribution

M. Tech BI		I	II	III	IV	Total Credits	
1.	Program core	8	14			22	33%
2.	Specialization Core	8				8	12%
3.	Program Elective		3	6		9	14%
4.	Open Elective			3		3	5%
5.	Value Addition Course		2			2	3%
6.	Thesis/Project		2	8	12	22	33%
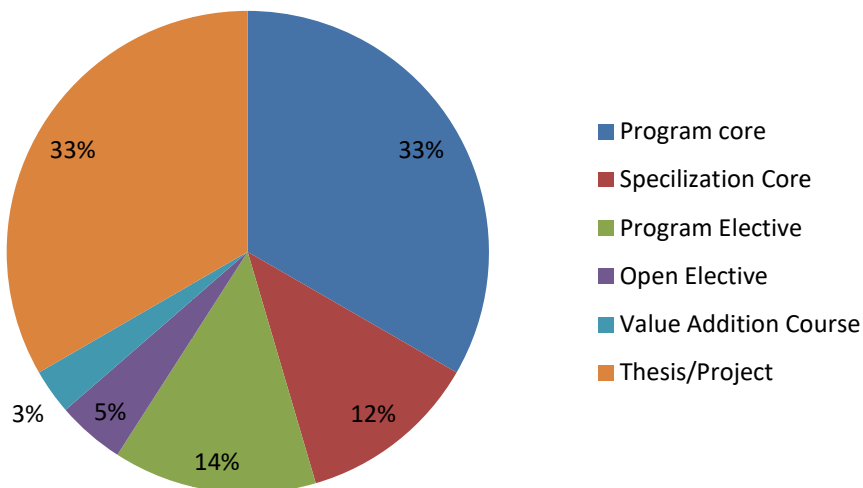
- Program core
- Specilization Core
- Program Elective
- Open Elective
- Value Addition Course
- Thesis/Project

Table 1: **First Semester**

Hard-Core Subjects

Sl. No.	Course Name	Code	Type	Credit	Hours
					L-T-P-S
1.	Biomedical Circuits and Instrumentation	PC-AS-BCI501	PCC	4	3–0–2-0
2.	Biomechanics	PC-AS-BOM502	PCC	4	3–0–2-0
3.	Research Methodology & IPR	PC-AS-RMA503	ELC	2	2–0–0-0
			Total Credit:	**10**	12 Hrs./week

Soft-Core Subjects (Choose a single basket)

Basket 1: Medical/B.Pharma. /Pharmacology/Biotechnology/M.Sc. in Biology or Life sciences

Sl. No.	Course Name	Code	Type	Credit	Hours
					L-T-P-S
1.	Biosignal Processing	ES-AS-BOP501	PCC	4	3–0–2-0
2.	Biomath and Biostatistics	BS-AS-BMB501	PCC	4	3–0–2-0
			Total Credit:	**8**	10 Hrs./week

Basket 2: Engineering/Technology/Instrumentation/Electronics/IT/CS/Physics/Applied Physics

Sl. No.	Course Name	Code	Type	Credit	Hours
					L-T-P-S
1.	Molecular Biology	ES-AS-MBO502	PCC	4	3–0–2-0
2.	Anatomy & Physiology	ES-AS-APH503	PCC	4	3–0–2-0
			Total Credit:	**8**	10 Hrs./week

Basket 3: Applied Chemistry/Applied Math

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Anatomy & Physiology	ES-AS-APH503	PCC	4	3–0–2-0
2.	Biosignal Processing	ES-AS-BOP501	PCC	4	3–0–2-0
	Total Credit:			**8**	10 Hrs./week

Table 2:   Second Semester

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Advanced Medical Instrumentation	PC-AS-AMI504	PCC	4	3–0–2-0
2.	Biomedical Imaging	PC-AS-BIM505	PCC	4	3–0–2-0
3.	Medical Sensors and Actuators	PC-AS-MSA506	PCC	4	3–0–2-0
4.	Elective I	PE-AS-XXX501	PEC	3	3–0–0-0
5.	Mini Project	PC-AS-MPJ507	ELC	2	0–0–4-0
6.	HSMC	HM-AS-RMI501	VEC	2	2–0–0-0
	Total Credit:			**19**	24 Hrs./week

EXIT: After the end of second Semester, after clearing all the papers, the M. Tech student may eligible for PG Diploma in Biomedical Engineering. However, these students have to secure **additional 5 credits** from summer semester for awarding PG diploma, which is mandatory. For regular M. Tech students there is no need of summer semester.

Table 3:   Summer Semester (for **PG-Diploma**)

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Summer Project	PC-AS-SPJ508	ELC	2	0–0–4-0
2.	Medical Instrumentation Course/NPTEL	PC-AS-MIC509	PCC	3	3–0–0-0
	Total Credit:			**5**	7 Hrs./week

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Table 4: **Third Semester**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Elective II	PE-AS-XXX502	PEC	3	3–0–0-0
2.	Elective III	PE-AS-XXX503	PEC	3	3–0–0-0
3.	Open Electives	OE-XX-xxx501	OE	3	3–0–0-0
4.	Major Project	PC-AS-MPJ509	ELC	8	0–0–16-0
			Total Credit:	**17**	25 Hrs./week

Table 5: **Fourth Semester**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	M. Tech Thesis	PC-MTH510	ELC	12	0–0–24-0
			Total Credit:	**12**	24 Hrs./week

Table 6: **List of Electives (for elective I, II and III)**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Bioelectrics	PE-AS-BIE501	PEC	3	3–0–0-0
2.	Biomaterials and Tissue Engineering	PE-AS-BTE502	PEC	3	3–0–0-0
3.	Medical Image Processing	PE-AS-MIP503	PEC	3	3–0–0-0
4.	Nanobiotechnology and Nanoinformatics	PE-AS-NBN504	PEC	3	3–0–0-0
5.	Bio-MEMs	PE-AS-BIM505	PEC	3	3–0–0-0
6.	Artificial Organs and Implants	PE-AS-AOI506	PEC	3	3–0–0-0
7.	Engineering Processes in Biological Systems	PE-AS-EPB507	PEC	3	3–0–0-0
8.	Soft Computing Tools for Biomedical Engineering	PE-AS-SCT508	PEC	3	3–0–0-0
9.	Computational Methods for Biomedical Engineers	PE-AS-CMB509	PEC	3	3–0–0-0
10	Modeling of Biomedical Engineering Systems	PE-AS-MBE510	PEC	3	3–0–0-0
11	Telemedicine	PE-AS-TEM511	PEC	3	3–0–0-0

12	Immunotechnology	PE-AS-IMT5012	PEC	3	3–0–0-0
13	Medical Information Systems and PACS	PE-AS-MIP513	PEC	3	3–0–0-0
14	Machine Learning for Medical Systems	PE-AS-MLM514	PEC	3	3–0–0-0
15	Computer Aided Drug Designing	PE-AS-CAD515	PEC	3	3–0–0-0
16	Clinical Biochemistry	PE-AS-CBC516	PEC	3	3–0–0-0
17	Infectious Disease Modeling	PE-AS-IDB517	PEC	3	3–0–0-0
18	Material Informatics	PE-AS-MIN518	PEC	3	3–0–0-0
19	Instrumentations	PE-AS-INS519	PEC	3	3–0–0-0
20	Biomedical Engineering for Space	PE-AS-BES520	PEC	3	3–0–0-0
21	Fluid Mechanics for Biological Systems	PE-AS-FMB521	PEC	3	3–0–0-0
22	Survival Analysis	PE-AS-SAN522	PEC	3	3–0–0-0
23	All the electives provided in M. Tech BI basket are available for M. Tech BME students also				
24	**OPEN ELECTIVES**				
25	Open Elective from IT		OE	3	
26	Open Elective from ECE		OE	3	

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Bioinformatics (M.Tech& Dual degree M.Tech-PhD)

Bioinformatics is one of the interdisciplinary courses which involve study of biology, computer science, and information technology. Bioinformatics uses both computation and assessment tools to collect and translate biological data. This is suitable for development of algorithms and tools suitable for large biological databases, design data frameworks, and develop and adjust algorithms. M. Tech Bioinformatics at the Indian Institute of Information Technology – Allahabad, is a four semester's program designed to develop the skills in Information Technology and Data science applied on Biological Data. M. Tech in Bioinformatics is an excellent avenue to build your career, which provides an interdisciplinary platform through the amalgamation of Information Technology, Statistics, Mathematics and Biology. The coursework is designed to include a balance of functional knowledge as well as practical learning spread over four semesters covering, Computer programming, Data structure and Algorithms, Database Management System/Biological Information System and Management(Applied on Large Scale Biological Data), Mathematics, Statistics, Machine Learning and emerging topics such as Big Data, Deep Learning, Pattern Recognition as electives.

Total Credit Distribution

Semester	Semester I	Semester II	Summer Semester	Semester III	Semester IV	Total Credits
M. Tech	18	19	0	17	12	66
PG Diploma	18	19	5	-	-	42

Dual degree M. Tech-PhD*	20	19	*After Second semester, Dual degree M. Tech-PhD students will follow PhD ordinance/Curriculum

M.Tech BI, Credit Distribution

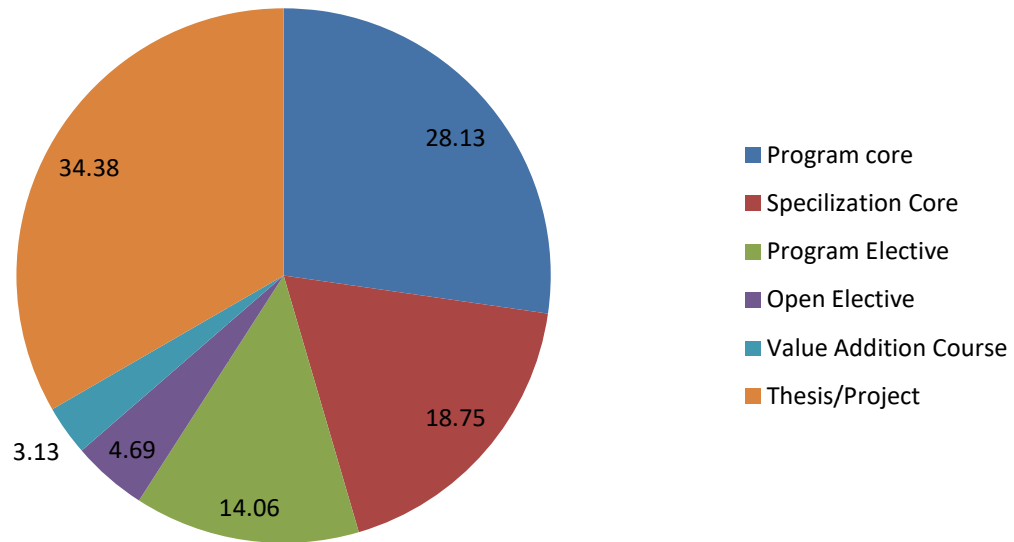| M. Tech BI	I	II	III	IV	Total Credits	
Program core	6	12			18	28.13 %
Specialization Core	12				12	18.75%
Program Elective		3	6		9	14.06%
Open Elective			3		3	4.69%
Value Addition Course		2			2	3.13%
Thesis/Project		2	8	12	22	34.38%

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Dual Degree M. Tech-PhD BI, Credit Distribution

M. Tech BI	I	II	III	IV	V	VI	VII	VIII	Total Credits	
1. Program core	6	12	8						26	20%
2. Specialization Core	12								12	10%

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3.	Program Elective	3							3	2.5%
4.	Open Elective		3						3	2.5%
5.	Value Addition Course	2							2	1.6%
6.	Thesis/Project/Summer Project	2	8						10	8%
7.	Research Credit/ Colloquium		8	12	12	12	12	12	68	57%
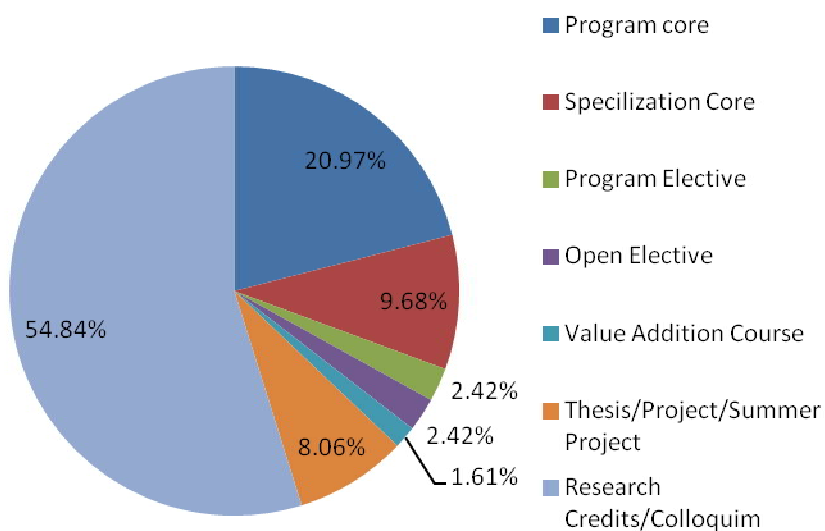
Table 7: **First Semester (M. Tech and Dual Degree M. Tech-PhD)**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	OMICS	BS-AS-OMI501	PCC	4	3–0–2-0
2.	Biological Data Analytics	PC-AS-BDA501	PCC	4	3–0–2-0

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Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
3.	Scripting and Computer Environments	ES-AS-SCE501	PCC	4	2–0–4-0
4.	Data Structure and Algorithms	ES-AS-DSA502	PCC	4	2–0–4-0
5.	Research Methodology & IPR **(for M. Tech and M. Tech-PhD)**	PC-AS-RMA504	ELC	2	2–0–0-0
6.	Research Methodology **(for M. Tech-PhD)**	PC-AS-RMA505	ELC	2	2–0–0-0
	Total Credit:			18/20	24Hrs./week 26Hrs./week

Table 8:   Second Semester (M. Tech and Dual Degree M. Tech-PhD)

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Next Generation Sequencing Tools and Algorithms	PC-AS-NGS502	PCC	4	3–0–2-0
2.	Molecular Structure Prediction and Visualization	PC-AS-MPV502	PCC	4	3–0–2-0
3.	Biological Information System and Management	ES-AS-BIM503	PCC	4	3–0–2-0
4.	HSMC	HM-AS-RMI501	VEC	2	2–0–0-0
5.	Elective-1	PE-AS-XXX	PEC	3	3–0–0-0
6.	Mini Project	PC-AS-MPJ510	ELC	2	0–0–4-0
	Total Credit:			19	24 Hrs./week

EXIT: *after the end of second Semester, after clearing all the papers, the M. Tech student may eligible for PG Diploma in Bioinformatics. However, these students have to secure **additional 5 credits** from summer semester for awarding PG diploma, which is mandatory.*

Dual degree M. Tech-Ph.D.: *After the end of II Semester the M. Tech-PhD student moves into the Ph. D Section of the Degree and will be henceforth governed by the Ph.D. ordinance. Please note that there is a **Summer Semester** which will be between II and III Semester. For regular M. Tech students there is no need of summer semester.*

Table 9: **Summer Semester**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Summer Project (for **PG Diploma**)	PC-AS-SPJ503	ELC	2	0–0–4-0
2.	Systems Biology/ Cheminformatics/NPTEL (for **PG Diploma**)	PC-AS-SCN509	PCC	3	3–0–0-0
3.	Summer Project (for M. Tech-PhD)	PC-AS-SPJ504	ELC	8	0–0–16-0
	Total Credit:			**5/8**	7 Hrs./week 16 Hrs./week

Table 10: **Third Semester (M. Tech)**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Elective II	PE-AS-XXX	PEC	3	3–0–0-0
2.	Elective III	PE-AS-XXX	PEC	3	3–0–0-0
3.	Open Electives	OE-EC/IT	OEC	3	3–0–0-0
4.	Major Project	PC-AS-MRP501	ELC	8	0–0–16-0
	Total Credit:			**17**	25 Hrs./week

Table 11: **Third Semester (M. Tech-PhD)**

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Research specific breadth course/Self study	PC-AS-RSB501	PCC	4	0–0–0-8
2.	Research specific depth course/Self study	PC-AS-RSD502	PCC	4	0–0–0-8
3.	Open Electives	OE-EC/IT	OEC	3	3–0–0-0
4.	Research Credit	PC-AS-RGC 601	ELC	8	0–0–16-0
	Total Credit:			**19**	35 Hrs./week

Table 12: **Fourth Semester (M. Tech)**

Sl.	Course Name	Code	Type	Credit	Hours

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No.					L-T-P-S
2.	M. Tech Thesis	PC-MTH502	ELC	12	0–0–24–0
	Total Credit:			**12**	24 Hrs./week

Table 13:   Fourth Semester (M. Tech-PhD)

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Research Credit	PC-AS-RPC601		12	0–0–24–0
	Total Credit:			**12**	24 Hrs./week

Table 14:   List of Electives (for elective I, II and III)

Sl. No.	Course Name	Code	Type	Credit	Hours L-T-P-S
1.	Machine Learning for Biological Systems	PE-AS-MLB501	PEC	3	2-0-1-0
2.	Cheminformatics	PE-AS-CHI502	PEC	3	3-0-0-0
3.	Molecular Medicine	PE-AS-MOM503	PEC	3	3-0-0-0
4.	Cognitive Modeling	PE-AS-CGM504	PEC	3	3-0-0-0
5.	Advance Data Analytics Deep Learning	PE-AS-ADD505	PEC	3	2-0-1-0
6.	Systems Biology	PE-AS-SYS506	PEC	3	3-0-0-0
7.	Parallel Computing	PE-AS-PLP507	PEC	3	3-0-0-0
8.	Pattern Recognition	PE-AS-PRE508	PEC	3	2-0-1-0
9.	Numerical Methods	PE-AS-NUM509	PEC	3	3-0-0-0
10	All the electives provided in M. Tech BME basket are available for M. Tech BI students also				
11	**OPEN ELECTIVES**				
12	Open elective from IT	OE-IT		3	
13	Open elective ECE	OE-ECE		3	

Proposed Minor courses for B. Tech IT/ECE

(A)Minor in Biological Data Analytics Course Curriculum

Sl. No.	Course Name	Semester	Credit	L-T-P
1.	Proteomics and Genomics		3	3-0-0
2.	Next Generation Sequencing		3	3-0-0
3.	Cheminformatics for Engineers		3	3-0-0
4.	Systems Biology and Modeling		3	3-0-0
5.	Molecular Structure Prediction		3	3-0-0
		Total Credits	15	

(B)Minor in Medical Diagnostics and Therapeutic Technology Curriculum

Sl. No.	Course Name	Semester	Credit	L-T-P
1.	Basics of Human Anatomy & Physiology		3	3-0-0
2.	Biomedical Instrumentation		3	3-0-0
3.	Bio-MEMs and Nanotechnology		3	3-0-0
4.	Medical Imaging		3	3-0-0
5.	Tissue engineering and Gene therapy		3	3-0-0
		Total Credits	15	

(C) Minor in Quantum Computation and Quantum Information Course Curriculum

Sl. No.	Course Name	Lab requirement	Credit	L-T-P
1.	Fundamentals of Quantum Computation		3	3-0-0
2.	Information Theory and Entropy		3	3-0-0
3.	Spintronics		3	3-0-0
4.	Quantum Cryptography		3	3-0-0
5.	Functional Quantum Materials		3	3-0-0
		Total Credits	**15**	

List of Open Electives for IT/ECE (B. Tech)

Sl. No.	Course Name	Semester	Credit	L-T-P
1.	Tomography Imaging		3	3-0-0
2.	Bioinformatics		3	3-0-0
3.	Introduction to quantum computing and Information		3	3-0-0
4.	Advanced quantum computing and Information		3	3-0-0
5.	System modeling and simulation		3	2-0-1
6.	Nonlinear dynamics		3	3-0-0
7.	Solid State Physics -I		3	3-0-0
8.	Solid State Physics -II		3	2-0-1
9.	Spintronic and Magnetic Materials		3	3-0-0
10.	Photonic Crystals and Metamaterials		3	3-0-0

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Department of Applied Sciences

11.	Algebra and Number Theory		3	3-0-0
12.	Introduction to Topology		3	3-0-0
13.	Real Analysis		3	3-0-0
14.	Numerical Analysis		3	3-0-0