VIT Vidyalankar Institute of Technology
Accredited A+ by NAAC

Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Biomedical Engineering

Programme Structure

(As per NEP 2020, with effect from Academic Year 2023-24)

Preamble

The National Education Policy (NEP) framework aims to break the mould from teacher centric to student centric educational practices. It empowers the students with flexibility in terms of choosing courses across different faculties and mode of learning.

This multidisciplinary approach will encourage learners to follow their passion and inherent interests. The learner is free to learn at a pace that he is comfortable with and this enables lifelong learning. It also enhances the scope for holistic personality development.

This premise is truly reflected in preamble of the NEP document, "The future of nation is decided in the classrooms of the schools and colleges today".

Details of implementation:

NEP curriculum framework enables us to accelerate change, redesign systems with equity in mind, respond to feedback, encourage collaboration, catch and pollinate ideas and create a culture of research and development. It will allow us to offer the required academic flexibility which will focus on improving competency level of students with diverse strengths.

The curriculum planned by VIT has vertical **Program Courses** consisting of core courses (PCC) of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. This vertical also includes Professional elective courses (PEC) which offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a special feature of this curricula ensuring employability.

The vertical **Multidisciplinary Courses** consists of Open Elective (OE) courses and multidisciplinary minor (MD M) courses. Special vocational and skill development courses are included as a part of **Skill courses** vertical that make student capable to work in industrial environment.

The student is expected to demonstrate their ability through course in **Experiential Learning Courses** vertical like internships/On Job Training, Community Engagement Project, Real Industry Project/ research problem. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking. This will lead to creation of products and/ or patents through this program.

For holistic development of students, apart from technical courses, Ability Enhancement Courses, Entrepreneurship/Economics/Management Courses, Indian Knowledge System and Value Education courses from vertical **Humanities and Social Science and Management** develop the required soft-skills and attitude amongst learners.

In **Liberal Learning** vertical. courses like Various Dance Forms, Global citizenship Education, Facets of Astronomy etc. aims to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses.

In addition to core courses, professional and open electives; our framework offers honor degree in each programme of engineering. It includes specialized courses along with field/ domain study that make student capable of working on industry relevant problems.

Chairman, Board of Studies
Department of Biomedical Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Vertical Based Credit Allotment as Per NEP2020

Sr. No.	Verticals	Baskets	Credits
I	BSC/ESC	Basic Science Course	15
		Engineering Science Courses	12
II	Program Courses	Program Core Courses (PCC)	46
		Program Elective Courses (PEC)	18
III	Multidisciplinary Courses	Multidisciplinary Minor (MD M)	14
		Open Elective (OE) Other than a particular Program	8
IV	Skill Courses	Vocational and Skill Enhancement course (VSEC)	9
V	Humanities, Social Sciences and Management (HSSM)	Ability Enhancement Course (AEC -01, AEC-02)	5
		Entrepreneurship/Economics/ Management Courses	3
		Indian Knowledge System (IKS)	2
		Value Education Course (VEC)	3
VI	Experiential Learning Courses	Research Methodology	3
		Comm. Engagement. Project (CEP)/Field Project (FP)	2
		Project	6
		Internship/ OJT	13
VII	Liberal Learning Courses	Co-curricular Courses (CC)	4
		Total	**163**

Learner is expected to complete requirement of 164 credits (with minimum credits under each vertical and/or bucket as mentioned above) for B.Tech. degree in Biomedical Engineering with Multidisciplinary Minor.

Additionally, learners can choose to avail i) B.Tech. in Biomedical Engineering – Honors and Multidisciplinary Minor or ii) B.Tech. in Biomedical Engineering - Honours with Research and Multidisciplinary Minor or iii) B.Tech. in Biomedical Engineering with Double Minors (Multidisciplinary and Specialization Minor) Degree by completing requirements of 18 credits, which will be over and above the 163 credits required for B.Tech. with Multidisciplinary Minor degree.

Structure of Honour/Minor Degree Programme

Sr. No.	Category	Credits
1	Course Work	9
2	Industry Interaction	1
3	Survey Paper	2
4	Seminar	2
5	Specialized Project	4
Total		**18**

Definition of Credit

Duration	Credit
1 Hr. Lecture (L)per week	1
1 Hr. Tutorial (T)per week	1
1 Hr. Practical(P) per week	0.5

Courses Under Various Baskets

I. BSC/ESC

a) Basic Science Courses (BSC)

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	BS20T	Physics for Biomedical Engineering	2	-	-	2	1
2	BS20P	Physics for Biomedical Engineering Lab	-	2	-	1	1
3	BS02	Engineering Mathematics-I	3	-	-	3	1
4	BS16T	Engineering Chemistry	2		-	2	2
5	BS16P	Engineering Chemistry Lab	-	2	-	1	2
6	BS04	Engineering Mathematics-II	3	-	-	3	2
7	BS18T	Human Anatomy & Physiology	2	-	-	2	3
8	BS18P	Human Anatomy & Physiology Lab	-	2	-	1	3

b) Engineering Science Courses (ESC)

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	ES02T	Engineering Mechanics	2	-	-	2	1
2	ES02P	Engineering Mechanics Lab	-	2	-	1	1
3	ES08T	Basic Electrical & Electronics Engineering	2	-	-	2	1
4	ES08P	Basic Electrical & Electronics Engineering Lab	-	2	-	1	1
5	ES01T	Engineering Graphics	2	-	-	2	2
6	ES01P	Engineering Graphics Lab	-	2	-	1	2

4	BM03T	Electronic Devices and Circuits	2	-	-	2	3
5	BM03P	Electronic Devices and Circuits	-	2	-	1	3
Total						**12**	

II. Program Courses

a) Program Core Courses (PCC)

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	BM04T	Biomedical Transducers and Control Systems	2	-	-	2	3
2	BM04P	Biomedical Transducers and Control Systems Lab	-	2	-	1	3
3	BS06	Engineering Mathematics - III	3	-	-	3	3
4	BM01T	Digital logic design and analysis	2	-	-	2	4
5	BM01P	Digital logic design and analysis Lab	-	2	-	1	4
6	BM02	Biomechanics Prosthetics and Orthotics	2	-	1	3	4
7	BS08	Engineering Mathematics-IV	3	-	-	3	4
8	BM05T	Analytical and Clinical Equipment	2	-	-	2	4
9	BM05P	Analytical and Clinical Equipment Lab	-	2	-	1	4
10	BM06T	Linear Integrated Circuits	2	-	-	2	4
11	BM06P	Linear Integrated Circuits Lab	-	2	-	1	4
12	BM07T	Biological Modelling and Simulation	2	-	-	2	4

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
13	BM07P	Biological Modelling and Simulation Lab	-	2	-	1	4
16	BM09T	Diagnostic and Monitoring Equipment	2	-	-	2	5
17	BM09P	Diagnostic and Monitoring Equipment Lab	-	2	-	1	5
18	BM10T	Microprocessors and Microcontrollers	2	-	-	2	5
19	BM10P	Microprocessors and Microcontrollers Lab	-	2	-	1	5
20	BM11T	Biomedical Digital Signal Processing	2	-	-	2	5
21	BM11P	Biomedical Digital Signal Processing Lab	-	2	-	1	5
22	BM12T	Medical Imaging Equipment	2	-	-	2	5
23	BM12P	Medical Imaging Equipment Lab	-	2	-	1	5
24	BM13T	Critical Care Equipment	2	-	-	2	6
25	BM13P	Critical Care Equipment Lab	-	2	-	1	6
26	BM14T	Digital Image Processing	2	-	-	2	6
27	BM14P	Digital Image Processing Lab	-	2	-	1	6
28	BM15T	Biomedical Microsystems	2	-	-	2	6
29	BM16T	Hospital Management	2	-	-	2	6

II. Program Courses

b) Program Elective Courses (PEC)

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	BM21T	Integrated Data Management	2	-	-	2	5
2	BM21P	Integrated Data Management Lab	-	2	-	1	5
3	BM22T	Modern Sensors for Internet of Things (IoT)	2	-	-	2	5
4	BM22P	Modern Sensors for Internet of Things (IoT) Lab	-	2	-	1	5
5	BM23T	Bio-Photonics	2	-	-	2	5
6	BM23P	Bio-Photonics Lab	-	2	-	1	5
7	BM24T	Artificial Intelligence	2	-	-	2	6
8	BM24P	Artificial Intelligence Lab	-	2	-	1	6
9	BM25T	Principles of Internet of Things (IoT)	2	-	-	2	6
10	BM25P	Principles of Internet of Things (IoT) Lab	-	2	-	1	6
11	BM26T	Robotics in Medicine	2	-	-	2	6
12	BM26P	Robotics in Medicine Lab	-	2	-	1	6
13	BM27T	Machine Learning	2	-	-	2	6
14	BM27P	Machine Learning Lab	-	2	-	1	6
15	BM28T	Embedded System Design with Tiny Operating System (OS)	2	-	-	2	6
16	BM28P	Embedded System Design with Tiny Operating System (OS) Lab	-	2	-	1	6
17	BM29T	Point of Care Technology	2	-	-	2	6

18	BM29P	Point of Care Technology Lab	-	2	-	1	6
19	BM30T	Deep learning	2	-	-	2	7
20	BM30P	Deep learning Lab	-	2	-	1	7
21	BM31T	Internet of Things (IoT) and Edge Computing	2	-	-	2	7
22	BM31P	Internet of Things (IoT) and Edge Computing Lab	-	2	-	1	7
23	BM32T	Biomedical Equipment Safety	2	-	-	2	7
24	BM32P	Biomedical Equipment Safety Lab	-	2	-	1	7
25	BM33T	Data Analytics	2	-	-	2	7
26	BM33P	Data Analytics Lab	-	2	-	1	7
27	BM34T	Internet of Things (IoT) Security and Trust	2	-	-	2	7
28	BM34P	Internet of Things (IoT) Security and Trust Lab	-	2	-	1	7
29	BM35T	Medical Device Regulation	2	-	-	2	7
30	BM35P	Medical Device Regulation Lab	-	2	-	1	7
31	BM36T	Basics of Natural Language Processing	2	-	-	2	7
32	BM36P	Basics of Natural Language Processing Lab	-	2	-	1	7
33	BM37T	Industrial Internet of Things (IIoT)	2	-	-	2	7
34	BM37P	Industrial Internet of Things (IIoT) Lab	-	2	-	1	7
35	BM38T	Installation & Maintenance of Medical Equipment	2	-	-	2	7
36	BM38P	Installation & Maintenance of Medical Equipment Lab	-	2	-	1	7

III. Multidisciplinary Courses

a. Open Elective Courses

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	OE01	Cyber Law	3	-	-	3	7/8
2	OE05	Operation Research	3	-	-	3	7/8
3	OE06	IPR and Patenting	3	-	-	3	
4	OE08	Renewable Energy Management	3	-	-	3	7/8
5	OE09	Energy Audit and Management	3	-	-	3	7/8
6	OE10	E-Farming	3	-	-	3	7/8
7	OE11	Bioinformatics	3	-	-	3	7/8
8	OE12	Nanotechnology	3	-	-	3	7/8

b. Multidisciplinary Minor (MDM)

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
2	OE02	Project Management	3	-	-	3	Any
3	OE03	Product Lifecycle Management	3	-	-	3	Any
4	OE04	Sustainability Management	3	-	-	3	Any
5	GESB07	Psychology	2	-	-	2	Any
6	GENS02	Modern Farming	2	-	-	2	Any
7	EC10T	Basics of VLSI	2	-	-	2	Any
8	EC10P	Basics of VLSI Lab		2	-		Any
9	IT10T	Data warehousing & Mining	2	-	-	2	Any
10	IT10P	Data warehousing & Mining Lab	-	2	-	1	Any
11	ET02T	Principles of Communication Engineering	2	-	-	2	Any
12	ET02P	Principles of Communication Engineering Lab	-	2	-	1	Any
13	ET09T	Digital Communication	2	-	-	2	Any

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
14	ET09P	Digital Communication Lab	-	2	-	1	Any
15	ET11T	Electromagnetics and Antenna	3	-	-	3	Any
16	ET11P	Electromagnetics and Antenna Lab	-	2	-	1	Any
17	EC05T	Control Systems Engineering	2	-	-	2	Any
18	EC05P	Control Systems Engineering Lab	-	2	-	1	Any
19	EC06T	Signals and Systems	2	-	-	2	Any
20	EC06P	Signals and Systems Lab	-	2	-	1	Any
21	EC07T	Web Technology	2	-	-	2	Any
22	EC07P	Web Technology Lab	-	2	-	1	Any
23	EC03T	Data Structures	2	-	-	2	Any
24	EC03P	Data Structures Lab	-	2	-	1	Any
25	EC04T	Computer Organization and Architecture	2	-	-	2	Any
26	EC04P	Computer Organization and Architecture Lab	-	2	-	1	Any

IV. Vocational and Skill Enhancement Courses (VSEC)
Skill Courses

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	ES04T*	Structured Programming	2	-	-	2	1
2	ES04P*	Structured Programming Lab	-	2	-	1	1
3	ES05T*	Object Oriented Programming	2	-	-	2	2
4	ES05P*	Object Oriented Programming Lab	-	2	-	1	2
5	BM08P	Python Programming Lab	-	2	-	1	4

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
	BM08P	Python Programming	2	-	-	2	4

V. Humanities, Social Sciences and Management Courses (HSSM)

a. Ability Enhancement Courses (AEC)

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	$GE01	Internship with other Institutes (Credit Transfer)	Minimum 120 hours			4	SE Break
2	GEA01	Voice Culture for Professional Speaking	2	-	-	2	Any
	GESB04	Corporate and Social Etiquettes	2	-	-	2	Any
	HS01T	Effective Communication	2	-	-	2	1
	HS01P	Effective Communication Lab	-	2	-	1	1
	HS03	Technical and Business Writing	1	2	-	2	3

$ GE01- Internship with other Institutes (Credit Transfer): Internship with other reputed institutes equivalent to 4 credits is recommended to be done by learner during second year inter semester break(i.e. summer break between semester 4 and semester 5)

V. Humanities, Social Sciences and Management Courses (HSSM)

b. Entrepreneurship/Economics/ Management Courses

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	GECI01	Design Thinking	2	-	1	3	2
2	GECI02	Innovation and Entrepreneurship	3	-	-	2	Any
3	GEF01	Basics of Finance & Legal aspects for Business	2	-	-	2	Any
4	GEF02	Financial Management for beginners	2	-	-	2	Any

5	HS06	Principles of Economics and Management	2	-	-	3	4

V. Humanities, Social Sciences and Management Courses (HSSM)

c. Indian Knowledge System (IKS)

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	GESB03	Indian Traditional Knowledge System	2	-	-	2	Any
2	GEPS01	Indian Constitution	2	-	-	2	Any
3	GEA03	Exploring Indian Art	2	-	-	2	Any

V. Humanities, Social Sciences and Management Courses (HSSM)

d. Value Education Courses (VEC)

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	GESB02	Universal Human Values	2	-	-	2	Any
2	GESB06	Responsibility towards sustainable environment	2	-	-	2	Any
3	GEPS02	Four Pillars of Democratic Nation	2	-	-	2	Any
4	HS02T	Professional skills	2	-	-	2	Any
5	HS02P	Professional skills Lab		2	-	1	Any
6	HS05	E Waste and Environmental Management	2	-	-	2	Any
7	GEWI01	Railways - Wonders of Infrastructure	2	-	-	2	Any

VI. Experiential Learning Courses

a. Research Methodology (RM)

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	OE07	Research Methodology	3	-	-	3	7/8

VI. Experiential Learning Courses

b. Community Engagement Project /Field Project (CEP/FP)

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	GESB01#	Social Service Internship/ Project			-	2	3

 # For GESB01- Social Service Internship/ Project: 2 hours / week slot will be provided during the semester (in regular timetable). Additional work of 60 hours needs to be completed during the semester (besides regular timetable) or after the semester (during inter semester break).

VI. Experiential Learning Courses

c. Project

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	BM44	Project 2 - Demonstration	1	6	-	4	8
2	BM43	Publication / Patent	-	-	-	2	8

VI. Experiential Learning Courses

d. Internship/On Job Training

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	BM39	Mini Project-1		4		2	5
2	BM40	Mini Project-2		4		2	6
3	BM41	Industry Internship	Minimum 150 hours			6	7/8
4	BM42	Project-1 (Synopsis)	3			3	7

VII. Liberal Learning Courses

Co-curricular Courses (LLC-CC)

Sr. No.	Course Code	Course Name	Hours Per Week			Credits	Preferred Semester
			Theory	Practical	Tutorial		
1	GEA02	Various Dance Forms	2	-	-	2	Any
2	GESB05	Global Citizenship Education	2	-	-	2	Any
3	GEPEW01	Wellness – Body, Mind & Spirit	2	-	-	2	Any
4	GEPEW02	IQ vs EQ	2	-	-	2	Any
5	GEPEW03	Nutrition and Physical Wellness	2	-	-	2	Any
6	GENS01	Facets of Astronomy	2	-	-	2	Any

Illustrative Semester wise
Credit Distribution Structure and Assessment Guidelines
(Based on NEP 2020 Guidelines)
for
Bachelor of Technology
in
Biomedical Engineering-One Major, One Minor

Semester			I	II	III	IV	V	VI	VII	VIII	Credits /Audit
Sr. No	**Sub-Category**	**Verticals**									
I	Basic Science Course	BSC/ESC	6	6	3						15
	Engineering Science Courses		6	3	3						12
II	Program Core Courses (PCC)	Program Courses			6	18	12	10			46
	Program Elective Courses (PEC)						3	6	9		18
III	Multidisciplinary Minor (MD M)	Multidisciplinary Courses					3	3	3	5	14
	Open Elective (OE) Other than a particular Program									8	8
IV	Vocational and Skill Enhancement course (VSEC)	Skill Courses	3	3	3						9
V	Ability Enhancement Course (AEC -01, AEC-02)	Humanities, Social Sciences and Management (HSSM)	3		2						5
	Entrepreneurship/Economics/ Management Courses			3							3
	Indian Knowledge System (IKS)					2					2
	Value Education Course (VEC)			3							3
VI	Research Methodology	Experiential Learning Courses								3	3
	Comm. Engagement. Project (CEP)/Field Project (FP)				3						3
	Project								6		6
	Internship/ OJT						2	5		6	13
VII	Co-curricular Courses (CC)	Liberal Learning Courses	2	2							4
	Total		**20**	**20**	**19**	**20**	**20**	**24**	**18**	**22**	**163**

First Year B. Tech. Biomedical Engineering **Preferred Semester: I**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
HSSM -AEC	HS01T	Any HSSM_AEC course offered	Theory	2	15	20	40	075
HSSM -AEC	HS01P		Practical	1	25	-	25	050
BSC	BS02T	Engineering Mathematics-I	Theory	3	20	30	50	100
BSC	BS20T	Physics for Biomedical Engineering	Theory	2	15	20	40	075
BSC	BS20P	Physics for Biomedical Engineering Lab	Practical	1	25	-	25	050
SC-VSEC	ES04T	Structured Programming	Theory	2	15	20	40	075
SC-VSEC	ES04P	Structured Programming Lab	Practical	1	25	-	25	050
ESC	ES08T	Basic Electrical Engineering	Theory	2	15	20	40	075
ESC	ES08P	Basic Electrical Engineering Lab	Practical	1	25	-	25	050
ESC	ES02T	Engineering Mechanics	Theory	2	15	20	40	075
ESC	ES02P	Engineering Mechanics Lab	Practical	1	25	-	25	050
LLC-CC	GEXX*	Any LLC_CC course from the list	As per course	2	As per course			
Total				**20**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESE= End Semester Examination
*Selection based on the subset of GE courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

First Year B. Tech. Biomedical Engineering **Preferred Semester: II**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
HSSM-VEC	HS02T	Professional Skills	Theory	2	15	20	40	075
HSSM-VEC	HS02P	Professional Skills Lab	Practical	1	25	-	25	050
BSC	BS04T	Engineering Mathematics-II	Theory	3	20	30	50	100
BSC	BS16T	Engineering Chemistry	Theory	2	15	20	40	075
BSC	BS16P	Engineering Chemistry Lab	Practical	1	25	-	25	050
ESC	ES01T	Engineering Graphics	Theory	2	15	20	40	075
ESC	ES01P	Engineering Graphics Lab	Practical	1	25	-	25	050
SC-VSEC	ES05T	Object-Oriented Programming	Theory	2	15	20	40	075
SC-VSEC	ES05P	Object-Oriented Programming Lab	Practical	1	25	-	25	050
LLC-CC	GEXX*	Any LLC_CC course from the list	As per course	2	As per Course			
HSSM-EEMC	GEXX*	Any HSSM_EEMC course	As per course	3	As per course			
Total				**20**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination
*Selection based on the subset of GE courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Second Year B. Tech. Biomedical Engineering **Preferred Semester: III**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
HSSM-AEC	HS03	Technical and Business Writing	Theory +Practical	2	75	-	-	075
PC-PCC	BS06	Engineering Mathematics - III	Theory	3	20	30	50	100
BSC	BS18T	Human Anatomy & Physiology	Theory	2	15	20	40	075
BSC	BS18P	Human Anatomy & Physiology Lab	Practical	1	25	-	25	050
PC-PCC	BM04T	Biomedical Transducers and Control Systems	Theory	2	15	20	40	075
PC-PCC	BM04P	Biomedical Transducers and Control Systems Lab	Practical	1	25	-	25	050
ESC	BM03T	Electronic Devices and Circuits	Theory	2	15	20	40	75
ESC	BM03P	Electronic Devices and Circuits Lab	Practical	1	25	-	25	50
SC-VSEC	BM08T	Python Programming	Theory	2	15	20	40	75
SC-VSEC	BM08P	Python Programming Lab	Practical	1	25	-	25	100
CEP/FP	GESB01#	Social Service Internship/ Project		2	75	-	-	75
Total				**19**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination
*Selection based on the subset of GE courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Second Year B. Tech. Biomedical Engineering **Preferred Semester: IV**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
HSSM_IKS		Any HSSM_IKS course from Basket	Theory+ Tutorial	2	15	20	40	075
PC-PCC	BS08	Engineering Mathematics-IV	Theory	3	20	20	60	100
PC-PCC	BM02	Biomechanics Prosthetics and Orthotics	Theory+ Tutorial	3	40	20	40	100
PC-PCC	BM05T	Analytical and Clinical Equipment	Theory	2	15	20	40	075
PC-PCC	BM05P	Analytical and Clinical Equipment Lab	Practical	1	25	-	25	050
PC-PCC	BM06T	Linear Integrated Circuits	Theory	2	15	20	40	075
PC-PCC	BM06P	Linear Integrated Circuits Lab	Practical	1	25	-	25	050
PC-PCC	BM07T	Biological Modelling and Simulation	Theory	2	15	20	40	075
PC-PCC	BM07P	Biological Modelling and Simulation Lab	Practical	1	25	-	25	050
PC-PCC	BM01T	Digital logic design and analysis	Theory	2	15	20	40	075
PC-PCC	BM01P	Digital logic design and analysis Lab	Practical	1	25	-	25	050
Total				**20**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESE= End Semester Examination

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Third Year B. Tech. Biomedical Engineering **Preferred Semester: V**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
MDM	MDMXX	Multidisciplinary Minor Course-1	Theory	3	As per Course			
PC-PCC	BM09T	Diagnostic and Monitoring Equipment	Theory	2	15	20	40	075
PC-PCC	BM09P	Diagnostic and Monitoring Equipment Lab	Practical	1	25	-	25	050
PC-PCC	BM10T	Microprocessors and Microcontrollers	Theory	2	15	20	40	075
PC-PCC	BM10P	Microprocessors and Microcontrollers Lab	Practical	1	25	-	25	050
PC-PCC	BM11T	Biomedical Digital Signal Processing	Theory	2	15	20	40	075
PC-PCC	BM11P	Biomedical Digital Signal Processing Lab	Practical	1	25	-	25	050
PC-PCC	BM12T	Medical Imaging Equipment	Theory	2	15	20	40	075
PC-PCC	BM12P	Medical Imaging Equipment Lab	Practical	1	25	-	25	050
PC-PEC	BMXXT	Prof. Elective 1	Theory	2	15	20	40	75
PC-PEC	BMXXP	Prof. Elective 1 Lab	Practical	1	25	-	25	50
INT/OJT	BM39P	Mini Project-1	Practical	2	25	-	50	75
	Total			**20**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESE= End Semester Examination

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Guidelines for Professional Elective Courses and Specialization Certificate – Refer Appendix-A

Important Note 1: Learners are required to go through the Appendix-A carefully before selecting the Professional Elective courses. Detailed guidelines regarding Professional Elective courses, specialization tracks and courses relevant to each track are given in Appendix-A.

Professional Elective Courses-1 (BMXX)

Code	Course Name	Specialization Track Name#
BM21T	Integrated Data Management	AI in Healthcare
BM21P	Integrated Data Management Lab	AI in Healthcare
BM22T	Modern Sensors for Internet of Things (IoT)	Internet of Things (IoT)
BM22P	Modern Sensors for Internet of Things (IoT) Lab	Internet of Things (IoT)
BM23T	Bio-Photonics	Biomedical Technology and Innovation
BM23P	Bio-Photonics Lab	Biomedical Technology and Innovation

Third Year B. Tech. Biomedical Engineering **Preferred Semester: VI**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
PC-PCC	BM13T	Critical Care Equipment	Theory	2	15	20	40	075
PC-PCC	BM13P	Critical Care Equipment Lab	Practical	1	25	-	25	050
PC-PCC	BM14T	Digital Image Processing	Theory	2	15	20	40	075
PC-PCC	BM14P	Digital Image Processing Lab	Practical	1	25	-	25	050
PC-PCC	BM15T	Biomedical Microsystems	Theory	2	15	20	40	075
PC-PCC	BM16T	Hospital Management	Theory	2	15	20	40	075
PC-PEC	BMXXT	Prof. Elective 2	Theory	2	15	20	40	075
PC-PEC	BMXXP	Prof. Elective 2 Lab	Practical	1	25	-	25	050
MDM	MDM-2	Multidisciplinary Minor-2	Theory	3	As per Course			
INT/OJT	BM40P	Mini Project-2	Practical	2	25	-	50	075
INT/OJT	BM42	Project-1 Synopsis	Theory	3	50	-	50	100
	Total			**21**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Professional Elective - 2 Courses (BMXX)

Code	Name	Specialization Track Name#
BM24T	Artificial Intelligence	AI in Healthcare
BM24P	Artificial Intelligence Lab	AI in Healthcare
BM25T	Principles of Internet of Things (IoT)	Internet of Things
BM25P	Principles of Internet of Things (IoT) Lab	Internet of Things
BM26T	Robotics in Medicine	Biomedical Technology and Innovation
BM26P	Robotics in Medicine Lab	Biomedical Technology and Innovation

Final Year B. Tech. Biomedical Engineering **Preferred Semester: VII**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
PC-PEC	BMXXT	Prof. Elective 3	Theory	2	15	20	40	075
PC-PEC	BMXXP	Prof. Elective 3 Lab	Practical	1	25	-	25	050
PC-PEC	BMXXT	Prof. Elective 4	Theory	2	15	20	40	075
PC-PEC	BMXXP	Prof. Elective 4 Lab	Practical	1	25	-	25	050
PC-PEC	BMXXT	Prof. Elective 5	Theory	2	15	20	40	075
PC-PEC	BMXXP	Prof. Elective 5 Lab	Practical	1	25	-	25	050
PC-PEC	BMXXT	Prof. Elective 6	Theory	2	15	20	40	075
PC-PEC	BMXXP	Prof. Elective 6 Lab	Practical	1	25	-	25	050
MDM	MDM	Multidisciplinary Minor-3	Theory	3	15	20	40	75
Project	BM43	Publication / Patent	Practical	2	25		50	075
Project	BM44	Project	Theory+ Practical	4	75	-	50	125
	Total			**21**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination
*Selection based on the subset of OE courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

#For details of Specialization Certificate, refer Appendix-A

Professional Elective -3 Courses (BMXX)

Code	Name	Specialization Track Name#
BM27T	Machine Learning	AI in Healthcare
BM27P	Machine Learning Lab	AI in Healthcare
BM28T	Embedded System Design with Tiny Operating System (OS)	Internet of Things
BM28P	Embedded System Design with Tiny Operating System (OS) Lab	Internet of Things
BM29T	Point of Care Technology	Biomedical Technology and Innovation
BM29P	Point of Care Technology Lab	Biomedical Technology and Innovation

Professional Elective -4 Courses (BMXX)

Code	Name	Specialization Track Name#
BM30T	Deep learning	AI in Healthcare
BM30P	Deep learning Lab	AI in Healthcare
BM31T	Internet of Things (IoT) and Edge Computing	Internet of Things (IoT)
BM31P	Internet of Things (IoT) and Edge Computing Lab	Internet of Things (IoT)
BM32T	Biomedical Equipment Safety	Biomedical Technology and Innovation
BM32P	Biomedical Equipment Safety Lab	Biomedical Technology and Innovation

Professional Elective -5 Courses (BMXX)

Code	Name	Specialization Track Name#
BM33T	Data Analytics	AI in Healthcare
BM33P	Data Analytics Lab	AI in Healthcare
BM34T	Internet of Things (IoT) Security and Trust	Internet of Things (IoT)
BM34P	Internet of Things (IoT) Security and Trust Lab	Internet of Things (IoT)
BM35T	Medical Device Regulation	Biomedical Technology and Innovation
BM35P	Medical Device Regulation Lab	Biomedical Technology and Innovation

Professional Elective -6Courses (BMXX)

Code	Name	Specialization Track Name#
BM36T	Basics of Natural Language Processing	AI in Healthcare
BM36P	Basics of Natural Language Processing Lab	AI in Healthcare
BM37T	Industrial Internet of Things (IIoT)	Internet of Things (IoT)
BM37P	Industrial Internet of Things (IIoT) Lab	Internet of Things (IoT)
BM38T	Installation & Maintenance of Medical Equipment	Biomedical Technology and Innovation
BM38P	Installation & Maintenance of Medical Equipment Lab	Biomedical Technology and Innovation

Final Year B. Tech. Biomedical Engineering **Preferred Semester: VIII**

Course Structure and Assessment guidelines

Course			Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP Vertical	Code	Name			ISA	MSE	ESE	
MC-OE	OEXX*	Any 3 Open Elective courses from the list offered.	Theory	3	20	30	50	100
MC-OE	OEXX*		Theory	3	20	30	50	100
MC-OE	OEXX*		Theory	2	20	30	50	100
MDM	MDM	Multidisciplinary Minor-4	Theory	2	15	20	40	75
MC-MDM	MDM	Multidisciplinary Minor-5	Theory	3	15	20	40	75
ELC-RM	OE07	Research Methodology	Theory	3	20	30	50	100
INT/OJT	BM41	Industry Internship	Practical	6	As decided by Internal and External guide			
	Total Credits			**22**	**-**	**-**	**-**	**-**

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination
*Selection based on the subset of OE courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Appendix-A
Guidelines for Professional Elective Courses and Specialization Certificate

Professional Elective courses are designed to meet industrial requirements. All learners must opt for 6 professional elective courses (both Theory and Practical component) as a part of requirement for B.Tech. degree.

Specialization Certificate is introduced in order to build competency of learners in the chosen domain. Department of Biomedical Engineering offers the following specialization tracks:

1. AI in Healthcare
2. Internet of Things (IoT)
3. Biomedical Technology and Innovation

Learners can take courses from any track. **However, if learners complete all professional elective courses from the same chosen track, they will be eligible to receive a Specialization Certificate from the institute.**

Learners who choose professional elective courses from different specialization tracks from semester are not eligible for a Specialization Certificate.

It should be noted that there are no additional credit requirements for these specializations.

AI & Data Science track: Courses to be chosen for specialization in AI in Healthcare

Semester	Course Code	Course Name
V	BM21T	Integrated Data Management
V	BM21P	Integrated Data Management Lab
VI	BM24T	Artificial Intelligence
VI	BM24P	Artificial Intelligence Lab
VI	BM27T	Machine Learning
VI	BM27P	Machine Learning lab
VII	BM30T	Deep learning
VII	BM30P	Deep learning Lab
VII	BM33T	Data Analytics
VII	BM33P	Data Analytics Lab
VII	BM36T	Basics of Natural Language Processing
VII	BM36P	Basics of Natural Language Processing

Internet of Things (IoT) track: Courses to be chosen for specialization in Internet of Things

Semester	Course Code	Course Name
V	BM22T	Modern Sensors for Internet of Things (IoT)
V	BM22P	Modern Sensors for Internet of Things (IoT) Lab
VI	BM25T	Principles of Internet of Things (IoT)
VI	BM25P	Principles of Internet of Things (IoT) Lab

VI	BM28T	Embedded System Design with Tiny Operating System (OS)
VI	BM28P	Embedded System Design with Tiny Operating System (OS) Lab
VII	BM31T	Internet of Things (IoT) and Edge Computing
VII	BM31P	Internet of Things (IoT) and Edge Computing Lab
VII	BM34T	Internet of Things (IoT) Security and Trust
VII	BM34P	Internet of Things (IoT) Security and Trust Lab
VII	BM37T	Industrial Internet of Things (IIoT)
VII	BM37P	Industrial Internet of Things (IIoT) Lab

BEM track: Courses to be chosen for specialization in Biomedical Technology and Innovation

Semester	Course Code	Course Name
V	BM23T	Bio-Photonics
V	BM23P	Bio-Photonics Lab
VI	BM26T	Robotics in Medicine
VI	BM26P	Robotics in Medicine Lab
VI	BM29T	Point of Care Technology
VI	BM29P	Point of Care Technology Lab
VII	BM32T	Biomedical Equipment Safety
VII	BM32P	Biomedical Equipment Safety Lab
VII	BM35T	Medical Device Regulation
VII	BM35P	Medical Device Regulation Lab
VII	BM38T	Installation & Maintenance of Medical Equipment
VII	BM38P	Installation & Maintenance of Medical Equipment Lab

Appendix-B
Guidelines for Award of Honours/ Minor Degree Programme

Honours and Minor Degree programme is introduced in order to facilitate learners to enhance the depth of knowledge, diversity, breadth and skills in emerging fields. An Honours or Minor degree typically refers to a higher level of academic achievement either for research orientation or for improving employability. learners can select any Honours or Minor degree programme as per his/her choice.

In our curriculum, learners can choose to avail Honours/Minor Degree programme by completing requirements of 15 credits, which will be over and above the minimum credits required for B.Tech. degree i.e. credit requirement for the award of degree programme and Honours/ Minor degree programme are required to be explicitly carried out. Learner shall opt for Honours or Minor specialisations during the break of Semester 5 and Semester 6. **Learners may complete the B.Tech. degree programme without opting for Honours or Minor degree programme** i.e. opting for Honours/Minor Degree programme is not mandatory as a part of B.Tech. degree programme.

For Honours degree, learner shall select Honour programme offered by his/her own department. Alternatively, for Minor degree, learner shall select Honour programme offered by any other department.

Eligibility Criteria

- All students are eligible to apply for Honours/ Minor degree programmes
- If student has already completed any course(s) that is listed in the chosen Honours/ Minor degree programme, as additional learning course(s), then the transfer credits for such course(s) shall be carried out towards Honours/ Minor degree programme.
- For a student to get Honours/ Minor degree, it is mandatory that the student completes the relevant courses before graduating.

Syllabus Scheme Template

Sr. No.	Course			Preferred Semester	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
	Code	Head of Learning	Name			ISA	MSE	ESE	
1	XXXX	Theory	Industry Interaction	Break of Sem5 and Sem6	1	25	-	-	025
2	XXXX	Theory	Honours / Minor Degree Course 1	6	2	15	20	40	075
		Practical	Honours / Minor Degree	6	1	25	-	25	050

Sr. No.	Course			Preferred Semester	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
	Code	Head of Learning	Name			ISA	MSE	ESE	
			Course 1 Lab						
3	XXXX	Theory	Survey Paper	Break of Sem6 and Sem7	2	25	-	25	050
4	XXXX	Theory	Honours / Minor Degree Course 2	7	2	15	20	40	075
		Practical	Honours / Minor Degree Course 2 Lab	7	1	25	-	25	050
5	XXXX	Theory	Seminar	Break of Sem7 and Sem8	2	25	-	25	050
6	XXXX	Theory	Honours / Minor Degree Course 3	8	2	15	20	40	075
		Practical	Honours / Minor Degree Course 3 Lab	8	1	25	-	25	050
7	XXXX	Practical	Specialized Project	8	4	75	-	50	125
Total					**18**				

Honours Degree Programmes Offered

Sr. No.	Honors Degree Programme	Department offering Honors
1	Advanced AIML	Biomedical Engineering
2	Advanced Internet of Things (AIoT)	Biomedical Engineering
3	Medical Imaging Technology	Biomedical Engineering

Minor Degree Programmes Offered

Sr. No.	Honors Degree Programme	Department offering Minor
1	User Interface & User Experience (UI/UX)	Information Technology
2	Blockchain	Information Technology

Detailed list of courses under each Honours/ Minor Degree Programme:

- Biomedical Department learners can refer to the list of Honours Degree Programme and their corresponding courses in the Appendix-C.
- Learners of Biomedical Department who wish to opt for Minor Degree Programme offered by other department can obtain details of these programmes from Appendix-C of the respective department.

Appendix-C

Honours / Minor Degree Programmes offered by Department of Biomedical Engineering

Department of Biomedical Engineering offers the below listed Honours degree programme for learners of Biomedical Engineering these programmes can be availed as Minor degree programme by learners of other departments.

1. Advanced AIML
2. Advanced Internet of Things (AIoT)
3. Medical Imaging Technology
4. User Interface & User Experience (UI/UX)
5. Blockchain

Courses to be successfully completed as a part of Honours / Minor Degree Programme

1. Advanced AIML

Semester	Course Code	Course Name
VI	BM53T	Ethics, Privacy, & Security in AI Driven Healthcare
VI	BM53P	Ethics, Privacy, & Security in AI Driven Healthcare Lab
VII	BM59T	Applied Machine Learning for Biomedical Signals
VII	BM59P	Applied Machine Learning for Biomedical Signals Lab
VIII	BM65T	Application of ML in Healthcare
VIII	BM65P	Application of ML in Healthcare Lab

2. Advanced Internet of Things (AIoT)

Semester	Course Code	Course Name
VI	BM54T	Embedded Linux System
VI	BM54P	Embedded Linux System Lab
VII	BM60T	IoT and Data Analytics
VII	BM60P	IoT and Data Analytics Lab
VIII	BM66T	IoT Applications and Web Development
VIII	BM66P	IoT Applications and Web Development Lab

3. Medical Imaging Technology

Semester	Course Code	Course Name
VI	BM55T	Structural Imaging Technology
VI	BM55P	Structural Imaging Technology Lab
VII	BM61T	Functional Imaging Technology
VII	BM61P	Functional Imaging Technology Lab
VIII	BM67T	Nuclear Imaging Techniques
VIII	BM67P	Nuclear Imaging Techniques Lab

4. User Interface & User Experience (UI/UX)

Semester	Course Code	Course Name
VI	BM56T	Foundations of UI and UX
VI	BM56P	Foundations of UI and UX Lab
VII	BM62T	Design and Evaluation
VII	BM62P	Design and Evaluation Lab
VIII	BM68T	Applied UI UX with capstone project
VIII	BM68P	Applied UI UX with capstone project Lab

5. Blockchain

Semester	Course Code	Course Name
VI	BM57T	Blockchain Technology
VI	BM57P	Blockchain Technology Lab
VII	BM63T	Solidity Programing
VII	BM63P	Solidity Programing Lab
VIII	BM69T	Blockchain Architecture
VIII	BM69P	Blockchain Architecture Lab