SAHRDAYA AUTONOMOUS
COLLEGE OF ENGINEERING & TECHNOLOGY
A CENTRE OF EXCELLENCE IN SCIENCE & TECHNOLOGY | MANAGED BY IRINJALAKUDA DIOCESAN EDUCATION TRUST
Approved by AICTE & Affiliated to APJ Abdul Kalam Technological University | Accredited by:
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B. Tech

Curriculum (2024) - Semester I to VIII

Biomedical Engineering

Branch Code: BME

(SHR/AC/Auto/Acad. Council/B.Tech/2/Curri. /BME)

Recommended by BoS on 29/08/2024

Approved by Academic Council on 31/08/2024

Preface to the Curriculum

The B.Tech. Biomedical Engineering (BME) curriculum is meticulously drafted to cultivate industry-ready professionals endowed with creativity and innovative thinking. This comprehensive curriculum includes induction programs, core and elective courses, practical courses, projects, internships, skill enhancement courses, and extracurricular activities. Designed to total 170 credits, the curriculum ensures a holistic education that prepares students for the dynamic field of Biomedical Engineering. Below is a detailed overview of the curriculum's salient features:

1. **Project-Based Learning Courses:** From the first semester to the fifth semester, one course integrated with Project-Based Learning **(PBL)** empowers students with creativity, engaging them in meaningful projects to learn, investigate, and explore. PBL promotes teamwork and collaboration, essential skills for any professional, by having students work together in teams, each contributing unique skills and perspectives to achieve a common goal.
2. **Skill Enhancement Courses**: These courses are designed to provide students with industry-relevant certifications from reputed organizations, enhancing their employability by certifying their skill sets. They are integral to the academic curriculum and offered from Semester 1 to Semester 5, each carrying one credit.
3. **Foreign Language Courses**: To prepare students for global careers, the curriculum includes options to learn foreign languages, promoting cross-cultural communication skills and international collaboration. These courses are available in the seventh semester.
4. **Program Electives and Micro Specializations**: Students can pursue micro-specializations by completing thematic courses, which allow them to gain in-depth knowledge in specific sub-areas of their discipline. Starting in the fourth semester, this provides an opportunity for focused learning and expertise in emerging fields in alignment with program elective courses.
5. **Industry Elective Courses**: Offered jointly with industry partners, these courses ensure relevance and practical applicability. The academic department and industry partners develop and assess them collaboratively, without end-semester examinations, providing continuous and practical learning experiences.
6. **Startups and Entrepreneurial Skills**: The curriculum encourages students to pursue startups, offering options to engage in product-based or service-based startups during their seventh and eighth semesters. This fosters innovation, creativity, and entrepreneurial skills, preparing students for the dynamic business environment.
7. **Courses Embedded with Practicals**: The curriculum includes theory courses embedded with practicals and projects, ensuring students apply theoretical knowledge to real-world problems. This hands-on approach enhances learning outcomes and practical skills.

8. **Internships**: The program includes mandatory internships, allowing students to gain industry exposure and practical experience. Students can undertake at least four to six months of internship in a recognized industry, research organization, or prestigious institution relevant to their field. This bridges the gap between academic learning and industry requirements, enhancing employability.
9. **Community Work, Social Responsibility, and Universal Human Value Courses**: The curriculum integrates opportunities for community work and socially relevant projects, promoting civic responsibility and leadership skills. Universal Human Value courses also aim to cultivate a holistic understanding of life, enhancing physical and mental well-being and social and life skills. These courses address various dimensions of life, including individual, family, society, and the environment, promoting a healthy and harmonious lifestyle.
10. **Activity Points**: In addition to academic credits, students must earn activity points through participation in extracurricular activities such as sports, cultural events, community service, and entrepreneurship. This holistic approach ensures the development of leadership, teamwork, and communication skills, preparing students for global challenges.
11. **MOOC Courses:** Students selected for internships can fulfil their credit requirements in the seventh and eighth semesters through MOOC courses, providing flexibility and additional learning opportunities.
12. **Higher Credit Elective:** These courses carry more than the standard credit weight of elective courses. They allow students pursuing honors to reduce the number of required courses by earning additional credits through higher-credit electives. Additional credits earned from higher credit electives can be credited towards the total credit requirement of the honors program, with a maximum of 12 additional credits being applied towards the honors credit requirement.

This curriculum is designed to seamlessly blend theoretical knowledge with practical experience, foster interdisciplinary learning, and enhance employability through hands-on projects and internships, preparing students for successful careers in Biomedical engineering.

General Course Structure

1. Credit and Courses:

Credits are a unit of measurement for coursework based on the number of hours of instruction required per week. One hour of classroom lecture (L), 60 minutes long per week and carried out during all weeks of the semester, is considered one instructional unit or one credit. The same goes for a tutorial (T) or a project (R) that is 60 minutes long per week and carried out during all weeks of the semester. In addition, a minimum of 120 minutes per week of laboratory session, practical or fieldwork, training (P) or a combination of these, carried out during all weeks of the semester, is also considered one

Instructional Unit or one Credit.

Classification	Credit assigned
1 Hour Lecture [L] per week	1 Credit
1 Hour Tutorial [T] per week	1 Credit
1 Hour Project [R] per week	1 Credit
1-2 Hours Practical [P] per week	1 Credit
3-4 Hours Practical [P] per week	2 Credit

- *For internship/Start-Up/Main project, the credit weightage for equivalent hours is 50% of that for lectures/tutorials*

2. Course Category and Credits

The B.Tech. Program curriculum has 168 academic credits and 2 additional pass/fail credits that can be gained through 100 activity points. The program is expected to accommodate courses from other disciplines so that students have multi-disciplinary exposure. Additionally, the program should provide sufficient opportunities for students to enhance their communication, soft, managerial, and technical skills. Depending on the program, the courses should fall under the engineering, basic science, humanities science, and management categories. The structure of the UG program should essentially have the following categories of courses with the breakup of credits as given:

Sl. No	Category	Code	Credits
1	Humanities and Social Sciences including Management Courses	HMC	9
2	Basic Science Courses	BSC	20
3	Engineering Science Courses	ESC	26
4	Programme (Professional) Core Courses	PCC	52
5	Programme (Professional) Core Courses-Project Based Learning	PBL	16
6	Program Elective Courses	PEC	18
7	Open Elective Courses/Industry Linked Elective	OEC/ILE	9
8	Project Work and Seminar	PS	12
9	UHV and Community Work	PW	1
10	Skill Enhancement Courses	SEC	5
11	Mandatory Student Activities.	MSA	2
	Total Mandatory Credits	**170**	

A 10% to 15 % deviation in credits is permitted under each discipline. While developing the curriculum, the department offering the program should ensure that the students

attain the above distribution upon completing their program. Either Minor or Honors can be opted from the optional specialization.

The courses are organized into 1/2/3/4 credit courses based on the content delivery mechanism and desired depth. The delivery methods include Theory-only, Theory with tutorial, Theory with practice, Theory with project, etc. The L-T-P-R-C for each course indicates the number of credits delivered as Lecture (L), Tutorial (T), Practical (P), Project (R) and the total instructional delivery indicated as Credits (C).

$$C = L + T + [P/2] + R$$

Apart from lectures, tutorials, practical/practice and project hours, the curriculum offers Self-learning hours (S) that indicate the number of hours students are expected to spend for activities that should be completed outside the class defined by the faculty handling courses. The activities aim to support learning and should be initiated by the students themselves without guidance or direction from tutors. For each course, the self-learning hour per week is calculated as:

$$S = (L*1+P*1+[R/2])$$

Categories of courses included in the curriculum and their L-T-P-R-C components are given in the table below:

Sl. No.	Lecture- Tutorial- Practical- Project [L-T-P-R]	Credit [C]	Description
1.	1-0-2-0	2	Theory course without End Semester Examination [ESE]
2.	1-0-0-0	1	
3.	2-0-2-1	4	Theory course embedded with practical and project
4.	3-1-0-0	4	Theory course embedded with tutorial
5.	3-0-0-0	3	Theory course
6.	2-0-0-0	2	
7.	3-0-2-0	4	Theory course embedded with practical
8.	3-0-0-1	4	Theory course embedded with project
9.	0-0-2-0	1	Practical course without ESE
10.	0-0-3-0	2	Practical course
11.	0-0-0-3	2	Mini Project
12.	0-0-3-0	2	Seminar
13.	0-0-0-8	4	Major Project/Internship/Start-Up
14.	0-0-0-0	1	MOOC Course
Mandatory Courses			
15.	0-0-2-0	1	Skill Enhancement Courses
Minor/ Honors Course			
16.	4-0-0-0	4	Theory course
17.	0-0-0-4	4	Project only course

3. Course Code

Every course of B. Tech. The program shall take a code from the table given below.

Course category	Description
PCC	Program (Professional) Core Courses
PBL	Project Based Learning
CLT	Combined Lab Theory
PEC	Professional Elective Course
OEC	Open Elective Course
BSC	Basic Science Course
ESC	Engineering Science Course
HMC	Humanities, Social Sciences and Management course
MOOC	MOOC Course
IEL	Industry Elective Course
PW	Socially Relevant course
PS	Project Work and Seminar
SEC	Skill Enhancement Courses
HR	Honours
MR	Minor

Structure of Course Code: Each course will be identified by a unique Course Code consisting of eight alphanumeric characters, formatted as **24XXYABC**. The code can be interpreted as follows: "24" represents the regulation year, "XX" is the course/Branch category code, "Y" indicates the course delivery mode, "A" is the semester number (ranging from 1 to 8, with 0 indicating the course is offered in both odd and even semesters), "B" denotes the version of the course under each category, and "C" signifies the course sequence number.

For example, 24CET303 is a theory course offered by the Civil Engineering department in the third semester of the 2024 scheme.

24BML408 - laboratory course offered by the biomedical engineering department in the fourth semester of the 2024 scheme

The detailed expansion of the abbreviation of the Course/Program code structure is listed in the table below:

XX	Y	A	B	C
Course category	Course delivery mode	Semester No	Version of the course	Serial No: of course
BM-Biomedical Engineering BT-Biotechnology CE – Civil Engineering CS-Computer Science Engineering	T-Theory L-Laboratory R-Theory Embedded with Project K-Certification			

EC-Electronics and Communication Engineering EE-Electrical and Electronics Engineering MA-Mathematics CY – Chemistry PH-Physics ES-Engineering Science course HU-Humanities and Management Courses SE-Skill Enhancement Courses PW-Social Science and Community work	Course E-Elective Course G- Minor H-Honour M- MOOC O-Open Elective I-Industry Elective S-Seminar P-Project N-Internship U-Start Up C – Theory Embedded with practical	0 1 2 3 etc.	1 2 3 etc.	1 2 3 4 5 6 etc.

4. Allotted and Cumulative Credits

The allotted and cumulative credits are given in the table below:

Semester	Allotted Credits	Cumulative Credits
First	21	-
Second	22	43
Third	26	69
Fourth	24	93
Fifth	24	117
Sixth	23	140
Seventh	17	157
Eighth	11	168

FIRST SEMESTER (July-December)												
10 Days Compulsory Induction Program												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs./ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24MAT121	BSC	Linear Algebra, Differential Equations and Laplace transforms	3	0	0	0	40	60	3	3
2	B	24CYC132	BSC-CLT	Chemistry for Bioengineering	3	0	2	0	50	50	4	5
3	C	24EST123	ESC	Engineering Mechanics for Biomedical Engineers	3	0	0	0	40	60	3	3
4	D	24EST134	ESC	Basics of Electrical & Electronics Engineering	4	0	0	0	40	60	4	4
5	F	24ESR105	ESC-PBL	Algorithmic Thinking with Python	2	0	2	1	50	50	4	5
6	L	24ESL006	ESC	Basic Electrical and Electronics Engineering Workshop	0	0	2	0	50	---	1	2
7	I*	24HUT107	HMC	Communicative English	0	0	2	0	100	---	1	2
8	J*	24SEK10N	SEC	Skill Enhancement Course -1							1	
Total											**21**	**24**

SECOND SEMESTER (January-June)												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs./ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24MAT221	BSC	Infinite Series, multiple integrals & Vector Calculus	3	0	0	0	40	60	3	3
2	B	24PHC222	BSC-CLT	Physics for Electrical Science	3	0	2	0	50	50	4	5
3	C	24EST003	ESC	Engineering Graphics	3	0	0	0	40	60	3	3
4	D	24ESC204	ESC-CLT	Programming in C	3	0	2	0	50	50	4	5
5	E	24BMR205	PCC-PBL	Anatomy and Physiology for Biomedical Engineers	3	0	0	1	50	50	4	4
6	I*	24HUT006	HMC	Professional Ethics & Sustainable Development	1	0	2	0	100	--	2	3
7	L	24ESL007	ESC	Computer Aided Drawing (CAD) & Manufacturing workshop	0	0	2	0	50	--	1	2
8	J*	24SEK10N	SEC	Skill Enhancement Course-2							1	
Total											**22**	**25**

No Grade Points will be awarded for the MOOC, I and J slot courses.
***The self-learning (S) hours for each course is calculated based on the formulae,* S= (L*1+P*1+[R/2])**

THIRD SEMESTER (July-December)												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs/ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24MAT321	BSC	Complex Analysis & Partial Differential Equations	3	0	0	0	40	60	3	3
2	B	24BMT302	PCC	Analog Electronics	3	1	0	0	40	60	4	4
3	C	24BMT303	PCC	Digital Electronics	3	1	0	0	40	60	4	4
4	D	24BMR304	PCC-PBL	Medical Physics	3	0	0	1	50	50	4	4
5	F	24HUT005	HMC	Engineering Economics	2	0	0	0	50	50	2	2
6	G	24EST306	ESC	Introduction to Artificial Intelligence and Data Science	3	1	0		40	60	4	4
7	L	24BML307	PCL	Analog Electronics Lab	0	0	3	0	50	50	2	3
8	Q	24BML308	PCL	Digital Electronics Lab	0	0	3	0	50	50	2	3
9	J*	24SEK10N	SEC	Skill Enhancement Course 3							1	
10	R/M	24BMG3XX	VAC	Remedial/Minor							4*	4*
Total											**26/ 30***	**27/ 31***

FOURTH SEMESTER (January-June)												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs./ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24MAT421	BSC	Probability Distributions, Numerical Methods and Transforms	3	0	0	0	40	60	3	3
2	B	24BMT402	PCC	Microcontrollers and Interfacing	3	1	0	0	40	60	4	4
3	C	24BMT403	PCC	Electronic Instrumentation and Communication Systems	4	0	0	0	40	60	4	4
4	D	24BMR404	PCC-PBL	Biosensors and Transducers	3	0	0	1	50	50	4	4
5	E	24BME41N	PE	PE-1	3	0	0	0	40	60	3	3
6	L	24BML406	PCL	Microcontrollers and Interfacing Lab	0	0	3	0	50	50	2	3
7	Q	24BML407	PCL	Medical Electronics Lab	0	0	3	0	50	50	2	3
8	I*	24PWT208	PW	UHV II, Life skills & Community work	1	0	0	0	100	-	1	1
9	J*	24SEK10N	SEC	Skill Enhancement Course 4							1	
10	R/ M	24BMG4XX/ 24BMH4XX	VAC	Remedial/Minor/ Honours							4*	4*
Total											**24/ 28***	**25/ 29***

PROGRAM ELECTIVE I: 24BME41N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
E	24BME411	Signals and Systems	**3-0-0-0**	**3**	**3**
	24BME412	IOT & Biomedical Applications	**3-0-0-0**		**3**
	24BME413	Clinical Engineering	**3-0-0-0**		**3**
	24BME414	Biostatistics	**3-0-0-0**		**3**
	24BME415	IVD-1	**3-0-0-0**		**3**
	24BME416	Quantitative Physiology#	**3-1-2-0**	**6**	5

#- Higher credit elective

FIFTH SEMESTER (July-December)												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs./ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24BMT501	PCC	Biomedical Signal Processing	3	1	0	0	40	60	4	4
2	B	24BMT502	PCC	Biomaterials	3	0	0	0	40	60	3	4
3	C	24BMT503	PCC	Medical Imaging Techniques	4	0	0	0	40	60	4	4
4	D	24BMR504	PCC-PBL	Analytical and Diagnostic Equipments	3	0	0	1	50	50	4	4
5	E	24BME52N	PE	PE-2	3	0	0	0	40	60	3	3
6	I*	24HUM506	HMC	Constitution Of India (MOOC)	-	-	-	-	-	-	1	-
7	L	24BML507	PCL	Biomedical Signal Processing Lab	0	0	3	0	50	50	2	3
8	Q	24BML508	PCL	Clinical Instrumentation Lab	0	0	3	0	50	50	2	3
9	J*	24SEK10N	SEC	Skill Enhancement Course 5							1	
10	R/ M	24BMG5XX/ 24BMH5XX	VAC	Remedial/Minor/ Honours							4*	4*
S_5/ S_6		Industrial Visit (Maximum 10 Days are permitted, Not Exceeding more than 5 Working Days) /Industrial Training										
Total											**24/ 28***	**24/ 28***

PROGRAM ELECTIVE 2: 24BME52N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
E	24BME521	Control Systems Engineering	**3-0-0-0**	**3**	**3**
	24BME522	Biomedical Optics & Biophotonics	**3-0-0-0**		**3**
	24BME523	Product Design & Engineering	**3-0-0-0**		**3**
	24BME524	Implants & Prosthetic Engineering	**3-0-0-0**		**3**
	24BME525	IVD-2	**3-0-0-0**		**3**
	24BME526	Artificial Neural Networks#	**3-1-2-0**	**6**	**5**

#- Higher credit elective

SIXTH SEMESTER (January-June)													
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs./ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24BMT601	PCC	Biomechanics	3	1	0	0	40	60	4	4
2	B	24BMT602	PCC	Therapeutic Equipment's	3	0	0	0	40	60	3	3
3	C	24BME63N	PE	PE-3	3	0	0	0	40	60	3	3
4	D	24BMC604	PCC-CLT	Principles of Medical Image Processing-CLT	3	0	2	0	50	50	4	5
5	F	24EST605	ESC	Design Thinking and Product Development	2	0	0	0	50	50	2	2
6	O	24XXO61N/ 24XXI61N	OE / ILE	OE-1/ILE-1	3	0	0	0	40	60	3	3
7	L	24BML607	PCC	Medical Device Testing and Dissection Lab	0	0	3	0	50	50	2	3
8	P	24BMP608	PS	Mini project	0	0	3	0	100	0	2	3
9	R/M/H	24BMG6XX/ 24BMH6XX	VAC	Remedial/Minor/ Honours							4*	4*
S5/ S6		Industrial Visit (Maximum 10 Days are permitted, Not exceeding more than 5 Working Days) /Industrial Training										
Total											**23/ 27***	**24/ 28***

Note: Open Electives are courses that other departments will offer.

PROGRAM ELECTIVE 3: 24BME63N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
A	24BME631	Embedded System Design	**3-0-0-0**	**3**	**3**
	24BME632	Radiological Equipments	**3-0-0-0**		**3**
	24BME633	Bio Fluid Mechanics	**3-0-0-0**		**3**
	24BME634	Computational Methods in Biomedical Engineering	**3-0-0-0**		**3**
	24BME635	Introduction To Bio nanotechnology	**3-0-0-0**		**3**
	24BME636	Advanced Biomedical Signal Processing & Applications #	**3-1-2-0**	**6**	**5**

#- Higher credit elective

OPEN ELECTIVE 1: 24BMO61N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
O	24BMO611	Biosensors & Transducers	**3-0-0-0**	**3**	**3**
	24BMO612	Biomechanics	**3-0-0-0**		**3**
	24BMO613	Bio signals & Signal Processing	**3-0-0-0**		**3**
	24BMO614	Biomaterials	**3-0-0-0**		**3**

SEVENTH SEMESTER (July-December)												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs./ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24BME74N/ 24BMM74N	PE	PE-4 (Internship Students: Self Study/MOOC Approved by the University/Online Classes)	3	0	0	0	40	60	3	3
2	B	24BME75N/ 24BMM75N	PE	PE-5 (Internship Students: Self Study/MOOC Approved by the University/Online Classes)	3	0	0	0	40	60	3	3
3	O	24XXO72N/ 24XXI72/ 24XXM73N	OE/ ILE	OE-2/ILE-2 (Internship Students: Self Study/MOOC Approved by the University/Online Classes)	3	0	0	0	40	60	3	3
4	I*	24HUT704/ 24HUM70N	HMC	HMC Elective (Internship Students: Self Study/MOOC Approved by the University/Online Classes)	2	0	0	0	50	50	2	2
5	S	24BMS705	PS	Seminar	0	0	3	0	50	-	2	3
6	P	24BMP706/ 24BMN706/ 24BMU706	PS	Option 1: Major Project Option 2: Internship (4-6 Months) Option 3: Startup	0	0	0	8	100	-	4	8
	R/M /H	24BMG7XX/ 24BMH7XX	VAC	Remedial/Minor/ Honours	0	0	0	4			4*	4*
Total											**17/ 21***	**22/ 26***

**The students can take the internship option either in 7th or in 8th semester.*
** Option 1: Work on a Project in the institute/department under the mentorship of faculty members.*
*Option 2: Full semester Internship in Industry/organization (**7th or 8th semester**)*
*Option 3: Full semester startup if the startup is service-based (**7th or 8th semester**), full year startup if the startup is product-based (**7th and 8th semester**)*

PROGRAM ELECTIVE 4: 24BME74N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
B	24BME741	Advanced Microprocessors & Microcontrollers	**3-0-0-0**	**3**	**3**
	24BME742	Human Factors in Engineering and Design	**3-0-0-0**		**3**
	24BME743	Neural Prosthesis & Implants	**3-0-0-0**		**3**
	24BME744	Assistive Medical Devices	**3-0-0-0**		**3**
	24BME745	Advanced Computer Programming Techniques	**3-0-0-0**		**3**
	24BME746	Deep Learning Techniques#	**3-1-2-0**	**6**	**5**

PROGRAM ELECTIVE 5: 24BME75N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
A	24BME751	Communication Techniques	**3-0-0-0**	**3**	**3**
	24BME752	Design of Biomedical Devices	**3-0-0-0**		**3**
	24BME753	Rehabilitation Engineering	**3-0-0-0**		**3**
	24BME754	Medical Informatics	**3-0-0-0**		**3**
	24BME756	Tissue Engineering and Bio Fabrication Technology	**3-0-0-0**		**3**
	24BME755	Advanced Medical Imaging and Image Processing Techniques#	**3-1-2-0**	**6**	**5**

#- Higher credit elective

OPEN ELECTIVE 2: 24BMO72N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
O	24BMO721	Biomedical Instrumentation	**3-0-0-0**	**3**	**3**
	24BMO722	Assistive Devices	**3-0-0-0**		**3**
	24BMO723	Medical Imaging Techniques	**3-0-0-0**		**3**
	24BMO724	Artificial Organs & Implants	**3-0-0-0**		**3**

HMC Elective

Slot	Course Code	Courses
I*	24HUT704	Project Management: Planning, Execution, Evaluation and Control
	24HUM701	Proficiency course in French (B1 level). (MOOC)
	24HUM702	Proficiency Course in German (B1 Level). (MOOC)
	24HUM703	Proficiency Course in Spanish (B1 Level). (MOOC)
	24HUM704	Introduction to Japanese Language and Culture (N5 level). (MOOC)

EIGHTH SEMESTER (January-June)												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs / Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24BME86N/ 24BMM86N	PE	PE-6 (Internship Students: Self Study/MOOC Approved by the University/Online Classes)	3	0	0	0	40	60	3	3
2	O	24XXO83N/ 24XXI83N/ 24XXO84N	OE/ ILE	OE/ILE-3 (Internship Students: Self Study/MOOC Approved by the University/Online Classes)	3	0	0	0	40	60	3	3
3	I*	24HUT803/ 24HUM803	HMC	Organizational Behavior and Business Communication (Internship Students: Self Study/MOOC Approved by the University/Online Classes)	2	0	0	0	50	50	1	2
4	P	24BMP806/ 24BMN06/ 24BMJ806/ 24BMU806	PS	Option 1: Major Project Option 2: Internship (4-6 Months) Option 3: Major Project Phase –II (For the students who have not opted for internship in S7/S8) Option 4: Startup	0	0	0	8	100	0	4	8
	R/H	24BMH8XX	VAC	Project: Honours	0	0	0	4			4*	4*
Total											**11/ 15***	**16/ 20***

PROGRAM ELECTIVE 6: 24BME86N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
B	24BME861	Medical Device Regulations & Standards	**3-0-0-0**	**3**	**3**
	24BME862	Telemedicine	**3-0-0-0**		**3**
	24BME863	Biomedical Transport Phenomena	**3-0-0-0**		**3**
	24BME864	Modelling of Physiological Systems	**3-0-0-0**		**3**
	24BME865	Artificial Organs & Implants	**3-0-0-0**		**3**
	24BME866	AI for Medical Image Analysis#	**3-1-2-0**	**6**	**5**

#- Higher credit elective

OPEN ELECTIVE 3: 24BMO83N

Slot	Course Code	Courses	L-T-P-R	Hours	Credit
O	24BMO831	IoT & Biomedical Applications	3-0-0-0	3	3
	24BMO832	Human Factors in Engineering and Design	3-0-0-0		3
	24BMO833	Medical Image Processing	3-0-0-0		3
	24BMO834	Rehabilitation Engineering	3-0-0-0		3

Micro Specialization

Micro Specialization Group ID	Specialization	Courses
G-I	Hospital Engineering and Rehabilitation	24BME413 Clinical Engineering (E1)
		24BME632 Radiological Equipment (E3)
		24BME753 Rehabilitation Engineering (E5)
		24BME861 Medical Device Regulations & Standards (E6)
G-II	In vitro Diagnostics & Bio Fabrication Technology	24BME415 IVD-1 (E1)
		24BME525 IVD-2 (E2)
		24BME633 Bio Fluid Mechanics (E3)
		24BME756 Tissue Engineering and Bio Fabrication Technology (E5)
G-III	Medical Device Design, Regulations and Standardization	24BME523 Product Design & Engineering (E2)
		24BME742 Human Factors in Engineering and Design (E4)
		24BME752 Design of Biomedical Devices (E5)
		24BME861 Medical Device Regulations & Standards (E6)

HMC Courses				
Sl. No:	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S1/S2**	24HUT107	Communicative English	1
2		24HUT106	Engineering Ethics and Sustainable Development	2
3	**S3/S4**	24HUT206	Engineering Economics	2
4	**S5**	24HUM506	Constitution of India. (MOOC)	1
5	**S7**	24HUT704/ 24HUM70N	Elective (Project Management/Foreign Languages)	2
6	**S8**	24HUT803/ 24HUM803	Organizational Behavior and Business Communication	1
Total Credits				**9**

BSC Courses				
Sl. No:	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S1**	24MAT121	Linear Algebra, Differential Equations and Laplace transforms	3
2		24CYC132	Chemistry for Bioengineering	4
3	**S1/S2**	24PHC222	Physics for Electrical Science	4
4		24MAT221	Infinite Series, multiple integrals & Vector Calculus	3
5	**S3**	24MAT321	Complex Analysis & Partial Differential Equations	3
6	**S4**	24MAT421	Probability Distributions, Numerical Methods and Transforms	3
Total Credits				**20**

ESC Courses				
Sl. No:	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S1**	24EST123	Engineering Mechanics for Biomedical Engineers	3
2		24EST134	Introduction to Electrical and Electronics Engineering	4
3		24ESR105	Algorithmic Thinking with Python (PBL)	4
4		24BTL106	Basic Electrical and Electronics Engineering Workshop	1
5	**S2**	24EST003	Engineering Graphics	3
6		24EST204	Programming in C	4
7		24ESL007	Computer Aided Drawing (CAD)& Manufacturing Workshop	1
8	**S3**	24EST204	Introduction to Artificial Intelligence and Data Science	4
9	**S6**	24EST605	Design Thinking and Product Development	2

Total Credits	**26**

Programme Core Courses (PCC)				
Sl. No:	**Semester**	**Course Code**	**Course Area**	**Credits**
1.	**S3**	24BMT302	Analog Electronics	4
2.		24BMT303	Digital Electronics	4
3.		24BML307	Analog Electronics Lab	2
4.		24BML308	Digital Electronics Lab	2
5.	**S4**	24BMT402	Microcontrollers and Interfacing	4
6.		24BMT403	Electronic Instrumentation and Communication Systems	4
7.		24BML406	Microcontrollers and Interfacing Lab	2
8.		24BML408	Medical Electronics Lab	2
9.	**S5**	24BMT501	Biomedical Signal Processing	4
10.		24BMT502	Biomaterials	4
11.		24BMT503	Medical Imaging Techniques	3
12.		24BML507	Biomedical Signal Processing Lab	2
13.		24BML508	Clinical Instrumentation Lab	2
14.	**S6**	24BML601	Biomechanics	4
15.		24BML602	Therapeutic Equipment	3
16.		24BMC604	Principles of Medical Image Processing	4
17.		24BML607	Medical Device Testing and Dissection Lab	2
Total Credits (Theory -10, Lab-7)				**52**

Programme Core-Project Based Learning (PBL)				
Sl. No:	**Semester**	**Course Code**	**Course Area**	**Credits**
1.	**S2**	24BMR205	Anatomy and Physiology for Biomedical Engineers PBL-2	4
2.	**S3**	24BMR304	Medical Physics - PBL 3	4
3.	**S4**	24BMR404	Biosensors and Transducers - PBL 4	4
4.	**S5**	24BMR504	Analytical and Diagnostic Equipment's - PBL 5	4
Total Credits				**16**

Programme Elective Courses (PE)				
Sl. No:	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S4**	24BMM41N	PE-1	3
2	**S5**	24BMM52N	PE-2	3
3	**S6**	24BMM63N	PE-3	3
4		24BMM74N	PE-4	3

5	**S7**	24BMM75N	PE-5	3
6	**S8**	24BMM86N	PE-6	3
Total Credits				**18**

Open Elective Courses/Industry Elective (OE/IEL)				
Sl. No	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S6**	24XXO61N/ 24XXI61N	OE/ILE-1	3
2	**S7**	24XXO72N/ 24XXI72N	OE/ILE-2	3
3	**S8**	24XXO83N/ 24XXI83N	OE/ILE-3	3
Total Credits				**9**

Project Work & Seminar				
Sl. No	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S6**	24BMP608	Mini project	2
2	**S7**	24BES705	Seminar	2
3		24BMP706/ 24BMN706/ 24BMU706	Project/Internship/Startup	4
4	**S8**	24BMP806/ 24BMN806/ 24BMJ806	Project/Internship/Startup	4
Total Credits				**12**

UHV and Community Work				
Sl. No	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S4**	24PST206	UHV II, Life skills & Community work	1
Total Credits				**1**

Skill Enhancement Course				
Sl. No	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**S1-S5**	24SEK10N	Skill Enhancement Course	5
Total Credits				**5**

Mandatory Student Activities				
Sl. No	**Semester**	**Course Code**	**Course Area**	**Credits**
1	**-**	-	Mandatory Student Activities	2
Total Credits				**2**

Total Credits	**170**

RULES FOR ASSIGNING ACTIVITY POINTS

Apart from technical knowledge and skills, students should have excellent soft skills, leadership qualities and team spirit to be successful as professionals. They should have entrepreneurial capabilities and societal commitment. Student activity points to be earned, covering extracurricular and co-curricular activities, have been specified to nurture these qualities. All students must earn at least 100 activity points from various activity segments listed to qualify for the B.Tech degree. Two credits are given for this on a pass/ fail basis, which is mandatory for getting the B.Tech Degree. As no grade for these two credits is given, they are not included in the CGPA calculation. For lateral entry students joining from the third semester, the activity point requirement is 75 Points earned by the student, which will be indicated in the consolidated academic statement. In the case of NSS and NCC, points can be entered after completing a two-year Programme. All documental proof for awarding the activity points should be obtained, and the points will be consolidated. The rules for assigning activity points are given in the following sections.

The following table lists the main activity segments and the maximum points associated with each segment.

<table>
<tr><th colspan="5">Activity Points</th></tr>
<tr><th>Sl. No.</th><th>Group</th><th>Courses</th><th>Credits</th><th>Minimum Credit Requirements</th></tr>
<tr><td>1</td><td rowspan="3">I</td><td>NSS, NCC, NSO (National Sports Organization)</td><td rowspan="3">1 (50 Points)</td><td rowspan="6">2 Credits (One credit from each Group)</td></tr>
<tr><td>2</td><td>Arts/Sports/Games</td></tr>
<tr><td>3</td><td>Union/Club Activities</td></tr>
<tr><td>4</td><td rowspan="3">II</td><td>English Proficiency Certification (TOFEL, IELTS, BEC etc.)</td><td rowspan="3">1 (50 Points)</td></tr>
<tr><td>5</td><td>Aptitude Proficiency Certification (GRE, CAT, GMAT etc.)/Valid Gate Score</td></tr>
<tr><td>6</td><td>Short Term Internship, Clinical Exposure/Training (Minimum 2 weeks), Conferences/Paper Presentation/ Workshop Activities/ Professional Body Activities/ MOOC Courses/ Entrepreneurship and Innovation</td></tr>
</table>

- ***75% per group for B. Tech Lateral Entry Students***

- ***To obtain the 2 Activity Credits required in the curriculum, students must acquire at least 100 activity points.***

The following table lists the activities under each of these segments, the expected level of achievement, activity points, the evidence needed to assign the points, and the minimum duration required for certain activities. Additional activities under these segments can be considered after approval from the Academic Council.

Group	Activity Head	Sl. No	Activity	Achievement Levels and Assigned Activity Points					** Approval Document	Max. Points	Min. duration of activity
			*Level	I	II	III	IV	V			
GROUP I	National Initiatives Participation	1.	NCC	-	-	-	-	-	a/b	50	2 Year
		2.	NSS	-	-	-	-	-	a/b	50	2 Year
		For a C certificate / outstanding performance supported by certification, additional marks up to 20 can be provided, subject to a maximum limit of 80 points. Best NSS Volunteer Awardee (University level) / Participation in National Integration Camp/ Pre-Republic Day Parade Camp (South India), supported by certification, additional marks up to 10 can be provided, subject to a maximum limit of 70 points. For the best NSS Volunteer Awardee (State / National level), Participation in Republic Day Parade Camp or International Youth Exchange Programme supported by certification, additional marks up to 20 can be provided, subject to a maximum limit of 80 points.										
	Sports & Games Participation	3.	Sports	5	10	20	30	50	a	50	1 Year
		4.	Games	5	10	20	30	50	a	50	1 Year
			First Prize	8	8	8	15	15	Additional points can be provided for winning. The maximum limit for activity points is 60. However, the maximum point limit is enhanced to 80 for Level IV and V winning.		
			Second Prize	5	5	5	12	12			
			Third Prize	3	3	3	9	9			
	Cultural Events	5.	Music	5	10	20	30	50	a	50	1 Year
		6.	Performing arts	5	10	20	30	50	a	50	1 Year
		7.	Literary arts	5	10	20	30	50	a	50	1 Year
			First Prize	8	8	8	15	15	Additional points can be provided for winning. The maximum limit for activity points is 60. But for Level IV and V winning, the maximum		
			Second Prize	5	5	5	12	12			
			Third Prize	3	3	3	9	9			

									point limit is enhanced to 80.		
	Union/Club Activities			**Coordinator**		**Sub/joint-coordinator**		**Volunteer**			
		8.	Elected student representatives	25 (Chairman)		20 (Secretary)		10 (Members)	d	50	1 Year
		9.	Hobby Clubs	10		5		3	d	30	1 Year
		10.	Placement Activities	10		5		3	d	30	1 Year
		11.	Student Professional Societies (IEEE, IET, ASME, SAE, NASA etc.)	10		5		3	d	30	1 Year
		12.	Department Associations	10		5		3	d	30	1 Year
		13.	Festival & Technical Events (College approved)	10		5		3	d	30	1 Year
GROUP II	**14. Professional Self Initiatives**		**Activity**	**Achievement Levels and Assigned Activity Points**							
			***Level**	**I**	**II**	**III**	**IV**	**V**			
		14.	Tech Fest, Tech Quiz	10	20	30	40	50	a	40	
		15.	MOOC with final assessment certificate (Other than specified in the curriculum)	30					a	40	
		16.	Competitions conducted by Professional Societies - (IEEE, IEI, IET, ASME, SAE, NASA etc.)	5	10	15	20	30	a	30	
			Hackathon	5	10	15	20	30	a	30	
		17.	Additional 10 points for Winners of Smart India Hackathon (SIH)/ India Innovation Challenge Design Contest (IICDC)								
		18.	Attending Full time Conference/ Seminars / Exhibitions/ Workshop/ STTP conducted at IITs /NITs	10					a	20	

		18a	Attending Full time Conference/ Seminars / Exhibitions/ Workshop/ STTP conducted at KTU or its affiliated institutes	4	a	8	
		19.	Paper presentation/ publication at IITs/NITs	15	a	30	
			Additional 10 points for certificate of recognition.				
		19. a	Paper presentation/ publication at KTU or its affiliated institutes	6	a	12	
			Additional 2 points for a certificate of recognition.				
		20.	Poster Presentation at IITs /NITs	8	a	15	
			Additional 10 points for certificate of recognition.				
		20.a	Poster Presentation at KTU or its affiliated institutes	3	a	5	
			Additional 2 points for a certificate of recognition.				
		21.	Industrial Training/ Internship (at least for 2 weeks)	15	a/b	15	
		22.	Industrial/ Exhibition visits	3	a/b/ d	8	
		23.	Foreign Language Skills (TOEFL/ IELTS/ BEC exams, etc.)	40	a	40	
		24.	Aptitude Proficiency Certification (GRE, CAT, GMAT, etc)/Valid Gate Score	40	a	40	
		25.	Skilling Certificates (if not considered as part of the curriculum)	25	a	25	

	Entrepreneurship and Innovation	26.	Start-up Company Registered Legally (if not considered as part of the curriculum)	50	d	50	
		27.	Patent-Filed	25	d	25	
		28.	Patent - Published	30	d	50	
		29.	Patent- Granted (if Grace marks are not awarded)	40	d	50	
		30.	Patent- Licensed	70	d	70	
		31.	Prototype developed and tested	50	d	50	
		32.	Awards for Products developed	50	d	50	
		33.	Innovative technologies developed and used by industries/users	50	d	50	
		34.	Got venture capital funding for innovative ideas/products.	70	d	70	
		35.	Startup Employment (Offering jobs to two persons not less than Rs. 15000/- per month)	70	d	70	
		36.	Societal innovations	40	d	40	

*Level I College Events
*Level II Zonal Events
*Level III State/ University Events
*Level IV National Events
*Level V International Events
**Approval Documents: (a) Certificate (b) Letter from Authorities (c) Appreciation recognition letter (d) Documentary evidence (e) Legal Proof (f) Others (specify)