

**SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE  
(Autonomous)  
Gobichettipalayam, Erode-638455**



**Regulation 2023  
(Autonomous)**

**Curriculum and Syllabus  
Choice Based Credit System (CBCS)  
BE- BIOMEDICAL ENGINEERING**



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**Regulation 2023 (UG)**  
**Curriculum and Syllabus**  
**BE- Biomedical Engineering**

## I. Program Educational Objective (PEO)

**PEO1 :Foundational Concepts:** To enable the graduates to demonstrate their skills in design and develop medical devices for health care system through the core foundation and knowledge acquired in engineering and biology.

**PEO2 :Professionalism:** To enable the graduates to exhibit leadership in health care team to solve health care problems and make decisions with societal and ethical responsibilities.

**PEO3 :Innovation:** To Carryout multidisciplinary research, addressing human healthcare problems and sustain technical competence with ethics, safety and standards.

**PEO4 :Lifelong Learning:** To ensure that graduates will recognize the need for sustaining and expanding their technical competence and engage in learning opportunities throughout their careers.

## II. Program Outcomes (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### III. Program Specific Outcomes (PSOs)

1. **Core Skills:** To design and develop diagnostic and therapeutic devices that reduces physician burnout and enhance the quality of life for the end user by applying fundamentals of Biomedical Engineering.
2. **Problem Solving Skills:** To apply software skills in developing algorithms for solving healthcare related problems in various fields of Medical sector.
3. **Social Consciousness:** To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions for current societal and scientific issues thereby developing indigenous medical instruments that are on par with the existing technology

**Mapping of Course Outcome and Programme Outcome**

Year	Sem	Course name	PO												PSO			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
I	I	Induction Programme																
		Professional English - I	-	-	-	2	-	1	-	-	3	3	-	2	-	-	-	
		Matrices and Calculus	3	3	1	1	-	-	-	-	2	-	2	3	-	-	-	
		Engineering Physics	3	3	2	1	2	-	-	-	-	-	-	1	-	-	-	
		Engineering Chemistry	3	2	2	1	2	2	3	-	-	-	-	1	-	-	-	
		Problem Solving and Python Programming	2	3	3	3	2	-	-	-	-	-	2	2	3	3	3	
		தமிழர் மரபு /Heritage of Tamils																
		Problem Solving and Python Programming Laboratory	2	3	3	3	2	-	-	-	-	-	2	2	3	3	3	
		Physics and Chemistry Laboratory	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
			3	2	1	-	1	3	2	1	-	-	-	1	-	-	-	
	English Laboratory	-	-	-	-	-	-	-	1	3	3	-	2	-	-	-		
	II	Professional English - II	-	1	1	-	-	-	1	1	2	3	-	2	-	-	-	
		Numerical Methods and Statistics	3	3	1	1	1	-	-	-	2	-	2	3	-	-	-	
		Biosciences for Medical Engineering	3	2	2	1	-	1	-	-	-	-	-	2	3	1	-	
		Basic Electrical and Electronics Engineering	3	3	2	2	-	-	-	-	-	1	-	-	3	3	2	
		Medical Physics	3	3	1	1	1	1	-	-	-	-	-	-	-	-	-	
		Engineering Graphics	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-	
		தமிழரும் தொழில்நுட்பமும் /Tamils and Technology																
		Engineering Practices Laboratory	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1	
		Biosciences Laboratory	3	3	2	1	1	2	-	-	-	-	-	2	1	-	-	
Communication Laboratory / Foreign Language \$		-	-	2	-	-	-	-	1	3	3	-	3	-	-	-		

1 - low, 2 - medium, 3 - high, '-' - no correlation

**SUMMARY OF CREDITS**

S.No	Course Category	Credits per Semester								Total Credits	Credits in %	Credits as per AU Curriculum R21
		I	II	III	IV	V	VI	VII	VIII			
1	HSS	4	3					5		12	7.27	12
2	BS	12	4	4	6					26	15.75	26
3	ES	5	9	12						26	15.75	26
4	PC		8	8.5	16	9.5	11			53	32.12	53
5	PE					9	9			18	10.9	18
6	OE						3	9		12	7.27	12
7	EEC	1	2	1				4	10	18	10.90	16
8	MC		√		√	$\frac{\sqrt{\quad}}{\sqrt{\quad}}$	√					
<b>Total Credits / Semester</b>		<b>22</b>	<b>26</b>	<b>25.5</b>	<b>22</b>	<b>18.5</b>	<b>23</b>	<b>18</b>	<b>10</b>	<b>165</b>		<b>163</b>

**CATEGORIZATION OF COURSES**

- i. Humanities and Social Sciences including Management Courses (HSS)
- ii. Basic Science Courses (BS)
- iii. Engineering Science Courses (ES)
- iv. Professional Core Courses (PC)
- v. Professional Elective Courses (PE)
- vi. Open Elective Courses (OE)
- vii. Mandatory Courses (MC)
- viii. Employability Enhancement Courses (EEC)
- ix. Other Courses (OC)

**ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)**

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes,



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Regulation 2023 (UG)

Curriculum and Syllabus

BE- Biomedical Engineering

## SEMESTER I

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Induction Program</b>											
1.	23IPA11	Induction Programme	-	-	-	-	-	0	-	-	-
<b>Theory</b>											
2.	23ENT11	Professional English - I	HSS	3	0	0	3	3	40	60	100
3.	23MAT11	Matrices and Calculus	BS	3	1	0	4	4	40	60	100
4.	23PHT11	Engineering Physics	BS	3	0	0	3	3	40	60	100
5.	23CYT11	Engineering Chemistry	BS	3	0	0	3	3	40	60	100
6.	23CST11	Problem Solving and Python Programming	ES	3	0	0	3	3	40	60	100
7.	23TAT11	தமிழர் மரபு /Heritage of Tamils	HSS	1	0	0	1	1	40	60	100
<b>Practicals</b>											
8.	23CSL11	Problem Solving and Python Programming Laboratory	ES	0	0	4	4	2	60	40	100
9.	23PCL11	Physics and Chemistry Laboratory	BS	0	0	4	4	2	60	40	100
10.	23ENL11	English Laboratory	EEC	0	0	2	2	1	60	40	100
<b>Total</b>				<b>16</b>	<b>1</b>	<b>10</b>	<b>27</b>	<b>22</b>			



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**SEMESTER II**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Theory</b>											
1.	23ENT21	Professional English - II	HSS	2	0	0	2	2	40	60	100
2.	23MAT21	Numerical Methods and Statistics	BS	3	1	0	4	4	40	60	100
3.	23BMT21	Biosciences for Medical Engineering	PC	3	0	0	3	3	40	60	100
4.	23EET22	Basic Electrical and Electronics Engineering	ES	3	0	0	3	3	40	60	100
5.	23PHT26	Medical Physics	PC	3	0	0	3	3	40	60	100
6.	23MET21	Engineering Graphics	ES	2	0	4	6	4	40	60	100
7.	23TAT21	தமிழ்நுட்ப தொழில்நுட்பமும் /Tamil and Technology	HSS	1	0	0	1	1	40	60	100
<b>Practicals</b>											
8.	23MEL21	Engineering Practices Laboratory	ES	0	0	4	4	2	60	40	100
9.	23BML21	Biosciences Laboratory	PC	0	0	4	4	2	60	40	100
10.	23ENL21	Communication Laboratory	EEC	0	0	4	4	2	60	40	100
<b>Mandatory Courses</b>											
11.	23MCL21	Mandatory Course - I &	MC	0	0	1	1	0	100	-	100
<b>Total</b>				<b>17</b>	<b>1</b>	<b>17</b>	<b>35</b>	<b>26</b>			

**& Mandatory Course-I**

Yoga for Human Excellence	Non-credit Course
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### SEMESTER III

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Theory</b>											
1.	23MAT32	Transforms and Partial Differential Equations	BS	3	1	0	4	4	40	60	100
2.	23BMT31	Fundamentals of Electronic Devices and Circuits	ES	3	0	0	3	3	40	60	100
3.	23BMT32	Sensors and Measurements	PC	3	0	0	3	3	40	60	100
4.	23BMT33	Electric Circuit Analysis	ES	3	0	0	3	3	40	60	100
5.	23CST33	Object oriented programming	ES	3	0	0	3	3	40	60	100
6.	23BMI31	Anatomy and Human Physiology	PC	3	0	2	5	4	50	50	100
<b>Practicals</b>											
7.	23BML31	Fundamentals of Electronic Devices and Circuits Laboratory	ES	0	0	3	3	1.5	60	40	100
8.	23BML32	Sensors and Measurements Laboratory	PC	0	0	3	3	1.5	60	40	100
9.	23CSL33	Object oriented programming Laboratory	ES	0	0	3	3	1.5	60	40	100
10.	23PDL31	Professional Development	EEC	0	0	2	2	1	10	0	100
<b>Total</b>				<b>18</b>	<b>1</b>	<b>13</b>	<b>32</b>	<b>25.5</b>			





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### SEMESTER IV

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Theory</b>											
1.	23MAT34	Random Processes and Linear Algebra	BS	3	1	0	4	4	40	60	100
2.	23BMT41	Biomedical Instrumentation	PC	3	0	0	3	3	40	60	100
3.	23BMT42	Analog and Digital Integrated Circuits	PC	3	0	0	3	3	40	60	100
4.	23BMT43	Bio Control Systems	PC	3	0	0	3	3	40	60	100
5.	23CYT41	Environmental Sciences and Sustainability	BS	2	0	0	2	2	40	60	100
6.	23BMI41	Signal Processing	PC	3	0	2	5	4	50	50	100
<b>Practicals</b>											
7.	23BML41	Biomedical Instrumentation Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23BML42	Analog and Digital Integrated Circuits Laboratory	PC	0	0	3	3	1.5	60	40	100
<b>Mandatory Courses</b>											
9.	23SAT41	Soft and Analytical Skills-I&	MC	1	0	0	1	0	-	-	-
<b>Total</b>				<b>18</b>	<b>0</b>	<b>8</b>	<b>27</b>	<b>22</b>			

& Soft and Analytical Skills-I is a Non-credit Course



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### SEMESTER V

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Theory</b>											
1.	23BMT51	Embedded Systems and IoMT	PC	3	0	0	3	3	40	60	100
2.	23BMT52	Diagnostic and Therapeutic Equipment	PC	3	0	0	3	3	40	60	100
3.		Professional Elective I*	PE	-	-	-	-	3	40	60	100
4.		Professional Elective II*	PE	-	-	-	-	3	40	60	100
5.		Professional Elective III*	PE	-	-	-	-	3	40	60	100
<b>Practicals</b>											
6.	23BML51	Embedded systems and IOMT Laboratory	PC	0	0	3	3	1.5	60	40	100
7.	23BML52	Diagnostic and Therapeutic Equipment Laboratory	PC	0	0	4	4	2	60	40	100
<b>Mandatory Courses</b>											
8.		Mandatory Course - II&	MC	3	0	0	3	0	100	0	100
9.	23SAT51	Soft and Analytical Skills-II&&	MC	1	0	0	1	0	-	-	-
<b>Total</b>				-	-	-	-	<b>18.5</b>			

\* Professional Elective - I to III shall be chosen from the list of Professional electives (Verticals) offered by same Programme

& Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-II)

&& Soft and Analytical Skills-II is a non credit course



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### SEMESTER VI

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Theory</b>											
1.	23BMT61	Fundamentals of Healthcare Analytics	PC	3	0	0	3	3	40	60	100
2.	23CSI41	Artificial Intelligence and Machine Learning	PC	3	0	2	5	4	50	50	100
3.	23BMI61	Medical Image Processing	PC	3	0	2	5	4	50	50	100
4.		Professional Elective IV*	PE	-	-	-	-	3	40	60	100
5.		Professional Elective V*	PE	-	-	-	-	3	40	60	100
6.		Professional Elective VI*	PE	-	-	-	-	3	40	60	100
7.		Open Elective - I**	OE	-	-	-	-	3	40	60	100
<b>Mandatory Courses</b>											
8.		Mandatory Course - III&	MC	3	0	0	3	0	100	-	100
<b>Total</b>				-	-	-	-	<b>23</b>			

\* Professional Elective - IV to VI shall be chosen from the list of Professional electives (Verticals) offered by same Programme

\*\* Open Elective - I shall be chosen from the list of open electives offered by other Programmes

& Mandatory Course-III is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-III)

@ The students individually undergo Hospital training in reputed firms/ research institutes / laboratories for the specified duration (04 Weeks) during summer vacation. After the completion of training, a detailed report should be submitted within ten days from the commencement of VII semester.



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**SEMESTER VII**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Theory</b>											
1.	23UHV71	Human Values and Ethics	HSS	2	0	0	2	2	40	60	100
2.		Elective - Management <sup>#</sup>	HSS	3	0	0	3	3	40	60	100
3.		Open Elective - II <sup>**</sup>	OE	-	-	-	-	3	40	60	100
4.		Open Elective - III <sup>**</sup>	OE	-	-	-	-	3	40	60	100
5.		Open Elective - IV <sup>**</sup>	OE	-	-	-	-	3	40	60	100
<b>Practicals</b>											
6.	23BML71	Hospital Training <sup>@</sup>	EEC	0	0	0	0	2	100	-	100
7.	23BML72	Mini Project	EEC	0	0	4	4	2	-	-	100
<b>Total</b>				-	-	-	-	<b>18</b>			

<sup>#</sup> Elective - Management shall be chosen from the Elective Management courses.

<sup>\*\*</sup>Open Elective - II to IV Shall be chosen from the list of open electives offered by other Programmes

<sup>@</sup> The students undergone Hospital Training during VI semester summer vacation and same will be evaluated in VII semester.

SEMESTER VIII											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>Practicals</b>											
1.	23BML81	Project Work	EEC	0	0	20	20	10	60	40	100
<b>Total</b>				<b>0</b>	<b>0</b>	<b>20</b>	<b>20</b>	<b>10</b>			

**TOTAL CREDITS: 165**

MANDATORY COURSES II											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MCT51	Introduction to Women and Gender Studies	MC	3	0	0	3	0	100	-	100
2.	23MCT52	Elements of Literature	MC	3	0	0	3	0	100	-	100
3.	23MCT53	Film Appreciation	MC	3	0	0	3	0	100	-	100
4.	23MCT54	Disaster Risk Reduction and Management	MC	3	0	0	3	0	100	-	100

MANDATORY COURSES III											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MCT61	Well Being with Traditional Practices -Yoga, Ayurveda and Siddha	MC	3	0	0	3	0	100	-	100
2.	23MCT62	History of Science and Technology in India	MC	3	0	0	3	0	100	-	100
3.	23MCT63	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0	100	-	100
4.	23MCT64	State, Nation Building and Politics in India	MC	3	0	0	3	0	100	-	100
5.	23MCT65	Industrial Safety	MC	3	0	0	3	0	100	-	100

ELECTIVE - MANAGEMENT COURSES											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MSE71	Principles of Management	HSS	3	0	0	3	3	40	60	100
2.	23MSE72	Total Quality Management	HSS	3	0	0	3	3	40	60	100
3.	23MSE73	Engineering Economics and Financial Accounting	HSS	3	0	0	3	3	40	60	100
4.	23MSE74	Human Resource Management	HSS	3	0	0	3	3	40	60	100
5.	23MSE75	Knowledge Management	HSS	3	0	0	3	3	40	60	100
6.	23MSE76	Industrial Management	HSS	3	0	0	3	3	40	60	100

**PROFESSIONAL ELECTIVE COURSES: VERTICALS**

<b>Vertical I Bio Engineering</b>	<b>Vertical II Medical Device Innovation and Development</b>	<b>Vertical III Management (Healthcare)</b>	<b>Vertical IV Mechanics</b>	<b>Vertical V Signal and Image Processing</b>	<b>Verticals VI Communication</b>	<b>Verticals VII Advanced Healthcare Devices</b>
Biomaterials	Foundation Skills in Integrated Product Development	Clinical Engineering	Biomechanics	Bio Signal Processing	Communication Systems	Bio MEMS
Artificial Organs and Implants	Medical Device Design	Hospital Planning and Management	Rehabilitation Engineering	Computer Vision	Wearable Devices	Critical Care Equipment
Biomedical Optics and Photonics	Patient safety, Standards and Ethics	Medical Waste Management	Physiological Modelling	Speech and Audio Signal Processing	Body Area Networks	Human Assist Devices
Neural Engineering	Medical Device Regulations	Economics and Management for Engineers	Assistive Technology	Medical Imaging Systems	Virtual Reality and Augmented Reality in Healthcare	Advancements in Healthcare Technology
Principles of Tissue Engineering	Medical Innovation and Entrepreneurship	Biostatistics	Ergonomics	Brain Computer Interface and Applications	Telehealth Technology	Robotics in Medicine
Genetic Engineering	Rapid Prototyping	Forensic Science in Healthcare	Haptics	Biometrics	Medical Informatics	Therapeutic Equipment

**Registration of Professional Elective Courses from Verticals:**

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2023(Clause 12).

**PROFESSIONAL ELECTIVE COURSES: VERTICALS****VERTICAL 1: BIO ENGINEERING**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23BME11	Biomaterials	PE	3	0	0	3	3	40	60	100
2.	23BME12	Artificial Organs and Implants	PE	3	0	0	3	3	40	60	100
3.	23BME13	Biomedical Optics and Biophotonics	PE	2	0	2	4	3	50	50	100
4.	23BME14	Neural Engineering	PE	3	0	0	3	3	40	60	100
5.	23BME15	Principles of Tissue Engineering	PE	3	0	0	3	3	40	60	100
6.	23BME16	Genetic Engineering	PE	3	0	0	3	3	40	60	100

**VERTICAL 2: MEDICAL DEVICE INNOVATION AND DEVELOPMENT**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23BME21	Foundation Skills in Integrated Product Development	PE	3	0	0	3	3	40	60	100
2.	23BME22	Medical Device Design	PE	3	0	0	3	3	40	60	100
3.	23BME23	Patient Safety, Standards and Ethics	PE	3	0	0	3	3	40	60	100
4.	23BME24	Medical Device Regulations	PE	3	0	0	3	3	40	60	100
5.	23BME25	Medical Innovation and Entrepreneurship	PE	3	0	0	3	3	40	60	100
6.	23BME26	Rapid Prototyping	PE	3	0	0	3	3	40	60	100



**VERTICAL 3: MANAGEMENT (HEALTHCARE)**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23BME31	Clinical Engineering	PE	3	0	0	3	3	40	60	100
2.	23BME32	Hospital Planning and Management	PE	3	0	0	3	3	40	60	100
3.	23BME33	Medical Waste Management	PE	3	0	0	3	3	40	60	100
4.	23BME34	Economics and Management for Engineers	PE	3	0	0	3	3	40	60	100
5.	23BME35	Biostatistics	PE	2	0	2	4	3	50	50	100
6.	23BME36	Forensic Science in Healthcare	PE	3	0	0	3	3	40	60	100

**VERTICAL 4: MECHANICS**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23BME41	Biomechanics	PE	2	0	2	4	3	50	50	100
2.	23BME42	Rehabilitation Engineering	PE	3	0	0	3	3	40	60	100
3.	23BME43	Physiological Modelling	PE	3	0	0	3	3	40	60	100
4.	23BME44	Assistive Technology	PE	3	0	0	3	3	40	60	100
5.	23BME45	Ergonomics	PE	3	0	0	3	3	50	50	100
6.	23BME46	Haptics	PE	3	0	0	3	3	40	60	100

**VERTICAL 5: SIGNAL AND IMAGE PROCESSING**

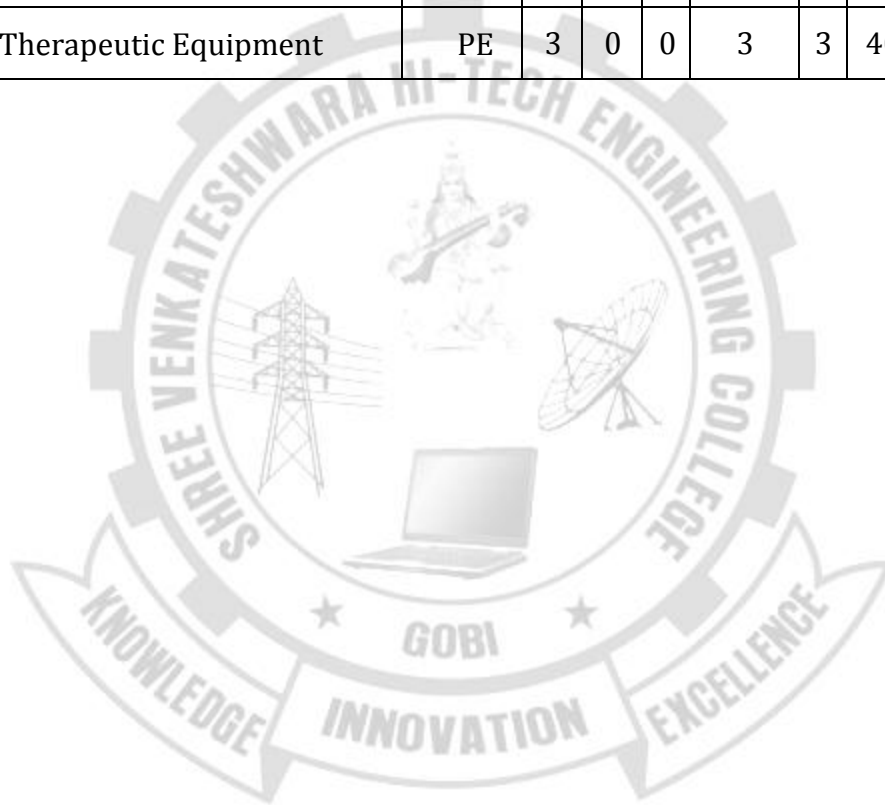
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23BME51	Bio Signal Processing	PE	3	0	0	3	3	40	60	100
2.	23BME52	Computer Vision	PE	2	0	2	4	3	50	50	100
3.	23BME53	Speech and Audio Signal Processing	PE	3	0	0	3	3	40	60	100
4.	23BME54	Medical Imaging Systems	PE	3	0	0	3	3	40	60	100
5.	23BME55	Brain Computer Interface and Applications	PE	3	0	0	3	3	40	60	100
6.	23BME56	Biometric Systems	PE	3	0	0	3	3	40	60	100

**VERTICAL 6: COMMUNICATION**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23BME61	Communication Systems	PE	3	0	0	3	3	40	60	100
2.	23BME62	Wearable Devices	PE	3	0	0	3	3	40	60	100
3.	23BME63	Body Area Networks	PE	3	0	0	3	3	40	60	100
4.	23BME64	Virtual Reality and Augmented Reality in Healthcare	PE	3	0	0	3	3	40	60	100
5.	23BME65	Tele health Technology	PE	2	0	2	4	3	50	50	100
6.	23BME66	Medical Informatics	PE	3	0	0	3	3	40	60	100

**VERTICAL 7: ADVANCED HEALTHCARE DEVICES**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
1.	23BME71	Bio MEMS	PE	3	0	0	3	3	40	60	100
2.	23BME72	Critical Care and Operation Theatre Equipment	PE	3	0	0	3	3	40	60	100
3.	23BME73	Human Assist Devices	PE	3	0	0	3	3	40	60	100
4.	23BME74	Advancements in Healthcare Technology	PE	3	0	0	3	3	40	60	100
5.	23BME75	Robotics in Medicine	PE	3	0	0	3	3	40	60	100
6.	23BME76	Therapeutic Equipment	PE	3	0	0	3	3	40	60	100



## OPEN ELECTIVES

S. NO.	COURSE CODE	COURSE TITLE	Category	PERIODS PER WEEK			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
<b>OFFERED BY DEPARTMENT OF CIVIL ENGINEERING</b>											
1	23CE011	Civil and Infrastructure Engineering	OE	3	0	0	3	3	40	60	100
2	23CE012	Environmental Pollution and waste management	OE	3	0	0	3	3	40	60	100
3	23CE013	Environmental Impact Assessment	OE	3	0	0	3	3	40	60	100
4	23CE014	Building Services	OE	3	0	0	3	3	40	60	100
5	23CE015	Water, Sanitation and Health	OE	3	0	0	3	3	40	60	100
<b>OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</b>											
1	23CS011	Foundation of AR/VR	OE	2	0	2	4	3	50	50	100
2	23CS012	Web Designing	OE	2	0	2	4	3	50	50	100
3	23CS013	Block Chain fundamentals	OE	2	0	2	4	3	50	50	100
4	23CS014	Knowledge Management	OE	2	0	2	4	3	50	50	100
5	23CS015	Cloud Computing Essentials	OE	2	0	2	4	3	50	50	100
<b>OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING</b>											
1	23ECO11	Basics of electronics in automation	OE	3	0	0	3	3	40	60	100
2	23ECO12	Optical engineering	OE	3	0	0	3	3	40	60	100
3	23ECO13	E-waste management	OE	3	0	0	3	3	40	60	100
4	23ECO14	Consumer electronics	OE	3	0	0	3	3	40	60	100
5	23ECO15	Principles of communication engineering	OE	3	0	0	3	3	40	60	100
<b>OFFERED BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING</b>											
1.	23EE011	Renewable Energy Sources	OE	3	0	0	3	3	40	60	100
2.	23EE012	Electrical Vehicle	OE	3	0	0	3	3	40	60	100
3.	23EE013	Energy Auditing and Conservation	OE	3	0	0	3	3	40	60	100
4.	23EE014	Domestic and Industrial Electrical Installations	OE	3	0	0	3	3	40	60	100
5.	23EE015	Microcontroller Based System Design	OE	3	0	0	3	3	40	60	100
<b>OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING</b>											
1	23MEO11	Industrial Instrumentation	OE	3	0	0	3	3	40	60	100

2	23ME012	Energy Technology	OE	3	0	0	3	3	40	60	100
3	23ME013	Reverse Engineering	OE	3	0	0	3	3	40	60	100
4	23ME014	Fire Safety Engineering	OE	3	0	0	3	3	40	60	100
5	23ME015	Nano Technology	OE	3	0	0	3	3	40	60	100
6	23ME016	Entrepreneurship Development	OE	3	0	0	3	3	40	60	100

**OFFERED BY DEPARTMENT ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

1	23AD011	Introduction to Big Data	OE	2	0	2	4	3	50	50	100
2	23AD012	Principles of Data Science	OE	2	0	2	4	3	50	50	100
3	23AD013	Data Visualization and its Applications	OE	2	0	2	4	3	50	50	100
4	23AD014	Data Warehousing and Mining	OE	2	0	2	4	3	50	50	100
5	23AD015	Principles of Cyber Security	OE	2	0	2	4	3	50	50	100

**OFFERED BY DEPARTMENT INFORMATION TECHNOLOGY**

1	23IT011	Basics of Java Programming	OE	2	0	2	4	3	50	50	100
2	23IT012	Ethical Hacking	OE	2	0	2	4	3	50	50	100
3	23IT013	E-Commerce and Applications	OE	2	0	2	4	3	50	50	100
4	23IT014	Basics of Android Application Development	OE	2	0	2	4	3	50	50	100
5	23IT015	Introduction to Web Design	OE	2	0	2	4	3	50	50	100

**OFFERED BY DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY**

1	23PT011	Nutraceuticals	OE	3	0	0	3	3	40	60	100
2	23PT012	IPR for Pharma Industry	OE	3	0	0	3	3	40	60	100
3	23PT013	Pharmaceutical Nanotechnology	OE	3	0	0	3	3	40	60	100
4	23PT014	Basics of Human Anatomy and physiology	OE	3	0	0	3	3	40	60	100

**OFFERED BY DEPARTMENT BIOMEDICAL ENGINEERING**

1	23BM011	Biomedical Instrumentation	OE	3	0	0	3	3	40	60	100
2	23BM012	Medical Optics	OE	3	0	0	3	3	40	60	100
3	23BM013	Biometric systems and their applications	OE	3	0	0	3	3	40	60	100
4	23BM014	Healthcare Management systems	OE	3	0	0	3	3	40	60	100
5	23BM015	IOT in Medicine	OE	3	0	0	3	3	40	60	100

**23BMT21                      BIOSCIENCES FOR MEDICAL ENGINEERING                      L   T   P   C**  
**3   0   0   3**

**COURSE OBJECTIVES:**

- 1. To study structural and functional properties of carbohydrates, proteins, lipids and amino acids.
- 2. To emphasize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules.
- 3. Gain knowledge on the structural and functional aspects of living organisms.

**UNIT-I                                      CARBOHYDRATES, LIPIDS, PROTEIN                                      10**

Classification of carbohydrates - mono, di, oligo and polysaccharides. Structure, physical and chemical properties of carbohydrates - Classification of lipids- simple, compound, and derived lipids. Nomenclature of fatty acid - Structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Nucleic acid: Structural aspects - Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding).

**UNIT-II                                      VITAMINS AND MINERALS                                      8**

Vitamins: classification (A, D, E, K, and B-complex members), basic structure, source, daily requirement, functions and deficiency symptoms- Minerals: classification- macro elements and microelements, specific function and deficiency disorders

**UNIT-III                                      CELL DEGENERATION, REPAIR AND NEOPLASIA                                      10**

Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

**UNIT-IV                                      HEMODYNAMIC DERANGEMENTS AND DISEASES                                      9**

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders- Bleeding disorders, Leukaemias, Lymphomas Haemorrhage- Lifestyle diseases - diabetes, obesity, blood pressure.

**UNIT-V                                      FUNDAMENTALS OF MICROBIOLOGY AND IMMUNOPATHOLOGY                                      8**

Structure of Bacteria and Virus - List of common bacterial, fungal and viral diseases of human beings.- Basics of Microscopes : Light microscope, Electron microscope (TEM & SEM). - Natural and artificial immunity - Immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**At the end of the course, the students will be able to**

- CO1:** Acquire knowledge on structure, properties and biological functions of carbohydrates, lipids and proteins.
- CO2:** Assess the significance of vitamins and minerals
- CO3:** Comprehend genetics and the immune system
- CO4:** Outline cause, symptoms, diagnosis and treatment of common diseases.
- CO5:** Understand the basics of microbiology and pathology

**TEXT BOOKS:**

1. RAFI MD "Text book of biochemistry for Medical Student" Fourth Edition, Universities Press, Orient Blackswan Private Limited - New Delhi 2021.
2. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of Diseases", 10th edition: South Asia Edition Elsevier India, 2020.
3. Lehninger, A. L, Nelson D. L and Cox, M. M, "Principles of Biochemistry", Freeman Publishers, New York, Eighth edition, 2021.

**REFERENCE BOOKS:**

1. Dubey RC and Maheswari DK. "A Text Book of Microbiology" Chand & Company Ltd, 5<sup>th</sup> edition, 2022.
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 6<sup>th</sup> edition, 2016.
3. Ananthanarayanan & Panicker, "Microbiology" Orientblackswan, 10th edition 2017.
4. Prescott, Harley and Klein, "Microbiology", 10th edition, McGraw Hill, 2017.

**E-RESOURCES:**

1. NPTEL-Online Courses and Video lectures: <https://nptel.ac.in/>

**CO's - PO's & PSO's MAPPING**

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	-	-	-	-	-	1	2	1	-
CO2	3	3	2	1	-	1	-	-	-	-	-	2	3	1	-
CO3	3	2	2	1	-	1	-	-	-	-	-	2	3	1	-
CO4	3	2	2	1	-	1	-	-	-	-	-	2	3	2	-
CO5	3	1	2	1	-	1	-	-	-	-	-	1	2	1	-
AVG	3	2	2	1	-	1	-	-	-	-	-	2	3	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

23BML21

BIOSCIENCES LABORATORY

L	T	P	C
0	0	4	2

**COURSE OBJECTIVES:**

- 1. Estimation and quantification of biomolecules.
- 2. Separation of macromolecules.
- 3. Practice on chemical examinations, Histopathological examinations etc

**LIST OF EXPERIMENTS**

1. Preparation of solutions: 1) percentage solutions, 2) molar solutions, 3) normal solutions.
2. Standardization of pH meter, preparation of buffers, emulsions.
3. Spectroscopy: Determination of absorption maxima ( $\lambda_{max}$ ) of a given solution.
4. General tests for carbohydrates, proteins and lipids.
5. Identification of Blood Collection Tubes and Phlebotomy equipment.
6. Preparation of serum and plasma from blood.
7. Estimation of Haemoglobin and blood glucose.
8. Estimation of creatinine, urea and Uric acid.
9. Separation of proteins by SDS electrophoresis (Demo) and amino acids by thin layer chromatography (Demo).
10. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood).
11. Basic staining – Hematoxylin and eosin staining.
12. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**At the end of the course, the students will be able to**

- CO1:** Understand the Biochemistry laboratory functional components
- CO2:** Have a sound knowledge of qualitative test of different biomolecules.
- CO3:** Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample.
- CO4:** Have a sound knowledge of separation technology of proteins and amino acids.
- CO5:** Student can perform practical experiments on staining Processes.



**TEXT BOOKS:**

1. Ramnik Sood, Modern Medical Laboratory Technology: methods and Interpretation, 7th Edition, Jaypee Brothers Medical Publishers, 2023.

**REFERENCE BOOKS:**

1. Manual prepared by the faculty of BME Department, SVHEC

**E-RESOURCES:**

1. NPTEL-Online Courses and Video lectures: <https://nptel.ac.in/>

**CO's - PO's & PSO's MAPPING**

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	-	-	-	-	-	1	1	-	-
CO2	3	3	1	1	2	2	-	-	-	-	-	2	1	-	-
CO3	3	3	2	1	2	2	-	-	-	-	-	2	1	-	-
CO4	3	3	2	1	1	2	-	-	-	-	-	2	1	-	-
CO5	3	2	2	1	1	1	-	-	-	-	-	1	1	-	-
AVG	3	3	2	1	1	2	-	-	-	-	-	2	1	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation