

### 13. Courses of Study and Scheme of Assessment

#### BE BIOMEDICAL ENGINEERING

(2019 Regulations)  
(Minimum credits to be earned: 165)

Course Code	Course Title	Periods / week			Maximum Marks				
		Lecture	Tutorial	Practical	Credits	CA	FE	Total	CAT
<b>SEMESTER 1</b>									
19D101	Calculus and its Applications	3	1	0	4	50	50	100	BS
19D102	Introduction to Electromagnetic Theory	3	0	0	3	50	50	100	BS
19D103	Chemistry of Electronic Materials	3	0	0	3	50	50	100	BS
19D104	Basics of Electrical Engineering	3	1	0	4	50	50	100	ES
19G105	English Language Proficiency	2	1	0	3	50	50	100	HS
19D110	Engineering Graphics	0	0	4	2	50	50	100	ES
19D111	Engineering Practices	0	0	2	1	50	50	100	ES
19D112	Electrical Laboratory	0	0	2	1	50	50	100	ES
19IP15	Induction Programme **	0	0	0	0	-	-	-	MC
<b>Total 25 periods</b>		<b>14</b>	<b>3</b>	<b>8</b>	<b>21</b>	<b>400</b>	<b>400</b>	<b>800</b>	
<b>SEMESTER 2</b>									
19D201	Complex Variables and Transforms	3	1	0	4	50	50	100	BS
19D202	Biomaterials	2	0	0	2	50	50	100	BS
19D203	Chemistry for Biomedical Engineering	2	0	0	2	50	50	100	BS
19D204	Electron Devices	3	0	0	3	50	50	100	ES
19D205	Problem Solving and C Programming	2	0	0	2	50	50	100	ES
19_____	Language Electives	0	0	4	2	50	50	100	HS
19D211	Problem Solving and C Programming Laboratory	0	0	2	1	50	50	100	ES
19D212	Electron Devices Laboratory	0	0	2	1	50	50	100	ES
19D213	Basic Sciences Laboratory	0	0	4	2	50	50	100	BS
19D215	Activity Point Programme *	-	-	-	Grade	-	-	-	MC
<b>Semester 2- Summer Term</b>									
19A213	Internship €	0	0	0	2£	100	0	100	EEC
<b>Total 25 periods</b>		<b>12</b>	<b>1</b>	<b>12</b>	<b>21</b>	<b>550</b>	<b>450</b>	<b>1000</b>	

\*\* As per norms

\* As per AICTE norms; Total 60 hrs; Grade: Completed / Not Completed; Not counted for CGPA

CA Continuous Assessment

FE Final Examination

€ This course will be conducted prior to the commencement of the third semester for a period of three weeks

£ For internship, one credit is equivalent to a minimum of 40 hours of work as per norms

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<b>SEMESTER 3</b>									
19D301	Linear Algebra and Numerical Analysis	3	1	0	4	50	50	100	BS
19D302	Digital Electronics and Logic Design	3	0	0	3	50	50	100	ES
19D303	Human Anatomy and Physiology	3	0	0	3	50	50	100	PC
19D304	Signals and Systems	3	1	0	4	50	50	100	PC
19D305	Analog Circuits	3	0	0	3	50	50	100	ES
19O306	Economics for Engineers	3	0	0	3	50	50	100	HS
19D310	Physiology Laboratory	0	0	4	2	50	50	100	PC
19D311	Analog and Digital Circuits Laboratory	0	0	4	2	50	50	100	ES
19K312	Environmental Science **	2	0	0	0	-	-	-	MC
19D315	Activity Point Programme *	-	-	-	Grade	-	-	-	MC
<b>Total 30 periods</b>		<b>20</b>	<b>2</b>	<b>8</b>	<b>24</b>	<b>400</b>	<b>400</b>	<b>800</b>	
<b>SEMESTER 4</b>									
19D401	Probability and Statistical Inference	3	1	0	4	50	50	100	BS
19D402	Computational Techniques	3	0	0	3	50	50	100	PC
19D403	Sensors and Measurements	3	0	0	3	50	50	100	PC
19D404	Electronic Communication Systems	3	0	0	3	50	50	100	PC
19D405	Biomedical Instrumentation	3	0	0	3	50	50	100	PC
19D406	Biomedical Signal Processing	2	2	0	4	50	50	100	PC
19D410	Biomedical Instrumentation Laboratory	0	0	2	1	50	50	100	PC
19D411	Python Programming Laboratory	0	0	4	2	50	50	100	ES
19Q413	Soft Skills Development	0	0	2	1	100	0	100	EEC
19O412	Indian Constitution **	2	0	0	0	-	-	-	MC
19D415	Activity Point Programme *	-	-	-	Grade	-	-	-	MC
<b>Total 30 periods</b>		<b>19</b>	<b>3</b>	<b>8</b>	<b>24</b>	<b>500</b>	<b>400</b>	<b>900</b>	

\*\* As per norms

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<b>SEMESTER 5</b>									
19D501	Image Processing	3	0	0	3	50	50	100	PC
19D502	Embedded Systems	3	0	0	3	50	50	100	PC
19D503	Biomedical Equipments	4	0	0	4	50	50	100	PC
19D504	Control Systems	3	1	0	4	50	50	100	PC
19D___	Professional Elective I	3	0	0	3	50	50	100	PE
19D510	Image Processing Laboratory	0	0	4	2	50	50	100	PC
19D511	Embedded Systems Laboratory	0	0	4	2	50	50	100	PC
19D512	Device Design Laboratory	0	0	2	1	50	50	100	EEC
19Q513	Business and Managerial Communications	0	0	2	1	100	0	100	EEC
19D515	Activity Point Programme *	-	-	-	Grade	-	-	-	MC
<b>Total 29 periods</b>		<b>16</b>	<b>1</b>	<b>12</b>	<b>23</b>	<b>500</b>	<b>400</b>	<b>900</b>	
<b>SEMESTER 6</b>									
19D601	Medical Informatics	2	1	0	3	50	50	100	PC
19D602	Artificial Organs	3	0	0	3	50	50	100	PC
19D603	Biomechanics	3	0	0	3	50	50	100	PC
19D604	BioMEMS and Nanotechnology	3	0	0	3	50	50	100	PC
19___	Open Elective I	3	0	0	3	50	50	100	OE
19D___	Professional Elective II	3	0	0	3	50	50	100	PE
19D610	Medical Informatics Laboratory	0	0	2	1	50	50	100	PC
19D611	Biomechanics Laboratory	0	0	2	1	50	50	100	PC
19D620	Innovation Practices	0	0	4	2	50	50	100	EEC
19Q613	Quantitative and Reasoning Skills	0	0	2	1	100	0	100	EEC
19D615	Activity Point Programme *	-	-	-	Grade	-	-	-	MC
<b>Total 28 periods</b>		<b>17</b>	<b>1</b>	<b>10</b>	<b>23</b>	<b>550</b>	<b>450</b>	<b>1000</b>	

At the end of 6th semester, the students are required to earn the minimum number of activity points from the AICTE mandated ACTIVITY POINT PROGRAMME to qualify for the award of BE/BTech degree (Refer Section 4 (vii) (c) of 2019 Regulations)

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FE Final Examination

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		Lecture	Tutorial	Practical	Credits	CA	FE	Total	CAT
<b>SEMESTER 7</b>									
19D701	Machine Learning	3	0	0	3	50	50	100	PC
19D702	Biofluidics and Thermodynamics	3	0	0	3	50	50	100	PC
19D___	Professional Elective III	3	0	0	3	50	50	100	PE
19D___	Professional Elective IV	3	0	0	3	50	50	100	PE
19_____	Open Elective II	3	0	0	3	50	50	100	OE
19D710	Bio Modeling and Simulation Laboratory	0	0	2	1	50	50	100	PC
19D711	Data Analytics Laboratory	0	0	2	1	50	50	100	PC
19D720	Project Work I	0	0	4	2	50	50	100	EEC
<b>Total 23 periods</b>		<b>15</b>	<b>0</b>	<b>8</b>	<b>19</b>	<b>400</b>	<b>400</b>	<b>800</b>	
<b>SEMESTER 8</b>									
19D___	Professional Elective V	3	0	0	3	50	50	100	PE
19D___	Professional Elective VI	3	0	0	3	50	50	100	PE
19D820	Project Work II	0	0	8	4	50	50	100	EEC
<b>Total 14 periods</b>		<b>6</b>	<b>0</b>	<b>8</b>	<b>10</b>	<b>150</b>	<b>150</b>	<b>300</b>	

CA      Continuous Assessment

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## PROFESSIONAL ELECTIVES

### Device and Application Development

- 19D001 Electromagnetic Fields in Biology and Medicine
- 19D002 Medical Optics
- 19D003 Ultrasound in Medicine
- 19D004 Magnetic Resonance Imaging
- 19D005 Embedded System Design
- 19D006 Advanced Medical Equipments
- 19D007 Hospital Systems Management

### Biosystems and Biological Engineering

- 19D008 Engineering of Nanomaterials
- 19D009 Drug Delivery Systems
- 19D010 Bioanalytical Techniques and Characterization
- 19D011 Cell Biology and Tissue Engineering
- 19D012 Modeling of Physiological Systems
- 19D013 Computational Biology and Bioinformatics

### Healthcare Technologies

- 19D014 Wearable Technologies
- 19D015 Telemedicine and Healthcare Delivery
- 19D016 Mobile Application Development
- 19D017 Medical Robotics
- 19D018 Rehabilitation Engineering
- 19D019 Occupational Biomechanics and Ergonomics

### Computational Methods for Biomedical Engineering

- 19D020 Pattern Recognition and Neural Networks
- 19D021 Advanced Digital Signal Processing
- 19D022 Database Management Systems
- 19D023 Artificial Intelligence
- 19D024 Advanced Machine Learning
- 19D025 Security for Medical Devices
- 19D026 Computer Aided Drug Design

## LANGUAGE ELECTIVES

- 19G001 Communication Skills for Engineers
- 19G002 German- Level A1.1
- 19G003 French Language Level 1
- 19G004 Basic Japanese

## ONE-CREDIT COURSES

### BIOMEDICAL ENGINEERING

- 19DF01 Radiation Protection in Medical Technology
- 19DF02 Radiation Oncology Physics
- 19DF03 Respiratory Physiology
- 19DF04 Speech Production and Processing
- 19DF05 Medical Textiles
- 19DF06 Medical Regulatory Standards
- 19DF07 Data Mining in Healthcare
- 19DF08 Internet of Things for Healthcare
- 19DF09 Biopolymers in Biomedical Applications

### ENGLISH

- 19GF01 Interpersonal and Organizational Communication
- 19GF02 Human Values Through Literature

### HUMANITIES

- 19OFA1 Export – Import Practices
- 19OFA2 Insurance - Concepts and Practices
- 19OFA3 Public Finance
- 19OFA4 Security Analysis and Portfolio Management
- 19OFA5 Social Entrepreneurship

**Summary of Credit Distribution**

<b>BE BIOMEDICAL ENGINEERING</b>										
<b>S. No</b>	<b>Course Category</b>	<b>Credits Per Semester</b>								<b>Total Credits</b>
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	
1	HS	3	2	3	0	0	0	0	0	8
2	BS	10	10	4	4	0	0	0	0	28
3	ES	8	7	8	2	0	0	0	0	25
4	PC	0	0	9	17	18	14	8	0	66
5	PE	0	0	0	0	3	3	6	6	18
6	OE	0	0	0	0	0	3	3	0	6
7	EEC	0	0+2	0	1	2	3	2	4	14
8	MC	-	-	-	-	-	-	-	-	-
	<b>TOTAL</b>	<b>21</b>	<b>19+2</b>	<b>24</b>	<b>24</b>	<b>23</b>	<b>23</b>	<b>19</b>	<b>10</b>	<b>165</b>

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