CURRICULUM

B.TECH. BIOMEDICAL ENGINEERING

CHOICE BASED CREDIT SYSTEM

STUDENTS LEARNING OUTCOMES

The curriculum and syllabi of B.Tech Biomedical Engineering program (2018-19) conform to Outcome Based Education (OBE) for a flexible and structured Choice Based Credit System (CBCS). In general, **TEN STUDENT OUTCOMES** (a-j) have been identified and the curriculum and syllabi have been chosen in such a way that each of the modules meets one or more of these outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further, each module in the program spells out clear instructional objectives which are mapped to the student outcomes.

The Student Outcomes are:

(a) Ability to apply knowledge of mathematics and science in medical engineering solutions.
(b) Ability to understand the engineering concepts and their applications using the acquired broad based knowledge.
(c) Ability to adress the problems associated with the interaction between living and non-living materials and systems.
(d) Ability to use the techniques, skills, and modern medical engineering tools based on software and hardware practices.
(e) Ability to make measurements on and interpret data from living systems.
(f) Ability to apply advanced science and engineering to solve the problems at the interface of engineering and biology.
(g) Ability to identify, formulate and solve biomedical engineering problems and challenges.
(h) Ability to use classical and modern engineering, mathematics, and biological tools for biomedical engineering practice.
(i) Ability to design, develop and verify engineering systems to meet desired needs ensuring its reliability and security in addition to satisfying economic, social and ethical constraints.
(j) Ability for recognition of the need for, and an ability to engage in life-long learning.

B.TECH BIOMEDICAL ENGINEERING

SUMMARY OF PROGRAM CURRICULUM

Category		Sub-Category	Total Number of Credits (B.Tech)	Total Number of Credits (B.Tech-LEET)	Min Required Credits (B.Tech)	Min Required Credits (B.Tech-LEET)	Percentage of Total credits
G	General		**52**	**0**	**48**	**0**	26%
E	Engineering	Program Core (PC)	73	73	73	73	
		Program Elective (PE)	28	28	24	24	
		Generic Elective (GE)	8	8	4	4	
		Project (PD)	20	20	20	20	
Total : Engineering			**129**	**129**	**121**	**121**	64%
M	Management		**7**	**7**	**7**	**7**	3%
P	Professional Enrichment	Ability enhancement (AE)	8	8	7	7	
		Skill enhancement (SE)	4	4	4	4	
		Creativity & Innovation (CI)	1	1	0	0	
		Co-Curricular Activity (CA)	1	1	0	0	
Total : Professional Enrichment			**14**	**14**	**11**	**11**	7%
Overall Total			202	150*	187	139*	100%

Note:
Students are to earn at least 187/139*credits out of 202/150* credits to become eligible for the award of B.Tech degree.

* FOR LATERAL ENTRY

PROGRAM SCHEME

SEMESTER - I

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total Marks
ENGL0101	G		ENGLISH	3	0	0	3	25	75	100
MATH0101	G		APPLIED MATHEMATICS – I	3	1	0	3.5	50	100	150
CHEM0101	G		INDUSTRIAL CHEMISTRY	3	0	0	3	25	75	100
CHEM0102	G		CHEMISTRY LAB	0	0	2	1	25	25	50
PHYS0101	G		APPLIED PHYSICS – I	3	1	0	3.5	50	100	150
PHYS0102	G		PHYSICS LAB – I	0	0	2	1	25	25	50
ECEN1101	G		ELECTRICAL TECHNOLOGY	2	0	0	2	25	50	75
ECEN1102	G		ELECTRICAL TECHNOLOGY LAB	0	0	2	1	25	25	50
CSEN1101	G		FUNDAMENTALS OF COMPUTERS AND PROGRAMMING (WITH C)	4	0	0	4	50	100	150
CSEN1102	G		FCPC LAB	0	0	2	1	25	25	50
	G		FOREIGN LANGUAGE PART-I #	2	0	0	2	25	50	75
TOTAL				**20**	**2**	**8**	**25**	**350**	**650**	**1000**

L = Lecture
T = Tutorial
P = Practical
C = Credit Point

 # FOREIGN LANGUAGE (One foreign language out of the following)

MODULE CODE	MODULE NAME
LANF0101	FRENCH
LANG0102	GERMAN
LANS0103	SPANISH

SEMESTER - II

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total
PHYS0103	G		APPLIED PHYSICS-II	3	1	0	3.5	50	100	150
PHYS0104	G		APPLIED PHYSICS LAB – II	0	0	2	1	25	25	50
ECEN0104	G		BASICS OF ELECTRONICS	2	0	0	2	25	50	75
ECEN0105	G		BASICS OF ELECTRONICS LAB	0	0	2	1	25	25	50
MECH0102	G		BASICS OF MECHANICAL ENGINEERING	2	0	0	2	25	50	75
MECH0103	G		BASICS OF MECHANICAL ENGINEERING LAB	0	0	2	1	25	25	50
MECH1102	G		WORKSHOP TECHNOLOGY LAB	0	0	2	1	25	25	50
CIVL0101	G		BASICS OF CIVIL ENGINEERING	2	0	0	2	25	50	75
CIVL0102	G		BASICS OF CIVIL ENGINEERING LAB	0	0	2	1	25	25	50
MATH0116	G		APPLIED MATHEMATICS-II	4	1	0	4.5	50	100	150
MATH0117	G		NUMERICAL METHODS	3	0	0	3	25	75	100
VALU1019	G		VALUE EDUCATION	2	0	0	2	25	50	75
CSEN1107	G		PC LAB	0	0	2	1	25	25	50
	G		FOREIGN LANGUAGE PART- II #	2	0	0	2	25	50	75
TOTAL				**20**	**2**	**12**	**27**	**400**	**675**	**1075**

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 # FOREIGN LANGUAGE

MODULE CODE	MODULE NAME
LANF0104	FRENCH
LANG0105	GERMAN
LANS0106	SPANISH

SEMESTER - III

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total Marks
BMEN2101	E	PC	BASICS OF HUMAN ANATOMY AND PHYSICOLOGY	3	1	0	3.5	50	100	150
BMEN2102	E	PC	DIGITAL SYSTEMS	3	1	0	3.5	50	100	150
BMEN2103	E	PC	DIGITAL SYSTEMS LAB	0	0	2	1	25	25	50
BMEN2104	E	PC	ELECTRONICS CIRCUITS	3	1	0	3.5	50	100	150
BMEN2105	E	PC	BIOMATERIALS AND ARTIFICIAL ORGANS	3	1	0	3.5	50	100	150
	E	PE	ELECTIVE-I	4	0	0	4	50	100	150
MGMT0101	M		MANAGEMENT & PROFESSIONAL LEADERSHIP	3	0	0	3	25	75	100
VALU0119	P	AE	APTITUDE I	2	0	0	2	25	50	75
VALU0123	P	SE	PROFESSIONAL COMMUNICATION-I	2	0	0	2	25	50	75
ENGL0109	P	AE	ACADEMIC WRITING	0	0	2	1	25	25	50
	P	AE	YOGA/ MEDITATION/ NSS	0	0	2	1	50	0	50
TOTAL				**23**	**4**	**6**	**28**	**425**	**725**	**1150**

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MODULE CODE	MODULE
VALU0118	YOGA
VALU0121	MEDITATION
VALU0122	NSS

ELECTIVE I

MODULE CODE	MODULE
BMEN2206	BIOMEDICAL LASER INSTRUMENTATION
BMEN2207	NUCLEAR MEDICINE
BMEN2208	RADIOTHERAPY EQUIPMENTS

SEMESTER - IV

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total Marks
BMEN2109	E	PC	BIOMEDICAL SENSORS & MEASURMENT DEVICES	3	1	0	3.5	50	100	150
BMEN2110	E	PC	BIOMEDICAL SENSORS & MEASURMENT DEVICES LAB	0	0	2	1	25	25	50
BMEN2111	E	PC	MEDICAL INSTRUMENTATION - I	3	1	0	3.5	50	100	150
BMEN2112	E	PC	MEDICAL INSTRUMENTATION - I LAB	0	0	2	1	25	25	50
BMEN2113	E	PC	BIOMEDICAL CIRCUITS AND NETWORKS	3	1	0	3.5	50	100	150
BMEN2114	E	PC	BIOMEDICAL CIRCUITS AND NETWORKS LAB	0	0	3	1.5	25	50	75
BMEN2115	E	PC	FUNDAMENTALS OF SIGNAL AND SYSTEMS	4	0	0	4	50	100	150
	E	PE	ELECTIVE- II	4	0	0	4	50	100	150
	E	PE	ELECTIVE-III	4	0	0	4	50	100	150
TOTAL				**21**	**3**	**7**	**26**	**375**	**700**	**1075**

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ELECTIVE II

MODULE CODE	MODULE
BMEN2216	MEDICAL RADIATION SAFETY ENGINEERING
BMEN2217	TROUBLESHOOTING OF MEDICAL INSTRUMENTS
BMEN2218	QUALITY CONTROL & REGULATORY ASPECTS IN MEDICAL DEVICES

ELECTIVE III

MODULE CODE	MODULE
BMEN2219	HOSPITAL ENGINEERING
BMEN2220	TELEMEDICINE & PICTURE ARCHIVAL COMMUNICATION SYSTEM
BMEN2221	ADVANCED DIAGNOSTIC AND SURGICAL EQUIPMENTS

SEMESTER - V

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total Marks
BMEN3101	E	PC	MATHEMATICS FOR MEDICAL IMAGING	3	0	0	3	25	75	100
BMEN3102	E	PC	BIOMEDICAL SIGNAL PROCESSING	3	0	0	3	25	75	100
BMEN3103	E	PC	BIOMEDICAL SIGNAL PROCESSING LAB	0	0	2	1	25	25	50
BMEN3104	E	PC	MEDICAL INSTRUMENTATION-II	3	0	0	3	25	75	100
BMEN3105	E	PC	MEDICAL INSTRUMENTATION-II LAB	0	0	2	1	25	25	50
BMEN3106	E	PC	CLINICAL SCIENCES	3	0	0	3	25	75	100
BMEN3107	E	PC	CLINICAL SCIENCES LAB	0	0	2	1	25	25	50
BMEN3108	E	PD	INDUSTRIAL TRAINING I (TRAINING TO BE UNDERGONE AFTER IV SEMESTER)	0	0	1	1	25	25	50
BMEN3109	E	PD	SPECIALIZED MINOR PROJECT (GROUP)	0	0	4	2	25	50	75
	E	PE	ELECTIVE-IV	4	0	0	4	50	100	150
	E	PE	ELECTIVE-V	4	0	0	4	50	100	150
VALU0136	P	AE	APTITUDE II	2	0	0	2	25	50	75
VALU0140	P	SE	PROFESSIONAL COMMUNICATION-II	2	0	0	2	25	50	75
TOTAL				**24**	**0**	**11**	**30**	**375**	**750**	**1125**

L = Lecture

T = Tutorial

P = Practical

C = Credit Point

ELECTIVE IV

MODULE CODE	MODULE
BMEN3210	HOSPITAL RADIOPHARMACY
BMEN3211	HOME MEDICARE TECHNOLOGY
BMEN3212	BIOMEDICAL MEMS AND NANOTECHNOLOGY

ELECTIVE V

MODULE CODE	MODULE
BMEN3213	APPLIED OPTOELECTRONICS IN MEDICINE
BMEN3214	BRAIN COMPUTER INTERFACE
BMEN3215	ELECTRO PHYSIOLOGY OF HUMAN SYSTEM

SEMESTER - VI

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total Marks
BMEN3116	E	PC	BIOMATERIALS & COMPONENTS	3	0	0	3	25	75	100
BMEN3117	E	PC	MEDICAL IMAGE PROCESSING AND ANALYSIS	3	1	0	3.5	50	100	150
BMEN3118	E	PC	MEDICAL IMAGE PROCESSING AND ANALYSIS LAB	0	0	3	1.5	25	50	75
BMEN3119	E	PC	MICROPROCESSOR AND MICROCONTROLLER BASED BIOMEDICAL INSTRUMENTATION	3	1	0	3.5	50	100	150
BMEN3120	E	PC	MICROPROCESSOR AND MICROCONTROLLER BASED BIOMEDICAL INSTRUMENTATION LAB	0	0	3	1.5	25	50	75
BMEN3121	E	PD	SPECIALIZED MINOR PROJECT (INDIVIDUAL)	0	0	8	4	100	100	200
	E	PE	ELECTIVE-VI	4	0	0	4	50	100	150
	E	GE	ELECTIVE-A	4	0	0	4	50	100	150
BMEN3122	P	CI	CREATIVITY AND INNOVATION	0	0	2	1	0	50	50
TOTAL				**17**	**2**	**16**	**26**	**375**	**725**	**1100**

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T = Tutorial
P = Practical
C = Credit Point

ELECTIVE-VI

MODULE CODE	MODULE
BMEN3223	ADVANCED MEDICAL IMAGING SYSTEMS
BMEN3224	REGULATORY ASPECTS IN BIOSCIENCES
BMEN3225	DESIGN & DEVELOPMENT OF MEDICAL DEVICES

GENERIC ELECTIVE - Aψ

MODULE CODE	MODULE
SAPA0320	ROBOTICS & AUTOMATION in MEDICINE
SAPM0321	SAP-MM
SAPS0322	SAP-SD
	ONE/TWO MOOCS MODULES (Consisting 4 credits in total)

ψAdditional fee, if any, shall be borne by the student.

SEMESTER - VII

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total Marks
BMEN4101	E	PC	REHABILITATION ENGINEERING	3	0	0	3	25	75	100
BMEN4102	E	PC	BIOMEDICAL CONTROL SYSTEMS	3	1	0	3.5	50	100	150
BMEN4103	E	PC	BIOMEDICAL CONTROL SYSTEMS LAB	0	0	2	1	25	25	50
BMEN4104	E	PC	VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL SYSTEMS	3	1	0	3.5	50	100	150
BMEN4105	E	PC	VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL SYSTEMS LAB	0	0	2	1	25	25	50
BMEN4106	E	PD	SPECIALIZED MAJOR PROJECT (GROUP) ##	0	0	8	4	50	100	150
BMEN4107			INDUSTRIAL TRAINING II (to be undergone after VI) semester)	0	0	0	1	50	0	50
	E	PE	ELECTIVE-VII	4	0	0	4	50	100	150
	E	GE	ELECTIVE-B **	4	0	0	4	50	100	150
CLUB0101	P	CA	*Co-Curricular Activity*	0	0	0	1	25	25	50
TOTAL				**17**	**2**	**12**	**26**	**400**	**650**	**1050**

L = Lecture
T = Tutorial
P = Practical
C = Credit Point

ELECTIVE VII

MODULE CODE	MODULE
BMEN4208	APPLIED NEURAL NETWROKS & FUZZY LOGIC IN MEDICINE
BMEN4209	ARTIFICIAL INTELLIGENCE & PATTERN RECOGNITION IN MEDICINE
BMEN4210	COMPUTATIONAL FLUID DYNAMICS ANALYSIS IN MEDICINE

**** To be chosen from Generic Electives offered by departments other than the parent Department.**

Only advisory support shall be provided by the faculty.

SEMESTER - VIII

MODULE CODE	CATEGORY	SUB-CATEGORY	MODULE	L	T	P	C	Internal Marks	External Marks	Total Marks
BMEN4111	E	PD	SPECIALIZED MAJOR PROJECT (INDIVIDUAL)##	0	0	16	8	200	200	400
ENVS0101	P	AE	ENVIRONMENTAL SCIENCES	2	0	0	2	25	50	75
MGMT0103	M		ENTREPRENEURSHIP	4	0	0	4	50	100	150
TOTAL				**6**	**0**	**16**	**14**	**275**	**350**	**625**

L = Lecture
T = Tutorial
P = Practical
C = Credit Point

Only advisory support shall be provided by the faculty.