SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B.TECH.

BIOMEDICAL ENGINEERING

ACADEMIC REGULATIONS 2023
(R-2023)

CURRICULUM AND SYLLABI

25 years of ACADEMIC EXCELLENCE

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society

Mission

M1: Quality Education

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation

To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship

To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

Vision

To provide quality education in Biomedical Engineering focused on promoting continuous enrichment in the relevant research field and innovations in medical diagnosis for human health care.

Mission

M1: Medical science Engineering

To provide quality Biomedical Engineering education that integrates engineering principles with biomedical sciences.

M2: Research and Development

To develop Biomedical engineers to apply innovative strategies for the design and development of medical equipment.

M3: Industrial Intelligence

To incorporate novel technologies towards the healthcare industrial needs for medical applications and to become an entrepreneur.

M4: Ethical Responsibilities

To impart the desirable skill sets to become globally competent ethical professional**.**

PROGRAM OUTCOMES (POs)

PO1: Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: 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.

PO4: 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.

PO5: **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.

PO6: 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.

PO7: 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.

PO8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: 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.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Professional Skills

To become outstanding professionals to demonstrate their skills in solving challenges for healthcare diagnosis.

PEO2: Higher Education and Research

To work successfully in multi-disciplinary environments or pursue higher studies.

PEO3: Entrepreneurial Competencies

To address the challenges in biomedical engineering that supports employment and entrepreneurship to serve the society.

PEO4: Leadership Quality

To enable the graduates to exhibit leadership, make decisions with ethical responsibilities.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Knowledge in Biomedical Engineering

Comprehending fundamental concepts in Biomedical Engineering to meet the emerging trends.

PSO2: Problem Solving in Medical Diagnosis

Apply Bio Signal and Image processing techniques to solve real time problems in medical field.

PSO3: Troubleshooting of Medical Equipment

Troubleshoot the faulty medical Equipment used in health care industry.

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl.No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences including Management courses (HS)	15
2	Basic Science Courses (BS)	24
3	Engineering Science including workshop, drawing, basics of electrical / mechanical / computer etc. (ES)	25
4	Professional Core Courses (PC)	65
5	Professional Electives Courses (PE)	18
6	Open Electives Courses (OE)	9
7	Project Work and Internship (PA)	13
8	Ability Enhancement Courses (AEC*)	-
9	Mandatory Courses (MC*)	-
Total		169

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences including Management courses (HS)	3	5	1	1	2	-	-	3	15
2	Basic Sciences(BS)	11	4	5	4	-	-	-	-	24
3	Engineering Sciences (ES)	8	5	4	4	4				25
4	Professional Core (PC)	-	8	13	10	8	15	11	-	65
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18
6	Open Electives (OE)	-	-	-	-	3	3	3	-	9
7	Project Work (PA)	-	-	-	-	1	1	2	8	12
8	Internship (PA)	-	-	-	-	-	-	1	-	1
9	Ability Enhancement Courses (AEC*)	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	-
Total		**22**	**22**	**23**	**22**	**21**	**22**	**20**	**17**	**169**

**** AEC and MC credits are not included for CGPA calculation***

HONOURS DEGREE PROGRAMME:

The student is permitted to opt for earning an *honours degree* in the same discipline of engineering in addition to the degree in his/her own discipline. To earn an honours degree the student is required to earn an additional 18 - 20 credits (over and above the total 169 credits prescribed in the curriculum) starting from fourth semester onwards by completing 5 additional courses offered in respective semesters. A student is

eligible to exercise this option if he/she has passed all the courses offered upto third semester in the first attempt itself and has earned a CGPA / GPA* (*for lateral entry) of not less than 8.0.The prescribed courses offered for Honours degree are given in **Annexure – V**

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics – I	BS	3	1	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23BMT101	Human Anatomy and Physiology	BS	3	0	0	3	25	75	100
4	U23BMT102	Basic Electrical Circuits	ES	3	0	0	3	25	75	100
5	U23ESTC01	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC01	Communicative English - I	HS	2	0	2	3	50	50	100
Practical										
7	U23BMP101	Physiology Laboratory	BS	0	0	2	1	50	50	100
8	U23BMP102	Basic Electrical Circuits Laboratory	ES	0	0	2	1	50	50	100
9	U23ESPC02	Design Thinking and IDEA Lab	ES	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23BMC1XX	Certification Course - I**	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23BMM101	Induction Programme	MC	2 weeks			-	-	-	-
							22	425	575	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC02	Engineering Mathematics – II	BS	3	1	0	4	25	75	100
2	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
3	U23BMTC01	Electron Devices and Circuits	PC	3	0	0	3	25	75	100
4	U23BMT203	Biosensors and Transducers	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values II	HS	2	0	0	2	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English - II	HS	2	0	2	3	50	50	100
Practical										

7	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
8	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
9	U23BMPC01	Electron Devices and Circuits Laboratory	PC	0	0	2	1	50	50	100
10	U23BMP203	Biosensors and Transducers Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23BMC2XX	Certification Course - II**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23BMM202	Sports Yoga and NSS	MC	0	0	2	-	100	-	100
							22	575	625	1200

***** Certification courses are to be selected from the list given in Annexure III***

SEMESTER – III										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	U23MATC03	Probability and Statistics	BS	3	1	0	4	25	75	100
2	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
3	U23BMT304	Biosignals and Systems	PC	2	1	0	3	25	75	100
4	U23ICTC01	Linear Integrated Circuits	PC	3	0	0	3	25	75	100
5	U23ICTC02	Digital Logic Circuits	PC	2	1	0	3	25	75	100
Theory cum Practical										
6	U23BMB301	Pathology and Microbiology	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC01	General Proficiency - I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
10	U23ICPC01	Linear and Digital Integrated Circuits Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23BMC3XX	Certification Course – III******	AEC	0	0	4	-	100	-	100
12	U23BMS301	Skill Enhancement Course-1*****	AEC	0	0	2	**-**	100	-	100
Mandatory Course										
13	U23BMM303	Climate Change	MC	2	0	0	**-**	100	-	100
							23	675	625	1300

SEMESTER – IV										
Sl. No	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	U23MATC04	Numerical Methods and Optimization	BS	3	1	0	4	25	75	100
2	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
3	U23BMT405	Biomechanics	PC	3	0	0	3	25	75	100

4	U23BMT406	Microcontroller and its Medical Applications	PC	3	0	0	3	25	75	100
5	U23BME4XX	Professional Elective – I#	PE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23BMB401	Biosignal Processing	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
9	U23BMP404	Microcontroller and its Medical Applications Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23BMC4XX	Certification Course - IV**	AEC	0	0	4	-	100	-	100
11	U23BMS402	Skill Enhancement Course-2*	AEC	0	0	2	-	100	-	100
Mandatory Course										
12	U23BMM404	Right to Information and Good Governance	MC	2	0	0	-	100	-	100
							22	625	575	1200

 # Professional Electives are to be selected from the list given in Annexure I

** Skill Enhancement Courses (1 and 2) are to be selected from the list given in Annexure IV*

SEMESTER – V										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23ITTC03	Programming in Java	ES	3	0	0	3	25	75	100
3	U23BMT507	Biomedical Instrumentation	PC	3	0	0	3	25	75	100
4	U23BME5XX	Professional Elective – II#	PE	3	0	0	3	25	75	100
5	U23XX05XX	Open Elective – I$	OE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23BMB502	Biocontrol Systems	PC	2	0	2	3	50	50	100
Practical										
7	U23ITPC03	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
8	U23BMP505	Biomedical Instrumentation Laboratory	PC	0	0	2	1	50	50	100
9	U23BMP506	Hospital Training	PC	0	0	2	1	50	50	100
Project Work										
10	U23BMW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23BMC5XX	Certification Course – V**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23BMM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	625	575	1200

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23BMT608	Diagnostic and Therapeutic Equipment	PC	3	0	0	3	25	75	100
2	U23BMT609	Embedded Systems for Healthcare	PC	3	0	0	3	25	75	100
3	U23BMT610	Medical Internet of Things	PC	3	0	0	3	25	75	100
4	U23BMT611	Artificial Intelligence and Machine learning in Healthcare	PC	3	0	0	3	25	75	100
5	U23BME6XX	Professional Elective – III#	PE	3	0	0	3	25	75	100
6	U23XX06XX	Open Elective – II$	OE	3	0	0	3	25	75	100
Practical										
7	U23BMP607	Diagnostic and Therapeutic Equipment Laboratory	PC	0	0	2	1	50	50	100
8	U23BMP608	Embedded Systems for Healthcare Laboratory	PC	0	0	2	1	50	50	100
9	U23BMP609	Medical Internet of Things Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23BMW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23BMC6XX	Certification Course – VI**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23BMM606	Gender Equality	MC	2	0	0	-	100	-	100
							22	600	600	1200

$ Open electives are to be selected from the list given in Annexure II

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23BMT712	Biomaterials and Artificial Organs	PC	3	0	0	3	25	75	100
2	U23BMT713	Rehabilitation Engineering	PC	3	0	0	3	25	75	100
3	U23BMT714	Medical image processing	PC	3	0	0	3	25	75	100
4	U23BME7XX	Professional Elective – IV#	PE	3	0	0	3	25	75	100
5	U23XXO7XX	Open Elective III	OE	3	0	0	3	25	75	100
Practical										
6	U23BMP710	Bioprinting Research Laboratory	PC	0	0	2	1	50	50	100
7	U23BMP711	Medical Image Processing Laboratory	PC	0	0	2	1	50	50	100
Project Work										
8	U23BMW703	Project Phase – I	PA	0	0	4	2	50	50	100
9	U23BMW704	Internship/Inplant Training	PA	0	0	2	1	100	-	100
							20	375	525	900

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC03	Entrepreneurship and Business Management	HS	3	0	0	3	25	75	100
2	U23BME8XX	Professional Elective – V#	PE	3	0	0	3	25	75	100
3	U23BME8XX	Professional Elective – VI#	PE	3	0	0	3	25	75	100
Project Work										
4	U23BMW805	Project Phase - II	PA	0	0	16	8	50	100	150
							17	125	325	450

Annexure – I

PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23BME401	Medical Physics
2	U23BME402	Environmental Biotechnology
3	U23BME403	Biometric Systems
4	U23BME404	Hospital Equipment Safety and Management
5	U23BMEC01	Communication Systems
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23BME505	Laser and Fiber Optics in Medicine
2	U23BME506	Computers in Medicine
3	U23BME507	Transportation in Living Systems
4	U23BME508	Medical Informatics
5	U23ECEC04	VLSI Systems
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23BME609	Troubleshooting and Quality Control in Medical Equipment
2	U23ICEC02	Soft Computing Techniques
3	U23BME610	Physiological System Modeling
4	U23BME611	Hospital Engineering and Information Systems
5	U23BME612	Biotelemetry and Telemedicine
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23BME713	Virtual Bioinstrumentation
2	U23BME714	Nanotechnology in Medicine
3	U23BME715	Dynamics of Biofluids
4	U23BME716	Medical Safety and Standards
5	U23BME717	Cryptography and Network Security

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23BME818	Modeling and Designing of implants
2	U23BMEC02	Wearable Technology
3	U23BME819	Tissue Engineering
4	U23BME820	Pattern Recognition and Expert System in Medicine
5	U23BME821	Bio MEMS
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23BME822	Clinical Engineering
2	U23BME823	Virtual Reality in Medicine
3	U23BME824	Brain Computer Interface and Applications
4	U23BME825	Medical Ethics and Intellectual Property rights
5	U23BME826	Acoustics and Optical Imaging

Annexure – II

OPEN ELECTIVE COURSES

S.No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I/ Open Elective – II (Offered in Semester V for **CSE, IT, MECH, Mechatronics, AI&DS**) (Offered in Semester VI for **EEE, ECE, ICE, CIVIL, BME, CCE, FT**)				
1	U23BMO501/ U23BMO601	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics
2	U23BMO502/ U23BMO602	Telemedicine	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, CIVIL , Mechatronics
Open Elective – III (Offered in Semester VII)				
3	U23BMO703	Medical Robotics	BME	EEE, ECE, ICE, CCE,CSBS
4	U23BMO704	Telehealth Technology	BME	EEE, ECE, ICE, CCE

Annexure – III
ABILITY ENHANCEMENT COURSES – (A) CERTIFICATION COURSES

S. No.	Course Code	Course Title	Certified By
1	U23XXCX01	Adobe Photoshop	Adobe
2	U23XXCX02	Adobe Animate	Adobe
3	U23XXCX03	Adobe Dreamweaver	Adobe
4	U23XXCX04	Adobe After Effects	Adobe
5	U23XXCX05	Adobe Illustrator	Adobe
6	U23XXCX06	Adobe InDesign	Adobe
7	U23XXCX07	Autodesk AutoCAD -ACU	Autodesk
8	U23XXCX08	Autodesk Inventor - ACU	Autodesk
9	U23XXCX09	Autodesk Revit - ACU	Autodesk
10	U23XXCX10	Autodesk Fusion 360 - ACU	Autodesk
11	U23XXCX11	Autodesk 3ds Max - ACU	Autodesk
12	U23XXCX12	Autodesk Maya - ACU	Autodesk
13	U23XXCX13	Cloud Security Foundations	AWS
14	U23XXCX14	Cloud Computing Architecture	AWS
15	U23XXCX15	Cloud Foundation	AWS
16	U23XXCX16	Cloud Practitioner	AWS
17	U23XXCX17	Cloud Solution Architect	AWS
18	U23XXCX18	Data Engineering	AWS
19	U23XXCX19	Machine Learning Foundation	AWS
20	U23XXCX20	Robotic Process Automation / Medical Robotics	Blue Prism
21	U23XXCX21	Advance Programming Using C	CISCO
22	U23XXCX22	Advance Programming Using C ++	CISCO
23	U23XXCX23	C Programming	CISCO
24	U23XXCX24	C++ Programming	CISCO
25	U23XXCX25	CCNP Enterprise: Advanced Routing	CISCO
26	U23XXCX26	CCNP Enterprise: Core Networking	CISCO
27	U23XXCX27	Cisco Certified Network Associate - Level 2	CISCO
28	U23XXCX28	Cisco Certified Network Associate- Level 1	CISCO
29	U23XXCX29	Cisco Certified Network Associate- Level 3	CISCO
30	U23XXCX30	Fundamentals of Internet of Things	CISCO
31	U23XXCX31	Internet of Things / Solar and Smart Energy System with IoT	CISCO
32	U23XXCX32	Java Script Programming	CISCO
33	U23XXCX33	NGD Linux Essentials	CISCO
34	U23XXCX34	NGD Linux I	CISCO
35	U23XXCX35	NGD Linux II	CISCO
36	U23XXCX36	Advance Java Programming	Ethnotech
37	U23XXCX37	Android Programming / Android Medical App Development	Ethnotech
38	U23XXCX38	Angular JS	Ethnotech
39	U23XXCX39	Catia	Ethnotech

40	U23XXCX40	Communication Skills for Business	Ethnotech
41	U23XXCX41	Coral Draw	Ethnotech
42	U23XXCX42	Data Science Using R	Ethnotech
43	U23XXCX43	Digital Marketing	Ethnotech
44	U23XXCX44	Embedded System Using C	Ethnotech
45	U23XXCX45	Embedded System with IOT / Arduino	Ethnotech
46	U23XXCX46	English For IT	Ethnotech
47	U23XXCX47	Plaxis	Ethnotech
48	U23XXCX48	Sketch Up	Ethnotech
49	U23XXCX49	Financial Planning, Banking and Investment Management	Ethnotech
50	U23XXCX50	Foundation Of Stock Market Investing	Ethnotech
51	U23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis	Ethnotech
52	U23XXCX52	IOT Using Python	Ethnotech
53	U23XXCX53	Creo (Modelling & Simulation)	Ethnotech
54	U23XXCX54	Soft Skills, Verbal, Aptitude	Ethnotech
55	U23XXCX55	Software Testing	Ethnotech
56	U23XXCX56	MX-Road	Ethnotech
57	U23XXCX57	CLO 3D	Ethnotech
58	U23XXCX58	Solid works	Ethnotech
59	U23XXCX59	Staad Pro	Ethnotech
60	U23XXCX60	Total Station	Ethnotech
61	U23XXCX61	Hydraulic Automation	Festo
62	U23XXCX62	Industrial Automation	Festo
63	U23XXCX63	Pneumatics Automation	Festo
64	U23XXCX64	Agile Methodologies	IBM
65	U23XXCX65	Block Chain	IBM
66	U23XXCX66	Devops	IBM
67	U23XXCX67	Artificial Intelligence	ITS
68	U23XXCX68	Cloud Computing	ITS
69	U23XXCX69	Computational Thinking	ITS
70	U23XXCX70	Cyber Security	ITS
71	U23XXCX71	Data Analytics	ITS
72	U23XXCX72	Databases	ITS
73	U23XXCX73	Java Programming	ITS
74	U23XXCX74	Networking	ITS
75	U23XXCX75	Python Programming	ITS
76	U23XXCX76	Web Application Development (HTML, CSS, JS)	ITS
77	U23XXCX77	Network Security	ITS & Palo alto
78	U23XXCX78	MATLAB	MathWorks
79	U23XXCX79	Azure Fundamentals	Microsoft
80	U23XXCX80	Azure AI (AI-900)	Microsoft
81	U23XXCX81	Azure Data (DP -900)	Microsoft
82	U23XXCX82	Microsoft 365 Fundamentals (SS-900)	Microsoft
83	U23XXCX83	Microsoft Security, Compliance and Identity (SC-900)	Microsoft

84	U23XXCX84	Microsoft Power Platform (PI-900)	Microsoft
85	U23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM	Microsoft
86	U23XXCX86	Microsoft Excel	Microsoft
87	U23XXCX87	Microsoft Excel Expert	Microsoft
88	U23XXCX88	Securities Market Foundation	NISM
89	U23XXCX89	Derivatives Equinity	NISM
90	U23XXCX90	Research Analyst	NISM
91	U23XXCX91	Portfolio Management Services	NISM
92	U23XXCX92	Cyber Security	Palo alto
93	U23XXCX93	Cloud Security	Palo alto
94	U23XXCX94	PMI – Ready	PMI
95	U23XXCX95	Tally – GST & TDS	Tally
96	U23XXCX96	Advance Tally	Tally
97	U23XXCX97	Associate Artist	Unity
98	U23XXCX98	Certified Unity Programming	Unity
99	U23XXCX99	VR Development	Unity

Annexure – IV

ABILITY ENHANCEMENT COURSES – (B) SKILL ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	U23BMS301	Skill Enhancement Course 1*
		1) Troubleshooting of Medical Equipment
		2) Masters in Microsoft Excel
		3) Power Point Presentation Design and Animation
2	U23BMS402	Skill Enhancement Course 2*
		1) Testing of Electronic and Medical Devices
		2) PCB Board Designing
		3) Presentation Skills using ICT

**** Choose any one Skill Enhancement Course in the list for SEC 1 and SEC 2***

Annexure – V

Honours Programme – Biomedical Nanotechnology

Sl. No.	Semester	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
					L	T	P		CAM	ESM	Total
1	IV	U23BMH401	Biological Nanostructures	PC	3	1	0	4	25	75	100
2	V	U23BMH502	Nano composite Materials	PC	3	1	0	4	25	75	100
3	VI	U23BMH603	Nano Biosensors	PC	3	1	0	4	25	75	100
4	VII	U23BMH704	Nanotechnology in Tissue Engineering	PC	3	1	0	4	25	75	100
5	VIII	U23BMH805	Nanotechnology in Health Care	PC	3	1	0	4	25	75	100
								20	125	375	500
Equivalent NPTEL courses[##]											
1	Fundamentals of Micro and Nanofabrication							**3**	**12 Weeks Course**		
2	Physics of Nanoscale devices							**3**			
3	Fundamentals of Nano and Quantum Photonics							**3**			
4	Nano Biotechnology							**3**			
5	Nanobiophotonics: Touching our Daily Life							**3**			

[##]The student shall be given an option to earn 3 credits through one equivalent 12 weeks NPTEL course instead of any one course listed for honours degree programme that should be completed before the commencement of eighth semester. The equivalent courses are subject to change based on its availability as per NPTEL course list.

SEMESTER – I

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **BS**			End Semester Exam Type: **TE**			
Course Code	**U23MATC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Mathematics – I**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

(Common to ALL Branches Except CSBS)

Prerequisite	Basic Mathematics		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the concept of Eigen values and Eigen vectors, Diagonalization of a Matrix	**K3**
	CO2	Solve higher order differential equations	**K3**
	CO3	Understand the different types of partial differential equations	**K3**
	CO4	Know about the Applications of double and triple integrals	**K3**
	CO5	Gain the knowledge about Vector Calculus and its Applications	**K3**

UNIT – I	**Matrices**	**Periods:12**	
Rank of a Matrix – Systems of Linear Equations – Characteristic equation – Cayley Hamilton Theorem – Eigen values and Eigen vectors of a real Matrix – Diagonalization of Matrices.			**CO1**
UNIT – II	**Differential Equations (Higher Order)**	**Periods:12**	
Linear Differential equations of higher order with constant coefficients – Euler's linear equation of higher order with variable coefficients – Method of Variation of parameters.			**CO2**
UNIT – III	**Functions of Several Variables**	**Periods:12**	
Partial derivatives – Total derivatives – Maxima and Minima of two variables – Lagrange's Method of multipliers.			**CO3**
UNIT – IV	**Multiple Integrals**	**Periods:12**	
Multiple Integrals – Change of order of integration (Cartesian form). Applications: Area as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).			**CO4**
UNIT – V	**Vector Calculus**	**Periods:12**	
Gradient – Divergence and Curl – Directional derivatives – Irrotational and Solenoidal vector fields – Properties (Statement only) – Gauss Divergence Theorem and Stoke's Theorem (without proofs).			**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. M.K. Venkataraman, "Engineering Mathematics", The National Publishing Company, 2nd Edition, 2016.
2. N. P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 9th Edition, 2018.
3. S.Narayanan and T.K. Manickavasagam Pillay," Differential Equations and Its Applications", Viswanathan. S, Printers & Publishers Pvt Ltd, 2009.

Reference Books

1. G. Balaji, "Matrices and Calculus (Engineering Mathematics – I)" Balaji Publications, 9th Edition June 2023
2. A. Singaravelu, "Engineering Mathematics – I", Meenakshi publications, 1998.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", Wiley, 10th Edition, 2019.
4. B.V. Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. C W. Evans, "Engineering Mathematics", A Programmed Approach, 3rd Edition, 2019.

Web References

1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linearalgebra –slides- systems of equation-handout.pdf

2.	http://www.math.cum.edu/~wn0g/2ch6a.pdf
3.	https://nptel.ac.in/courses/122/104/122104017/
4.	https://nptel.ac.in/courses/111/106/111106051/
5.	https://nptel.ac.in/courses/111/108/111108081/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	2	1	1	-	-	-	-	1	3	-	-
2	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
3	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
5	2	2	1	-	-	-	1	-	-	-	-	1	3	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Physics and Chemistry**	Programme: **B.Tech.**						
Semester	**I / II**	Course Category: **BS**				End Semester Exam Type: **TE**		
Course Code	**U23BSTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Physical Science for Engineers**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to all Branches)								
Prerequisite	Physics of 12th standard or equivalent / Chemistry of 12th standard or equivalent.							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic of properties of magnetic, dielectric and superconductors.	**K2**
	CO2 Identify the wave nature of the particles, physical significance of wave functions	**K3**
	CO3 Understand the basic principles of laser and fiber optics communication	**K2**
	CO4 Understand and familiar with the water treatment.	**K2**
	CO5 Understand the electrode potential for its feasibility in electrochemical reaction and uses of various batteries.	**K2**
	CO6 Understand the specific operating condition under which corrosion occurs and suggest a method to control corrosion.	**K2**

SECTION A – PHYSICS

UNIT-I	**Magnetic, Dielectric and Superconducting Materials**	**Periods: 8**
Introduction to magnetic materials, Ferromagnetism- Domain Theory-Types of energy-Hysteresis-Hard and Soft magnetic materials-ferrites-Dielectric materials-Types of polarization – Langevin-Debye equation-Frequency effects on polarization-Dielectric breakdown- Ferroelectric materials-Superconducting materials and their properties.		**CO1**

UNIT-II	**Quantum Mechanics**	**Periods: 7**
Matter Waves - de Broglie Wavelength - Uncertainty Principle –Physical Significance of wave functions - Schrodinger wave Equation - Time Dependent - Time Independent - Application to Particle in a One Dimensional Box - Tunnel Diode.		**CO2**

UNIT-III	**Laser And Fiber Optics**	**Periods: 7**
Lasers - Principles of Laser - Spontaneous and Stimulated Emissions - Einstein's Coefficients - Population Inversion and Laser Action –components of laser - Types of Lasers - NdYAG, CO_2 laser, GaAs Laser Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode)		**CO3**

SECTION B – CHEMISTRY

UNIT-IV	**Water And Its Treatment**	**Periods: 8**
Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse osmosis-disadvantages of using hard water in boiler - Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment–Ion exchange demineralization and zeolite process.		**CO4**

UNIT-V	**Electrochemical Cells and Storage Devices**	**Periods: 8**
Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen, calomel and Ag/AgCl. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium battery- fuel cell H_2 -O_2 fuel cell-applications.		**CO5**

UNIT-VI	**Corrosion**	**Periods: 7**
Corrosion –Introduction - factors – types – chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – electrochemical protection – sacrificial anode method and impressed current cathodic		**CO6**

method. Uses of inhibitors, metallic coating – anodic coating, cathodic coating. Metal cladding, Electroplating of Copper and electroless plating of nickel.

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Text Books

1. V Rajendran, "Engineering Physics", TMH, New Delhi , 2nd Edition ,2011.
2. S.S Dara – "A text book of Engineering Chemistry" -. S.Chand Publications, 15th Edition, 2021
3. C.Jain, Monica Jain"Engineering Chemistry. Dhanpat Rai Pub. Co., New Delhi, 17th Edition (2015).

Reference Books

1. R.Murugeshan, "Modern Physics", S. Chand &Co, New Delhi,2006.
2. William D Callister Jr., "Material Science and Engineering", John Wiley and sons, 6th Edition, 2009.
3. Jain & Jain "Engineering chemistry", DhanpatRai Publishing Company. 23rd Edition, 2022
4. Mars Fontana "Corrosion Engineering", July 2017
5. JinaRedlin, "Handbook of Electrochemistry", March 2005

Web References

1. https://www.sciencedaily.com/terms/materials_science.htm.
2. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials science.html.
3. https://study.com/academy/lesson/semiconductors-superconductors-definition-properties.html
4. https://mechanicalc.com/reference/engineering-materials
5. http://ndl.ethernet.edu.et/bitstream/123456789/89589/1/%5BPerez_N.%5D_Electrochemistry_and_corrosion%28BookZZ.org%29.pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	2	-	-
2	3	2	3	2	-	-	-	-	-	-	-	-	2	-	-
3	3	2	3	2	-	-	-	-	-	-	-	-	2	2	-
4	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
5	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
6	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Biomedical Engineering**	Programme:**B.Tech.**						
Semester	**I**	Course Category:**BS**			*End Semester Exam Type:**TE**			
Course Code	**U23BMT101**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Human Anatomy and Physiology**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite								

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Describe basic structural and functional elements of human body.	**K2**
	CO2	Explain the function of heart and its conduction and knowledge on nervous systems**.**	**K3**
	CO3	Illustrate the Physiological function of Eye, Ear and Excretory systems	**K3**
	CO4	Distinguish the types of skeletal systems and functions of respiration	**K3**
	CO5	Elucidate the classification, Metabolism of Macromolecules and its Measurement	**K3**

UNIT-I	**Basic Elements of Human Body**	**Periods:9**	
Structure and function of Cell and cellular components, Membrane Potential, Action Potential, Generation and Conduction, Blood Cell: Composition, Fluid and electrolytic balance, Blood Groups - ABO and Rh System, Estimation of RBC and WBC.			**CO1**
UNIT-II	**Cardiovascular and Nervous System**	**Periods:9**	
Cardiovascular system - Heart and vascular system, ECG, Blood Pressure, Homeostasis, Cardiac Cycle, Basics of Cardiac Output and Heart Sounds, PCG. **Nervous System** - Structure and functions of Neurons, Synapse, Reflex action and Receptors, Velocity of Conduction of Nerve Impulses, Nerve conduction Test, Nervous control of Heart.			**CO2**
UNIT-III	**Urinary and Visual -Auditory System**	**Periods:9**	
Gastro Urinal system, Structure and function of kidneys and Nephron, Mechanism of Urine formation, Urine Reflex. Optics of Eye: Retina, Photochemistry of Vision, Accommodation, Neurophysiology of Vision, Structure and functions of Internal Ear, Mechanism of Hearing, Auditory pathway, Hearing Tests.			**CO3**
UNIT-IV	**Musculo Skeletal and Respiratory System**	**Periods:9**	
Musculo Skeletal System: Muscle Tissue, Structure of Skeletal Muscle, Types of Muscle, Types of Joints, Major Muscles of Limbs and their actions. **Respiratory system:** Physiological aspects of respiration, Exchange of gases, Regulation of Respiration, Pulmonary function test, Artificial respiration.			**CO4**
UNIT-V	**Macromolecules and Measurement**	**Periods:9**	
Carbohydrates: Classification, Metabolism of carbohydrate and its dysfunction. Lipids: Classification, Metabolism of lipids and dysfunction, Protein: Classification of Amino acids, architecture of protein molecules. Measurement: Principles of Photometry, Spectrophotometry, Flurometry, Flame Photometry, Densitometry, Calorimetry,			**CO5**

LecturePeriods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. Guyton, “Text book of Medical Physiology”, WB Jaunder company Philadelphia, 10th Edition, 2010
2. Elaine.N. Marieb, “Essential of human Anatomy and Physiology”, Pearson Education New Delhi, 8th Edition, 2010
3. C.L.Ghai, “A textbook of Practical physiology”, Jaypee Medical Publishers, 5th Edition, 2013

Reference Books

1. Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew, “Fundamentals of Anatomy and Physiology”, Pearson Publishers, 5th Edition, 2014
2. Gillian Pocock, Christopher D. Richards, “The Human Body – An introduction for Biomedical and Health Sciences”, Oxford University Press, USA, 8thEdition, 2013
3. William F.Ganong, “Review of Medical Physiology”, McGraw Hill, New Delhi, 22nd Edition, 2010
4. Eldra Pearl Solomon, “Introduction to Human Anatomy and Physiology”, W.B. Saunders Company, 2015
5. Guyton & Hall, “Medical Physiology”, Elsevier Saunders, 13th Edition ,2015

Web References

1. https://byjus.com/biology/human-body-anatomy/
2. https://www.khanacademy.org/
3. https://www.youtube.com/channel/UCJayvjGvKEblkA3KYK1BQQw
4. https://www.britannica.com/browse/Anatomy-Physiology

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	1	-	-	-	-	-	-	-	2	-	-
2	3	3	2	1	1	-	-	-	-	-	-	-	2	-	-
3	3	3	2	1	1	-	-	-	-	-	-	-	2	-	-
4	3	3	2	1	1	-	-	-	-	-	-	-	2	-	-
5	3	3	2	1	2	-	-	-	-	-	-	-	2	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Biomedical Engineering**		Programme :**B.Tech.**					
Semester	**I**		Course Category:**ES**			*End Semester Exam Type:**TE**		
Course Code	**U23BMT102**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Basic Electrical Circuits**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite									
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Gain knowledge in fundamentals of electrical circuits						**K2**	
	CO2	Analyze the electrical parameters of the circuits using basic theorems						**K3**	
	CO3	Compare frequency response of resonant circuits						**K3**	
	CO4	Determine the steady state and transient response of RL, RC and RLC circuits						**K4**	
	CO5	Analyze the working principle and application of electrical machines						**K3**	

UNIT-I	**Introduction to Electrical Circuits**	**Periods:12**	
Basic Components of electric Circuits, Ohms Law, Kirchhoff's Law, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Star-Delta conversion Concepts of AC circuits: RMS value, Average Value, Form Factor, Peak Factor, study of RL, RC, RLC series and parallel circuit, phasor representation in Polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor.			**CO1**
UNIT-II	**Network Theorems**	**Periods:12**	
Mesh analysis, Nodal analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Compensation Theorem, Maximum Power Transfer Theorem, Millman's Theorem.			**CO2**
UNIT-III	**Resonance And Coupled Circuits**	**Periods:12**	
Resonance: Series and Parallel resonance, Variation of Impedance, Current and Voltage with frequency in series and parallel resonant circuits, Bandwidth, Q factor and Selectivity. **Coupled Circuits**: Self-inductance, Mutual inductance, Dot rule, Coefficient of coupling - Series and Parallel connection of coupled inductors - Single tuned coupled circuit.			**CO3**
UNIT-IV	**Transient Response Analysis**	**Periods:12**	
Steady State and Transient Response, Source free, Step, Impulse, Sinusoidal and exponential response for RL, RC and RLC circuits.			**CO4**
UNIT-V	**Electrical Machines and Safety**	**Periods:12**	
Working principle of DC generator, motor-EMF and Torque equation – Types: Shunt, Series and Compound, Applications. Working principle of transformer-EMF equation-Operating principles of three phase and single- phase induction motor-Applications. Operating principles of Synchronous motor, stepper motor-Applications. Safety measures in electrical system- Electrical tools and accessories–wiring standards.			**CO5**

LecturePeriods:45	**TutorialPeriods:15**	**Practical Periods: -**	**TotalPeriods:60**

Text Books

1. Charles K. Alexander, Matthew N. O. Sadiku" Fundamentals of Electric Circuits", McGraw Hill May, 7th Edition ,2022.

2..ChakrabatiA,"CircuitTheoryAnalysisandSynthesis", Dhanpath Rai and Sons,New Delhi, 7th edition, 2018
3.WilliamH.Hayt,Jr.JackE.KemmerlyandStevenM.Durbin,"EngineeringCircuitAnalysis", McGraw Hill Science Engineering, 8th Edition, 11th Reprint 2016.

Reference Books

1. William Haystack, E Kemmerly and Steven M Durbin, "Engineering Circuits Analysis", Tata McGraw-Hill, 8thEdition 2013,
2. John Bird, "Electrical Circuit theory and technology", Routledge, 5th Edition2013.
3. KothariDPandI.JNagrath,"BasicElectricalandElectronicsEngineering", McGrawHillEducation,7thEdition2014.
4. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum"s Outline Series, , Tata McGraw Hill
5. Publishing Company, New Delhi, 5th Edition Reprint 2016.
6. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5th Edition, McGraw Hill, 9th Edition Reprint 2015.

Web References

1. https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic
2. https://www.thelearningpoint.net/home/electrical-science-andengineering/circuit-theory
3. https://www.classcentral.com/course/edx-circuits-and-electronics-1-basic-circuit-analysis-444
4. https://swayam.gov.in/nd1_noc19_ee36/preview
5. https://nptel.ac.in/courses/117/106/117106108/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	-	-	-	2	2	2	-	1
2	3	2	2	2	2	-	-	-	-	-	2	2	2	-	1
3	3	2	2	2	2	-	-	-	-	-	2	2	2	-	1
4	3	2	2	2	2	-	-	-	-	-	2	2	2	-	1
5	3	2	2	2	2	-	-	-	-	-	2	2	2	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Civil and Mechanical**	Programme:**B.Tech.**						
Semester	**I / II**	Course Category:**ES**			*End Semester Exam Type:**TE**			
Course Code	**U23ESTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Basics of Civil and Mechanical Engineering**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to ECE, EEE, ICE, MECH, CIVIL,MCTR,BME Branches)								
Prerequisite	**Basic Science**							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the types of buildings and materials.	**K2**
	CO2	Summarize on the various components of buildings and surveying concepts	**K2**
	CO3	Identify the various infrastructure facilities	**K2**
	CO4	To familiarize the working principles of IC engines and automobile systems	**K2**
	CO5	To understand about the power generation systems and its components	**K1**
	CO6	To acquire knowledge about the various machining process.	**K2**

SECTION A - CIVIL ENGINEERING

UNIT - I	**Buildings And Buildings Materials**	**Periods: 08**
Buildings – Definition – Classification according to NBC-plinth area, Floor area, carpet area, floor space index - Development of Smart cities - Green building, Benefits from green building. Building Materials - stone, brick, cement, cement mortar, concrete, steel, Timber - their properties and uses		**CO1**
UNIT - II	**Buildings Components and Surveying**	**Periods: 08**
Various Buildings Components and their functions. Foundation: function and types - Brick masonry, Stone Masonry and its types – Floors, Roofs and its types. Surveying: Objects – Classification – Principles – Measurements of Distances and areas – Leveling		**CO2**
UNIT - III	**Basic Infrastructure**	**Periods: 07**
Roads and Bridges – types, components advantage and disadvantages. Railways - Permanent way and its elements. Sources of Water - Quality of Water- Domestic sewage Treatment – Rain Water harvesting – Dams - site selection for dam construction, types of dams.		**CO3**

SECTION B – MECHANICAL ENGINEERING

UNIT- IV	**Internal And External Combustion Systems**	**Periods: 08**
IC engines – Classification – Working principles – Diesel and Petrol Engines: Two stroke and four stroke engines – merits and demerits. Steam generators (Boilers) – Classification – Constructional features (of only low-pressure boilers) – Boiler mountings and accessories – Merits and demerits – Applications.		**CO4**
UNIT- V	**Power Generation Systems, Refrigeration and Air Conditioning System**	**Periods: 07**
Power plants: Thermal – Nuclear, Hydraulic, Solar, Wind, Geothermal, Wave, Tidal and Ocean Thermal Energy Conversion systems - Functions, Applications - Schemes and layouts (Description only) Refrigeration and Air Conditioning System: Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.		**CO5**
UNIT- VI	**Manufacturing Process**	**Periods: 07**
Lathe - types, Specifications, Operations of a centre lathe. Casting - Pattern making, Allowances, Green sand and dry sand		**CO6**

moulding, casting defects. Welding - Arc and Gas welding process, brazing and soldering (process description only).			
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Dr. S. Jayakumar, "Basic Civil Engineering", Aagash Nekaa Publications, 2011
2. G Shanmugam, MS Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education, 1st Edition, 2018.
3. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.

Reference Books

1. M.P. Poonia, S.C. Sharma and T.R. Banga, Basic Mechanical Engineering, Khanna Publishing House 2018.
2. S.S.Bhavikatti, Basic Civil engineering, New Age International Ltd. 2018.
3. V. Rameshbabu, Basic Civil & Mechanical Engineering, VRB Publishers Private Limited, January 2017.
4. Serope Kalpakjian, Steven Schmid, Manufacturing Engineering and Technology, Pearson Publication, 7th Edition, 2014.
5. Gopi Satheesh, Basic Civil engineering, Pearson Publications, 3rd Edition, 2015.

Web References

1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/ lecture-notes/
4. https://nptel.ac.in/courses/105102088/
5. https://nptel.ac.in/courses/105104101/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	-	1	-	-	-
2	3	1	1	-	1	-	-	-	-	-	-	1	-	-	-
3	3	1	1	-	1	-	-	-	-	-	-	1	-	-	-
4	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**					
Semester	**I**	Course Category : HS			End Semester Exam Type:**TE**		
Course Code	U23ENBC01	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Communicative English - I**	**2**	**-**	**2**	**3**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the communication flow in organization and its objectives	**K2**
	CO2 Write the technical contents with grammatically precise sentences	**K2**
	CO3 Articulate with correct pronunciation and overcome vernacular impact in speaking	**K3**
	CO4 Express opinions confidently in formal and informal communicative contexts	**K2**
	CO5 Attend interview with assertiveness	**K3**

UNIT- I	**Workstead Communication**	**Periods:10**	
Communication, Definition, Process, Channels, Barriers, Strategies for Effective Communication, Verbal and Nonverbal Communication - Listening, Types, Barriers, Enhancing Listening Skills - Bibliography: Book, Journal and Internet References			**CO1**
UNIT- II	**Common Errors In Writing And Comprehension Strategies**	**Periods:10**	
Subject Verb Agreement, Misplaced Modifiers, Squinting Modifiers, Dangling Modifier, Fused Sentence, Comma Splice, Sentence Fragment - Reading Comprehension: Technical passage, Strategies: Skimming, Scanning, Intensive and Extensive Reading, Prediction, and Contextual Meaning			**CO2**
UNIT- III	**Phonetics**	**Periods:10**	
Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non-silent Letters, Intonation, Spelling Rules and Words often misspelled, Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue			**CO3**
UNIT- IV	**Communication Practice-I**	**Periods:15**	
List of Exercises **Listening**: Self Introduction videos **Speaking**: Self-Introduction, Extempore, and Role Play **Reading**: Non-Technical Comprehension Passage **Writing:** Common Errors in Writing			**CO4**
UNIT-V	**Interpersonal Communication-I**	**Periods:15**	
List of Exercises **Listening:** Speech Sounds, Interview Videos **Speaking**: Debate, Structured Group Discussion, and Conversation **Reading**: Commonly Confused Words **Writing:** Transcription			**CO5**

Lecture Periods:30	**Tutorial Periods:-**	**Practical Periods:30**	**Total Periods:60**

Text Books

1. Richa Mishra , Ratna Rao, “A textbook of English Language Communication Skills”, Macmillan Publishers India Private Ltd., Revised Edition 2021.
2. Rizvi M. Ashraf, “Effective Technical Communication”, New Delhi: Tata-McGraw-Hill Publishing Company Limited, 4th Edition, 2010.
3. Balasubramanian T, “English Phonetics for Indian students workbook”, 2nd Edition, Trinity Press, 2016.

Reference Books

1. N.P.Sudharshana, C. Savitha," English for Engineers", Cambridge University Press, 2018.
2. Raman, Meenakshi, and Sharma, Sangeetha, "Technical Communication - Principles and Practice", 3rd Edition, Oxford University Press, 2017.
3. Comfort, Jeremy,etal., "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge, Reprint 2011.
4. Wren & Martin, "High School English Grammar and Composition", S Chandh &Co. Ltd, 2015.
5. Boove, Courtland L, "Business Communication Today", Pearson Education, New Delhi,2002.

Web References

1. https://lemongrad.com/subject-verb-agreement-rules/
2. https://opentextbc.ca/advancedenglish/chapter/misplaced-and-dangling-modifiers/
3. https://www.hitbullseye.com/Reading-Comprehension-Tricks.php
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://worldscholarshipvault.com/neutralize-mother-tongue-interference/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	1	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		
Listening (L)*	10	Listening (L)*	10	40
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

- **LRW components of Practical can be evaluated through Language Lab Software**

Department	**Biomedical Engineering**	Programme:**B.Tech.**						
Semester	**I**	Course Category:**BS**			*End Semester Exam Type:**LE**			
Course Code	**U23BMP101**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Physiology Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
Prerequisite								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Evaluate and Analysis the practice of Physiology	**K4**
	CO2 Identify the General Tests of carbohydrates, Proteins and lipids	**K4**
	CO3 Apply the principles and preparation of serum and plasma from blood	**K3**
	CO4 Identify the Quantitative Estimation present in the slide	**K3**
	CO5 Measurement of pH level in the body fluids	**K3**

List of Experiments:

1. Blood Group Test
2. Estimation of RBC count
3. Estimation of WBC count
4. General tests for Carbohydrates
5. General tests for Proteins
6. General tests for Lipids
7. Preparation of Serum from blood.
8. Preparation of Plasma from blood.
9. Quantitative estimation of Blood Glucose
10. Quantitative estimation of Creatinine
11. Quantitative estimation of Cholesterol
12. Quantitative estimation of Urea
13. Study of Measurement of pH and conductivity of body fluids

Lecture Periods: -0	**Tutorial Periods: -0**	**PracticalPeriods:30**	**TotalPeriods:30**

Reference Books

1. Mohammad A, “Practical Examination Manual of Pathology”, CBS, January 2011.
2.Kanika Sharma Ane’s student edition, “Manual of Microbiology tools and techniques”, March 2010.
3. Sabitri Sanyal Aparna Bhattacharrya, “Clinical Pathology: A Practical Manual”,Elsevier India, 3rd Edition, 2014
4. McPherson Henry's “Clinical Diagnosis and Management by Laboratory Methods”, Elsevier, 24e”, South Asia Edition January 2021
5. Rajbala Yadav, Nidhi Verma, Meeta Singh, “Essentials of Practical Pathology for Undergraduates”, Elsevier India1st Updated Edition Paperback – October 2019.

Web References

1. https://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/videolectures
2. https://ocw.mit.edu/courses/biology/8-012-introduction-to-biology-fall-2004/videolectures
3. nptel.ac.in/courses/102105034/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	2	2	-	-	1	-	-	-	1	2	-	1
2	3	1	2	2	2	-	-	1	-	-	-	1	2	-	1
3	3	1	2	2	2	-	-	1	-	-	-	1	2	-	1
4	3	1	2	2	2	-	-	1	-	-	-	1	2	-	1
5	3	1	2	2	2	-	-	1	-	-	-	1	2	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Biomedical Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category:**ES**			*End Exam Type:**LE**			
Course Code	**U23BMP102**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Basic Electrical Circuits Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
Prerequisite								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Construct electrical circuits to analyze the basic laws	**K4**
	CO2 Observe and analyze the theorems in electrical circuits	**K4**
	CO3 Analyze the electrical characteristics of RL, RC and RLC circuits	**K4**
	CO4 Classify the operation of types of lamps	**K3**
	CO5 Understand the wiring concepts and trouble shooting of electrical equipment	**K3**

List of Experiments:

1. Verification of ohms law and Kirchhoff law
2. Verification of mesh and nodal analysis
3. Verification of superposition theorem
4. Verification of Thevenin's and Norton's Theorem
5. Verification of maximum power transfer theorem and reciprocity theorem
6. Demonstration of CRO (Measurement of Amplitude, Time and Frequency)
7. Measurement of electrical quantities–voltage, current, power & power factor in RL, RC and RLC circuits.
8. Study of types of wiring (fluorescent lamp wiring, staircase wiring, etc.)
9. Study of types of lamps
10. Measurement of resistance to earth of an electrical equipment
11. Study of troubleshooting of electrical equipment (fan, iron box, mixer-grinder, etc.)

Lecture Periods: -	**Tutorial Periods: -**	**PracticalPeriods:30**	**TotalPeriods:30**

Reference Books

1. Brian Kelly, "Introduction to Electrical Circuits", Lab manual, OUP Canada, 8th Edition, August 2008
2. Karen Craigs, Lauren Fuentes, "Introduction to Electric Circuits: Lab Manual",OUP Canada., 10th Edition August 2019.
3. K.A. Navas ," Electronics Lab Manual Volume-1",, PHI Learning,5th Edition, November 2015.
4. David A. Bell "Fundamentals of Electric Circuits: Lab Manual, OUP Canada," 7thEdition, September 2009.
5. Robert Boylestad , Louis Nashelsky, Franz Monssen ," Lab Manual for Electronic Devices and Circuit Theory", Pearson, 11th Edition ,August 2012.

Web References

1. https://www.classcentral.com/course/edx-circuits-and-electronics-1-basic-circuit-analysis-444

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	2	1	-	-	1	-	-	-	1	2	-	-
2	3	1	2	2	1	-	-	1	-	-	-	1	2	-	-
3	3	1	2	2	1	-	-	1	-	-	-	1	2	-	1
4	3	1	2	2	1	-	-	1	-	-	-	1	2	-	-
5	3	1	2	2	1	-	-	1	-	-	-	1	2	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Mechanical Engineering**		Programme: **B.Tech.**					
Semester	**I / II**		Course Category : **ES**			*End Semester Exam Type: **LE**		
Course Code	**U23ESPC02**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Design Thinking and IDEA Lab**		**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to ALL Branches)									
Prerequisite	Basic Knowledge of Science								
Course Outcomes	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)
	CO1	Demonstrate a comprehensive understanding of the tools and inventory associated with the IDEA Lab.							**K2**
	CO2	Develop proficiency in ideation techniques to generate creative and innovative solutions for various design and problems challenges							**K3**
	CO3	Acquire practical knowledge of mechanical and electronic fabrication processes, including hands-on experience with machinery, tools, and techniques used in the manufacturing and assembly of physical components.							**K3**
	CO4	Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends, and technological advancements into the design process.							**K4**
	CO5	Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects							**K4**

Design process: Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation

Design team-Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.

Sustainable product design, Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, establishing target specifications, Setting the final specifications. Design projects for teams.

List of Lab Activities and Experiments

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.

8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10. Discussion and implementation of a mini project.
11. Documentation of the mini project (Report and video).

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 30	Total Periods: 30

Text Books

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd
2. Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.

Reference Books

1. Ulrich and Eppinger, Product Design and Development, McGraw Hill, 3rd Edition, 2004
2. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018.
3. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan, Weldon Owen; 2017.
4. . Paul Horowitz and Winfield Hill " The Art of Electronics" Cambridge University Press. 3rd edition.
5. Paul Sherz and Simon Monk "Practical Electronics for Inventors". .. McGraw Hill. 4th edition
6. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education.
7. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill.
8. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer
9. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and Distributors, 5th Edition,2002.

Web References

1. https://onlinecourses.nptel.ac.in/noc23_mg72

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	2	-	-	2	-	3	2	-	-	-
2	3	3	3	2	2	2	-	-	2	-	3	2	-	-	-
3	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
4	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
5	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	Viva				
Marks	15	5	5	15	10	50	100

Department	**Biomedical Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **AEC**			*End Semester Exam Type:**LE**			
Course Code	**U23BMC1XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course – I**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

Students shall choose an international certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods:-	**Tutorial Periods: -**	**Practical Periods: 50**	**Total Periods:50**

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**Biomedical Engineering**	Programme: **B.Tech.**					
Semester	**I**	Course Category: **MC**			End Semester Exam Type: -		
Course Code	**U23BMM101**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Induction Programme**	**2 weeks**			Non-Credit	-	-	-
Prerequisite	**-**							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Develop holistic attitude and harmony in the individual, family, and Society	**K2**
	CO2	Acquire grammar skills and capable to write and speak English confidently	**K2**
	CO3	Understand the basic concepts in Mathematics and Programming	**K2**
	CO4	Know about the art and culture, language and literature of this vastsecularnation	**K2**
	CO5	Identify the inherent talent and develop it professionally	**K3**

UNIT-I	**Universal Human Values**	**Periods:12**
Welcome and Introductions - Getting to know each other, Aspirations and Concerns - Individual Academic and Career, Expectations of Family, Peers, Society, Nation, Fixing one's Goals, Self-Management - Self-confidence, Peer Pressure, Time Management, Anger, Stress Personality Development, Self-improvement, Health - Health issues, Healthy diet, Healthy lifestyle, Hostel life, Relationships - Home sickness, Gratitude towards Parents, Teachers and others Ragging and interaction, Competition and Cooperation, Peer Pressure, Society - Participation in Society, Natural Environment - Participation in Nature, Sum Up - Role of Education, Need for a Holistic Perspective, Self-evaluation and Closure - Sharing and feedback.		**CO1**

UNIT-II	**Proficiency in English**	**Periods:12**
Communication skills – Prognostic test on Grammar - Synonyms, Antonyms, Tenses, Sentence Completion, Idioms and Phrases, One- word Substitution, Homophones, Homonyms, Use of Prepositions, Subject-verb Agreement - Writing –Paragraph writing, Letter writing, Essay writing, Story Development.		**CO2**

UNIT-III	**Bridge Course in Mathematics and C Programming**	**Periods:12**
Mathematics: Fundamentals of differential and integral calculus: Theory and Practice, Limit of function - Fundamental results on limits - Continuity of a function - Concept of differentiation - Concept of derivative - Slope of a curve -Differentiation Techniques - Derivatives of elementary functions from first principle –Derivatives of inverse functions – Logarithmic differentiation – Method of substitution – Differentiation of parametric functions – Differentiation of implicit functions –Higher order derivatives. Integrals of functions containing linear functions -Method of integration (Decomposition method, method of substitution, integration by parts) – Definite integrals. Simple definite integrals – Properties of Definite integrals –Reduction formulae - Area and volume –Length of curve –surface area of a solid. **C Programming:** Features of C and its basic Structure - Keywords - constants - variables - operators - Data types - Formatted input and output statements - Control and Looping statement - Arrays - Functions - Strings - writing simple C programs.		**CO3**

UNIT-IV	**Literary Activities**	**Periods:12**
Team building activities - Quiz - Oral Exercises - Group discussion, Debate, Extempore, Role play, □□□□□□□ □□□□□□□□□□□□□ – □□□□□□□□□□□ □□□□□□□ □□□□□□ □□□□□□ □□□□□□□.		**CO4**

UNIT-V	**Creative Arts**	**Periods:12**
Introduction to painting ad renowned artworks - Documentary and Short films - Music - Vocal, Instrumental - Dance - Classical, Cinematic -Mimicry -Mime.		**CO5**

Lecture Periods:60	Tutorial Periods:-	Practical Periods:-	Lecture Periods:60

Reference Books

1. R.R Gaur, R. Asthana, G.P. Bagaria," A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
2. Kumar Mohan R, "English Grammar for all (Functional and Applied Grammar)", Unicare Academy, 2022.
3. Seely, John," Oxford A-Z of Grammar and Punctuation, Oxford Publication, 2013.
4. B.V. Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2019.
6. E. Balagurusamy, "PROGRAMMING IN ANSI C", Mc Graw Hill, 8th Edition, 2019.
7. Dr.K.K.Pillay,"Social Life of Tamils", A joint publication of TNTB & ESC and RMRL
8. R.Balakrishnan, "Journey of Civilization", Roja muthiah research publishers, 1st Edition 2019
9. □□□□□□□□□□□□ - □□□□□□□□□□□□□□□□□□□□, □□□□□□□, □□. □□. ,
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10. □□□□□□□□□□□□□ - □□□□□□□□□□.□□□□□□□□□, □□□□□□□□□□□□□□□□.
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1. http://www.newsociety.com/Books/S/Slow-isBeautiful
2. https://www.aplustopper.com/formal-letter/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. http://www.math.cum.edu/~wn0g/2ch6a.pdf
5. https://education.nsw.gov.au/teaching-and-learning/curriculum/creative-arts

SEMESTER – II

Department	**Mathematics**	Programme : **B.Tech.**						
Semester	**II**	Course Category: **BS**			*End Semester Exam Type: TE			
Course Code	**U23MATC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Mathematics – II**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

(Common to ALL Branches Except CSBS, FT)

Prerequisite	Basic Mathematics		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Convert a periodic function into series form.	**K2**
	CO2	Compute Fourier transforms of various functions.	**K3**
	CO3	Solve Differential Equations using Laplace transforms.	**K3**
	CO4	Apply inverse Laplace transform of simple functions.	**K3**
	CO5	Solve difference equations using Z – transforms.	**K3**

UNIT – I	**Fourier Series**	**Periods:12**	
Dirichlet's conditions – General Fourier series – Odd and Even functions – Half-Range sine series and cosine series – Change of intervals – Parseval's Identity.			**CO1**
UNIT – II	**Fourier Transforms**	**Periods:12**	
Fourier Transforms and its inverse – Properties of Fourier Transform (without proof) – Fourier sine and cosine Transforms and their properties (excluding proof).			**CO2**
UNIT – III	**Laplace Transforms**	**Periods:12**	
Laplace transforms of elementary functions and Periodic functions – Basic properties (excluding proof) – Laplace transforms of derivatives and integrals – Initial and final value theorems.			**CO3**
UNIT – IV	**Inverse Laplace Transforms**	**Periods:12**	
Definition of inverse Laplace Transforms – Convolution theorem (excluding proof) – Solutions of Linear Ordinary Differential Equations of second order with constant coefficients.			**CO4**
UNIT – V	**Z – Transforms**	**Periods:12**	
Z-transforms – Elementary Properties – Inverse Z-transforms (using partial fraction and Residues) – Solution of difference equations using Z - transform.			**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 3rd Edition, 2011.
2. C. P. Gupta, Shree Ram Singh. M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2nd Edition, 2016.
3. H.K. Dass, "Advanced Engineering Mathematics", S. Chand, New Delhi, 22nd Edition2019.

Reference Books

1. N.P. Bali and Dr. Manish Goyal, "A Textbook of Engineering Mathematics", University Science Press, India, 8th Edition, 2016.

2. P. Sivaramakrishna Das and C. Vijayakumari, “Engineering Mathematics”, Pearson India Education services Pvt. Ltd, India 1st 2017.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. G. Balaji, “Engineering Mathematics - Transforms and Partial Differential Equations”, G. Balaji Publishers, 18th Edition, 2022.
5. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill, New Delhi, 2017.

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1. https://nptel.ac.in/courses/111105121/
2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/11110711
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103/111103021/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	1	-	-	-	-	-	1	1	-	-
2	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**I / II**	Course Category: **ES**			*End Semester Exam Type: **TE**			
Course Code	**U23CSTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in C**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to All Branches)

Prerequisite	-	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Comprehend the basics of Computers.	**K2**
	CO2 Illustrate the concepts of control structures and looping.	**K2**
	CO3 Implement programs using arrays and functions.	**K3**
	CO4 Demonstrate programs using Structure and Pointers.	**K3**
	CO5 Build the programs using Union and File management Operations.	**K3**

UNIT-I	**Introduction**	**Periods:09**
Generation and Classification of Computers - Block Diagram of a Computer –Categories of Software – Network Structure - Number System – Binary – Decimal – Conversion – Algorithm – Pseudo code – Flow Chart.		**CO1**
UNIT-II	**C Programming Basics**	**Periods:09**
Introduction to ' C' Programming – Basic structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements.		**CO2**
UNIT-III	**Arrays and Functions**	**Periods:09**
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations- Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion		**CO3**
UNIT-IV	**Structure and Pointers**	**Periods:09**
Structure Introduction – Structure definition – Structure declaration – Structure within a structure –Self Referential Structure. Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays -Pointer to Function –Pointer and Structure- Simple programs.		**CO4**
UNIT-V	**Unions and Files**	**Periods:09**
Union Introduction - Programs Using Structures and Unions – Introduction to File - File Operations - File Input and Output Functions - Random Access to Files - File System Functions - Command Line Arguments- Storage Classes - Pre-Processor Directives- Dynamic Memory Functions.		**CO5**

LecturePeriods:45	**Tutorial Periods:**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, 8thEdition,2019.
2. YashvantKanetkar, "Let us C", BPB Publications, 16th Edition, 2017
3. Herbert Schildt," C: The Complete Reference", McGraw Hill, FourthEdition,2014

ReferenceBooks

1. Vikas B. Agarwal Jyoti P. Mirani, "Computer Fundamentals , Nirali Prakashan Aug-2019,
2. Ashok N Kamthane, "Computer Programming", Pearson education, 2nd Impression,2012.
3. VikasVerma, "A Workbook on C ", Cengage Learning, 2nd Edition,2012.
4. P.Visu, R.Srinivasan and S.Koteeswaran, "Fundamentals of Computing and Programming", Sri Krishna Publications, 4th Edition, 2012.
5. PradipDev, ManasGhoush, "Programming in C", Oxford University Press,2nd Edition, 2011.

Web References

1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c
5. https://nptel.ac.in/courses/106/104/106104128/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Biomedical Engineering**	Programme:**B.Tech.**						
Semester	**II**	Course Category:**PC**			*End Semester Exam Type:**TE**			
Course Code	**U23BMTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Electron Devices and Circuits**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to BME and ICE Branches)

Prerequisite: **Physics**

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the operation of basic semiconductor diodes and its applications	**K2**
	CO2 Classify the transistors configuration and analyze its characteristics	**K3**
	CO3 Distinguish the special semiconductor devices and its applications	**K3**
	CO4 Analyze the transistor using small signal model and understand the operation of different categories of amplifiers	**K4**
	CO5 Investigate the operation of different types of feedback amplifiers and oscillators	**K3**

UNIT-I	**Diodes and their Applications**	**Periods:9**

Formation of P-N junction diode- forward and reverse biased P-N junction, V-I characteristics, diffusion and transient capacitance, Zener diode and its reverse characteristics, Zener breakdown, Avalanche breakdown, Rectifiers-half wave rectifier, full wave rectifier with and without filters, Clippers, Clampers, Voltage Regulator – Zener diode as Voltage regulator. **CO1**

UNIT-II	**Bipolar Junction Transistor and Field Effect Transistor**	**Periods:9**

Bipolar Junction Transistor: Principle of operation –Current components, CE, CB, and CC Configurations, Input and output characteristics – Cut-off, active and saturation region, Transistor as a switch, Transistor as an amplifier.
Field Effect Transistor: Classification - JFET and its characteristics – JFET parameters, MOSFET – principle of operation-Depletion and enhancement modes. **CO2**

UNIT-III	**Special Semiconductor Devices**	**Periods:9**

Unijunction Transistor (UJT), Tunnel diode, Varactor diode, Schottky diode, Gunn diode, Light Emitting Diode (LED), Laser, PIN diode, Photo diode, Liquid Crystal Display (LCD), Silicon Control Rectifier (SCR), DIAC, TRIAC, Applications of SCR, DIAC, TRIAC. **CO3**

UNIT-IV	**Amplifiers**	**Periods:9**

BJT small signal low frequency model using h parameter – Analysis of CE, CB and CC amplifiers, RC coupled amplifiers, Cascade amplifier, Power amplifiers –Class A, Class B, Class AB, Push Pull, Class C amplifiers. **CO4**

UNIT-V	**Feedback Amplifiers and Oscillators**	**Periods:9**

Feedback amplifiers-Properties of negative feedback-voltage and current, Series and Shunt feedback, Positive feedback, Barkhausen Condition for oscillations, Classification of Oscillators, RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators. **CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. S.Salivahanan, N. Suresh Kumar, A. Vallavaraj, “Electronic Devices and Circuits”, Tata Mcgraw-Hill, 2nd Edition, 2017

2. Jacob Millman,Chritos CHalkias,"Electronic Devices and Circuits",McGrawHill, 4th edition, 2015
3. R S Sedha "A Textbook of Applied Electronics"S.Chand Publications, 2008

Reference Books

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits Theory, Pearson, 9th Edition, 2013.
2. ThomasL.Floyd,"Electronicdevices"PrenticeHall",10th Edition,2018
3. Kumar and Jain, "Electronic devices and Circuits" PHI learning, 2016
4. Bakshi, U. A., &Godse, A. P.,"Electronic Devices and Circuits", Technical Publications,2008
5. Anil Kumar Maini.,Varsha Agrawal, "Electronic devices and circuits", Wiley,2019

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1. https://nptel.ac.in/courses/117/103/117103063/
2. https://nptel.ac.in/courses/108108122/
3. https://www.electronics-tutorials.ws/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	2	2	-	-	-	-	-	-	3	-	2
2	3	2	2	1	2	2	-	-	-	-	-	-	3	-	2
3	3	2	2	1	2	2	-	-	-	-	-	-	3	-	2
4	3	3	2	1	2	2	-	-	-	-	-	-	3	-	2
5	3	3	2	1	2	2	-	-	-	-	-	-	3	-	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Biomedical Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23BMT203**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Biosensors and Transducers**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	**-**							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand various measurements and instruments	**K2**
	CO2 Apply fundamental transduction and photo sensing principles using various sensors	**K3**
	CO3 Distinguish transducers and electric sensors its application	**K3**
	CO4 Analyze different types of electrodes in biological measurements	**K3**
	CO5 Interpret various biochemical sensors used in physiological measurement	**K3**

UNIT-I	**Introduction To Measurements**	**Periods:09**	
Measurement System–Instrumentation–Classification and Characteristics of Transducers– Static and Dynamic–Errors in Measurements– Calibration–Primary and secondary standards. Measurements using AC & DC Bridges			**CO1**

UNIT-II	**Displacement, Pressure and Temperature Sensors**	**Periods:09**	
Strain Gauge: Gauge factor, sensing elements, configuration, unbounded strain gauge, biomedical applications; strain gauge as displacement & pressure transducers: Capacitive transducer, Inductive transducer, LVDT, Passive types: RTD materials range, relative resistances. temperature characteristics, thermistor characteristics, biomedical applications of Temperature sensors. Active type: Thermocouple–Characteristics.			**CO2**

UNIT-III	**Transducers And Photoelectric Sensors**	**Periods:09**	
Introduction to Transducers, Piezoelectric active transducer and biomedical applications as pressure& Ultrasound transducer comparison of photoelectric transducers, Spectro photometric applications of photoelectric transducers. Ionizing & Non-Ionizing radiation and its effects. Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photoconductive cells, photo diodes, phototransistor,			**CO3**

UNIT- IV	**Electrodes**	**Periods:09**	
Recording Electrodes– Half cell potential and action potential, Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Surface Electrodes– Needle electrodes– Microelectrodes-Electrical conductivity of electrode. Measurement of Skin Resistance			**CO4**

UNIT-V	**Biochemical Transducers**	**Periods:09**	
Biosensors– Chemoreceptor, hot and cold receptors, Baro receptors, sensors for smell, sound, vision, osmolality and taste. Transducers for the measurement of ions and dissolved gases. Ion exchange membrane electrodes– Measurement of pH– Glass pH electrodes. Measurement of pO2, Measurement of pCO2.ISFET for glucose.			**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: -**	**TotalPeriods:45**

Text Books

1.A.K. Sawhney, “A Course in Electrical and Electronic measurements and Instruments”, Dhanpat Rai and Sons,2012.

2.Prof.PingWang and Dr. Qingjun Liu, “Biomedical Sensors and Measurement “,Springer Publications”, 1st Edition,2011.

3.Tatsuo Tagawa, Toshio Tamura and Ake Oberg, “Biomedical Sensors and Instruments”, CRC Press Taylor and Francis Group, 2nd

Edition, 2011.

Reference Books

1.R. Anandanatarajan, “Biomedical Instrumentation nad measurements”, PHI Learning, 2nd Edition,December20
2.Ernest O Doebelin and Dhanesh N Manik, “Measurement Systems, Applications and Design”, MCGraw-Hill, 5th edition 2007.
3.MichaelJ.McGrath, Cliodhna Ní Scanaill,“Sensor Technologies: Healthcare, Wellness and Environmental Applications, Apress,8th Edition 2013.
4.RichardS.C.Cobbold, “Transducers for Biomedical Measurements: Principles and Applications “, John Wiley and Sons, 7th Edition ,2004.
5, NandiniK.Jog,“ElectronicsinMedicineandBiomedicalInstrumentation“,,PHI, 2nd Edition ,2013.

Web References

1. http://www.gvpcew.ac.in/unit%202.pdf
2. http://www.123seminarsonly.com/Seminar-Reports/018/31005914-Notes-on-Transducers.pdf
3. https://nptel.ac.in/courses/108/108/108108147/
4. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
5. https://www.uvpce.ac.in/content/biomedical-transducers-and-biosensors-laboratory

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	-	1	3	2	-
2	2	3	3	3	3	-	-	1	-	-	-	1	3	2	-
3	3	3	3	-	3	-	-	1	-	-	-	1	3	2	-
4	3	3	3	-	3	-	-	-	-	-	-	1	3	2	-
5	3	3	3	2	3	-	-	-	-	-		1	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Biomedical Engineering**	Programme:**B.Tech.**						
Semester	**II**	Course Category:**HS**			End Semester Exam Type: -			
Course Code	**U23HSTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Universal Human Values –II**	**2**	**0**	**0**	**2**	**25**	**75**	**100**
Prerequisite	UHV-I: Universal Human Values-Introduction							

Course Outcomes		The course will enable the student to	BT Mapping (Highest Level)
	CO1	Aware of themselves, and their family, society and nature.	**K2**
	CO2	Be responsible in life, and in handling problems while keeping human relationships and human nature in mind.	**K2**
	CO3	Apply creativity in their education and develop holistic model.	**K2**
	CO4	Apply what they have learnt to their real life.	**K2**
	CO5	Be proficient to provide sustainable solutions to the problems in society and nature.	**K2**

UNIT-I	**Introduction to Value Education**	**Periods:09**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) - Understanding Value Education - Self-exploration as the Process for Value Education -Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario- Method to Fulfil the Basic Human Aspirations		**CO1**
UNIT-II	**Harmony in the Human Being**	**Periods:09**
Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-The Body as an Instrument of the Self-Understanding Harmony in the Self-Harmony of the Self with the Body-Programme to ensure self-regulation and Health		**CO2**
UNIT-III	**Harmony in the Family and Society**	**Periods:09**
Harmony in the Family – the Basic Unit of Human Interaction- 'trust' – the Foundational Value in Relationship- 'Respect' – as the Right Evaluation-Other Feelings, Justice in Human-to-Human Relationship-Understanding Harmony in the Society-Vision for the Universal Human Order.		**CO3**
UNIT-IV	**Harmony in the Nature/Existence**	**Periods:09**
Understanding Harmony in the Nature-Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature-Realizing Existence as Co-existence at All Levels-The Holistic Perception of Harmony in Existence		**CO4**
UNIT-V	**Implications of the Holistic Understanding – a Look at Professional Ethics**	**Periods:09**
Natural Acceptance of Human Values-Definitiveness of (Ethical) Human Conduct-: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics-Holistic Technologies, Production Systems and Management Models-Typical Case Studies-Strategies for Transition towards Value-based Life and Profession		**CO5**

LecturePeriods:45	**Tutorial Periods: -**	**Practical Periods: -**	**TotalPeriods:45**

Text Books

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**						
Semester	**II**	Course Category : HS			End Semester Exam Type:**TE**			
Course Code	U23ENBC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Communicative English - II**	**2**	**-**	**2**	**3**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Draft effective written communication in professional environment	**K2**
	CO2	Apply the mechanics of creative writing with precision and clarity	**K3**
	CO3	Acquire language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation	**K2**
	CO4	Develop language fluency and gain self-confidence	**K3**
	CO5	Express thoughts and ideas with clarity and focus	**K2**

UNIT-I	**Business Correspondence**	**Periods:10**	
Business Writing: Circular, Agenda, Memoranda, Notice, Instruction, Minutes, Email Writing ,Report Writing- Official and Demi Official Letters : Applying for Educational / Car / Home Loans / Joining Report, Leave Letter, Industrial Visit, In plant Training, Letter to the Editor, Calling for a quotation, Placing Order, Letter of Complaints, Letter seeking Clarification, Resume', Job Application Letter, Bio-data, CV			**CO1**
UNIT-II	**Functional Writing Skills**	**Periods:10**	
Four Modes of Writing, Sentence Structure , Art of condensation: Summary Writing and Note Making, Use of phrase and clause in sentence, Principles of paragraph writing, Techniques of Essay Writing, Jumbled Sentence, Paraphrasing			**CO2**
UNIT-III	**Etiquettes**	**Periods:10**	
Etiquette: Meaning, Kinds: Corporate Etiquette, Meeting Etiquette, Telephone Etiquette, Email Etiquette, Social Media Etiquette, Dining Etiquette, Communication Etiquette			**CO3**
UNIT-IV	**Communication Practice-II**	**Periods:15**	
List of Exercises **Listening:** Letter writing tips **Speaking:** Just a Minute, Impromptu Speech, Contemporary Issues **Reading:** Variety of examples for Modes of Writing **Writing:** Different types of letters			**CO4**
UNIT-V	**Interpersonal Communication-II**	**Periods:15**	
List of Exercises **Listening:** Videos on different types of Etiquettes **Speaking:** Team Presentation, Negotiation Skills **Reading:** Phrases and Clauses **Writing:** Free writing on any given topic, Paraphrasing Practice			**CO5**

LecturePeriods:30	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:60**

Text Books

1. PC Das, "Letter Writing including Official and Business Letters", New Central Book Agency, 2020.
2. Kumar, Sanjay, Pushpalatha," Communication Skills". Oxford University Press, 2018.
3. Raman, Meenakshi&Sangeetha Sharma," Communication Skills", New Delhi: OUP,2018.

Reference Books

1. Sahukar, Nimeran , Bhalla, Prem,, “The book of Etiquettes and Manners”.PustakMahal Publisher, New Delhi; 1st Edition 2009.
2. Gerson Sharon J, Steven M. Gerson, “Technical Writing Process and Product”, Pearson Education Pvt. Ltd. 3rd Edition, 2009.
3. Grussendorf, Marion, “English for Presentations”. Oxford University Press, Oxford, 2007.
4. Seely John, “The Oxford Guide to Writing and Speaking”, Oxford University Press, 2006.
5. R.C. Sharma, Krishna Mohan, “Business Correspondence and Report Writing”, Tata McGraw Hill &Co.Ltd., New Delhi, 2001.

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1. https://www.indeed.com/career-advice/finding-a-job/how-to-write-an-application-letter
2. https://owlcation.com/humanities/Four-Types-of-Writing
3. https://targetstudy.com/languages/english/paragraph-writing.html
4. https://www.businessnewsdaily.com/8262-email-etiquette-tips.html
5. https://www.youtube.com/watch?v=UOceysteIjo

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		
Listening (L)*	10	Listening (L)*	10	40
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

- **LRW components of Practical can be evaluated through Language Lab Software**

Department	**Mechanical Engineering**		Programme : **B.Tech.**					
Semester	**I / II**		Course Category: **ES**			*End Semester Exam Type: **LE**		
Course Code	**U23ESPC03**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Graphics Using AutoCAD**		**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches)									
Prerequisite	-								
Course Outcomes	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)
	CO1	Familiarize with the fundamentals and standards of engineering graphics.							**K3**
	CO2	Perform drawing of basic geometrical constructions and multiple views of objects.							**K2**
	CO3	Visualize the isometric and perspective sections of simple solids.							**K3**
	CO4	Connect side view associate on front view.							**K4**
	CO5	Correlate sectional views and lateral surface developments of various solids.							**K4**

List of Experiments

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing a Title Block with necessary text and projection symbol.
3. Drawing 2D sketch by applying modify tools like fillet, mirror, array, etc.,
4. Drawing front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Simple stool, V-block, Mixie Base).
6. Drawing a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing lateral surface development of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creating 3D model of simple object and obtaining 2D multi-view drawings.
11. Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. James D. Bethune, Engineering Graphics with AutoCAD A Spectrum book 1st Edition, Macromedia Press, Pearson, 2020.
2. NS Parthasarathy and Vela Murali, Engineering Drawing, Oxford university press, 2015.
3. M.B Shah, Engineering Graphics, ITL Education Solutions Limited, Pearson **Education** Publication, 2011.
4. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
5. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd., 7th Edition, New Delhi, 2016.
6. C M Agrawal, Basant Agrawal, Engineering Graphics, McGraw Hill, 2012.
7. Dhananjay A. Jolhe, Engineering Drawing: With An Introduction To CAD McGraw Hill, 2016.
8. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php
2. http://www.nptelvideos.in/2012/12/computer-aided-design.html
3. https://mech.iitm.ac.in/meiitm/course/cad-in-manufacturing/
4. https://autocadtutorials.com
5. https://dwgmodels.com

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
2	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
3	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
4	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
5	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Engineering**	Programme:**B.Tech.**						
Semester	**I / II**	Course Category:**ES**			*End Semester ExamType:**LE**			
Course Code	**U23CSPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming In C Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches)								
Prerequisite	-							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Implement logical formulations to solve simple problems leading to specific applications.	**K3**
	CO2 Execute C programs for simple applications making use of basic constructs, arrays and strings.	**K3**
	CO3 Experiment C programs involving functions, recursion, pointers, and structures.	**K3**
	CO4 Demonstrate applications using sequential and random access file processing.	**K3**
	CO5 Build solutions for online coding challenges.	**K3**

List of Exercises **Periods:09**

1. Create a C program to find the Area of the triangle.
2. Develop a C program to read a three digit number and produce output like
   1 hundreds
   7 tens
   2 units
   For an input of 172.
3. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
4. Print the numbers from 1 to 10 along with their squares using C program.
5. Demonstrate do—While loop in C to find the sum of ‘n’ numbers.
6. Find the factorial of a given number using Functions in C.
7. Write a C program to check whether a given string is palindrome or not?
8. Write a C program to check whether a value is prime or not?
9. Develop a C program to swap two numbers using call by value and call by reference.
10. Construct a C program to find the smallest and largest element in an array.
11. Implement matrix multiplication using C program.
12. Create a C program to perform various string handling functions like strlen, strcpy, strcat, strcmp.
13. Develop a C program to remove all characters in a string except alphabets.
14. Create a C program to find the sum of an integer array using pointers.
15. Write a C program to find the Maximum element in an integer array using pointers.
16. Construct a C program to display Employee details using Structures
17. Write a C program to display the contents of a file on the monitor screen.
18. Create a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
19. Write a C program to create two files with a set of values. Merge the two file contents to form a single file
20. Create a C program to pass the parameter using command line arguments.

Lecture Periods:	**Tutorial Periods:**	**PracticalPeriods:30**	**TotalPeriods:30**

Reference Books

1. Zed A Shaw, “Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)”, Addison Wesley,2016.
2. Anita Goel and Ajay Mittal,” Computer Fundamentals and programming in C”, Pearson Education, First edition, 2011.
3. Maureen Sprinkle Hubbard,” Problem Solving and Programming Concepts,” Pearson,9th Edition, 2011.

4. Yashwanth Kanethkar, “Let us C”, BPB Publications,13th Edition,2008.
5. B.W.Kernighan and D.M. Ritchie, “The C Programming Language”, Pearson Education, 2nd Edition, 2006.

Web References

1. https://alison.com/course/introduction-to-c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Biomedical Engineering**			Programme:**B.Tech.**				
Semester	**II**			Course Category:**PC**		*End Semester Exam Type:**LE**		
Course Code	**U23BMPC01**			Periods/Week		Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Electron Devices and Circuits Laboratory**			**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to ICE and BME Branches)										
Prerequisite	-									
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)		
	CO1	Demonstrate the characteristic of PN Junction diode and Zener diode						**K3**		
	CO2	Construct and analyze the applications of diodes						**K4**		
	CO3	Analyze the characteristics of different types of transistors and special diodes.						**K4**		
	CO4	Design the LC oscillators and analyze the frequency response of CE amplifier.						**K4**		
	CO5	Simulate the power amplifiers and feedback amplifiers.						**K3**		

List of Experiments:

1. Characteristics of PN Junction Diode and Zener Diode.
2. Analysis of Half wave and Full wave Rectifiers.
3. Analysis of wave shaping circuits (Clippers and Clampers).
4. Characteristics of LED and Photo diode.
5. Characteristics of BJT in CB configuration
6. Characteristics of BJT in CE configuration
7. Characteristics of JFET
8. Negative resistance characteristics of UJT
9. Characteristics of Thyristors
10. Study the frequency response of CE Amplifier.
11. Design and Testing of LC Oscillators.
12. Simulation of Power Amplifiers and Feedback Amplifiers.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods:30**

Reference Books

1. Srinivasa Murthy, “Electronic Devices and Circuits Laboratory Manual”, 4th Edition, October 2015
2. David A.Bell,” Lab Manual For Electronic Devices & Circuits”, Fourth edition, PHI learning private limited, January 2004
3. Robert Boylestad , Louis Nashelsky, Franz Monssen ,“ Lab Manual for Electronic Devices and Circuit Theory”, Pearson, 11th Edition, August 2012.
4. Maheswari. L.K and Anand.M.M.S, “Laboratory Manual for Introductory Electronic Experiments”, New Age, 2010.
5. Muhammad H. Rashid “Introduction to PSpice using OrCAD for circuits and electronics,Pearson, 3rd Edition , 2004.

Web References

1. www.allaboutcircuits.com
2. www.circuitstoday.com
3. www.tutorialspoint.com

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	1	-	-	2	-	-	1	3	1	2
2	3	2	2	2	2	2	-	-	2	-	-	1	3	1	2
3	3	2	2	3	2	1	-	-	2	-	-	1	3	1	2
4	3	2	2	3	2	2	-	-	2	-	-	2	3	2	2
5	3	2	2	3	2	2	-	-	2	-	-	1	3	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Biomedical Engineering**	Programme:**B.Tech.**						
Semester	**II**	Course Category:**PC**			*End Semester Exam Type:**LE**			
Course Code	**U23BMP203**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Biosensors and Transducers Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
Prerequisite								

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Study the characteristics of instruments and measurements	**K3**
	CO2	Performance measurements of AC and DC bridges	**K3**
	CO3	Perform the displacement, temperature and pressure measurement using appropriate sensors / transducers	**K4**
	CO4	Study the characteristics of an LVDT, load cell and pH Electrodes	**K4**
	CO5	Perform torque measurement with strain gauge and bio transducers and bioelectrodes	**K4**

List of Experiments:

1. Study of Instruments and Measurements.
2. Measurement of resistance using DC Bridges.
3. Measurement of Inductance using AC Bridges.
4. Measurement of Capacitance using AC Bridges
5. Temperature measurement using AD590IC sensor
6. Displacement measurement by using a capacitive transducer
7. Torque measurement Strain gauge transducer
8. Study and characterize Bio transducers–Pressure, Temperature, Humidity
9. Pressure and displacement measurement by using LVDT
10. Study and characterize Bioelectrodes–ECG, EMG, EEG
11. Study and Characterize pH electrodes
12. Measurement of change in temperature using thermocouple, thermistor and RTD
13. Measurement of optical variables with the aid of photo diodes and photo transistors.

Lecture Periods:-	**Tutorial Periods:-**	**Practical Periods: 30**	**TotalPeriods:30**

Reference Books

1. A.E.G. Cass, “Biosensors: A Practical Approach “, Oxford University Press, 2nd Edition,July 1990.
2. Jonathan Cooper, Anthony Cass, “Biosensors: Practical Approach”, OUP Oxford, 2ndEdition, March 2004.
3. Robert S. Marks (Editor), Christopher R. Lowe, David C. Cullen, Howard H. Weetall, Isao Karube, “Handbook of Biosensors and Biochips”, Wiley, 1st Edition,October 2007.
4. R. P. Areny and T. G. Webster, “Sensors and Signal Conditioning”, Wiley- Interscience, 2015
5. Albert D. Helfrick and William D.Cooper. “Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 2007

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2. www.scilab.in/textbook_companion/generate_book/174

3. https://nptel.ac.in/courses/108/105/108105153/
4. https://nptel.ac.in/courses/108/108/108108147/
5. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	-	-	-	1	-	-	1	3	1	1
2	3	-	-	-	-	-	-	-	1	-	-	1	3	1	1
3	3	3	3	3	3	-	-	-	1	-	-	1	3	1	1
4	3	3	3	3	3	-	-	-	1	-	-	1	3	1	1
5	3	3	3	3	3	-	-	-	1	-	-	1	3	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Biomedical Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **AEC**			*End Semester Exam Type:**LE**			
Course Code	**U23BMC2XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course - II**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods:-	**Tutorial Periods:-**	**Practical Periods: 50**	**Total Periods:50**

* TE – Theory Exam, LE – Lab Exam

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**Biomedical Engineering**	Programme:**B.Tech.**						
Semester	**II**	Course Category:**MC**			End Semester Exam Type:-			
Course Code	**U23BMM202**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sports Yoga and NSS**	0	0	2	Non-Credit	100	-	100
Prerequisite	**-**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility and relaxation.	**K2**
	CO2	Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	**K2**
	CO3	Develop understanding of psychological problems associated with age and lifestyle.	**K2**
	CO4	Recognize the importance of national service in community development.	**K2**
	CO5	Convert existing skills into socially relevant life skills.	**K2**

UNIT-I	**Introduction To Physical Education**	**Periods: 06**	
Definition, Aims and Objectives of Physical Education - Changing trends in Physical Education **Physical Fitness, Wellness and Lifestyle:** Importance of Physical Fitness and Wellness - Components of Physical fitness - Components of Health related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle.			**CO1**
UNIT-II	**Yoga And Lifestyle**	**Periods: 06**	
Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra. Asanas as preventive measures – Hypertension – Obesity - Back Pain-Diabetes - Asthema.			**CO2**
UNIT-III	**Training And Planning In Sports**	**Periods: 06**	
Training - Warming up and limbering down-Skill, Technique and Style - Objectives of Planning – Tournament - Knock-Out, League/Round Robin and Combination. **Psychology and Sports** - Important of Psychology in Physical Education and Sports - Differentiate Between Growth and Development - Adolescent problems and their Management - Emotion: Concept, Type and Controlling of emotions - Concepts and Types of Aggressions in Sports - Psychological benefits of exercise - Anxiety and Fear and its effects on Sports Performance - Motivation, its type and techniques - Understanding Stress and Coping strategies			**CO3**
UNIT-IV	**Introduction To National Service Scheme**	**Periods: 06**	
Orientation of NSS volunteers: History, motto, symbol, awards, structure and activities of NSS - Days of National and International Importance - Sensitizing about the thrust areas and awareness activities - Importance of tree plantation and voluntary blood donation - The role of SHGs and NGOs in community development – CSR - Life skills and youth development-extension activities in HEIs - various clubs and schemes like RRC, ELC, YRC, UBA, SBA, etc.,			**CO4**
UNIT-V	**Community Issues And The Use Of Technology**	**Periods: 06**	
Common Problems of rural India - Technology development and its suitability – Sustainability - Value addition to agricultural products - Service learning and youth volunteering – Shramdaan - Campus cleaning - Field visit to nearby communities - village survey - Initiatives to clean and green environment - preservation of water bodies in adopted villages.			**CO5**
Lecture Periods:-	**Tutorial Periods:-**	**Practical Periods:30**	**Total Periods: 30**
Reference Books			

1. Brar Ajmer Singh, Gill Jagtar Singh, Bains Jagdish, “Modern Textbook of Physical Education Health and Sports- I”, Kalyani Publishers , 6th Edition, 2014
2. B.K.S. Iyengar, “Light on Yoga: The Definitive Guide to Yoga Practice”,Thorsons Publishers, Thorsons Classics edition, 2015
3. Joseph, Siby K, Mahodaya, “Bharat Essays on Conflict Resolution”, Institute of Gandhian Studies Publishers, 2007
4. Barman Prateeti , Goswami, “Document on Peace Education”, Triveni Akansha Publishing House, New Delhi, 2009
5. Prof R.B.S. Verma, “Field Work Practicum in Social Work-Emerging Concerns”,Rapid Publisher, Lucknow, 2020
6. Sibereisen, K , Richard M, “Lerner Approaches to Positive Youth Development”, Sage Publications, New Delhi, 2007
7. Hoshiar Singh, “Administration of Rural Development in India”, Sterling Publisher, the University of Michigan, 2009

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2. http://en.wikipedia.org/wiki/national-service-scheme 19=http://nss.nic.in/adminstruct
3. http://nss.nic. In
4. http://socialworknss.org/about.html
5. Young Journal on Youth published by SAGE: http://you.sagepub.com

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100