



SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)



7th Board of Studies Meeting in the department of
Biomedical Engineering

for the Programme
B.Tech – Biomedical Engineering

Venue

Seminar Hall, Department of BME
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date & Time

28.02.2024 & 10.30 a.m

Minutes of Seventh Board of Studies

The Seventh Board of Studies meeting for B.Tech. Biomedical Engineering was held on 28th February 2024 at 10.30 A.M in the Seminar Hall, Department of BME, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl. No.	Name of the Member	Designation
1. Head of the Department concerned (Chairperson)		
1	Dr. A.Vijayalakshmi, Professor and Head Specialization: Wireless Sensor Networks, Signal Processing Email: hodbme@smvec.ac.in Mobile: 9486985430	Chairman
2. All faculty members of the Department		
2	Dr.A.V.Srinath, Assistant Professor Specialization: Electronics and Instrumentation, Biomedical Engineering	Member
3	Mr.P.M.Bharath, Assistant Professor Specialization: Embedded System Technologies	Member
4	Mrs. N.Radha, Assistant Professor Specialization: Wireless Communication	Member
5	Mrs. S.Suguna, Assistant Professor Specialization: Digital Signal Processing	Member
6	Mrs.T. Logasundari, Assistant Professor Specialization: Biomedical Engineering	Member
7	Mr.A.Aravind, Assistant Professor Specialization: Nanoscience and Technology	Member
8	Mr.M.Vadivelan, Assistant Professor Specialization: VLSI Design	Member
9	Mr.K.Babu, Assistant Professor Specialization: Communication and Networks	Member
10	Dr.T.Poovaragavan, Assistant Professor Specialization: Mathematics	Member
11	Dr.K.Samuvel, Assistant Professor Specialization: Physics	Member
12	Dr.A.Balamurugan, Assistant Professor Specialization: Chemistry	Member
13	Dr.D.Jaichithra, Professor Specialization: English	Member

3. Two subject experts from outside the Parent University nominated by the Academic Council.		
14	Dr. Anima Nanda Dean, IQAC Sathyabama Institute of Science and Technology, Jeppiaar Nagar, Chennai - 600 119. Email: dean.iqac@sathyabama.ac.in Mobile: 9443786840	Subject Expert
15	Dr. S. Pravin Kumar Associate Professor Department of Biomedical Engineering, SSN College of Engineering, Chennai. Email : pravinkumars@ssn.edu.in Mobile: 9994246503	Subject Expert
4. One expert nominated by the Vice-Chancellor from a panel of six recommended by the Autonomous College Principal as a University Nominee.		
16	Dr. Varshini Karthik Professor and Head, Department of BioMedical Engineering, SRM Institute of Science and Technology, Kattankulathur-603 203 Email : varshink@srmist.edu.in Mobile: 9841582226	University Nominee
5. One representative from industry/corporate sector/allied areas nominated by the Principal as an Industry Nominee.		
17	Dr. S.Atheena Milagi Pandian Founder and Chief Executive Officer Atheenapandian Private Limited, Courtallam,Tamilnadu. Email : atheenapandian@gmail.com Mobile: 7502599891	Industry Expert
6. One member of the College alumni nominated by the Principal.		
18	S.Rosy Associate Analyst Zifo RnD Solutions,Chennai Email : rosyymaryy200@gmail.com Mobile: 8870890106	Alumni
7. Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, nominated by the Principal.		
19	Dr. B.Hema Kumar Associate Dean, Department of Electronics and Instrumentation Engineering, Puducherry Technological University, Puducherry Email: hemakumarb@pec.edu Mobile: 9994196804	Member
20	Dr. A.K. Jayanthi Professor and Head Department of Medical Engineering Sri Ramachandra Faculty of Engineering and Technology Chennai-600116 Email ID: jayanthiyak@sret.edu.in Mobile:9841265925	Invited Member

Agenda of the Meeting

Item No.	Particulars
BoS/2024/UG/BME/7.1	To Welcome the BoS members and introduction of new external experts to all the members.
BoS/2024/UG/BME/7.2	To apprise about the College Preamble, Highlights and Achievements.
BoS/2024/UG/BME/7.3	To review the Composition of Governing Body, Academic Council and Finance committee as per UGC Regulations 2018 and 2023.
BoS/2024/UG/BME/7.4	To discuss the composition of Previous BoS members as per UGC Regulations 2018, Revised BoS composition as per UGC Regulations 2023, Highlights of R-2020 Regulations, Curriculum, syllabi and the suggestions received from previous meetings of BoS.
BoS/2024/UG/BME/7.5	To deliberate the suggestions received from Curriculum advisory committee and the stakeholders for the revision of R-2020 Regulations and Curriculum
BoS/2024/UG/BME/7.6	To review the New Regulations R-2023 Curriculum Structure for B.Tech - Biomedical Engineering for the students admitted from the academic year 2023-24 and to apprise the uniqueness of new Regulations R-2023.
BoS/2024/UG/BME/7.7	To review and confirm the minutes of Sixth Board of Studies meeting.
BoS/2024/UG/BME/7.8	To discuss and approve the Syllabi of III Semester and IV Semester courses for B.Tech – Biomedical Engineering under Regulations R-2023.
BoS/2024/UG/BME/7.9	To discuss and approve the Professional elective- I syllabi offered for IV semester B.Tech – Biomedical Engineering under Regulations R-2023.
BoS/2024/UG/BME/7.10	To apprise and approve the syllabi of Honours degree courses under Regulations R-2023.
BoS/2024/UG/BME/7.11	To discuss and approve the Ability Enhancement courses and Mandatory courses offered for III and IV semesters under Autonomous Regulations 2023.
BoS/2024/UG/BME/7.12	To apprise and approve the Professional electives and open elective courses, Employability enhancement and Mandatory courses, NPTEL/MOOC courses offered for VI semester and VIII semester students under Regulations 2020.

BoS/2024/UG/BME/7.13	To apprise the academic calendar and academic activities for the Academic Year 2023-24.
BoS/2024/UG/BME/7.14	To apprise and approve the End Semester Examinations August 2023 Results and Graduation details of the first Batch 2019-2023 students under Autonomous Regulations R-2019.
BoS/2024/UG/BME/7.15	To discuss and recommend the panel of examiners to the Academic Council.
BoS/2024/UG/BME/7.16	Any other item with the permission of the chair.

Dr.A.Vijayalakshmi
Chairman-BoS/BME

Minutes of the Meeting

Dr.A.Vijayalakshmi, BoS Chairman started the meeting by a warm welcome and thanked the members for accepting the invitation to conduct Seventh Board of Studies meeting on 28th February 2024.

The Chairman proceeded the meeting with the presentation on the agenda items:

BoS/2024/UG/BME/7.1	The BoS Chairman greeted the BoS members and introduced the new external experts to all the members.
BoS/2024/UG/BME/7.2	Apprised about the College Preamble, Highlighted the Institution infrastructure facilities, Students Achievements, placement record, Student awards in various events and silver jubilee celebrations.
BoS/2024/UG/BME/7.3	Reviewed the Composition of Governing Body, Academic Council and Finance committee as per UGC Regulations 2018 and 2023.
BoS/2024/UG/BME/7.4	Discussed about the composition of Previous BoS members as per UGC Regulations 2018 and Revised seventh BoS composition as per UGC Regulations 2023. Explained the highlights of R-2020 Regulations, Curriculum, syllabi and the suggestions received from previous meetings of BoS.
BoS/2024/UG/BME/7.5	Deliberated the suggestions received from Curriculum advisory committee and the stakeholders for the revision of R-2020 Regulations and Curriculum
BoS/2024/UG/BME/7.6	Reviewed the New Regulations R-2023 Curriculum Structure for B.Tech - Biomedical Engineering to the BoS members. Apprised the uniqueness of new Regulations R-2023 and highlighted the new Courses included in the curriculum R-2023 as per NEP such as • Design Thinking and IDEA Lab • Universal Human Values II • Theory cum practical courses • Ability enhancement courses • Micro and Mini projects • Honours degree Courses • Research methodology • Value added courses
BoS/2024/UG/BME/7.7	Reviewed the minutes of Sixth Board of Studies meeting with the members and confirmed the incorporation of minor modifications in I semester courses syllabi of B.Tech BME Curriculum under Regulations 2023 as mentioned below: • Human Anatomy and Physiology Unit 3 title is modified as Urinary and Visual – Auditory System • In Basic Electrical Circuits, Unit 3 is vast and few topics are removed. The above modifications are incorporated and approved by BoS members.
BoS/2024/UG/BME/7.8	Discussed the Curriculum and Syllabi of III and IV Semester courses for B.Tech –

	Biomedical Engineering under Regulations 2023 and the BoS members suggested the following modifications: Suggested to provide Microcontroller and its Medical Applications Course in V semester and Biomedical Instrumentation in IV semester <table><tr><th>S.No.</th><th>Semester</th><th>Course title with Code</th><th>Unit</th><th>Suggestions</th></tr><tr><td>1</td><td>III</td><td>Biosignal and systems (U23BMT304)</td><td>I</td><td>Asked to include basic bio signals</td></tr><tr><td>2</td><td>III</td><td>Pathology and Microbiology (U23BMB301)</td><td>V</td><td>Instead of Staining Methods, experiments on Analyser can be included</td></tr><tr><td>3</td><td>IV</td><td>Biosignal Processing (U23BMB401)</td><td>V</td><td>Suggested to include Speech signal analysis experiments</td></tr></table> The Suggestions are incorporated and the Regulations 2023 Curriculum, Syllabi of III and IV Semester courses is given in Annexure I and approved by BoS members.	S.No.	Semester	Course title with Code	Unit	Suggestions	1	III	Biosignal and systems (U23BMT304)	I	Asked to include basic bio signals	2	III	Pathology and Microbiology (U23BMB301)	V	Instead of Staining Methods, experiments on Analyser can be included	3	IV	Biosignal Processing (U23BMB401)	V	Suggested to include Speech signal analysis experiments
S.No.	Semester	Course title with Code	Unit	Suggestions																	
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2	III	Pathology and Microbiology (U23BMB301)	V	Instead of Staining Methods, experiments on Analyser can be included																	
3	IV	Biosignal Processing (U23BMB401)	V	Suggested to include Speech signal analysis experiments																	
BoS/2024/UG/BME/7.9	The Professional Elective-I syllabi offered for IV semester B.Tech – Biomedical Engineering under Regulations R-2023 are discussed and the BoS members suggested the following modifications: <table><tr><th>S.No</th><th>Semester</th><th>Course title with Code</th><th>Unit</th><th>Suggestions</th></tr><tr><td>1</td><td>IV</td><td>Biometric systems (U20BME403)</td><td>V</td><td>Suggested to include Voice and Gait authentication.</td></tr><tr><td>2</td><td>IV</td><td>Hospital Equipment Safety and Management (U20BME404)</td><td>III</td><td>Suggested to include Indian Standards.</td></tr><tr><td>3</td><td>IV</td><td>Communication Systems (U20BMECO1)</td><td>V</td><td>Suggested to include the introduction about 4G, 5G technologies.</td></tr></table> The Suggestions are incorporated, and the Syllabi is given in Annexure I and approved by BoS members.	S.No	Semester	Course title with Code	Unit	Suggestions	1	IV	Biometric systems (U20BME403)	V	Suggested to include Voice and Gait authentication.	2	IV	Hospital Equipment Safety and Management (U20BME404)	III	Suggested to include Indian Standards.	3	IV	Communication Systems (U20BMECO1)	V	Suggested to include the introduction about 4G, 5G technologies.
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2	IV	Hospital Equipment Safety and Management (U20BME404)	III	Suggested to include Indian Standards.																	
3	IV	Communication Systems (U20BMECO1)	V	Suggested to include the introduction about 4G, 5G technologies.																	
BoS/2024/UG/BME/7.10	The syllabi of Honours degree courses under Regulations R-2023 are discussed and approved by the BOS members with the following suggestions: • Asked to include Nano Composite Materials content in Biological Nanostructures course offered in IV Semester and to provide Self-Assembly of Nanostructures course in V Semester. The Suggestions are incorporated and the Syllabi is given in Annexure II and approved by BoS members																				
BoS/2024/UG/BME/7.11	The Ability Enhancement and Mandatory courses offered for III and IV semesters under Autonomous Regulations 2023 are discussed with BoS members. They suggested to rename Troubleshooting of Medical Equipment (Skill Enhancement Course 1) as Testing and Troubleshooting of Medical Equipment. The Suggestion is incorporated and approved by BoS members																				
BoS/2024/UG/BME/7.12	Apprised the Professional Electives and Open Elective courses, Employability Enhancement and Mandatory courses. NPTEL/MOOC courses offered for VI semester																				

	and VIII semester students under Regulations 2020 and approved by the BoS members.																												
BoS/2024/UG/BME/7.13	The academic activities for the Academic Year 2023-24 are discussed with the BoS members and approved,																												
BoS/2024/UG/BME/7.14	The End Semester Examinations Schedule which is to be conducted in the month of June/July 2024 is discussed with BoS members.																												
BoS/2024/UG/BME/7.15	The revised list of panels of examiners and question paper setters for the end semester examinations are discussed and confirmed with the members. (Annexure - III)																												
BoS/2024/UG/BME/7.16	Discussed the Equivalent courses of Regulations 2023 B.Tech Biomedical Engineering Curriculum with Regulations 2020 courses and approved by BoS members.																												
	Equivalent course details:																												
	<table><tr><th>S.No.</th><th>R-2020 Curriculum Course title with code</th><th>R-2023 Curriculum Course title with code (Retained)</th><th>Modification</th></tr><tr><td>1</td><td>U20BST111 - Human Anatomy and Physiology</td><td>U23BMT101 - Human Anatomy and Physiology</td><td>Unit V</td></tr><tr><td>2</td><td>U20EST132 - Basic Electrical Circuits</td><td>U23BMT102 - Basic Electrical Circuits</td><td>-</td></tr><tr><td>3</td><td>U20BMT201 -Electron Devices and Circuits</td><td>U23BMTC01 - Electron Devices and Circuits</td><td>-</td></tr><tr><td>4</td><td>U20BMT306 - Biosignals and Systems</td><td>U23BMT304 - Biosignals and Systems</td><td>-</td></tr><tr><td>5</td><td>U20BMT307 -Digital Logic Circuits</td><td>U23ICTC02 - Digital Logic Circuits</td><td>Unit I</td></tr><tr><td>6</td><td>U20BMT410 - Linear Integrated Circuits</td><td>U23ICTC01 - Linear Integrated Circuits</td><td>-</td></tr></table>	S.No.	R-2020 Curriculum Course title with code	R-2023 Curriculum Course title with code (Retained)	Modification	1	U20BST111 - Human Anatomy and Physiology	U23BMT101 - Human Anatomy and Physiology	Unit V	2	U20EST132 - Basic Electrical Circuits	U23BMT102 - Basic Electrical Circuits	-	3	U20BMT201 -Electron Devices and Circuits	U23BMTC01 - Electron Devices and Circuits	-	4	U20BMT306 - Biosignals and Systems	U23BMT304 - Biosignals and Systems	-	5	U20BMT307 -Digital Logic Circuits	U23ICTC02 - Digital Logic Circuits	Unit I	6	U20BMT410 - Linear Integrated Circuits	U23ICTC01 - Linear Integrated Circuits	-
	S.No.	R-2020 Curriculum Course title with code	R-2023 Curriculum Course title with code (Retained)	Modification																									
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	3	U20BMT201 -Electron Devices and Circuits	U23BMTC01 - Electron Devices and Circuits	-																									
	4	U20BMT306 - Biosignals and Systems	U23BMT304 - Biosignals and Systems	-																									
	5	U20BMT307 -Digital Logic Circuits	U23ICTC02 - Digital Logic Circuits	Unit I																									
6	U20BMT410 - Linear Integrated Circuits	U23ICTC01 - Linear Integrated Circuits	-																										

Dr. A.Vijayalakshmi, Chairman-BoS and Head of the Department, Biomedical Engineering concluded the meeting with vote of thanks.

Dr. A.Vijayalakshmi
Chairman-BoS/BME

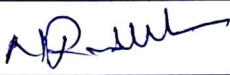
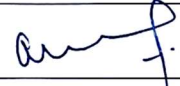
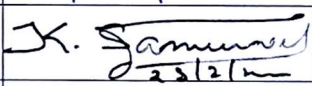
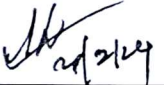


DEPARTMENT OF BIOMEDICAL ENGINEERING

SEVENTH BOS MEETING ATTENDANCE

Board of Studies Members:

Sl. No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	Dr.A. Vijayalakshmi Professor and Head Department of Biomedical Engineering, Sri Manakula Vinayagar Engineering College, Puducherry	Chairman	
2	Dr. Anima Nanda Dean, IQAC Sathyabama Institute of Science and Technology, Jeppiaar Nagar, Chennai - 600 119.	Academic Expert	
3	Dr. S. Pravin Kumar Associate Professor Department of Biomedical Engineering, SSN College of Engineering, Chennai.	Academic Expert	
4	Dr. Varshini Karthik Professor and Head, Department of BioMedical Engineering, SRM Institute of Science and Technology, Kattankulathur-603 203	University Nominee	
5	Dr. S.Atheena Milagi Pandian Founder and Chief Executive Officer Atheenapandian Private Limited, Courtallam, Tamilnadu.	Industry Expert	
6	S.Rosy Associate Analyst Zifo RnD Solutions, Chennai	Alumni Member	
7	Dr. B.Hema Kumar Associate Dean, Department of Electronics and Instrumentation Engineering, Puducherry Technological University, Puducherry	Member	
8	Dr. A.K. Jayanthi Professor and Head Department of Medical Engineering Sri Ramachandra Faculty of Engineering and Technology Chennai-600116	Invited Member	

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
9	Dr.A.V.Srinath , Assistant Professor Specialization: Electronics and Instrumentation, Biomedical Engineering	Internal Member	
10	Mr.P.M.Bharath , Assistant Professor Specialization: Embedded System Technologies	Internal Member	
11	Mrs. N.Radha , Assistant Professor Specialization: Wireless Communication	Internal Member	
12	Mrs. S.Suguna , Assistant Professor Specialization: Digital Signal Processing	Internal Member	
13	Mrs.T. Logasundari , Assistant Professor Specialization: Biomedical Engineering	Internal Member	
14	Mr.A.Aravind , Assistant Professor Specialization: Nanoscience and Technology	Internal Member	
15	Mr.M.Vadivelan , Assistant Professor Specialization: VLSI Design	Internal Member	
16	Mr.K.Babu , Assistant Professor Specialization: Communication and Networks	Internal Member	
17	Dr.T.Poovaragavan , Assistant Professor Specialization: Mathematics	Internal Member	
18	Dr.K.Samuvel , Assistant Professor Specialization: Physics	Internal Member	
19	Dr.A.Balamurugan , Assistant Professor Specialization: Chemistry	Internal Member	
20	Dr.D.Jaichithra , Professor Specialization: English	Internal Member	

ANNEXURE I

Regulations 2023 Curriculum

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	Biomedical Instrumentation	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	Biomedical Instrumentation 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
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	Microcontroller and its Medical Applications	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	Microcontroller and its Medical Applications 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

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

ANNEXURE IV**ABILITY ENHANCEMENT COURSES – (B) SKILL ENHANCEMENT COURSES**

Sl. No.	Course Code	Course Title
1	U23BMS301	Skill Enhancement Course 1*
		1) Testing and 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**

Department	Mathematics			Programme: B.Tech.						
Semester	III			Course Category Code:BS*End Semester Exam Type:TE						
Course Code	U23MATC03			Periods/Week		Credit	Maximum Marks			
				L	T	P	C	CAM	ESE	TM
Course Name	Probability and Statistics			3	1	-	4	25	75	100
(Common to All Branches Except CSBS)										
Prerequisite	Basic Probability									
Course Outcomes	On completion of the course, the students will be able to								BT Mapping (Highest Level)	
	CO1	Apply the concept of probability.							K3	
	CO2	Solve the problem on Random variables.							K3	
	CO3	Evaluate the correlation and Regression.							K3	
	CO4	Find Correlation between variables.							K3	
	CO5	Analyze the problems in small samples.							K3	
UNIT – I	Theory of Probability						Periods:12			
Random Experiments - Sample Space - Exhaustive events- Axioms of probability – Conditional probability – Total probability – Bayes theorem.									CO1	
UNIT – II	Random Variables						Periods:12			
Moments–Moment generating functions and their properties. Binomial distribution – Poisson distribution – Exponential distribution – Normal distribution (Excluding Derivation of Mean, Variance and MGF)									CO2	
UNIT – III	Design of Experiments						Periods:12			
Analysis of variance: One way and two-way classifications. Correlation – Rank correlation and Regression.									CO3	
UNIT – IV	Large Samples						Periods:12			
Large Samples: Single Propositions – Difference of Proportions – Single Mean – Difference of Mean – Difference of Standard Deviations									CO4	
UNIT – V	Small Samples						Periods:12			
Test for Mean – Test for Ratio of Variances – Chi-Square test for Goodness of Fit and Independence of Attributes.									CO5	
Lecture Periods:45			Tutorial Periods:15			Practical Periods:-		Total Periods:60		
Textbooks										
1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna publishers, 3 rd Edition, 2017.										
2. T. Veerarajan, “Probability, Statistics and Random Processes”, Tata McGraw-Hill, 3 rd Edition, 2008.										
3. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, 2019.										
Reference Books										
1. Ravish R. Singh, Mukul Bhatt “Engineering Mathematics”, McGraw-Hill, 1 st Edition, 2017.										
2. William Mendenhall, Robert J. Beaver and Barbara M. Beaver: “Introduction to Probability & Statistics”, Cengage Learning, 15 th Edition, 2019.										
3. Richard. A. Johnson, Irwin Miller and John E. Freund,” Probability and Statistics for Engineers”, Pearson Education, Asia, 9 th Edition, 2018.										
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, “An Introduction to Probability and Statistics”, Wiley, 3 rd Edition 2008.										
Web References										
1. www.stat110.net										
2. http://www.nptel.ac.in/courses/111105035 (R.V)										
3. http:// www.probabilitycourse.com .										



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4. www.edx.org/Probability5. <http://www2.aueb.gr/users/demos/pro-stat.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	1	1	-	-	-	-	-	-	-	1	1	1	1
2	3	2	1	1	-	-	-	-	-	-	-	1	1	1	1
3	2	2	-	-	-	1	-	-	-	-	-	1	1	1	1
4	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	1	1	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	5	5	5	5	5	75	100

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



Dr. A. Vijayalakshmi

Department	Artificial Intelligence and Data Science			Programme: B.Tech						
Semester	III			Course Category : ES			End Semester Exam Type: TE			
Course Code	U23ADTC01			Periods / Week		Credit	Maximum Marks			
				L	T	P	C	CAM	ESE	TM
Course Name	Programming in Python			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	Interpret the basic concepts of Python programs.							K2	
	CO2	Articulate the concepts of Sets, Dictionaries and Object-Oriented concepts.							K2	
	CO3	Experiment with Numpy package.							K3	
	CO4	Apply and analyze Data Manipulation with Pandas.							K3	
CO5	Illustrate programming concept for Visualization with Matplotlib.							K3		
UNIT-I	Introduction to Python						Periods: 09			
Structure of Python Program – Underlying mechanism of Module Execution – Branching and Looping – Problem Solving Using Branches and Loops – Functions – Lambda Functions – Lists and Mutability – Problem Solving Using Lists and Functions.										CO1
UNIT-II	Sequence Datatypes and Object-Oriented Programming						Periods: 09			
Sequences – Mapping and Sets – Dictionaries. Classes: Classes and Instances – Inheritance – Exception Handling – Introduction to Regular Expressions using “re” module.										CO2
UNIT-III	Using Numpy						Periods: 09			
Basics of NumPy – Computation on NumPy – Aggregations – Computation on Arrays – Comparisons – Masks and Boolean Arrays – Fancy Indexing – Sorting Arrays – Structured Data: NumPy’s Structured Array.										CO3
UNIT-IV	Data Manipulation with Pandas						Periods: 09			
Introduction to Pandas Objects – Data indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Combining Data Sets. Aggregation and Grouping – Pivot Tables –Vectorized String Operations – Working with Time Series – High Performance Pandas – eval() and query().										CO4
UNIT-V	Visualization With Matplotlib						Periods: 09			
Basic functions of Matplotlib – Simple Line Plot – Scatter Plot – Density and Contour Plots – Histograms – Binnings and Density – Customizing Plot Legends – Colour Bars – Three-Dimensional Plotting in Matplotlib.										CO5
Lecture Periods: 45			Tutorial Periods:		Practical Periods:			Total Periods: 45		
Text Books										
1. Jake VanderPlas, “Python Data Science Handbook - Essential Tools for Working with Data”, O’Reilly Media Inc, 2016. 2. Zhang.Y, “An Introduction to Python and Computer Programming”, Springer Publications, 2016. 3. Wesley J Chun, “Core Python Programming”, Pearson Education, 2 nd Edition, 2006.										
Reference Books										
1. John Paul Mueller, Luca Massaron, “Python for Data Science for Dummies”, 2 nd Edition, John Wiley& Sons, 2019. 2. Jesus Rogel-Salazar, “Data Science and Analytics with Python”, CRC Press Taylor and Francis Group, 2017. 3. Brian Draper, “Python Programming A Complete Guide for Beginners to Master and Become an Expert in Python Programming Language”, CreateSpace Independent Publishing Platform, 2016. 4. Mark Lutz, Laura Lewin, Frank Willison, “Programming Python”, O’Reilly Media, 3 rd Edition, 2006. 5. Gowrishankar S. Veena A. “Introduction to Pvthon Programming”. CRC Press. 2018.										



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Web References

1. <https://nptel.ac.in/courses/106/106/106106212/>
2. <https://www.geeksforgeeks.org/data-analysis-visualization-python/>
3. <https://www.coursera.org/learn/python-data-analysis>
4. <https://www.python.org/>
5. <https://www.programiz.com/python-programming>

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	2	1	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	3	2	3
4	3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
5	3	3	2	3	-	-	-	-	-	-	-	2	3	3	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



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Department	Biomedical Engineering			Programme: B.Tech.						
Semester	III			Course Category Code: PC		*End Semester Exam Type: TE				
Course Code	U23BMT304			Periods/Week			Credit	Maximum Marks		
				L	T	P	C	CAM	ESE	TM
Course Name	Biosignals and Systems			2	1	-	3	25	75	100
Prerequisite	-									
Course Outcomes	On completion of the course, the students will be able to								BT Mapping (Highest Level)	
	CO1	Distinguish the continuous and discrete-time signals and systems							K2	
	CO2	Capable of characterizing LTI-CT systems in the Transform domain							K3	
	CO3	Understand the concepts of Z-transform and discrete Fourier transform							K3	
	CO4	Capable of characterizing LTI-DT systems in the Transform domain							K4	
	CO5	Apply DFT for the analysis of digital signals and systems							K4	
UNIT – I	Basics of Discrete and Continuous Time Signals and Systems						Periods:12			
Generation, Representation of discrete time signals and continuous time signals – Standard discrete time signals, Standard continuous time signals – Classification of signals: Continuous time (CT) Discrete time (DT) signals, Basic bio signals, Mathematical operations on CTS and DTS – Scaling, folding, time shifting, addition and multiplication. Classification of systems: static and dynamic systems – time invariant and time variant – linear and nonlinear systems – causal and non-causal systems, stable and unstable systems.									CO1	
UNIT – II	Linear Time Invariant Continuous Time Systems						Periods:12			
Impulse response – Convolution integrals- Differential Equation- Fourier and Laplace transforms in analysis of CT systems – Systems connected in series / parallel.									CO2	
UNIT – III	Transforms of Discrete Time Signals						Periods:12			
Z transform-properties-Region of convergence – Representation of poles and zeros in z transform, Inverse z transform – Power series expansion, Partial Fraction method, Discrete time Fourier transform – Properties, Relation between Z transform and DTFT									CO3	
UNIT – IV	Linear Time Invariant-Discrete Time Systems						Periods:12			
Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.									CO4	
UNIT – V	Discrete Fourier Transforms						Periods:12			
Discrete Fourier transforms (DFT) – Properties of DFT – Periodicity, Symmetry, Circular convolution. Linear filtering using DFT. Filtering long data sequences – Overlap save and overlap add method. Fast computation of DFT – Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.									CO5	
Lecture Periods:60			Tutorial Periods:15		Practical Periods: -			Total Periods:60		
Textbooks										
1. P. Ramesh Babu, “Signals and Systems”, Fifth Edition, Scitech Publishers, 2014.										
2. Allan V. Oppenheim, Allan S.Willsky and S.HamidNawab, “Signals and Systems”, Second Edition, PHI Learning, New Delhi, 2010.										
B. P. Lathi, “Principles of Linear Systems and Signals”, Third Edition, Oxford University Press, 2012.										
Reference Books										
1. A. Anand Kumar, “Signals and systems”, Third edition PHI learning Pvt. Ltd., 2015.										
2. M.J. Roberts, “Signals and Systems: Analysis using transform methods and MATLAB”, Second edition, Tata McGraw Hill, 2012.										



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3. Suresh R, Devashayam, "Signals and Systems in Biomedical Engineering", Second edition, Springer US, 2013.
4. Dr Chitode "Signals and system", Technical Publications 2014.
5. A.Nagoor Kani, "Digital Signal Processing", 2nd edition, McGraw Hill Education, 2016.

Web References

1. <http://www.nptelvideos.in/2012/12/signals-and-system.html>
2. <http://freevidelectures.com/Course/3177/Signals-and-Systems>
3. <https://nptel.ac.in/courses/117/101/117101055/>
4. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Electrical%20&%20Comm%20Engg/Signals%20and%20System/Course_home2.20.html
5. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Electrical%20&%20Comm%20Engg/Signals%20and%20System/Course_home4.30.html

* 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	-	-	-	-	1	-	-	-	-	2	2	-
2	3	3	3	2	-	-	-	1	-	-	-	-	2	2	-
3	3	3	3	2	-	-	-	1	-	-	-	-	2	2	-
4	3	3	3	2	-	-	-	1	-	-	-	-	2	2	-
5	3	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	5	5	5	5	5	75	100

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



Dr. A. Vijayalakshmi

Department	Instrumentation and Control Engineering				Programme: B.Tech.							
Semester	III				Course Category: PC			End Semester Exam Type: TE				
Course Code	U23ICTC01				Periods/Week			Credit	Maximum Marks			
					L	T	P	C	CAM	ESE	TM	
Course Name	Linear Integrated Circuits				3	0	0	3	25	75	100	
(Common to ICE & BME Branches)												
Prerequisite	Knowledge of electronic circuits											
Course Outcomes	On completion of the course, the students will be able to										BT Mapping (Highest Level)	
	CO1	Acquire knowledge on basic operation of op-amp										K2
	CO2	Understand the different applications of Operational Amplifier and their design										K3
	CO3	Gain knowledge on the comparators and waveform generators										K3
	CO4	Demonstrate the basic concepts and design of active filters and data converters										K4
	CO5	Gain knowledge on operation, applications of timers and describe the basic concepts of PLL and Voltage regulators.										K3
UNIT – I	Op-Amp and its Characteristics							Periods:09				
Basics of operational amplifier (op amp) and its ideal characteristics, Internal Building Block, Inverting and non-inverting amplifier, Voltage follower, Differential Amplifier, DC characteristics and AC characteristics.											CO1	
UNIT – II	Op-Amp Applications							Periods:09				
Basic Op Amp Applications- Summing Amplifier, Subtractor, Differentiator and Integrator, Half wave rectifier and Full wave rectifier, Peak detector, Clipper and Clamper, Sample and hold circuit, log amplifier, Instrumentation amplifier, V-I and I-V converter.											CO2	
UNIT – III	Comparators and Waveform Generators							Periods:09				
Comparator and its applications - Schmitt trigger, Astable multivibrator, Monostable multivibrator, Triangular wave generator, Sawtooth wave generator, RC Phase shift oscillator, Wien bridge oscillator.											CO3	
UNIT – IV	Active Filters and Data Converters							Periods:09				
Active Filters: First order low pass and high pass filter, Band Pass Filter, Band Stop Filter. Digital to Analog converters (DAC): Weighted Resistor DAC, R-2R ladder DAC, Inverted R-2R DAC. Analog to Digital converters (ADC): Flash type ADC, Successive approximation ADC, Dual slope ADC.											CO4	
UNIT – V	Timer, PLL and Voltage Regulators							Periods:09				
555 timer IC pin diagram and functional diagram, 555 timer in monostable mode and its application as pulse width modulation, 555 timer in astable mode and its application as frequency shift keying (FSK), Phase Lock Loop IC 565. Voltage Regulators: Series op-amp regulator, LM78XX, 79XX fixed voltage regulator, 723 General Purpose Regulator, Switched Mode Power Supply.											CO5	
Lecture Periods: 45			Tutorial Periods: -			Practical Periods: -			Total Periods: 45			
Textbooks												
1. D Roy Choudhury and Shail Jain, “Linear integrated circuits”, New Age Science Limited, Fourth edition, 2018 2. Ramakant A. Gayakwad, “OP-AMP and Linear ICs”, Fourth Edition, Prentice Hall / Pearson Education, 2015 3. S.Salivahanan & V.S. Kanchana Bhaskaran, “Linear Integrated Circuits”, TMH, 2010.												
Reference Books												
1. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Fourth Edition, Tata Mc Graw-Hill, 2016. 2. S.Salivahanan& V.S. Kanchana Bhaskaran, “Linear Integrated Circuits”, Second Edition, TMH, 4th Reprint, 2016. 3. Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Sixth Edition, PHI, 2008.												



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4. B.S.Sonde, "System design using Integrated Circuits", Second Edition, New Age Pub, 2010
5. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 2009.

Web References

1. <http://www.ti.com/applications/industrial/medical/technical-documents.html>
2. <https://e-box.co.in/linear-integrated-circuits.shtml>
3. https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.html

* TE – Theory Exam, LE – Lab Exam

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	3	1	-
2	3	2	2	-	-	-	1	-	-	-	-	1	3	1	-
3	3	3	3	-	-	-	1	-	-	-	-	1	3	1	1
4	3	2	2	-	-	-	1	-	-	-	-	2	3	1	-
5	3	3	3	1	2	-	1	-	-	-	-	2	3	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	5	5	5	5	5	75	100



Dr. A. Vijayalakshmi

Department	Instrumentation and Control Engineering				Programme: B.Tech.							
Semester	III				Course Category: PC		End Semester Exam Type: TE					
Course Code	U23ICTC02				Periods/Week		Credit	Maximum Marks				
					L	T	P	C	CAM	ESE	TM	
Course Name	Digital Logic Circuits				2	1	0	3	25	75	100	
(Common to ICE & BME Branches)												
Prerequisite -												
Course Outcomes	On completion of the course, the students will be able to										BT Mapping (Highest Level)	
	CO1	Interpret the concepts of number systems and binary codes.										K2
	CO2	Analyze the operations of Boolean algebra and logic gates.										K3
	CO3	Design and implement combinational logic circuits										K3
	CO4	Design and implement sequential logic circuits										K3
	CO5	Understand the memory devices, programmable logic devices and Logic families										K3
UNIT – I	Number Systems and Binary Codes							Periods:12				
Number Systems-Binary, Octal, Decimal, Hexadecimal. Number system conversions, Binary Arithmetic, Representation of signed binary numbers, 1s and 2s Complements. Binary Codes - Classification, Binary coded decimal (BCD), Weighted, non-weighted, Reflective, sequential, Alphanumeric codes. Error detection codes. Error correction codes.											CO1	
UNIT – II	Boolean Algebra and Logic Gates							Periods:12				
Boolean Algebra: Basic Theorems and Properties, Standard Forms of Boolean Expression-Sum of Product (SOP), Product of Sum(POS), Canonical and Standard forms, Simplification of Boolean expressions - Algebraic simplification, Karnaugh-Map simplification, Quine McClusky simplification. Logic gates: Basic logic gates; Universal gates; Implementation of Boolean function using gates											CO2	
UNIT – III	Combinational Logic Circuits							Periods:12				
Binary adders- Half adder, Full adder, Parallel Adder, Look ahead carry adder, Binary Subtractors - Half subtractor, Full subtractor, 1bit and 2bit Magnitude comparators, Code converters, Decoders and encoders, Multiplexers and Demultiplexers, Parity bit generator and checker.											CO3	
UNIT – IV	Sequential Logic Circuits							Periods:12				
Types of sequential circuits, Comparison between combinational and sequential circuits, Latches-RS latch; Flip flops (FF) – RS,D, JK, and T, JK Master/Slave FF, triggering of flip flops, Excitation tables, Flip flop conversions. Design of Counters- Asynchronous (Ripple) Counters, synchronous counters, Shift registers, Classification of shift registers, Universal Shift Register, Ring Counter, Johnson counter.											CO4	
UNIT – V	Memory, Programmable Logic Circuits and Logic Families							Periods:12				
Memory Classification- Random Access Memory (RAM), Static RAM, Dynamic RAM, Read Only Memory (ROM); PROM, EPROM, EEPROM. Programmable Logic Devices: Programmable ROM (PROM), Programmable Array Logic (PAL), Programmable Logic Array (PLA), Implementation of combinational circuits using PROM, PAL, PLA. Logic families: Characteristics - propagation delay, power dissipation, fan-in, fan-out, noise margin, TTL, ECL, CMOS.											CO5	
Lecture Periods: 60		Tutorial Periods: -		Practical Periods: -		Total Periods: 60						
Textbooks												
1. M. Morris Mano, Digital Design, Fourth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2008. 2. Anand Kumar, Fundamentals of Digital Circuits Prentice Hall of India, Pvt Ltd, New Delhi, Second Edition, 2014. 3. R.P. Jain, Modern Digital Electronics, Fourth edition, Tata McGraw Hill, 2010.												



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Reference Books

1. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003.
2. Charles H. Roth, Larry L. Kinney, Raghunandan G.H. Fundamentals of Logic Design, Cengage Learning India Pvt. Ltd.; 1st edition, 1 September 2019
3. William H. Gothmann, Digital Electronics Prentice Hall, 2001
4. John M. Yarbrough, Digital logic: Applications and Design Thomas Vikas Publishing House, 2002.
5. Ananda Natarajan R, Digital Design, Second edition, Eastern Economy Editions, PHI Learning Pvt. Ltd., 2015.

Web References

1. <https://nptel.ac.in/courses/117106086/>
2. <https://learn.ni.com/teach/resources/1104/digital-electronics>
3. <http://nptel.ac.in/courses/117/106/117106086/>

* 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	-	-	-	-	-	-	-	-	-	3	1	1
2	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
3	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
4	3	-	1	-	-	-	-	-	-	-	-	-	3	1	1
5	3	2	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
	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



Dr. A. Vijayalakshmi

Department	Biomedical Engineering				Programme: B.Tech							
Semester	III				Course Category: PC		End Semester Exam Type: TE & LE					
Course Code	U23BMB301				Periods / Week		Credit	Maximum Marks				
					L	T	P	C	CAM	ESE	TM	
Course Name	Pathology and Microbiology				2	0	2	3	50	50	100	
Prerequisite	-											
Course Outcomes	On completion of the course, the students will be able to									BT Mapping (Highest Level)		
	CO1	Understand the structural and functional aspects of living organisms									K2	
	CO2	Understand the importance of Fluid related disorders									K2	
	CO3	Describe the structure of Bacteria and virus									K3	
	CO4	Knowledge about the function of microscope									K3	
	CO5	Define methods involved in easing the pathological diseases									K3	
UNIT-I	Cell Degeneration, Repair and Neoplasia						Periods: 10					
Cell injury and Necrosis, Apoptosis – Intracellular accumulations – Pathological calcification, cellular adaptations of growth and differentiation – Inflammation and Repair including fracture healing, Neoplasia – Classification, Benign and Malignant tumours – carcinogenesis, spread of tumours – Autopsy and biopsy.											CO1	
UNIT-II	Fluid and Hemodynamic Derrangements and Microscopes						Periods: 10					
Edema, normal hemostasis, thrombosis – disseminated intravascular coagulation – embolism, infarction, shock. Hematological disorders – Bleeding disorders, Leukaemias, Lymphomas. Microscopes: Light microscope – bright field, dark field, phase contrast, fluorescence – Electron microscope (TEM & SEM). – Preparation of samples for electron microscope – Staining methods – simple, gram staining and AFB staining.											CO2	
UNIT-III	Microbial Cultures and Immunology						Periods: 10					
Morphological features and structural organization of bacteria – growth curve, identification of bacteria – culture media and its types – culture techniques and observation of culture. Immunology: Natural and artificial immunity – opsonization, phagocytosis, inflammation – Immune deficiency syndrome – antibodies and its types – antigen and antibody reactions – immunological techniques: immune diffusion, immuno electrophoresis – RIA and ELISA – monoclonal antibodies.											CO3	
UNIT-IV	Pathology Lab Experiments						Periods: 15					
1. Sterilization techniques. 2. Preparation of culture media for micro-organisms. 3. ABO blood grouping and Cross matching of blood. 4. Hemoglobin estimation. 5. Bleeding time and clotting time. 6. Manual paraffin tissue processing and section cutting (Demonstration)											CO4	
UNIT-V	Microbiology Lab Experiments						Periods: 15					
1. Study and handling of light microscope. 2. Total RBC count. 3. Peripheral smear study (i) Morphology (ii) WBC differential count. 4. Urine physical and chemical examination. 5. Identification of Bacterial morphology by phase contrast Microscopy/Live and dead bacterial cells by Fluorescence Microscopy (Demonstration) 6. Identification of bacteria using 16s-rRNA sequencing (Demonstration)											CO5	
Lecture Periods: 30			Tutorial Periods:			Practical Periods:30			Total Periods: 60			
Textbooks												
1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, “Pathologic Basis of Diseases”, 10th edition, WB Saunders Co. 2020. 2. Prescott, Harlev and Klein. “Microbiology”. 10th edition. McGraw Hill. 2021												



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3. Harsh Mohan: Text book of Pathology. Jaypee publishers. 9th edition. 2023

Reference Books

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 5th edition, 2010.
2. Ananthanarayanan & Panicker, "Microbiology" Orientblackswan, 12/E, 2022.
3. Dubey RC and Maheswari DK. "A Textbook of Microbiology" Chand & Company Ltd, 5th edition, 2022
4. Vinay Kumar, Abul K. Abbas" Robbins Essential Pathology" Elsevier, 2020
5. Apurba S Sastry, Sandhya Bhat "Review of Microbiology & Immunology" Jaypee Brothers Medical Publishers Pvt. Limited, 2 Jun 2020

Web References

1. <https://tinyurl.com/ydcze6yx>
2. <http://www.rkmyat.in/up1/34/1629.pdf>
3. <http://moscmm.org/pdf/Ananthanarayan%20microbio.pdf>

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	1	3	-	1	1	-	-	-	1	2	-	-
2	3	3	3	1	-	-	1	1	-	-	-	1	2	-	-
3	3	3	3	1	-	-	1	1	-	2	-	1	2	-	-
4	2	2	2	2	-	-	1	-	1	2	-	-	1	2	2
5	1	-	-	-	3	1	2	-	1	1	3	2	-	-	2

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		40
Conduction of Practical	15 marks		Procedure / Algorithms	5 marks	
Report	10 marks		Experiment / Program Execution	10 marks	
Viva-Voce	5 marks		Result / Output	10 marks	
Total	30 marks		Viva-Voce	5 marks	



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Department	English		Programme: B.Tech.						
Semester	III		Course Category Code: HS			*End Semester Exam Type: LE			
Course Code	U23ENP301		Periods/Week			Credit	Maximum Marks		
			L	T	P	C	CAM	ESE	TM
Course Name	General Proficiency- I		0	0	2	1	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	Interpret meaning and apply reading strategies in technical and non-technical context							K3
	CO2	Develop interpersonal communication skills professionally							K4
	CO3	Demonstrate various forms of formal writing							K3
	CO4	Decode graphical data coherently							K2
	CO5	Apply the techniques of verbal aptitude in competitive exams							K3
UNIT- I	Comprehension Analysis					Periods:6			
Listening: Dialogue based on social contexts (IELTS based) - Speaking: Break the iceberg (IELTS based) Submitting Video Recording - Reading: Reading technical passage (IELTS based) - Writing: Writing Task: 2 (IELTS Academic) - Vocabulary: Synonyms (IELTS)								CO1	
UNIT- II	Personality Development					Periods:6			
Listening: Monologue about the everyday social issues (IELTS based) - Interview Videos - Speaking: Speak about the topic in the Flash Card (IELTS based) - Reading: British & American Vocabulary - Writing: SWOT Analysis - Vocabulary: Idioms and Phrases (IELTS)								CO2	
UNIT- III	Inferential Learning					Periods:6			
Listening: Conversation between 4 people regarding education (IELTS based), Anecdotes - Speaking: Structure Discussion (IELTS based) - Reading: Distinguish between facts & opinions (IELTS based), - Writing: Writing Conversation to different context - Vocabulary: Phrasal Verbs (IELTS)								CO3	
UNIT- IV	Interpretation And Functional Writing					Periods:6			
Listening: Monologue on an academic subject (IELTS based), Group Discussion videos - Speaking: Group Discussion Practice - Reading: Read and review (Books, Magazines) - Writing: Writing Task 1: (IELTS Academic: Graph/ chart/tables description) - Vocabulary: Collocations (IELTS)								CO4	
UNIT-V	Verbal Aptitude - I					Periods:6			
Language Enhancement: Articles, Preposition, Conjunction Verbal Ability Enhancement: Ordering of sentences, Blood Relation, Completing Statements- Cloze test, Spotting Errors - Sentence Improvement, Word Analogy, Word Groups (GATE)								CO5	
Lecture Periods: -		Tutorial Periods: -		Practical Periods:30			Total Periods:30		
Reference Books									
1.Lewis, Norman, “Word Power Made Easy”.Goyal Publishers and Distributors Pvt.Ltd., Latest Edition, 2020. 2.Patterson, Kerry, Joseph Grenny,Ron McMillan, Al Switzler, “Crucial Conversation Tools for talking when Stakes are High”, Kindle Publication,2nd Edition, 2011. 3.Comfort, Jeremy,et.al. “Speaking Effectively: Developing Speaking Skills for Business English”, Cambridge University Press, Cambridge: Reprint 2011. 4.Agarwal, R. S. “A Modern Approach to Verbal & Non-Verbal Reasoning”. S. Chand, 2010. 5.Wren, Percival Christopher, and Wren Martin. “High School English Grammar and Composition”. S Chand, 2005.									
Web References									
1. https://www.ielts-exam.net/grammar/									



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2. <https://ieltsfocus.com/2017/08/02/collocations-ielts/>
 3. <https://www.fresherslive.com/online-test/blood-relations-questions-and-answers>
 4. <https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/>
 5. <https://www.examsbook.com/word-analogy-test-questions-with-answers>

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	-	-	-	-	-	-	1	-	3	-	2	1	1	1
2	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
3	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
4	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
5	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1

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

Evaluation Methods

Practical					
Continuous Assessment Internal Evaluation			End Semester External Evaluation		Total Marks
50 marks			50 marks		100
Conduction of Practical (Assignment 1&2 -10 Marks Performance in practical classes - 5 Marks)	15		Listening (L)	20	
Record	5		Speaking(S)	10	
Viva	5		Reading(R)	10	
Model Practical Examination (Model Exam is conducted for 50 Marks that will be converted to 15 Marks)	15		Writing(W)	10	
Attendance	10				



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Department	Mathematics		Programme: B.Tech.						
Semester	III		Course Category Code: BS			*End Semester Exam Type: LE			
Course Code	U23MAPC01		Periods/Week			Credit	Maximum Marks		
			L	T	P	C	CAM	ESE	TM
Course Name	Engineering Mathematics Laboratory		0	0	2	1	50	50	100
(Common to all Branches Except CSBS)									
Prerequisite	Matrices, Fourier Transforms, Laplace Transforms								
Course Outcome	On completion of the course, the students will be able to						BT Mapping (Highest Level)		
	CO1	Perform and evaluate Matrix Operations						K3	
	CO2	Solve Differential and Integral Equations						K3	
	CO3	Construct Fourier series and Fourier Transforms of the given function						K3	
	CO4	Find the Measures of Central tendency						K3	
	CO5	Analyze Correlation and Regression lines						K3	
List of Experiments:									
1. Find the Inverse, Rank, Eigen values and Eigen Vectors of the matrix.									
2. Solve the first order differential equation.									
3. Find the integration of $\int_a^b f(x)dx$.									
4. Find the Fourier series of f(x).									
5. Find the Fourier Transform of f(x).									
6. Find the Laplace Transform of f(x).									
7. Find the Mean, Median and Mode.									
8. Construct the Pie and Bar Diagram.									
9. Find the Correlation coefficient.									
10. Find the Regression lines.									
Lecture Periods: - Nil		Tutorial Periods: - Nil		Practical Periods: 3 0			Total Periods :30		
Reference Books									
1. T. Veerarajan, “Engineering Mathematics, Tata McGraw Hill Education (India) Private Limited Chennai 2nd Edition Paperback – 1 January 2018.									
2. M.K. Venkataraman, “Engineering Mathematics, The National Publishing Company, Madras, 2016.									
3. Dr. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, Paperback – 1, 2019.									
Web References									
1. https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf									
2. https://www.nrigroupindia.com/niist/wp-content/uploads/sites/6/2022/02/lab-manual-it406matlab.pdf									
3. https://www.studocu.com/row/document/comsats-university-islamabad/signals-and-systems/lab-lab-manual/38332410									

* TE – Theory Exam, LE – Lab Exam



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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	1	1	-	1	-	-	-	-	-	1	1	1	1
2	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1
3	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
4	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	1	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



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Department	Artificial Intelligence and Data Science		Programme: B.Tech							
Semester	III		Course Category: ES			End Semester Exam Type:LE				
Course Code	U23ADPC01		Periods / Week			Credit	Maximum Marks			
			L	T	P	C	CAM	ESE	TM	
Course Name	Programming in Python Laboratory		0	0	2	1	50	50	100	
(Common to All Branches)										
Prerequisite	NIL									
Course Outcomes	On completion of the course, the students will be able to							BT Mapping (Highest Level)		
	CO1	Describe common Python functionality and features used for data science.							K2	
	CO2	Query Data Frame structures for cleaning and processing.							K2	
	CO3	Configure your programming environment							K3	
	CO4	Experiment the concept using data visualization.							K3	
	CO5	Analyze real time datasets,							K3	
List of Exercises										
</										



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4. <https://www.python.org/>
5. <https://www.programiz.com/python-programming>

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	2	2	1	3	-	-	-	-	-	-	-	2	2	2
2	2	3	2	2	3	-	-	-	-	-	-	-	2	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

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



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Department	Instrumentation and Control Engineering				Programme: B. Tech.						
Semester	III				Course Category: PC		*End Semester Exam Type: LE				
Course Code	U23ICPC01				Periods/Week		Credit	Maximum Marks			
					L	T	P	C	CAM	ESE	TM
Course Name	Linear and Digital Integrated Circuits Laboratory				0	0	2	1	50	50	100
(Common to ICE & BME Branches)											
Prerequisite	-										
Course Outcomes	On completion of the course, the students will be able to										BT Mapping (Highest Level)
	CO1	Design various applications of op-amp.									K4
	CO2	Able to design signal conditioning circuits necessary for instrumentation.									K3
	CO3	Design various sequential digital circuits like shift registers, counters.									K3
	CO4	Design asynchronous sequential circuits.									K3
	CO5	Implement Multiplexer and demultiplexer									K2
PART –A 1. Design and Testing of Inverting amplifier, Noninverting amplifier and Voltage Follower. 2. Design and Testing of Summer and Subtractor circuits. 3. Design and Testing of Differentiator and Integrator. 4. Design and Testing of Instrumentation amplifier. 5. Design and Testing of First order active filters (LPF, HPF). 6. Implementation of 4-bit DAC using OP AMP, ADC using op-amp. 7. Design and Testing of Astable and monostable multivibrators using 555 Timer. PART –B 8. Study of Logic Gates. 9. Design and implementation of Half Adder, Full Adder, Half Subtractor and Full Subtractor circuits. 10. Implementation of Code converters. 11. Implementation of Encoders and Decoders. 12. Verification of multiplexer and demultiplexer. 13. Implementation of Flip flops. 14. Design and implementation of counters. 15. Design and implementation of 4-bit shift registers.											
Lecture Periods:		Tutorial Periods: -			Practical Periods: 30			Total Periods: 30			
Reference Books											
1. D Roy Choudhury and Shail Jain, "Linear integrated circuits", New Age Science Limited, Fourth edition, 2018. 2. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", Fourth Edition, Prentice Hall / Pearson Education, 2015. 3. M. Morris Mano and Michael D. Cilette, Digital DesignII, Prentice Hall, Fifth Edition,2012 4. Thomas L Floyd, "Digital Fundamentals", Prentice Hall, 11th Edition, 2014. 5. Anand Kumar, Fundamentals of Digital CircuitsII, Prentice Hall of India, Pvt Ltd, New Delhi, 4th Edition, 2016.											
Web References											
1. https://www.electronics-lab.com/ 2. http://vlabs.iitkgp.ernet.in/be/# 3. https://nptel.ac.in/courses/122/106/122106025/											



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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	2	-	-	-	-	-	-	1	3	1	1
2	3	1	-	1	2	-	-	-	-	-	-	1	3	1	1
3	3	1	-	-	2	-	-	-	-	-	-	1	3	1	1
4	3	2	3	3	2	-	-	-	-	-	-	1	3	1	1
5	3	2	3	3	2	-	-	-	-	-	-	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



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Department	Biomedical Engineering	Programme: B.Tech.						
Semester	III	Course Category: AEC			*End Semester Exam Type: LE			
Course Code	U23BMC3XX	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Certification Course – III	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



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Department	Biomedical Engineering			Programme: B.Tech.					
Semester	III			Course Category: AEC			*End Semester Exam Type: LE		
Course Code	U23BMS301			Periods/Week			Credit	Maximum Marks	
				L	T	P	C	CAM	ESE
Course Name	Skill Enhancement Course 1*			0	0	2	-	100	100
Prerequisite									
Course Outcome	On completion of the course, the students will be able to								BT Mapping (Highest Level)
	CO1	Apply safety protocols in medical equipment troubleshooting.							K3
	CO2	Execute preventive maintenance for optimal blood pressure monitors.							K3
	CO3	Learn about the Shortcut keys, Formulae etc.							K3
	CO4	Explore about power point Presentation							K3
	CO5	Learn various methods to design in power point presentation							K3
Course Content:									
Testing and Troubleshooting of Medical Equipment									
1. Rules of Engagements									
a. Look at the device/procedure/process.									
b. Listen to the user/device/procedure/process.									
c. Applications for the device/procedure/process									
2. Blood Pressure Monitor Equipment (Manual)									
a. Preventive Maintenance									
b. Disassembling a Mercury Manometer									
c. Mercury handling protocol									
3. Centrifuge Equipment									
a. Preventive Maintenance									
b. Checking Motor Functions									
c. RPM Measurements									
d. Bypassing Interlock									
4. Microscope									
a. Preventive Maintenance									
b. Checking Light Source									
c. Adjustments of Knobs									
d. Ensuring the amount of Lubricants									
5. Sphygmomanometer									
a. Preventive Maintenance									
b. Mercury leakage									
c. Pressure check.									
d. Aneroid instrument pressure check.									
6. Stethoscopes									
a. Earpiece sound check.									
b. Tube connectors check in headpiece.									
c. Parts damaged or faulty.									
Lecture Periods:			Tutorial Periods:			Practical Periods:30		Total Periods: 30	
Reference Books									
1. Justin Cooper and Alex Dahinten, "Medical Equipment Troubleshooting Flowchart Handbook" Published by: Engineering world health. Vesion- 6, 2013									



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Web References

1. <https://www.youtube.com/watch?v=whp2pnCBs6s>
2. <https://www.youtube.com/watch?v=EJJVrCm3YT4>
3. <https://www.youtube.com/watch?v=T0QmUe0bwL8>
4. <https://www.youtube.com/watch?v=3kXnL0AQhYA>
5. <https://www.usms.biz/preventive-maintenance-for-medical-devices/>

Masters in Microsoft Excel**Module I: Excel Basics****(6 Hrs)**

About Excel, The Excel environment, The Title Bar – The Ribbon – Scroll Bars – The MS Office Button – The Quick Access Toolbar – The Formula Bar – The Workbook Window – The Status bar – The Workbook View Buttons – The Zoom Slider – the Mini toolbar – Keyboard Shortcuts.

Module II: Data handling**(6 Hrs)**

Sorting & Filtering: Techniques for sorting and filtering data, including controlling the order of precedence in a sort, advanced filters, and an introduction to PivotTables. Using sorting and filtering to check and 'clean' data. Controlling user input: Controlling the way users can enter data into a spreadsheet to reduce risk of error and increase efficiency. Covers Data Validation and using IS- functions to trap errors. Working with Text: Entering and formatting text, extracting or combining parts of text. 'Cleaning' data for typos and bugs. Lookup & Reference: Looking up information in a basic table, and more flexibly. VLOOKUP() and the more flexible INDEX()/MATCH() combination. Advanced lookups.

Module III: Formatting**(6 Hrs)**

Cell Formatting - Basic font formatting, alignment – Including horizontal and vertical alignment, wrapping, merging, orientation, Alt-Return; consistent, sensible row heights & column. Number Formatting - Types of number (E.g., currency, %, decimal, negative numbers) – and Excel formats best employed. Custom number formats and how to maximise impact and clarity. Conditional Formatting - Changing the format of cells depending on their value. Graphical conditional formats. Writing conditional format formulas.

Module IV: Presentation**(6 Hrs)**

Graphs and Charts - Creating simple charts and editing them to control and improve formatting. Choosing the right chart Principles and guidelines for communicating well with charts. Sparkline's and Maps (when and how to use). Page & Print Setup - Displaying spreadsheets as pages. Page layout view, page breaks, print area, Printing from multiple Worksheets (and that default will be to print only from active Worksheet). Headers and footers. Adjusting page setup. Printing very large sheets of data and finally printing!

Module V: Advanced Excel Capabilities**(6 Hrs)**

Conditional formatting, importing data and text to columns, Functions – Mathematical, String, IF, AND, OR, Searching: match, search, vlookup, Dates, Misc, Pivot tables, Recording and editing Macros.

Lecture Periods:	Tutorial Periods: 30	Practical Periods:	Total Periods: 30
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Textbooks

1. Michael Alexander, "Excel 2007 Dashboards and Reports for Dummies", John Wiley & Sons, 2011
2. Ellen Monk, Spring Davidson, Joseph Brady, "Problem Solving Cases in Microsoft Access and Excel", Cengage Learning, 2009
3. Colleen Conmy, Bill Hazlett, Bill Jelen, Adrienne Soucy, "Excel for Teachers", Tickling Keys, 2010

Reference Books

1. Noreen Brown, Barbara Lave, Julie Romey, "Beginning Excel 2019", Open Oregon Educational Resources, 2017
2. Greg Harvey, "Excel 2019 All-in-One For Dummies", John Wiley & Sons, 2018
3. John Walkenbach, "Excel 2007 Bible", John Wiley & Sons, 2011
4. Matthew MacDonald, "Excel 2010: The Missing Manual", O'Reilly Media, Inc., 2010



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5. Rob Bovey, Stephen Bullen, Dennis Wallentin, John Green, "Professional Excel Development: The Definitive Guide to Developing Applications Using Microsoft Excel, VBA, and .NET", Addison-Wesley Professional, 2009

Web References

1. <https://www.google.com/search?q=ms+excel+working&oq=MS+Excel+working&aqs=chrome.69j0l3j0l22i30l4.9421jOj4&sourceid=chrome&ie=UTF-8>
2. <https://www.investintech.com/resources/blog/archives/5430-excel-data-tips.html>
3. <https://edu.gcfglobal.org/en/excel2010/working-with-basic-functions/1/>
4. <https://www.online-tech-tips.com/ms-office-tips/microsoft-excel-basics-tutorial-learning-how-to-use-excel/>
5. <https://spreadsheeto.com/how-to-use-excel/>

Power Point Presentation Design and Animation

Module I: Getting acquainted with PowerPoint

(6 Hrs)

Understanding and working with the PowerPoint interface including: the Outline and Slides pane, the Ribbon, Quick Access toolbar, notes pane and the Status Bar.

Module II: Objects and Formatting

(6 Hrs)

Working with objects in PowerPoint. Copying and moving objects. Formatting including the format painter. Fonts and effects. Inserting new slides. Slide layout. Selecting multiple objects. Grouping objects. The different objects that you can include on a slide. Six slides that demonstrate the six content types: Table, Chart, Graphic, Picture, Clip art, Media clip (movie).

Module III: Slide Design

(6 Hrs)

Templates and Slide Masters, How to use themes, masters and templates to make slide design quick and consistent. Layouts and footers. Principles of slide design - Principles to guide good, clean design and formatting of slides. Making your slides clearer. Creating professional-looking slides with real impact.

Module IV: Making an Impact

(6 Hrs)

When and why to use images. How to insert and edit images. Cropping, resizing and manipulating images. Screenshots and videos. Removing picture backgrounds. Applying artistic effects.

Module V: Animation

(6 Hrs)

Adding and controlling transition effects between slides. Detailed animation and transition options. Animating individual elements of text boxes, charts and diagrams. Presenter tools and features. Custom slide shows. Annotating your slide during a talk. Navigating a presentation. Self-running presentations.

Lecture Periods:	Tutorial Periods: 30	Practical Periods:	Total Periods: 30
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Text Books

1. Joan Lambert, "Microsoft PowerPoint step by step 2016", Microsoft Press, 2016
2. Curtis Frye, Joan Preppernau, and Joyce Cox, "Microsoft® Office PowerPoint® 2007 Step by Step", Microsoft Press, 2015
3. John Walkenbach, Michael R. Groh, Herb Tyson, Faithe Wempen, "Office 2010 Library: Excel 2010 Bible, Access 2010 Bible, PowerPoint 2010 Bible, Word 2010 Bible", John Wiley & Sons, 2010

Reference Books

1. Joan Lambert, "Microsoft PowerPoint step by step 2019", Microsoft Press, 2019
2. David W. Beskeen, "Illustrated Course Guide: Microsoft PowerPoint 2013 Advanced" Cengage Learning, 2014
3. Joan Preppernau and Joyce Cox, "PowerPoint 2010", Microsoft Press, 2010
4. "Microsoft PowerPoint 2013", John Wiley and Sons, 2013
5. Ann Shaffer and Katherine T. Pinard, "New Perspectives Microsoft Office 365 & PowerPoint 2016: Intermediate", Course Technology, 2016

Web References

1. <https://smallbusiness.chron.com/bibliography-powerpoint-40572.html>
2. <https://bookboon.com/en/powerpoint-ebooks>
3. <https://penandthepad.com/cite-book-powerpoint-8344519.html>



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4. <https://www.bookdepository.com/category/1931/PowerPoint>

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	Report	Presentation / Demo / Skill Test	
Marks	10	40	50	100



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Department	Biomedical Engineering	Programme: B.Tech.						
Semester	IV	Course Category: MC				*End Semester Exam Type:-		
Course Code	U23BMM303	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Climate Change	2	0	0	-	100	-	100
UNIT- I	Atmosphere and its Components				Periods:6			
Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere- Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.								
UNIT- II	Global Climate				Periods:6			
Account of past climate Environmental indicators and instrumental records Human Footprints on global warming- Predicting future climates- Temperature regime - Extreme climate events								
UNIT- III	Impacts of Climate Change				Periods:6			
Causes of Climate change: Change of Temperature in the environment-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors Agriculture, Forestry and Ecosystem - Water Resources Human Health Industry, Settlement and Society Methods and Scenarios - Projected Impacts for Different Regions- Uncertainties in the Projected Impacts of Climate Change - Risk of Irreversible Changes.								
UNIT- IV	Observed Changes and its Causes				Periods:6			
Climate change and Carbon credits- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks-The Montreal Protocol UNFCCC - IPCC Evidences of Changes in Climate and Environment on a Global Scale and in India.								
UNIT-V	Climate Change and Mitigation Measures				Periods:6			
Clean Development Mechanism -Carbon Trading- examples of future Clean Technology - Biodiesel Natural Compost Eco Friendly Plastic Alternate Energy Hydrogen Bio-fuels-Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices-Carbon sequestration - Carbon capture and storage (CCS) - International and Regional cooperation- Remedial measures.								
Lecture Periods:-		Tutorial Periods: -		Practical Periods:30		Total Periods:30		
Textbooks								
1. Joan Fitzgerald "Greenovation: Urban Leadership on Climate Change, Oxford University Press 2020.								
2. J. David Neelin" Climate change and climate modelling" Cambridge University press (2011).								
3. Robin Moilveen "Fundamentals of weather and climate" Oxford University Press (2nd Edition) (2010),								
4. Andrew Dessler and Edward A. Parson "The Science and Politics of Global Climate Change" 2009								
5. Dash Sushil Kumar, "Climate Change An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.								
Reference Books								
1. Bill McKibben (2012), The Global Warming Reader: A Century of Writing About Climate Change,Penguin.								
2. Jason Smerdon(2009) Climate Change: The Science of Global Warming and Our Energy Future, Columbia University								
3. Adaptation (2006) and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge.								
4. J.M. Wallace and P.V. Hobbs (2006) Atmospheric Science, Elsevier / Academic Press.								
5. Jan C. van Dam, (2003) Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press.,								
Web References								
1. https://nptel.ac.in/courses/105102089/								
2. https://www.warmheartworldwide								
3. https://nptel.ac.in/content/storage								



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Evaluation methods

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



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Department	Mathematics			Programme : B.Tech.							
Semester	IV			Course Category Code: BS		End Semester Exam Type: TE					
Course Code	U23MATC04			Periods/Week		Credit	Maximum Marks				
				L	T	P	C	CAM	ESE	TM	
Course Name	Numerical Methods and Optimization			3	1	-	4	25	75	100	
(Common to EEE, ECE, ICE, BME, MECH, CIVIL & MECHATRONICS)											
Prerequisite	Basic Mathematics										
Course Outcomes	On completion of the course, the students will be able to								BT Mapping (Highest Level)		
	CO1	Solve Algebraic and Transcendental equations								K2	
	CO2	Solve Simultaneous Equations by various Numerical Techniques.								K3	
	CO3	Apply the Numerical Techniques of interpolation in various Intervals.								K3	
	CO4	Solve Linear programming problems by using Optimization Techniques.								K3	
	CO5	Find the solution of Transportation and Assignment Problems.								K3	
UNIT – I	Solution of algebraic and transcendental equations					Periods:12					
Solution of Algebraic and Transcendental equations – Bisection method - Method of False position – Newton Raphson method (single only) – Eigen value and Eigen vector by Power method.										CO1	
UNIT – II	Linear system of equations					Periods:12					
Solutions of Linear system of equations and Matrix Inversion – Gauss Elimination and Gauss - Jordan methods. Iterative methods – Gauss Jacobi – Gauss Seidel.										CO2	
UNIT – III	Interpolation and solution of ordinary differential equations					Periods:12					
Interpolation by Newton’s Forward and Backward Difference formula for equal intervals – Lagrange’s method for unequal intervals. Integration by Trapezoidal and Simpson’s rules (Single integration only). Fourth order Runge-Kutta method for solving first order Differential Equations.										CO3	
UNIT – IV	Linear programming problems					Periods:12					
Linear Programming Problems – Graphical Method – Simplex Method: Big M method – Two phase method.										CO4	
UNIT – V	Transportation and assignment problems					Periods:12					
Transportation Problems – Initial basic feasible solution using North-West Corner rule, Least Cost Method, Vogel’s Approximation Method – Optimality in Transportation Problem by Modified Distribution (MODI) Method. Assignment Problems – Solutions of Assignment Problems by Hungarian Method – Unbalanced Assignment Problems.										CO5	
Lecture Periods:45			Tutorial Periods:15		Practical Periods: -			Total Periods:60			
Textbooks											
1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, “Numerical Methods”, S. Chand Limited, 2008.											
2. R. Panneerselvam “Operations Research” Prentice Hall of India, 2 nd Edition,2004.											
3. P.K. Gupta, D.S. Hira, “Operations Research”, S. Chand, 5 th Edition, 2018.											
Reference Books											
1. Atul Goyal, Madhuchanda Rakshit Suchet Kumar, “Numerical Methods”, New India publishing Agency, 1 st Edition, 2019.											



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2. Rajesh Kumar Gupta, "Numerical Methods - Fundamental and Applications", Cambridge University Press, 1 st Edition, 2019.
3. S.Kalavathy, "Operation Research", Vikas Publishing house, 4 th Edition, 2012.
4. Kevin J. Hastings, "Introduction to the Mathematics of Operations Research with Mathematica", Taylor and Francis, 2 nd Edition, 2019.
5. T. Veerarajan, "Operations Research", McGraw Hill, 1 st Edition, 2018.
Web References
1. https://nptel.ac.in/courses/111106101/
2. https://www.geektonight.com/operation-research-notes-pdf/#.XrXzoP8za00
3. https://freecomputerbooks.com/Numerical-Methods-with-Applications.html
4. https://www.pphmj.com/journals/IJNMA.htm
5. https://nptel.ac.in/courses/106/108/106108056/

* 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	2	2	1	-	1	-	-	-	-	-	1	1	-	-
2	3	3	3	2	-	1	-	-	-	-	-	1	1	-	-
3	3	3	3	2	-	1	-	-	-	-	-	1	1	-	-
4	3	3	3	2	1	1	1	-	-	-	1	1	1	-	-
5	3	3	3	2	1	1	1	-	-	-	1	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



Dr. A. Vijayalakshmi

Department	Computer Science Engineering		Programme : B.Tech							
Semester	IV		Course Category: ES			End Semester Exam Type: TE				
Course Code	U23CSTC03		Periods/Week			Credit	Maximum Marks			
			L	T	P	C	CAM	ESE	TM	
Course Name	Data Structures		3	0	0	3	25	75	100	
(Common to All Branches except CSBS and FT)										
Prerequisite	Any Programming Knowledge									
Course Outcomes	On completion of the course, the students will be able to							BT Mapping (Highest Level)		
	CO1	Compute time and space complexity for given problems							K2	
	CO2	Demonstrate stack, queue and its operation.							K2	
	CO3	Illustrate the various operations of linked list.							K3	
	CO4	Use the concepts of tree for various applications.							K3	
	CO5	Outline the various Tables, Graphs and Sets techniques.							K3	
UNIT - I	Basic Terminologies of Data Structures					Periods:09				
Introduction: Basic Terminologies – Asymptotic Notations: Complexity analysis. Array and its operations - Searching: Linear Search and Binary Search Techniques. Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Shell Sort. Performance and Comparison among the sorting methods.								CO1		
UNIT - II	Stack and Queue Operations					Periods:09				
Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue – Circular Queue – Priority Queue – Deque.								CO2		
UNIT - III	Linked List Operations					Periods:09				
Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing – Searching – Insertion – Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.								CO3		
UNIT - IV	Trees					Periods:09				
Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree – Threaded Binary Tree – Binary Search Tree – Binary Tree Traversals – AVL Tree- Red Black Tree.								CO4		
UNIT - V	Graphs, Tables and Sets					Periods:09				
Graph: Basic Terminologies and Representations – Graph traversal algorithms. Tables: Different types of tables – Hash Table and its operations - Applications. Sets: Representation of Sets- Operations and its applications.								CO5		
Lecture Periods:45		Tutorial Periods:		Practical Periods:			Total Periods:45			
Text Books										
1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Illustrated Edition, Computer Science Press, 2018.										
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2010.										
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 4 th Edition, 2009.										
Reference Books										
1. D. Samanta, "Classic Data Structures", Prentice-Hall of India, Second Edition, 2012.										
2. Robert Kruse, C.L. Tondo and Bruce Leung, "Data Structures and Program Design in c" Prentice-Hall of India, Second Edition, 2007.										
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second. Edition, 2006.										
4. Mark Allen Weiss, " Algorithms, Data Structures and Problem Solving with C++", Illustrated Edition, Addison-Wesley Publishing Company, 1995.										
5. Mark Allen Weiss, " Algorithms, Data Structures and Problem Solving with C++", Addison- Wesley Publishing Company,										



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Illustrated Edition, 1995.

Web References

1. <https://www.geeksforgeeks.org/data-structures/>
2. <https://www.javatpoint.com/data-structure-tutorial/>
3. <https://www.studytonight.com/data-structures/>
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. <https://www.w3schools.in/data-structures-tutorial/intro/>

* 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	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	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 syllab



Dr. A. Vijayalakshmi

Department	Biomedical Engineering			Programme: B.Tech.							
Semester	IV			Course Category: PC			End Semester Exam Type: TE				
Course Code	U23BMT405			Periods/Week		Credit	Maximum Marks				
				L	T	P	C	CAM	ESE	TM	
Course Name	Biomechanics			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)		
	CO 1	Understand the fundamental principles of biomechanics								K2	
	CO 2	Analyse the deformability, strength of bone, modes of loading and failure								K3	
	CO 3	Analyse the elasticity and deformation properties of soft tissues								K3	
	CO 4	Explain the types and mechanics of skeletal joints								K2	
	CO 5	Know the locomotion principles of human body								K2	
UNIT-I	Introduction to biomechanics					Periods: 9					
Scope of mechanics in medicine, mechanics of bone structure, determination of in-vivo elastic modulus. Biofluid mechanics, flow properties of blood.										CO1	
UNIT-II	Hard tissue biomechanics					Periods: 9					
Hard Tissues: Bone structure and composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell and Voight models — anisotropy. Electrical properties of bone, type of fractures, biomechanics of fracture healing.										CO2	
UNIT-III	Soft tissue biomechanics					Periods: 9					
Soft Tissues: Structure and functions of Soft Tissues: Cartilage, Tendon, Ligament, and Muscle; Material Properties: Cartilage, Tendon, Ligament, and Muscle; Modelling: Cartilage, Tendon, Ligament, and Muscle.										CO3	
UNIT-IV	Joints biomechanics					Periods: 9					
Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, hip, knee and ankle.										CO4	
UNIT-V	Movement biomechanics					Periods: 9					
Gait analysis, body and limbs- mass and motion characteristics actions, forces transmitted by joints. Joints forces results in the normal and disable human body, normal and fast gait on the level. Patterns: Push/Throw Continuum Biomechanics of push - like motions, Biomechanics of throw - like motions										CO5	
Lecture Periods: 45		Tutorial Periods: -		Practical Periods: -			Total Periods: 45				
Textbooks											
1. Gerhard A. Holzapfel, Ray W. Ogden, “Mechanics of Biological Tissue”, Springer, 2010. 2. Sean P. Flanagan and Flanagan, “Biomechanics: A case-based Approach”, Jones and Bartlett Publishers, 2018.											



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3. Carol A. Oatis, "The Mechanics and Pathomechanics of Human Movement", Lippincott Williams and Wilkins, 2010.

Reference Books

1. Ozkaya, N, Leger, D, Goldsheyder, D, Nordin, M, "Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation", 4th edition. Springer International Publishing, 2017.
2. Donald R. Peterson and Joseph D. Bronzino, "Biomechanics: principles and applications", third edition. CRC Press, 2011.
3. Ray W. Ogden, "Biomechanics of Soft Tissue in Cardiovascular Systems", Springer Vienna, 2014.
4. Subrata Pal, "Text book of Biomechanics", Viva education Private limited, New Delhi. 2009
5. Susan J. Hall, "Basics Bio Mechanics" 5th Edition, McGraw-Hill Publishing Co, New York, 2007.

Web References

1. <https://tinyurl.com/y9bm4f9q>
2. <https://tinyurl.com/y8osnq6d>
3. <https://tinyurl.com/y78y4cvy>

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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



Dr. A. Vijayalakshmi

Department	Biomedical Engineering			Program: B.Tech.							
Semester	IV			Course Category: PC		End Semester Exam Type: TE					
Course Code	U23BMT406			Periods/Week		Credit	Maximum Marks				
				L	T	P	C	CAM	ESE	TM	
Course Name	Biomedical Instrumentation			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 electrodes and its functions.									K2
	CO2	Understand the different types of electrodes and its placement for various recordings.									K3
	CO3	Analyse bio amplifier and signal conditioning circuits.									K4
	CO4	Explain various techniques for non-electrical physiological measurements.									K3
	CO5	Investigate various assist and respiratory devices.									K3
UNIT – I	Biopotential Electrodes						Periods:9				
Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes, Needle electrodes										CO1	
UNIT – II	Biopotential Measurements						Periods:9				
Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven „s triangle, standard 12 lead system, Principles of vector cardiography. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. Recording of ERG, EOG and EGG										CO2	
UNIT – III	Signal Conditioning Circuits						Periods:9				
Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering										CO3	
UNIT – IV	Measurement of Non-Electrical Parameters						Periods:9				
Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods -Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.										CO4	
UNIT – V	Assist Devices and Respiratory Devices						Periods:9				
Pacemakers - Defibrillators – Audiometry – Hearing aid, Ventilators, Spirometer, Lung Volume and capacities, Pneumo tachometers: different types										CO5	
Lecture Periods: 45		Tutorial Periods:		Practical Periods: -		Total Periods: 45					
Textbooks											
1. R. S. Khandpur, “Biomedical Instrumentation Technology and Applications”, McGraw-Hill Professional, 2014.											
2. Leshie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, “Biomedical Instrumentation and Measurements”, 2nd edition. PHI, 2008.											
3. Raja Rao, C and Guha S.K, “Principles of Medical Electronics and Biomedical Instrumentation”, Orient Longman Publishers, 2001											
Reference Books											
1. R. Anandanatarajan, “Biomedical Instrumentation”, 2nd edition, PHI Learning, 2016.											



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2. Andrew G. Webb, "Principles of Biomedical Instrumentation", Cambridge University Press, 2018.
3. John G. Webster, "Medical Instrumentation: Application and Design", 4th edition. John Wiley and Sons, New York, 2010.
4. A.K. Sawhney, "A Course in Electrical and Electronic measurements and Instruments", DhanpatRai and Sons, 2015
5. M. Arumugam, "Biomedical Instrumentation", Anuradha Agencies Publishers, 2002.

Web References

1. <https://apm.iitm.ac.in/biomedical/sai/>
2. <https://www.youtube.com/watch?v=iK-6q4nnmtA>
3. <https://www.youtube.com/watch?v=8m8yNSaCMpg>

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO1	PO2	PO6	PO1	PO2	PO9	PO1	PO2	PO12	PO1	PO2	PSO3
1	3	3	3	2	2	2	-	-	-	-	-	2	2	1	2
2	3	3	2	2	2	2	-	-	-	-	-	2	2	1	2
3	3	3	2	2	2	2	-	-	-	-	-	2	2	1	2
4	3	3	2	2	2	2	-	-	-	-	-	2	2	1	2
5	3	3	2	2	2	2	-	-	-	-	-	2	2	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



Dr. A. Vijayalakshmi

Department	Biomedical Engineering		Programme: B.Tech.							
Semester	IV		Course Category Code: PC			*End Semester Exam Type: TE				
Course Code	U23BMB401		Periods/Week			Credit	Maximum Marks			
			L	T	P	C	CAM	ESE	TM	
Course Name	Biosignal Processing		2	-	2	3	50	50	100	
Prerequisite										
Course Outcome	On completion of the course, the students will be able to							BT Mapping (Highest Level)		
	CO1	Design and implement IIR digital filters							K4	
	CO2	Design and implement FIR digital filters							K4	
	CO3	Identify the process of analyzing ECG & EEG Signals							K3	
	CO4	Implement the FIR and IIR filters in various applications							K3	
	CO5	Simulates and analyses Bio signals							K3	
UNIT-I	Infinite impulse response filters					Periods:10				
Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.								CO1		
UNIT-II	Finite impulse response filters					Periods:10				
Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.								CO2		
UNIT-III	Biological signal processing					Periods:10				
Preprocessing of ECG signal, QRS detection Methods-Differentiation-based and template-based. Rhythm analysis and Arrhythmia detection algorithms, Automated ECG analysis, Correlation. Detection of EEG Rhythms, Template matching for EEG spike and wave detection, Sleep EEG classification and epilepsy. Medical Applications of Adaptive Noise Cancellation, Speech signal analysis.								CO3		
UNIT- IV	Frequency Analysis of Signals					Periods:15				
List of Experiments 1.Generation of Discrete and Continuous time signals 2.Linear and Circular Convolution 3.Frequency analysis using DFT 4. IIR Filter Design 5. FIR Filter Design								CO4		
UNIT-V	Biosignal Analysis					Periods:15				
List of Experiments 6. ECG Data Compression techniques 7. Detection of QRS Component from ECG signal 8. Analysis of PCG Signal 9. Analysis of EEG Signal 10. Speech signal analysis								CO5		
Lecture Periods:30			Tutorial Periods: -		Practical Periods:30		Total Periods:60			



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Textbooks

1. Rangayyan, R.M."Biomedical signal analysis (Vol. 33)", John Wiley & Sons,2015.
2. Reddy, D.C."Biomedical signal processing: principles and techniques". McGraw-Hill,2005
3. Willis J. Tompkins , "Biomedical Digital Signal Processing", Prentice-Hall of India Pvt. Ltd., 2012

Reference Books

1. Jonathan Wolpaw and Elizabeth Winter Wolpaw, "Brain-Computer Interfaces: Principles and Practice",Oxford University Press, 2012.
2. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", Wiley-India, 2010.
3. StephaneMallat, "Wavelet Tour of Signal Processing: The Sparse Way", Third edition. Academic Press, 2011.
4. Kayvan Najarian Robert Splinter "Biomedical Signal and Image Processing" by Taylor & Francis Group,LLC, Second edition. 2012
5. Li Tan , Jean Jiang "Digital Signal Processing fundamentals and Applications", Second edition,Academic Press, 2013

Web References

1. https://www.youtube.com/watch?v=S_U-s27nPLE
2. <https://www.youtube.com/watch?v=bFeYjFtSsrg>
3. <https://www.journals.elsevier.com/biomedical-signal-processing-and-control/recent-articles>
4. <https://www.classcentral.com/course/swayam-biomedical-signal-processing-10069>
5. https://nptel.ac.in/content/syllabus_pdf/108105101.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	3	3	3	3	2	-	-	-	-	-	1	3	3	-
2	3	3	3	3	3	2	-	-	-	-	-	1	3	3	-
3	2	2	3	3	3	2	-	-	-	-	-	1	3	3	-
4	3	3	3	3	3	2	-	-	-	-	-	1	3	3	-
5	3	3	3	3	3	2	-	-	-	-	-	1	3	3	-

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

Evaluation Method

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



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Practical					
Continuous Assessment Internal Evaluation			End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)			30 marks		40
Conduction of Practical	15 marks		Procedure / Algorithms	5 marks	
Report	10 marks		Experiment / Program Execution	10 marks	
Viva-Voce	5 marks		Result / Output	10 marks	
Total	30 marks		Viva-Voce	5 marks	



Dr. A.Vijayalakshmi

Department	English				Programme: B.Tech.						
Semester	IV				Course Category: HS				*End Exam Type : LE		
Course Code	U23ENPC02				Periods/Week		Credit	Maximum Marks			
					L	T	P	C	CAM	ESE	TM
Course Name	General Proficiency- II				0	0	2	1	50	50	100
Prerequisite	Basics of English Language										
Course Outcomes	On completion of the course, the students will be able to										BT Mapping (Highest Level)
	CO1	Infer ideas to attend international standardized test by broadening receptive and productive skills									K2
	CO2	Interpret the types of writing in different state of affairs									K3
	CO3	Acquire meticulous exposure in speaking and get rid of performance anxiety									K2
	CO4	Articulate the ideas and opinions effectively and coherently									K2
	CO5	Progress the skills to compete in various competitive exams like GATE, GRE, UPSC, etc.									K4
UNIT- I	Career Skills							Periods:6			
Listening: Listening at specific contexts - Speaking: Demonstrative speaking practice using visual aids (charts, graphs, maps) - Reading: Read and Review -Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) - Writing: Integrated Writing Task (TOEFL) - Vocabulary: Synonyms and Antonyms (IELTS)											CO1
UNIT- II	Corporate Skills							Periods:6			
Listening: Listening English news and reproducing in own words - Speaking: Team Presentation - Reading: Short texts and Longer Passages (cloze reading) - Writing: Analytical Writing: Analyzing an issue and Argument task (GRE based) - Vocabulary: Prefix and Suffix											CO2
UNIT- III	Functional Skills							Periods:6			
Listening: Listening TED Talks - Speaking: Brainstorming & Individual Presentation - Reading: Text Completion (GRE Based) - Writing: Picture Inference - Vocabulary: Word Formation											CO3
UNIT- IV	Transferrable Skills							Periods:6			
Listening: Listening Documentaries and making notes - Speaking: Mock Interview - Reading: Read texts on emerging trends - Writing: Agreeing & Disagreeing Essay (IELTS) - Vocabulary: Euphemism, Redundancy, Clichés and Intensifier.											CO4
UNIT-V	Verbal Aptitude - II							Periods:6			
Transformational Grammar: Tenses, Change of Voice, Concord Verbal Ability Enhancement: Letter Series, Coding &Decoding, Sentence Equivalence (GRE)Analytical Reasoning and Logical Reasoning (GATE), Syllogism, One-word Substitution, Jumbled Sentences											CO5
Lecture Periods: -			Tutorial Periods: -			Practical Periods:30				Total Periods:30	
Reference Books											
1. Cullen, Pauline, Amanda French, and Vanessa Jakeman. "The official Cambridge guide to IELTS for academic & general training".Cambridge, 2014. 2. Prasad, Hari Mohan, Sinha, Uma Rani, "Objective English for Competitive Examinations", Tata Mc Graw Hill: Noida,2010. 3. Lougheed, Lin. "Barron's Writing for the TOEFL IBT: With Audio CD". Barron's Educational series, 2008. 4. Grussendorf, Marion, "English for Presentations", Oxford University Press, Oxford, 2007. 5. Murphy, Raymond English Grammar in Use with answers: Reference and Practice for Intermediate students, Cambridge: CUP,2004.											



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Web References

1. <https://www.englishclub.com/grammar/nouns-compound.htm>
2. <https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1>
3. <https://www.grammarwiz.com/phrases-and-clauses-quiz.html>
4. <https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/>
5. <http://www.englishvocabularyexercises.com/general-vocabulary/>

* 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	-	-	-	-	-	-	1	-	3	-	2	-	-	-
2	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
3	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
4	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
5	1	-	-	-	-	-	-	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
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100



Dr. A. Vijayalakshmi

Department	Computer Science Engineering	Programme: B.Tech.						
Semester	IV	Course Category: ES			*End Semester Exam Type: LE			
Course Code	U23CSPC02	Periods/Week			Credit	Maximum Marks		
Course Name	Data Structures Laboratory	L	T	P	C	CAM	ESE	TM
		0	0	2	1	50	50	100

(Common to all Branches Except CSBS and FT)

Prerequisite	Basic Programming Knowledge							
Course Outcomes	On completion of the course, the students will be able to							BT Mapping (Highest Level)
	CO1	Analyse the algorithm's / program's efficiency in terms of time and space complexity.						K3
	CO2	Solve the given problem by identifying the appropriate Data Structure.						K3
	CO3	Solve the problems of searching and sorting techniques.						K3
	CO4	Solve problems in linear Data Structures.						K4
	CO5	Solve problems in non-linear Data Structures.						K4

List of Exercises:

- Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
- Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
- Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
- Write a C program to implement list ADT to perform following operations a) Insert an element into a list.
 - Delete an element from list
 - Search for a key element in list
 - count number of nodes in list.
- Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
- Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
- Write a C program to perform the following operations:
 - Insert an element into a binary search tree.
 - Delete an element from a binary search tree.
 - Search for a key element in a binary search tree.
- Write a C program that use recursive functions to traverse the given binary tree in
 - Preorder
 - Inorder
 - Postorder.
- Write a C program to perform the AVL tree operations.
- Write a C program to implement Graph Traversal Techniques.
- Write a C program to implement the Set operations.
 - Union
 - Intersection
 - Difference.

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

- Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd Edition, 2019.
- Tenebaum Aaron M, "Data Structures using C", Pearson Publisher, 1st Edition, 2019.
- Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India 1st Edition, 2017.
- Reema Thareja, "Data structures using C", Oxford University, 2nd Edition, 2014.
- Gav.pai, "Data Structures and Algorithms", McGraw-Hill India, 1st Edition, 2013.



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Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. <https://www.w3schools.in/data-structures-tutorial/intro/>
3. <https://nptel.ac.in/courses/106103069/>
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. <https://nptel.ac.in/courses/106103069>

* 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	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	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



Dr. A. Vijayalakshmi

Department	Biomedical Engineering	Programme : B.Tech.					
Semester	IV	Course Category: PC			*End Semester Exam Type: LE		
Course Code	U23BM P404	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE
Course Name	Biomedical Instrumentation Laboratory	0	0	2	1	50	50

Prerequisite							
Course Outcomes	On completion of the course, the students will be able to						BT Mapping (Highest Level)
	CO1	Determine the heart axis in different leads and analyse the heart rate					K4
	CO2	Examine the blood pressure using sphygmomanometer					K4
	CO3	Investigate cardiac efficiency test, tuning fork tests for hearing					K4
	CO4	Explain the stimulation of eye, near point and near response					K3
	CO5	Demonstrate Artificial respiration and Cardio Pulmonary Resuscitation					K4

LIST OF EXPERIMENTS

1. Determination of Heart Axis by measuring QRS amplitude in the different leads (Lead I, Lead II and Lead III) and Plotting Einthoven Triangle
2. Recording of blood pressure using sphygmomanometer and stethoscope
3. Measurements of various time intervals between each segment of ECG, Measurement of R-R interval and calculation of Heart Rate
4. Cardiac Efficiency Test
5. Measurement of Visually Evoked Potential
6. Galvanic Skin Resistance (GSR) Measurement
7. Peripheral pulse signal in different physical posture
8. EMG Signal for different stress on the muscle
9. Recording and interpretation of Heart sounds
10. Demonstration of Artificial respiration and Cardiopulmonary Resuscitation
11. Determination of Nerve conduction velocity

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

1. A.K.Sawhney, "A Course in Electrical and Electronic measurements and Instruments" Dhanpat Rai and Sons, 2000.
2. Leshie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd edition. PHI, 2018.
3. Raja Rao, C and Guha S.K, "Principles of Medical Electronics and Biomedical Instrumentation", Orient Longman Publishers, 2001



Reference Books

1. R. Anandanatarajan, Biomedical Instrumentation. PHI Learning, 2009.
2. Andrew G. Webb, Principles of Biomedical Instrumentation. Cambridge University Press, 2018.
3. John G. Webster, "Medical Instrumentation: Application and Design", 4th edition. John Wiley and Sons, New York, 2010.
4. A.K. Sawhney, "A Course in Electrical and Electronic measurements and Instruments", Dhanpat Rai and Sons, 2015
5. M. Arumugam, "Biomedical Instrumentation", Anuradha Agencies Publishers, 2002.

Web References

1. <https://www.uvpce.ac.in/content/biomedical-transducers-and-biosensors-laboratory>
2. <https://apm.iitm.ac.in/biomedical/sai/>
3. <https://www.electrical4u.com/introduction-to-biomedical-instrumentation/>

* 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	2	2	2	-	-	-	-	-	2	2	2	2
2	3	3	2	2	2	2	-	-	-	-	-	2	2	2	2
3	3	3	2	2	2	2	-	-	-	-	-	2	1	2	2
4	3	3	2	2	2	2	-	-	-	-	-	2	1	2	2
5	3	3	2	2	2	2	-	-	-	-	-	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
	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	U23BMC4XX	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Certification Course – IV	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	IV		Course Category: AEC			*End Semester Exam Type: -			
Course Code	U23BMS402		Periods/Week			Credit	Maximum Marks		
			L	T	P	C	CAM	ESE	TM
Course Name	Skill Enhancement Course 2*		0	0	2	-	100		100
Prerequisite									
Course Outcomes	On completion of the course, the students will be able to							BT Mapping (Highest Level)	
	CO1	Knowledge about electrical and electronic equipment that realize specified testing functions						K2	
	CO2	Analyze the different types of testing in medical equipment						K3	
	CO3	Understand the concept of PCB						K2	
	CO4	Gain adequate knowledge of PCB designing						K3	
	CO5	Acquire presentation skills using ICT						K2	
Course Content:									
Testing of Electronic and Medical Devices									
MODULE 1: Testing of Electrical Equipment (6 Hrs)									
AC, DC power supply, Grounding, shielding, Guarding, insulation testing, insulation resistance measurement, Types of Circuit Breakers, Rating – Testing of circuit breakers –Transformer testing- Earthing –Earth wires - Earthing of appliances – contactor, relay testing–CT and PT, Panel wiring- Megger-Testing equipment and instruments.									
MODULE 2: Testing of Electronic Components (6 Hrs)									
Troubleshooting of PCB boards, Calibration of analog and digital sensor probe, Display interface, DC Power supply design, testing, Safe electrical practice, Cables and standard, Fuse									
MODULE 3: Testing of Surgical Equipment (6 Hrs)									
Functions and operating procedure-Testing and maintenance of Heart lung machine, surgical lights, ventilator, patient monitor, anesthesia machine, dialyzer, surgical tools.									
MODULE 4: Testing of ICU Equipment (6 Hrs)									
X-ray machines, Testing of ECG recorders, incubator, baby warmer, infusion pumps, annual maintenance, contract requirements, vendor services, quality and safety standards.									
MODULE 5: Life Cycle Management of Medical Equipment (6 Hrs)									
Cost of the medical equipment, maintenance cost, replacement analysis, managing equipment service, decision making, extracting optimal benefit from medical equipment over its life cycle, Case study.									
Lecture Periods:			Tutorial Periods:			Practical Periods: 30		Total Periods:30	
Reference Books									
1. Joseph. J Carr, John M Brown, Introduction to Biomedical Equipment Technology, John Wiley& Sons, New York, 4th edition, 2008.									
2. Keith Willson, Keith Ison, Slavik Tabakov, “Medical equipment management”, CRC Press, UK, 2014.									
3. Jenny Dooley,John Lehnert Virginia Evans, “Career Paths: Medical Equipment Repair”, Express Publishing, UK,2018									
4. Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation systems”, Cengage Learning Technology & Engineering									

2010.

5. David Herres, "Troubleshooting and Repairing Commercial Electrical Equipment", McGraw Hill Professional edition, 2013.

Web References

1. <https://www.element.com/connected-technologies/electronics-test-methods>
2. <https://www.electronics-notes.com/articles/test-method>
3. <https://www.element.com/more-sectors/medical-device>
4. <https://www.metlabs.com/industries/medical-device-testing/>
5. <https://www.intertek.com/medical/>

PCB Board Designing:

MODULE 1: Introduction to PCB Designing Concepts

(6 Hrs)

Introduction & Brief History - What is PCB, Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials? Introduction to Electronic design Automation (EDA) - Brief History of EDA, Latest Trends in Market, How it helps and why it requires, Different EDA tools, Introduction to SPICE and PSpice Environment, Introduction and Working of PROTEUS.

MODULE 2: Component Introduction and their Categories

(6 Hrs)

Types of Components - Active Components, Passive Components, Component Package Types - Through Hole Packages: Axial lead o Radial Lead, Single Inline Package (SIP), Dual Inline Package (DIP), Transistor Outline (TO), Pin Grid Array(PGA), Through Hole Packages: Metal Electrode Face(MELF), Leadless Chip Carrier(LCC), Small Outline Integrated Circuit(SOIC), Quad Flat Pack(QFP) and Thin QFP (TQFP), Ball Grid Array(BGA), Plastic Leaded Chip Carrier(PLCC)

MODULE 3: Introduction to Development Tools

(6 Hrs)

Introduction to PCB Design using OrCAD tool, Introduction to PCB Design using PROTEUS tool

MODULE 4: Detailed Description and Practical of PCB Designing

(6 Hrs)

PCB Designing Flow Chart - Schematic Entry, Net listing, PCB Layout Designing, Prototype Designing - Design Rule Check (DRC), Design for Manufacturing (DFM), PCB Making - Printing, Etching, Drilling, Assembly of components. Description of PCB Layers - Electrical Layers, Mechanical Layers, Documentation Layers, PCB Materials, Rules for Track, Study of IPC Standards

MODULE 5: Designing and Fabrication Process

(6 Hrs)

Starting the PCB designing, Understanding the schematic Entry, Creating Library & Components, Drawing a Schematic, Flat Design / hierarchical Design, Setting up Environment for PCB, Design a Board Auto routing - Introduction to Auto routing, Setting up Rules, Defining Constraints, Auto router Setup, PCB Designing Practice, Post Designing & PCB Fabrication Process.

Lecture Periods:	Tutorial Periods:	Practical Periods: 30	Total Periods:30
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Reference Books

1. Christopher T Robertson, Printed Circuit Board Designer's Reference; Basics, Prentice Hall Modern Semiconductor Design, 2003
2. Bosshart, Printed Circuit Boards: Design and Technology, Tata McGraw-Hill Education, 1983
3. R. S. Khandpur, Printed Circuit Boards, McGraw-Hills, 2005.
4. Charles A. Harper, High Performance Printed Circuit Boards, McGraw Hill Professional, 2000



5. Jon Varteresian, Fabricating Printed Circuit Boards, Newnes, 2002

Web References

1. https://www.electronics-notes.com/articles/analogue_circuits/pcb-design/how-to-design-pcb-board-basics.php
2. <https://www.circuitbasics.com/make-custom-pcb/>
3. <https://learn.sparkfun.com/tutorials/pcb-basics/all>
4. <https://www.pcbpower.com/>
5. <https://www.build-electronic-circuits.com/pcb-design/>

Presentation Skills using ICT:

The methodology used is “learning by doing”, a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

CT skills

- Understand ICT work flow in cloud computing.
- Manage multitasking.
- Deal with main issues using technology in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Teaching tools

- Different ways to create audio visual activities.
- Handle audio visual editors.
- Collaborative working.
- Individualize learning experience.
- Get instant feedback from students.

Each one of the students will be assigned an ICT Topic and the student has to conduct detailed study and have to prepare a report, running to 15 or 20 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee for a total of 100 marks. The marks attained or this course is not considered for CGPA calculation.

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	Report	Presentation / Demo / Skill Test	
Marks	10	40	50	100



Department	Biomedical Engineering	Programme: B.Tech.						
Semester	IV	Course Category: MC				*End Semester Exam Type:-		
Course Code	U23BMM404	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ES E	TM
Course Name	Right to Information and Good Governance	2	0	-	-	100	-	100
UNIT- I	Introduction				Periods:6			
Conceptual background - Right to know - Open Government - Transparency in governance and accountability - Right to information under the Indian Constitution - Article 19 (1)(a) and Article 21 of the Constitution - Role of NGOs and movement for right to information - Right to Information Act, 2005 - Scope and objectives.								
UNIT- II	Obligation of Public Authorities				Periods:6			
Obligations of public authorities: Section 4 Designation of Public Information Officers: Section 5 Disposal of request: Section 7 Exemption from disclosure of information: Section 8 Grounds for rejection to access in certain cases: Section 9 Severability: Section 10 Third party information: Section 11								
UNIT- III	Central and State Information Commission				Periods:6			
Constitution of Central and State Information Commissions Terms of office and conditions of service Removal of Chief Information Commissioner or Information Commissioner. Powers and functions of Information Commissions.								
UNIT- IV	Judiciary and Right to Information Act				Periods:6			
Protection of right to access the information - Role of the Supreme Court and High Courts Recent attempts of dilution of the right to information Law								
UNIT-V	Right to Information Act, 2005 and its relevance to other laws				Periods:6			
Public Records Act, 1993 Whistle Blowers Protection Act, 2014 Official Secrets Act, 1923								
Lecture Periods: 30		Tutorial Periods:		Practical Periods:		Total Periods:30		

* TE – Theory Exam, LE – Lab Exam

Evaluation methods

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

A. V.

Dr. A.Vijayalakshmi

B.Tech. Biomedical Engineering

PROFESSIONAL ELECTIVE - I

Department	Biomedical Engineering					Programme: B.Tech						
Semester	IV					Course Category: PE		End Semester Exam Type:- TE				
Course Code	U23BME401					Periods/Week		Credit	Maximum Marks			
						L	T	P	C	CAM	ESE	TM
Course Name	Medical Physics					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	Comprehend the significance and role of non-ionizing radiation in Medical Applications										K2
	CO2	Understand radioactive decay and production of radio nuclides.										K2
	CO3	Understand the concepts of different interaction of radiation with matter										K2
	CO4	Discuss the measurement of ionizing radiation										K3
	CO5	Enumerate the effect of ionizing radiation in human body										K3
UNIT-I	Nonionizing radiation and its medical application							Periods: 09				
Light- Physics of light, Intensity of light color vision and limits of vision sound - Normal sound levels – Ultrasound fundamentals- Generation of ultrasound (Ultrasound Transducer) Interaction of Ultrasound with Materials- Reflection and Refraction – Absorption and Scattering Nonionizing Electromagnetic Radiation, Tissue as a leaky dielectric — Relaxation process- overview of non-ionizing radiation effects- low frequency effect- high frequencyeffect.												CO1
UNIT-II	Principles of radioactive nuclides							Periods: 09				
Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Decay series, Production of radionuclides – Cyclotron produced Radionuclide-Reactor produced Radionuclide-fission and electron Capture reaction, radionuclide Generator-Milking process – Linearaccelerator, Radionuclide used in medicine and Technology.												CO2
UNIT-III	Interaction of radiation with matter							Periods: 09				
Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of Gamma radiation with matter- Photoelectric effect, Compton Scattering, Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance.												CO3
UNIT-IV	Principles of radiation detection and dosimeters							Periods: 09				
Principles of radiation detection, Properties of dosimeters, Theory of gas filled detectors, Ionization Chamber, Proportional chamber, G.M. Counter, Film dosimetry, luminescence dosimetry, scintillation detectors, Radiation detection instruments, Area survey meters, Personal Radiation monitoring device, Film badge.												CO4
UNIT-V	Radiation effects							Periods: 09				
Acute Radiation Effects - The concept of LD 50 – Radiation syndromes- Central nervous system syndrome - Gastrointestinal syndrome –Bone Marrow syndrome Delayed Effects of Radiation -Stochastic and Deterministic effects Late Deterministic effect in different organs and tissues.												CO5
Lecture Periods: 45			Tutorial Periods: -			Practical Periods:			Total Periods: 45			



Textbooks															
1. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine", Fourth Edition, Springer, 2013. 2. ThayalanKuppusamy, "Basic Radiological Physics" Second Edition, Jaypee Brothers Medical Publishers, 2017. 3. Kwan Hoong Ng, "Problem and solutions in Medical Physics: Diagnostic imaging Physics", Third volume, CRC press, 2011.															
Reference Books															
1. Muhammad Maqbool, "An Introduction to Medical Physics", Springer, 2018. 2. SlavikTabakov, "Encyclopedia of Medical Physics", volume 1, CRC press, 2012. 3. Andrew Webb, Nadrine Barrie Smith, "Introduction to Medical Imaging: Physics, Engineering and Clinical Applications, Cambridge University press, 2010. 4. Faiz M Khan, "Khan's Lecture: Handbook of the Physics of Radiation Therapy", 2011. 5. Faiz M Khan, John P Gibbons, "Khan's the physics of Radiation Therapy" Fifth Edition, 2014.															
Web References															
1. https://q.co/kgs/CBBKUU https://en.m.wikipedia.org/wiki/Medical_physics 2. https://www.medphys.org/ 3. https://physicsworld.com/c/medical-physics/ 4. https://www.classcentral.com/course/medical-applications-particle-accelerato-12557															

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	-	-	-	-	3	-	-
2	3	3	-	-	-	-	-	1	-	-	-	-	3	-	-
3	3	3	2	-	-	-	-	1	-	-	-	-	3	-	-
4	3	3	2	3	3	-	-	1	-	-	-	-	3	-	2
5	3	3	2	3	3	-	2	1	-	-	-	-	3	-	-

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



Department	Biomedical Engineering				Programme: B.Tech.							
Semester	IV				Course Category: PE		End Semester Exam Type: TE					
Course Code	U23BME402				Periods/Week		Credit	Maximum Marks				
					L	T	P	C	CAM	ESE	TM	
Course Name	Environmental Biotechnology				3	1	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 the basic concepts of environmental biotechnology									K2	
	CO2	Familiarize with the biodegrading and bioremediation modules and its functions									K2	
	CO3	Describe the principles of microbiological treatment technologies to clean up contaminated environments.									K3	
	CO4	Explain the replacement of conventional treatment methodologies by using biocatalyst and bioreactors									K2	
	CO5	Understand the various bioproducts production and composting technology									K3	
UNIT – I	Introduction						Periods:9					
Biotechnology in the reduction of carbon dioxide emission- Microbial flora of soil - Microbial treatment of heavy Metal — bioleaching, bioaccumulation, biosorption and bioprecipitation Understand the various bioproducts production and composting technology of heavy metals - Soil, water and air - sources and effects - Removal of Pollutants.											CO1	
UNIT – II	Biodegradation and bioremediation						Periods:9					
Aerobic degradation of aliphatic and aromatics compounds - Anaerobic degradation of aromatic compounds - Biodegradation of herbicides and pesticides - Remediation Technologies - Bioventing, bio sparging and bio slurping, phytoremediation – Bio desulphurization of coal and oil - microbial treatment of oil pollution.											CO2	
UNIT – III	Microbial treatment of waste and wastewater						Periods:9					
Biological treatment of anaerobic and aerobic- methanogenesis, methanogenic, acetogenic- Use of genetically engineered organisms - Biotechnological Processes in waste - water treatment; Applications include treatment of municipal and industrial wastewaters.											CO3	
UNIT – IV	Biocatalysts and bioreactors						Periods:9					
Enzymes isolation, whole cell systems - Biocatalytic Application - Advantages & Disadvantages- Design of activated sludge process and anaerobic digestion system - Trickling Filter - Rotating biological contactors - Fluidized bed reactor - Up-flow anaerobic sludge blanket reactor (UASB) - High-rate anaerobic wastewater treatment.											CO4	
UNIT – V	Bioproducts and renewable sources						Periods:9					
Biofertilizers – Biopesticides - Biofuel production – Bioethanol – Biohydrogen – Biodiesel - Bioplastics and biopolymers - Composting technologies, composting systems, compost quality.											CO5	
Lecture Periods: 45			Tutorial Periods: -			Practical Periods: -			Total Periods: 45			
Textbooks												
1. Bhattacharya B. C. and Banerjee R, “ Environmental Biotechnology”, Oxford University Press, 2017.												
2. Jordening H. J. and Winter J., “Environmental Biotechnology: Concepts and Application”, Wiley ,2015.												
3. Bruce Rittmann and Perry McCarty,” Environmental Biotechnology”, McGraw-Hill, 2011.												
Reference Books												
1. W.D. Grant & P.E. Long, Blakie, Environmental Microbiology, Springer, 2019.												
2. H. Polasa, Microbial Gene Technology, South Asian Publishers, 2011.												
3. D. L. Wise, Biotreatment Systems. CRC Press, 2010.												
Web References												
1. https://en.wikipedia.org/wiki/Environmental_biotechnology												

2. <http://dbtindia.gov.in/schemes-programmes/research-development/energy-environment-and-bio-resource-based-applications-0>

3. <https://www.hindawi.com/journals/scientifica/si/269412/>

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO1	PO2	PO6	PO1	PO2	PO9	PO1	PO2	PO12	PO1	PO2	PSO3
1	2	2	2	-	-	2	-	-	-	-	-	2	2	-	-
2	2	2	2	-	-	2	-	-	-	-	-	2	2	-	-
3	2	2	3	2	-	2	-	-	-	-	-	2	2	-	-
4	2	2	2	2	2	2	-	-	-	-	-	2	2	-	-
5	2	2	2	2	2	2	-	-	-	-	-	2	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



Department	Biomedical Engineering				Programme: B.Tech.							
Semester	IV				Course Category: PE		End Semester Exam Type: TE					
Course Code	U23BME403				Periods/Week		Credit	Maximum Marks				
					L	T	P	C	CAM	ESE	TM	
Course Name	Biometric Systems				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 the knowledge of engineering principles underlying biometric systems									K2	
	CO2	Apply algorithms to model fingerprint									K3	
	CO3	Classify different face recognition and hand geometry pattern									K3	
	CO4	Analyze the design and performance of biometrics									K3	
	CO5	Explain various computations of authentication methods									K2	
UNIT – I	Introduction to biometrics							Periods:9				
Introduction and background – biometric technologies – passive biometrics – active biometrics - Biometric systems – Enrollment – templates – algorithm – verification – Biometric applications – biometric characteristics- Authentication technologies –Need for strong authentication - Protecting privacy and biometrics and policy – Biometric applications – biometric characteristics.										CO1		
UNIT – II	Fingerprint technology							Periods:9				
History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques – fingerprint quality assessment – computer enhancement and modeling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching										CO2		
UNIT – III	Face recognition and hand geometry							Periods:9				
Introduction to face recognition, Neural networks for face recognition – face recognition from correspondence maps Hand geometry – scanning – Feature Extraction - Adaptive Classifiers - Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithms – Biometric fusion.										CO3		
UNIT – IV	Multimodal biometrics and performance evaluation							Periods:9				
Voice Scan – physiological biometrics –Behavioral Biometrics - Introduction to multimodal biometric system – Integration strategies – Architecture – level of fusion – combination strategy – training and adaptability – examples of multimodal biometric systems – Performance Evaluation-Statistical Measures of Biometrics – FAR – FRR – FTE EER – Memory requirement and allocation.										CO4		
UNIT – V	Biometric authentication							Periods:9				
Introduction - Biometric Authentication Methods - Biometric Authentication Systems – Biometric authentication by fingerprint -Biometric Authentication by Face Recognition. Expectation-Maximization theory - Support Vector Machines. Biometric authentication by fingerprint – biometric authentication by hand geometry- Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC) – Multibiometrics and Two-Factor Authentication. Voice and Gait authentication.										CO5		
Lecture Periods: 45			Tutorial Periods: -			Practical Periods: -			Total Periods: 45			
Textbooks												
1. Joseph N. Pato, Lynette I. Millette, “Biometric Recognition: Challenges and Opportunities”, 2010.												
2. Zhenan Sun, Jianhuang Lai, Xilin Chen, Tieniu Tan, “ Biometric Recognition” Sixth Chinese conference, 2011.												
3. Anil Kumar Jain, Arun A Ross, KarthikNandakumar, “Introduction to Biometrics”, Springer, 2011.												
Reference Books												
1. Ravi Das, “Biometric Technology: Authentication, Biocryptography and cloud based architecture”, CRC Press, 2014.												
2. Sebastien Marcel, Mark S Nixon, Stan Z. Li, “Handbook of Biometric Anti- spoofing”, Springer, 2014.												
3. Mohammad S Obaidat, IssaTraoreIssacWoungang, “Biometric- Based Physical and cybersecurity systems”												

Springer, 2018.

4. Amine Nait-ali, "Hidden Biometrics when biometric security meets Biomedical Engineering", Springer, 2019.

5. Ted Dunstone, "Biometric system and Data Analysis", Springer, 2010.

Web References

1. <https://www.mooc-list.com/tags/biometric>

2. <https://www.coursera.org/lecture/usable-security/biometric-authentication-RXVog>

3. <https://www.udemy.com/course/biometrics/>

4. <https://nptel.ac.in/courses/106/104/106104119/>

5. http://www.scholarpedia.org/article/Biometric_authentication

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO1	PO2	PO6	PO1	PO2	PO9	PO1	PO2	PO12	PO1	PO2	PSO3
1	3	1	1	-	1	-	-	1	-	-	-	-	3	2	-
2	3	2	2	2	2	-	-	1	-	-	-	-	3	2	-
3	3	2	2	2	2	-	-	1	-	-	-	-	3	2	-
4	3	2	2	2	2	-	-	1	-	-	-	-	3	2	-
5	3	2	2	2	2	-	-	1	-	-	-	-	3	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



Department	Biomedical Engineering			Programme: B.Tech.							
Semester	IV			Course Category: PE		End Semester Exam Type: TE					
Course Code	U23BME404			Periods/Week		Credit	Maximum Marks				
				L	T	P	C	CAM	ESE	TM	
Course Name	Hospital Equipment Safety and Management			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	Assess practice-based learning and improvement in quality and health policies for patients								K2	
	CO2	Increase the trend for developing educational interventions in patient safety								K2	
	CO3	Know the necessity of improving standard and quality of the hospital								K2	
	CO4	Gain the roles and responsibilities of hospital staffs in various functions of hospital								K3	
	CO5	able to reach the hospital management standard for the patient safety								K4	
UNIT – I	Clinical engineering					Periods:9					
Clinical engineering program, Educational responsibilities, Role to be performed by them in hospital, Staff structure in hospital — HIS. Need for evolving health policy, Health organization in state, Health financing system, Health education, Health insurance, Health legislation.										CO1	
UNIT – II	Hospital and industrial organization					Periods:9					
Difference between hospital and industrial organization, Levels of training, Steps of training, Developing training program, Evaluation of training, Wages and salary, Employee appraisal method.										CO2	
UNIT – III	Standardization					Periods:9					
Necessity for standardization, Indian Standards, FDA, AERB, Joint Commission of Accreditation of hospitals, ICRP and other standard organization, methods to monitor the standards.										CO3	
UNIT – IV	Strategic management in hospitals					Periods:9					
Nature and value of strategic management in hospitals - Awareness on the application of IT in Various functions of Hospital. Application of statistical tools in the areas of Health services. Introduction to support services — Disaster management, Ambulance services, Laundry services, Civil Assets.										CO4	
UNIT – V	Safety measures					Periods:9					
Elements of Safety - Safety Publications and Standards Organizations - Orientation to Laboratory Safety - Types of risks in the hospitals - factors of environment - Safety showers and Eye Washes — Radiation hazards — radiation detection — safety measures — standards. Ergonomics - Flammables and Explosives — Formaldehydes - PEL Standards and Calculations - Material Safety - Organization of Safety in the hospitals.										CO5	
Lecture Periods: 45		Tutorial Periods: -		Practical Periods: -		Total Periods: 45					
Textbooks											
1. Joydeep Das Gupta, “Hospital Administration and Management: A Comprehensive Guide”, Jaypee Brothers Medical Publishers, 2015.											
2. Saxena.M, “Hospital Management”, CBS Publishing, First edition, 2016.											
3. Girdhar J Gyani and Alexander Thomas, “Handbook of Healthcare quality and patient safety” Second edition, Jaypee brothers medical publisher, 2019.											
Reference Books											
1. Sonu Dr. Goel, “Textbook of Hospital Administration”, Elsevier, 2014.											
2. William Charney,”Handbook of Modern Hospital Safety”, CRC press, Second edition, 2010.											
3. Ramani. K. V, “Hospital Management”, Pearson, 2011.											
4. Arnold D. Kalcizony& Stephen M. Shortell, “Health Care ManagementII”, Sixth Edition,Cengage Learning, 2011.											

5. Cindy Taylor, "The Hospital Safety Professional's Handbook", Fifth Edition, 2015.

Web References

1. https://en.wikipedia.org/wiki/Medical_equipment_management
2. http://www.who.int/hac/techguidance/preparedness/hospital_safety_index_forms.pdf
3. <https://www.who.int/news-room/fact-sheets/detail/patient-safety>
4. <https://www.coursera.org/browse/health/healthcare-management>
5. <https://www.who.int/management/newitems/en/index1.html>

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO1	PO2	PO6	PO1	PO2	PO9	PO1	PO2	PO12	PO1	PO2	PSO3
1	2	2	2	-	-	2	-	-	-	-	-	2	2	-	-
2	2	2	2	-	-	2	-	-	-	-	-	2	2	-	-
3	2	2	3	2	-	2	-	-	-	-	-	2	2	-	-
4	2	2	2	2	2	2	-	-	-	-	-	2	2	-	-
5	2	2	2	2	2	2	-	-	-	-	-	2	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

A. 

Department	Biomedical Engineering			Programme: B.Tech.							
Semester	IV			Course Category: PE		End Semester Exam Type: TE					
Course Code	U23BMECO1			Periods/Week		Credit	Maximum Marks				
				L	T	P	C	CAM	ESE	TM	
Course Name	Communication Systems			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 the various Analog modulation techniques								K2	
	CO2	Gain knowledge in Digital modulation techniques								K3	
	CO3	Knowledge about fiber optic and satellite communication systems								K2	
	CO4	Analyse spread spectrum and multiple access techniques								K3	
	CO5	Realize the importance of wireless communication								K3	
UNIT – I	Analog modulation					Periods:9					
Need for modulation - Amplitude modulation – Frequency spectrum of AM wave – Representation of AM – Power relation – Frequency modulation – Frequency spectrum of FM wave –AM transmitter – FM transmitter – Super heterodyne AM receiver –FM receivers.										CO1	
UNIT – II	Digital modulation					Periods:9					
Principles of pulse modulation – sampling theorem, PAM, PWM, PPM, Conversion of PWM wave to PPM wave – Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM, PPM – An introduction to digital modulation systems – PCM, DPCM, Delta Modulation, ADM, ASK, FSK and PSK.										CO2	
UNIT – III	Fiber optic and satellite communication					Periods:9					
Need for fiber optics- principle of light transmission through a fiber- fiber classification-fiber losses- Light sources and photo detectors- Block diagram of a fiber optic system - Power budget analysis for an optical link- Recent medical application of fiber optics. Block diagram of a satellite communication system, Satellite Orbits, satellite parameters, satellite link model, GPS services.										CO3	
UNIT – IV	Spread spectrum and multiple access techniques					Periods:9					
Pseudo-noise sequence, DS spread spectrum, FH spread spectrum, multiple access techniques –TDMA and FDMA, source coding of speech for wireless communication.										CO4	
UNIT – V	Wireless communication					Periods:9					
Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand off. Introduction to 4G & 5G technologies.										CO5	
Lecture Periods: 45			Tutorial Periods: -		Practical Periods: -		Total Periods: 45				
Text Books											
1. Wayne Tomasi, “Advanced Electronic Communication Systems”, Sixth Edition, Pearson Education, 2010.											
2. Kennedy Davis, “Electronic Communication Systems”, Fifth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.											
3. Rappaport T.S, "Wireless Communications: Principles and Practice", Second Edition, Pearson Education, 2010											
Reference Books											
1. Simon Haykin, “Communication Systems”, Fourth Edition, John Wiley and Sons, 2009.											
2. William C.Y. Lee, “Mobile Cellular Telecommunication Systems”, McGraw Hill International Edition, Third edition, 2008.											
3. H.Taub, D L Schilling and G Saha, “Principles of Communication”, Third Edition, Pearson Education, 2010											

4. B. P.Lathi, "Modern Analog and Digital Communication Systems", Third Edition, Oxford University Press,
5. 2009
6. Martin S.Roden, "Analog and Digital Communication System", Fifth Edition, Prentice Hall of India, 2012.

Web References

1. <https://nptel.ac.in/courses/108104091/>
2. <https://www.docsity.com/en/lecture-notes-of-intro-to-communication-systems/4580827/>
3. <https://nptel.ac.in/courses/117/105/117105143/>
4. <https://nptel.ac.in/courses/108104091/>
5. <https://www.docsity.com/en/lecture-notes-of-intro-to-communication-systems/4580827/>

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO1	PO2	PO6	PO1	PO2	PO9	PO1	PO2	PO12	PO1	PO2	PSO3
1	3	3	2	1	2	-	-	-	-	3	1	1	2	2	-
2	3	2	2	1	2	-	-	-	-	3	1	1	2	2	-
3	3	3	-	1	1	-	-	-	-	3	1	1	2	2	-
4	3	2	-	1	1	-	-	-	-	3	1	1	2	2	-
5	3	3	2	1	2	-	-	-	-	3	1	1	2	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



Annexure – II**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	Self-Assembly of Nanostructures	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.

Department	Biomedical Engineering			Programme : B.Tech.						
Semester	IV			Course Category Code: PC			End Semester Exam Type: TE			
Course Code	U23BHM401			Periods/Week			Credit	Maximum Marks		
				L	T	P	C	CAM	ESE	TM
Course Name	Biological Nanostructure			3	1	0	4	25	75	100
Prerequisite	-									
Course Outcome	On completion of the course, the students will be able to									BT Mapping (Highest Level)
	CO1	Understand the fundamental principles and concepts of biological nanostructures								K2
	CO2	Analyze the relationship between the structure and function of biological molecules								K3
	CO3	Explain the principles of nanoengineering in biology and its applications in designing								K2
	CO4	Gain knowledge in nanocomposites enhance material properties and performance.								K3
	CO5	Gain knowledge in diverse applications of nanocomposites in various industries.								K2
UNIT – I	Introduction to Biological Nanostructures						Periods:9			
Introduction to biological nanostructures: Proteins, DNA, RNA, lipids, and polysaccharides at the nanoscale - Natural vs. synthetic nanostructures: Comparison and examples - Cytoskeleton and Molecular Motors - microtubules, actin filaments, intermediate filaments - Molecular motors and their nanoscale movements within the cell.										CO1
UNIT – II	Design and Synthesis of Nanostructures						Periods:9			
Synthesis Techniques for Nanocomposites - Chemical vapor deposition (CVD), sol-gel, and other synthesis methods. - Nanoparticle functionalization for biological compatibility. - Electron microscopy, atomic force microscopy (AFM), and spectroscopic techniques - Mechanical, thermal, and biological characterization of nanocomposites - Mimicking natural structures for enhanced properties - Biomimetic synthesis approaches and their applications.										CO2
UNIT – III	Biophysical Properties						Periods:9			
Physical and chemical properties of biological nanostructures - Interactions at the nanoscale: Forces, binding dynamics, and self-assembly Characterization techniques for biological nanostructures: Biological Interactions and Biocompatibility - Understanding interactions between nanocomposites and biological systems - Assessing biocompatibility and toxicity for biomedical applications.										CO3
UNIT – IV	Functionalization and Engineering of Nanostructures						Periods:9			
Principles of nanoengineering: Design and synthesis of functional nanostructures - Bioconjugation techniques and surface modification Functionalization of nanostructures for targeting and delivery: Drug delivery systems, gene therapy vectors - Engineering of nanostructures for diagnostics: Biosensors and nanoprobes.										CO4
UNIT – V	Applications of Biological Nanostructures						Periods:9			
Nanostructures in medicine: Therapeutics: Cancer Therapy, Gene Therapy, Drug Delivery - Diagnostics: Biosensors, Imaging, Theragnostic, Point-of-Care Testing - Regenerative medicine - Environmental applications: Bioremediation, sensors for pollutant detection - Ethical, legal, and social implications of nanobiotechnology.										CO5
Lecture Periods:45		Tutorial Periods:15		Practical Periods: -				Total Periods:60		
Textbooks										
1. Christof M. Niemeyer and Chad A. Mirkin, "Nanobiotechnology: Concepts, Applications and Perspectives" , 2nd Edition, Wiley-VCH, 2004.										
2. Oded Shoseyov and Ilan Levy , "Nanobiotechnology: Bioinspired Devices and Materials of the Future" , Springer, 2008										
3. Sabu Thomas, Raghvendra Kumar Mishra, Raghvendra Kumar Mishra, Kalarikkal Nandakumar “Handbook of Nanoceramic and Nanocomposite Coatings and Materials” Elsevier, 2015										
4. Alexandru Mihai Grumezescu, "Nanotechnology-Based Precision Tools for the Detection and Treatment of										



Cancer", Springer , 2015.

Reference Books

1. Boris Rubinsky, "Nanobiotechnology: Bioinspired Devices and Materials of the Future" , Pearson, 2008.
2. Philip Nelson, "Biological Physics: Energy, Information, Life" 1st Edition, W. H. Freeman, 2004.
3. Hari Singh Nalwa , " Handbook of Nanostructured Materials and Nanotechnology, Five-Volume Set", Academic Press ,2000

Web References

1. <https://www.ncbi.nlm.nih.gov/>
2. <https://www.nanotech-now.com/>
3. <https://iopscience.iop.org/article/10.1088/0034-4885/73/2/026501>

* 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	2	2	2	1	2	1	-	-	-	-	3	3	-	2
2	2	2	3	2	1	2	1	-	-	-	-	3	3	-	2
3	2	2	3	2	1	2	1	-	-	-	-	3	3	-	2
4	2	2	3	2	1	2	1	-	-	-	-	3	3	-	2
5	2	2	3	2	1	2	1	3	-	-	-	3	3	-	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	Biomedical Engineering				Programme: B.Tech.							
Semester	V				Course Category: PC		End Semester Exam Type: TE					
Course Code	U23BMH502				Periods/Week		Credit	Maximum Marks				
					L	T	P	C	CAM	ESE	TM	
Course Name	Self-Assembly of Nanostructures				3	1	0	4	25	75	100	
Prerequisite	-											
Course Outcomes	On completion of the course, the students will be able to										BT Mapping (Highest Level)	
	CO1	Understand growth and self-assembly mechanisms in nanostructures.										K2
	CO2	Understand nanomanipulators, gripper design, and geometry for manipulation.										K3
	CO3	Explore Top-Down and Bottom-Up manufacturing Techniques with its advantages and limitations										K3
	CO4	Understand micro contact printing and self-assembly via stamp creation.										K3
	CO5	Explain Self-Assembly in biological systems and its properties.										K3
UNIT-I	Self-Organization of Nanostructured Materials						Periods: 9					
Self-organization of nanostructured materials, Growth Mechanism, Self-assembly of Nanostructures: Chemical, physical and biological self-assembly, Assembling and patterning of particles, Self-organization of different Nano-morphologies (Quantum Dots, Nanorods, Nanowires and Nanotubes).											CO1	
UNIT-II	Self-Assembled Monolayers and Guided Self-Assembly						Periods: 9					
Self-Assembled Monolayers (SAM), Guided Self Assembly - Nanolithography - Surface Topography - Surface Wetting - Electrostatic force; Nanomanipulators - Grippers – design - gripper arm geometry.											CO2	
UNIT-III	Top-Down and Bottom-Up Manufacturing Techniques						Periods: 9					
Top-Down Manufacturing Techniques: Lithography - photolithography, electron beam lithography, Etching - Reactive ion etching, and Milling - Advantages and limitations. Bottom-Up Manufacturing: Chemical Vapor Deposition (CVD), Molecular Beam Epitaxy (MBE), Self-Assembly - DNA self-assembly, Block copolymer self-assembly, and Atomic Layer Deposition (ALD) - Advantages and limitations.											CO3	
UNIT-IV	Self-Assembly Techniques and Applications						Periods: 9					
Self-Assembly by micro contact printing- creating the stamp, substrate- creating self-assembled monolayers - applications, Macroscopic expressions of Natural Nanomaterials- Hierarchical Ordering in Natural Nanoscale Materials											CO4	
UNIT-V	Bio-Inspired Approaches and Self-Assembly in Biological Systems						Periods: 9					
Bio-Inspired Approach for Complex Superstructures and Biological World, Self-Assembly in biological systems: Super hydrophobicity, Self-cleaning property, Multi scale ordering and function in Biological Nanoscale Materials: Proteins, Lipids, DNA and RNA and Shell as a Composite Materials.											CO5	
Lecture Periods: 45			Tutorial Periods: -			Practical Periods: -			Total Periods: 45			
Text Books												
1. “Self Organized Nanoscale Materials: Nanostructure Science and Technology” by Motonari Adachi and David J. Lockwood, 2006 Springer Science, Business Media, Inc. NY, USA 2. Self-Assembled Nanostructures: Jin Z. Zhang, Zhong-lin Wang, Jun Liu, Shaowei Chen, and Gang-yu Liu, 2003 Kluwer Academic/Plenum Publishers, NY, USA												

3. Nanoparticles: Theory to Applications by Günter Schmid, 2010 WILEY-VCH Verlag GmbH & Co. KGaA, Boschstr. 12, 69469 Weinheim.
4. " Nanofabrication: Principles, Capabilities and Limits" by ZHENG CUI , Springer Nature (SIE) (1 January 2012)

Reference Books

1. Hand Book of Nanotechnology, by Bharat Bhushan, 2007, Springer Science+Business Media, Inc, NY, USA.
2. Prospects in Nanotechnology: Toward Molecular Manufacturing, Markus Krummenacker and James Lewis (Editors), Wiley 1995.

Web References

1. <https://wires.onlinelibrary.wiley.com/doi/abs/10.1002/wnan.136>
2. <https://www.ncbi.nlm.nih.gov/>
3. <https://www.nano.gov/>

* 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	2	2	3	2	1	3	-	-	-	-	2	3	-	1
2	2	2	2	3	2	1	3	-	-	-	-	2	3	-	1
3	3	2	3	3	2	1	3	-	-	-	-	2	3	-	1
4	2	2	2	3	2	1	3	-	-	-	-	2	3	-	1
5	2	2	2	3	2	1	3	-	-	-	-	2	3	-	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	Biomedical Engineering				Programme: B.Tech.							
Semester	VI				Course Category: PC			End Semester Exam Type: TE				
Course Code	U23BMH603				Periods/Week		Credit	Maximum Marks				
					L	T	P	C	CAM	ESE	TM	
Course Name	Nano Biosensors				3	1	0	4	25	75	100	
Prerequisite	-											
Course Outcomes	On completion of the course, the students will be able to										BT Mapping (Highest Level)	
	CO1	Explain the principles underlying nanobiosensor design and operation										K2
	CO2	Familiarize with the detection mechanisms used in nanobiosensors.										K3
	CO3	Gain knowledge in analyzing the specificity of naobiosensors for target molecules.										K2
	CO4	Gain knowledge in describing methods for fabricating nanobiosensors.										K3
	CO5	Gain knowledge in Integrating naobiosensors into existing technologies for enhanced functionality.										K2
UNIT-I	Introduction to Biosensors and Nanotechnology						Periods: 9					
Basics of Biosensors - Definition and historical overview - Components of biosensors: Bioreceptor, transducer, and detector - Overview of biosensor applications. Introduction to nanomaterials and their unique properties - Role of nanotechnology in enhancing biosensor performance.											CO1	
UNIT-II	Nanomaterials in Biosensors						Periods: 9					
Types of Nanomaterials - Carbon-based nanomaterials (e.g., carbon nanotubes, graphene) - Metal nanoparticles (e.g., gold, silver) - Semiconductor nanoparticles (quantum dots) - Conducting polymers. Fabrication Techniques- Top-down and bottom-up approaches - Self-assembly and template synthesis - Surface functionalization strategies.											CO2	
UNIT-III	Design and Application of Nano Biosensors						Periods: 9					
Design Principles of Nano Biosensors - Transduction mechanisms (optical, electrochemical, mechanical) - Bioreceptor immobilization techniques - Signal amplification strategies.											CO3	
UNIT-IV	Applications of Nano Biosensors						Periods: 9					
Clinical diagnostics and point-of-care testing - Environmental monitoring - Food safety and quality control - Drug discovery and pharmacokinetics.											CO4	
UNIT-V	Current Trends and Future Directions						Periods: 9					
nnovations in Nano Biosensor Technology- Wearable biosensors - Lab-on-a-chip devices - Single-molecule detection - Internet of Things (IoT) integration.											CO5	
Lecture Periods: 45			Tutorial Periods: -		Practical Periods: -				Total Periods: 45			
Textbooks												
1. Aiguo Wu,"Nanobiosensors: From Design to Applications",1st Edition,Springer,2016 2. Sandro Carrara,"Nanobiosensors and Nanobioanalyses",1st Edition, Elsevier,2015. 3. Dmitry Zemlyanov,"Nanobiosensors: Carbon Nanotubes and Graphene",1st Edition,CRC Press,2013												
Reference Books												
1. Alexandru Grumezescu, "Nanobiosensors: Nanotechnology in the Agri-Food Industry", 1 st Edition , Academic Press, 2016. 2. Sandro Carrara,"Nanobiosensors: Theory and Applications in Healthcare" ,1 st Edition , Springer,2016. 3. Abhijit Bandyopadhyay , "Nanobiosensors: Carbon Nanotubes in Disease Diagnosis" , 1 st Edition, CRC Press 2012.												

Web References

1. <https://wires.onlinelibrary.wiley.com/doi/abs/10.1002/wnan.136>
2. <https://www.ncbi.nlm.nih.gov/>
3. <https://www.nano.gov/>

* 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	2	3	1	1	-	-	-	-	2	3	-	2
2	3	2	3	3	2	1	3	-	-	-	-	2	3	-	1
3	3	3	2	2	3	1	1	-	-	-	-	2	3	-	2
4	1	1	3	2	2	3	3	-	-	-	-	2	2	-	2
5	3	3	2	2	3	1	1	-	-	-	-	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
	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	VII			Course Category: PC			End Semester Exam Type: - TE				
Course Code	U23BMH704			Periods/Week			Credit	Maximum Marks			
				L	T	P	C	CAM	ESM	TM	
Course Name	Nanotechnology in Tissue Engineering			3	1	0	4	25	75	100	
Prerequisite	-										
Course Outcomes	On completion of the course, the students will be able to								BT Mapping (Highest Level)		
	CO1	Identify nanomaterials' role in enhancing tissue regeneration and repair mechanisms.								K2	
	CO2	Apply nanofabrication techniques to design advanced tissue engineering scaffolds								K3	
	CO3	Evaluate ethical considerations in nanotechnology-enabled tissue engineering practices								K2	
	CO4	Analyze current research trends and emerging applications in the field								K3	
	CO5	Demonstrate proficiency in communicating and presenting nanotechnology-based tissue solutions.								K2	
UNIT-I	Foundations of Nanotechnology in Tissue Engineering						Periods: 9				
Introduction to Nanotechnology: History, scope, and current advancements - Overview of Tissue Engineering: Goals, challenges, and the role of nanotechnology - Nanomaterials: Types, properties, and synthesis - Introduction to nanofabrication techniques: Top-down and bottom-up approaches										CO1	
UNIT-II	Design and Fabrication of Nanomaterials						Periods: 9				
Nanofibers and nanoparticles: Fabrication methods (electrospinning, self-assembly) - Characterization techniques for nanomaterials (SEM, TEM, AFM) - Biocompatibility and bioactivity of nanomaterials- Nanomaterials in bone, skin, and vascular tissue engineering										CO2	
UNIT-III	Scaffolds in Tissue Engineering						Periods: 9				
Design principles for tissue engineering scaffolds- Nanocomposites and hybrid materials for scaffold- 3D printing and bioprinting in scaffold fabrication- Functionalization of scaffolds with nanomaterials for enhanced tissue integration										CO3	
UNIT-IV	Nanotechnology in Drug Delivery						Periods: 9				
Nanocarriers for targeted drug delivery in tissue engineering- Role of nanotechnology in stem cell therapy and regenerative medicine-drug loading and release: methods of drug loading onto nanoparticles, controlled drug release mechanisms, factors affecting drug release										CO4	
UNIT-V	Applications of Tissue Engineering in Nanotechnology						Periods: 9				
Regenerative Medicine-Organ and Tissue Regeneration, Stem Cell Therapy Enhancement, Vascularization-Drug Delivery System, Targeted Drug Delivery, Controlled Release-Biomedical Devices, Implantable Biosensors, Artificial Organs and Prosthetics, Tissue-Engineered Constructs-Diagnostic Imaging, Contrast Agents, Theragnostic Imaging										CO5	
Lecture Periods: -45			Tutorial Periods: -			Practical Periods:3			Total Periods: 45		
Textbooks											
1. Yuan, Yingqiao Zhang, Cato T. Laurencin “Nanotechnology and Regenerative Engineering: The Scaffold”, Second Edition, CRC Press, 2015											
2. Alexandru Mihai Grumezescu “Nano biomaterials in Tissue Engineering: Applications of Nanobiomaterials”1st Edition, Elsevier, 2016											
3. Mauro Ferrari “Nanotechnology in Drug Delivery: Fundamentals, Design, and Applications”,2nd Edition, CRC Press,2013											

Reference Books

1. Mauro Ferrari, Peter Ma, "Cancer Nanotechnology: Principles and Applications in Radiation Oncology", 1st Edition, CRC Press, 2013
2. Laurencin, Lakshmi S. Nair, "Nanotechnology and Tissue Engineering: The Scaffold" 1st Edition, CRC Press, 2008
3. Mauro Ferrari, "BioMEMS and Biomedical Nanotechnology: Volume I: Biological and Biomedical Nanotechnology", 1st Edition, Springer, 2006

Web References

1. <https://www.nih.gov>
2. <https://www.nano.gov>
3. <https://www.advancedtissue.com>
4. <https://www.termis.org>
5. <https://asmedigitalcollection.asme.org/nanohealthcare>

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	2	2	2	2	1	2	-	-	-	-	3	3	-	1
2	2	2	2	2	2	1	2	-	-	-	-	3	3	-	1
3	2	2	2	2	2	1	2	-	-	-	-	3	3	-	1
4	2	2	2	2	2	1	2	-	-	-	-	3	3	-	1
5	2	2	2	2	2	1	2	-	-	-	-	3	3	-	1

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	VIII			Course Category: PC			End Semester Exam Type: - TE				
Course Code	U23BMH805			Periods/Week		Credit	Maximum Marks				
				L	T	P	C	CAM	ESM	TM	
Course Name	Nanotechnology in Healthcare			3	1	0	4	25	75	100	
Prerequisite	-										
Course Outcomes	On completion of the course, the students will be able to									BT Mapping (Highest Level)	
	CO1	Understand principles of nanotechnology for healthcare applications:									K2
	CO2	Apply nanotechnology for targeted drug delivery systems:									K3
	CO3	Evaluate nanomaterials for diagnostic tools and imaging techniques.									K2
	CO4	Analyze ethical and safety considerations in nanomedicine									K3
	CO5	Collaborate on interdisciplinary research in healthcare innovation									K2
UNIT-I	Introduction to Nanotechnology in Health Care					Periods: 09					
Nanotechnology: History, Principles, and Tools- Introduction to Nanomedicine: Scope and Current State- Nanomaterials: Types, Properties, and Synthesis- Nanotechnology in Drug Delivery Systems: Concepts and Mechanisms										CO1	
UNIT-II	Nano Diagnostics and Imaging Techniques					Periods: 09					
Nanotechnology in Imaging: Nanoparticles for MRI, CT, and PET- Nano-Based Sensors for Diagnostics: Design and Function- Lab-on-a-Chip Technologies: Principles and Applications in Health Care- Nano diagnostics										CO2	
UNIT-III	Therapeutic Applications of Nanotechnology					Periods: 09					
Targeted Drug Delivery Systems: Design and Mechanisms-Nanotechnology in Gene Therapy: Techniques and Applications- Regenerative Medicine: Nanomaterials for Tissue Engineering- Nanotechnology in Cancer Treatment: Nanoparticles, Photothermal Therapy										CO3	
UNIT-IV	Nanotechnology for Infectious Disease Control					Periods: 09					
Nanomaterials for antimicrobial applications- Nanoparticle-based vaccines and immunotherapy- Role of nanotechnology in combating antibiotic resistance- nanotechnology in infectious disease management Nanotoxicology and Safety Assessment: Risks associated with nanomaterial exposure- Methods for evaluating nanotoxicity- Regulatory considerations and guidelines for nanomedicine										CO4	
UNIT-V	Nanotechnology in Neurology and Neurosurgery					Periods: 09					
Nanotechnology-enabled drug delivery across the blood-brain barrier- Neural interfacing and brain-machine interfaces- Nanotechnology applications in neuroimaging and neurosurgery Challenges in treating neurological disorders Role of nanotechnology in scaffold fabrication- Applications in organ transplantation and wound healing										CO5	
Lecture Periods: -45		Tutorial Periods: -		Practical Periods:3			Total Periods: 45				
Textbooks											
1. Ratner, Mark A.; Hoffman, Allan S.; Schoen, Frederick “Biomaterials Science: An Introduction to Materials in Medicine”,3rd Edition, Academic Press, 2012											
2. Seichi, Takamatsu; Shimizu, Toshimi; Fukuda, Takeshi “Nanotechnology in Drug Delivery: Fundamentals, Design, and Applications”, 1st Edition, CRC Press, 2014											
3. Zhang, Meixiang“Nanomaterials in Pharmacology”,1st Edition, Springer, 2016											

Reference Books

1. Chun Wang "Nanotechnology in Drug Delivery: Fundamentals, Design, and Applications", 2nd Edition CRC Press, 2019
2. Sarmento, Bruno "Nanotechnology-Based Drug Delivery Systems for Personalized Medicine, 1st Edition, Elsevier, 2018
3. Mansoor M. Amiji, "Nanotechnology for Cancer Therapy", 1st Edition, CRC Press, 2006

Web References

1. <https://www.cancer.gov>
2. <https://www.hopkinsmedicine.org/news/articles/nanotechnology-in-medicine-huge-potential-but-what-are-the-risks>
3. <https://www.news-medical.net/life-sciences/Nanotechnology-in-Healthcare-Applications-Challenges-and-Opportunities.aspx>

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	2	2	2	2	1	1	-	-	-	-	2	2	-	1
2	2	2	2	2	2	1	1	-	-	-	-	2	2	-	1
3	2	2	2	2	2	1	1	-	-	-	-	2	2	-	1
4	2	2	2	2	2	1	1	-	-	-	-	2	2	-	1
5	2	2	2	2	2	1	1	-	-	-	-	2	2	-	1

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



Annexure – III



SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)



Department of Biomedical Engineering Panel of Examiners

S. No.	Name of the Examiner	Highest Qualification	Specialization	Experience (in Years)	Communication Address	Email ID with Mobile Number
1.	Dr.P.Shanmugaraja	Ph.D	Medical Electronics	26	Professor, Department of Electronics and Instrumentation, Annamalai University, Chidambaram	psraja70@gmail.com 9443275120
2.	Dr. B.Hema Kumar	Ph.D	Biomedical Engineering	21	Associate Professor, Department of Electronics and Instrumentation Pondicherry Technological University, Puducherry	hemakumarb@pec.edu 9944929804
3.	Dr.K.Kala	Ph.D	Anatomy and Physiology	22	Assistant Professor Department of Biomedical Engineering, Saveetha Engineering College, Chennai-602105	Kala.harishi@gmail.com 6381089711
4.	Dr.V.Janakiraman	Ph.D.	Signal processing	20	Professor , Department of Electronics and Communication Engineering Dhanalakshmi Srinivasan College of Engineering and Technology, Chennai- 603104	vjramece@gmail.com 9444255029, 7358374100
5.	Dr. V.Kamatchi Sundari	Ph.D	Image Processing	22	Professor Department of Electronics and Communication Engineering, SRM Institute of Science and Technology, Chennai	vkamatchisundari@gmail.com 9952041393

6.	Dr. P. Vijayakumar	Ph.D	Wireless Communication Network Security	13	Associate Professor, Department of Electronics Engineering, Vellore Institute of Technology, Chennai.	vijayrgcet@gmail.com 9894727271
7.	Dr. Jobin Christ	Ph.D	Biomedical signal processing	24	Professor, Department of Biomedical Engineering, Rajalakshmi Engineering College, Chennai.	jobinchrist@gmail.com jobinchrist.mc@rajalakshmi.edu.in 9842666844
8.	Dr. M. Vijayakarthish	Ph.D	Electronics and Instrumentation	18	Associate Professor, Department of Electronics and Instrumentation, Madras Institute of Technology, Chennai.	vijayakarthish@yahoo.co.in 9976995692
9.	Dr. J. Mohan	Ph.D	Biomedical Signal and Image Processing	18	Valliammai Engineering college, SRM Nagar, Kattankulathur.	mohanjece@valliammai.co.in, 9840791532
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11.	Dr. S. Sathishbabu	Ph.D	Biosignals and Systems	26	Associate Professor, Department of Electronics and Communication, Thanthai Periyar Government Institute of Technology, Vellore.	sathish3575@gmail.com 9894235162
12.	Dr. Ramji Kalidoss	Ph.D	Human Anatomy and Physiology	28	Associate Professor, Department of Biomedical Engineering Bharath Institute of Higher Education and Research, Chennai.	ramji.sat@gmail.com 9840959832
13	Dr. P. Thirunavukkarasu	Ph.D	Biotechnology	12	Assistant Professor Cancer Biology & Animal tissue culture Department of Biotechnology Dr. MGR Educational and Research University Maduravoyal, Chennai.	pthirunacas@gmail.com. 9952172249

14	Dr. M. Phemina Selvi	Ph.D	ECE	26	Assistant professor, Department of Electronics and Communication Engineering, University College of Engineering, Villupuram	vm.femina@gmail.com 9994267707
15	Dr. R. Sandanalakshmi	Ph.D	ECE	22	Assistant Professor Department of Electronics and Communication Engineering, Pondicherry Engineering College, Puducherry.	sandalalakshmi@pec.edu 9790972173
16	Dr. N. M. Hariharan	Ph.D	Biotechnology	12	Professor and Head, Department of Biotechnology, SreeSastha Institute of Engineering and Technology, Chennai.	biotechhod@ssiet.in 904062599
17	Dr. C. Siva	Ph.D	Nanotechnology	12	Assistant Professor, Department of Nano science and Technology, SRM Institute of Science and Technology Kattankulathur 603 203	chumshiva@gmail.com. 9944567367
18	Dr. Ashokan	Ph.D	Biomedical Engineering	10	Professor and Head, Department of Biomedical Engineering Kongunadu College of Engineering and Technology.	Hodbme@kongunadu.ac .in 8012505054
19	Dr.Srigitha.S.Nath	Ph.D	Applied Electronics	22	Associate Professor, Department of Electronics and Communication Engineering Saveetha Engineering college, Chennai.	hod.ece@saveetha.ac.in 9840367678
20	Dr.P.Muthu	Ph.D	Biomedical Engineering	16	Assistant Professor Department of Nano science and Technology, SRM Institute of Science and Technology Kattankulathur.	muthup@srmist.edu.in 9486338640

21	Dr. Prasath Alias Surendhar. S	Ph.D	Biomedical Engineering	8	Associate Professor Department of Biomedical Engineering, Arupadai Veedu Institute of Technology, Rajiv Gandhi Salai (OMR), Paiyanoor-603 104	prasaths.bme@gmail.com 8754581937
22	Dr. A. Uma Maheswari	Ph.D	Biosignals and Systems	15	Assistant Professor, Department of ECE, University College of Engineering, Panruti.	umamaheswaritrk@gmail.com 8838553935
23	Dr. S. Ashok	Ph.D	Communication Systems	12	Assistant Professor, Department of ECE, Veltech multitech Dr. Rangarajan Dr. Sakunthala Engineering college, Chennai.	sashok@veltechmultitech.org
24	Dr. S. Rajalaxmi	Ph.D	Biomedical Instrumentation	15	Associate Professor & Head, Department of Biomedical Engineering Mahendra college of Engineering, Salem.	hodbiomed@mahendracollege.com 9865147730
25	Dr. S. Saranya	Ph.D	Biomechanics	8	Assistant Professor, BME, Sri Sivasubramaniya Nadar College of Engineering, Chennai.	ssaranya@ssn.edu.in 9941163265
26	Dr. E. Sathish	Ph.D	Biomechanics	7	Assistant Professor, Dept of BME, Vellore Institute of Technology, Chennai.	sathish.e@vit.ac.in 9941163265
27	Dr. T. Rajalakshmi	Ph.D	Digital Logic Circuits	13	Assistant Professor, Dept of BME, SRM Institute of Science and Technology, Chennai.	rajalakt@srmist.edu.in 9884781995
28	Dr. V. Parthasaradi	Ph.D	Biosignals and Systems	7	Assistant Professor, Department of ECE, E.G. SPillay Engineering College, Nagapattinam.	saradi.66@gmail.com 8838553935
29	Dr. A. Uma Maheswari	Ph.D	Biosignals and Systems	8	Assistant Professor, Department of ECE, University College of Engineering, Panruti.	umamaheswaritrk@gmail.com 8838553935
30	Dr. D. Ashok Kumar	Ph.D	Diagnostic and Therapeutic Equipments	6	Associate Professor, Department of Biomedical Engineering, SRM Institute of Science and Technology, Chennai.	ashok.d@ktr.srmuniv.ac.in 9442139050

31	Dr. P.Mathivanan	Ph.D	Medical Image Techniques	7	Assistant Professor, Department of ECE, Sri Venkateswara college of engineering, Chennai.	pmathivanan@svce.ac.in 9840079520
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35	Dr .N. Senthilkumar	Ph.D	Nanotechnology	5	Assistant Professor, Department of ECE, M. Kumarasamy College of Engineering, Erode,	Senthilkumarn.ece@mke.ac.in 9894856176
36	Dr.Indhumathi	Ph.D	Biomedical Instrumentation	15	Professor/BME Bharath Institute of Technology Chennai.	indhumathir.biomedical@bharathuniv.ac.in Contact No:9384565205
37	Dr.Sandhiya,	Ph.D	Medical Electronics	8	Assistant Professor/BME, Aarupadai Veedu Institute of Technology, Chennai.	sandhiya.bme@avit.ac.in Contact No:9384565205
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41	Dr. P. Barani srinivasan	Ph.D	Biomedical Engineering	18	Professor, Department of Biomedical Engineering, Rajiv Gandhi college of Engineering and Technology, Puducherry	pbspy01l@gmail.com Contact No: 8778484608
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44	Dr.Babu Shanmugham	Ph.D	Electronics and Instrumentation	16	Associate Professor, Department of Biomedical Engineering, Rajiv Gandhi college of Engineering and Technology, Puducherry	Babulakshmi2007@gmail.com Contact No: 9884251898