DEPARTMENT OF

BIO MEDICAL

ENGINEERING

2021 REGULATION

DEPARTMENT OF BIO-MEDICAL ENGINEERING
2021 REGULATION

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	To enable the graduates to demonstrate their skills in design and develop medical devices for health care system through the core foundation and knowledge acquired in engineering and biology.
PEO 2	To enable the graduates to exhibit leadership in health care team to solve health care problems and make decisions with societal and ethical responsibilities.
PEO 3	To Carryout multidisciplinary research, addressing human healthcare problems and sustain technical competence with ethics, safety and standards.
PEO 4	To ensure that graduates will recognize the need for sustaining and expanding their technical competence and engage in learning opportunities throughout their careers.

PROGRAM OUTCOMES (POs)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

	write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	To design and develop diagnostic and therapeutic devices that reduces physician burnout and enhances the quality of life for the end user by applying fundamentals of Biomedical Engineering.
PSO2	To apply software skills in developing algorithms for solving healthcare related problems in various fields of Medical sector.
PSO3	To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions for current societal and scientific issues thereby developing indigenous medical instruments that are on par with the existing technology

LIST OF COURSES

REGULATION 2021

BIO-MEDICAL ENGINEERING		
SEMESTER I		
S. NO.	**COURSE CODE**	**COURSE TITLE**
1	IP3151	Induction Programme
THEORY		
2	HS3152	Professional English - I
3	MA3151	Matrices and Calculus
4	PH3151	Engineering Physics
5	CY3151	Engineering Chemistry
6	GE3151	Problem Solving and Python Programming
7	GE3152	Heritage of Tamils
PRACTICALS		
8	GE3171	Problem Solving and Python Programming Laboratory
9	BS3171	Physics and Chemistry Laboratory
10	GE3172	English Laboratory
SEMESTER II		
S. NO.	**COURSE CODE**	**COURSE TITLE**
THEORY		
1	HS3252	Professional English - II
2	MA3251	Statistics and Numerical Methods
3	BM3251	Biosciences for Medical Engineering
4	BE3251	Basic Electrical and Electronics Engineering
5	BM3252	Medical Physics
6	GE3251	Engineering Graphics
7	GE3252	Tamils and Technology
8		NCC Credit Course Level 1[#]
PRACTICALS		
9	GE3271	Engineering Practices Laboratory
10	BM3271	Biosciences Laboratory
11	GE3272	Communication Laboratory / Foreign Language $
SEMESTER III		
S. NO.	**COURSE CODE**	**COURSE TITLE**
THEORY		
1	MA3351	Transforms and Partial Differential Equations
2	BM3353	Fundamentals of Electronic Devices and CircuitS

3	BM3301	Sensors and Measurements
4	BM3352	Electric Circuit Analysis
5	BM3351	Anatomy and Human Physiology
6	CS3391	Object oriented programming
		PRACTICALS
7	BM3361	Fundamentals of Electronic Devices and Circuits Laboratory
8	BM3311	Sensors and Measurements Laboratory
9	CS3381	Object oriented programming Laboratory
10	GE3361	Professional Development$

SEMESTER IV

THEORY

S. NO.	COURSE CODE	COURSE TITLE
1	MA3355	Random Processes and Linear Algebra
2	BM3491	Biomedical Instrumentation
3	BM3402	Analog and Digital Integrated Circuits
4	BM3451	Bio Control Systems
5	BM3401	Signal Processing
6	GE3451	Environmental Sciences and Sustainability
7		NCC Credit Course Level 2
		PRACTICALS
8	BM3411	Biomedical Instrumentation Laboratory
9	BM3412	Analog and Digital Integrated Circuits Laboratory

SEMESTER V

THEORY

S. NO.	COURSE CODE	COURSE TITLE
1	BM3551	Embedded Systems and IoMT
2	BM3591	Diagnostic and Therapeutic Equipment
3		Professional Elective I
4		Professional Elective II
5		Professional Elective III
6		Mandatory Course-I
		PRACTICALS
7	BM3562	Embedded systems and IOMT Laboratory
8	BM3561	Diagnostic and Therapeutic Equipment Laboratory

SEMESTER VI

THEORY

S. NO.	COURSE CODE	COURSE TITLE
1	CS3491	Artificial Intelligence and Machine Learning
2	BM3651	Fundamentals of Healthcare Analytics
3	BM3652	Medical Image Processing
4		Open Elective – I

S. NO.	COURSE CODE	COURSE TITLE
5		Professional Elective IV
6		Professional Elective V
7		Professional Elective VI
8		Mandatory Course-II &
9		NCC Credit Course Level 3#
SEMESTER VII / VIII		
S. NO.	**COURSE CODE**	**COURSE TITLE**
THEORY		
1	GE3791	Human Values and Ethics
2		Management-Elective
3		Open Elective – II
4		Open Elective – III
5		Open Elective – IV
PRACTICALS		
6	BM3711	Hospital Training
SEMESTER VIII /VII		
PRACTICALS		
1	BM3811	Project Work / Internship

COURSE OUTCOME FOR BIO MEDICAL ENGINEERING

DEGREE	U.G
PROGRAMME	B.E.– BIO MEDICAL ENGINEERING
ACADEMIC YEAR	2022-23
REGULATION	2021

SEMESTER-01		
1.Course Code and Name :HS3152 - PROFESSIONAL ENGLISH - I		
	CO Statements	Knowledge Level
At the end of the course, learners will be able		
1	To use appropriate words in a professional context	K2
2	To gain understanding of basic grammatic structures and use them in right context	K2
3	To read and infer the denotative and connotative meanings of technical texts	K2
4	write definitions, descriptions, narrations and essay On various topic	K3
2.Course Code and Name : MA3151 -MATRICES AND CALCULUS		
	CO Statements	Knowledge Level
At the end of the course the students will be able to		
1	Use the matrix algebra methods for solving practical problems.	K3
2	Apply differential calculus tools in solving various application problems.	K3
3	Able to use differential calculus ideas on several variable functions.	K3
4	Apply different methods of integration in solving practical problems.	K3
5	Apply multiple integral ideas in solving areas, volumes and other practical problems	K3
3.Course Code and Name : PH3151 -ENGINEERING PHYSICS		
	CO Statements	Knowledge Level
After completion of this course, the students should be able to		
1	Understand the importance of mechanics.	K2
2	Express their knowledge in electromagnetic waves	K2
3	Demonstrate a strong foundational knowledge in oscillations, optics and lasers	K2
4	Understand the importance of quantum physics.	K2
5	Comprehend and apply quantum mechanical principles towards theformation of energy bands	K2
4.Course Code and Name :CY3151 -ENGINEERING CHEMISTRY		
	CO Statements	Knowledge Level
At the end of the course, the students will be able		

1	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.	K2
2	To identify and apply basic concepts of nano science and nanotechnology in designing the synthesis of nano materials for engineering and technology Applications.	K2
3	To apply the knowledge of phase rule and composites for material selection Requirements.	K2
4	To recommend suitable fuels for engineering processes and applications.	K2
5	To recognize different forms of energy resources and apply them for suitable applications in energy sectors.	K2

5.Course Code and Name : GE3151 -PROBLEM SOLVING AND PYTHON PROGRAMMING

	CO Statements	Knowledge Level
Upon completion of the course, students will be able to		
1	Develop algorithmic solutions to simple computational problems.	K2
2	Develop and execute simple Python programs.	K3
3	Write simple Python programs using conditionals and loops for solving problems.	K3
4	Decompose a Python program into functions	K3
5	Represent compound data using Python lists, tuples, dictionaries etc.	K3
6	Read and write data from/to files in Python programs.	K2

6.Course Code and Name : GE3171 -PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

	CO Statements	Knowledge Level
On completion of the course, students will be able to		
1	Develop algorithmic solutions to simple computational problems	K2
2	Develop and execute simple Python programs	K3
3	Implement programs in Python using conditionals and loops for solving problems..	K3
4	Deploy functions to decompose a Python program.	K3
5	Process compound data using Python data structures..	K3
6	Utilize Python packages in developing software applications.	K3

7.Course Code and Name : BS3171-PHYSICS AND CHEMISTRY LABORATORY

	CO Statements	Knowledge Level
The students should be able to		
PHYSICS LABORATORY		
1	Understand the functioning of various physics laboratory equipment.	K2
2	Use graphical models to analyze laboratory data.	K3
3	Use mathematical models as a medium for quantitative reasoning and describing physical reality.	K3
4	Access, process and analyze scientific information.	K3

5	Solve problems individually and collaboratively.	K3

CHEMISTRY LABORATORY		
6	Understand the functioning of various physics laboratory equipment.	K3
7	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.	K2
8	To determine the amount of metal ions through volumetric and spectroscopic techniques	K3
9	To analyze and determine the composition of alloys.	K3
10	To learn simple method of synthesis of nanoparticles	K3
11	To quantitatively analyses the impurities in solution by electro analytical techniques	K3

8.Course Code and Name : GE3172 -ENGLISH LABORATORY		
	CO Statements	**Knowledge Level**
At the end of the course, learners will be able		
1	To listen to and comprehend general as well as complex academic information	K1
2	To listen to and understand different points of view in a discussion	K2
3	To speak fluently and accurately in formal and informal communicative contexts	K2
4	To describe products and processes and explain their uses and purposes clearly and accurately	K3
5	To express their opinions effectively in both formal and informal discussions	K2

SEMESTER 02		
1.Course Code and Name : HS3252-PROFESSIONAL ENGLISH – II		
	CO Statements	**Knowledge Level**
At the end of the course, learners will be able		
1	To compare and contrast products and ideas in technical texts.	K2
2	To identify cause and effects in events, industrial processes through technical texts	K2
3	To analyze problems in order to arrive at feasible solutions and communicatethem orally and in the written format.	K2
4	To report events and the processes of technical and industrial nature.	K3
5	To draft effective resumes in the context of job search.	K3
2.Course Code and Name : MA3251 -STATISTICS AND NUMERICAL METHODS		
	CO Statements	**Knowledge Level**
Upon successful completion of the course, students will be able to		
1	Apply the concept of testing of hypothesis for small and large samples in real life problems	K3

2	Apply the basic concepts of classifications of design of experiments in the field ofagriculture.	K3
3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.	K3
4	Understand the knowledge of various techniques and methods for solving firstand second order ordinary differential equations.	K3
5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.	K3

3.Course Code and Name : BM3251 - BIOSCIENCES FOR MEDICAL ENGINEERING

	CO Statements	Knowledge Level
At the end of the course, the students should be able to		
1	Explain the fundamentals of biochemistry.	K2
2	Analyze structural and functional aspects of living organisms.	K2
3	Explain the function of microscope	K2
4	Describe methods involved in treating the pathological diseases.	K2

4.Course Code and Name : BE3251 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

	CO Statements	Knowledge Level
After completing this course, the students will be able to		
1	Compute the electric circuit parameters for simple problems	K2
2	Explain the working principle and applications of electrical machines	K3
3	Analyze the characteristics of analog electronic devices	K2
4	Explain the basic concepts of digital electronics	K2
5	Explain the operating principles of measuring instruments	K2

5.Course Code and Name : BM3252 - MEDICAL PHYSICS

	CO Statements	Knowledge Level
On successful completion of this course, the student will be able to		
1	Interpret the properties of electromagnetic radiations and its effect on human	K2
2	Apply the principles and understand the production of radioactive nuclides.	K3
3	Explain the interaction of radiation with matter.	K5
4	Identify and Analyse the radiation quantities and its effects	K2
5	Demonstrate the knowledge on the properties of sound and its application in medicine.	K6

6.Course Code and Name : GE3251 - ENGINEERING GRAPHICS

	CO Statements	Knowledge Level
On successful completion of this course, the student will be able to		

1	Use BIS conventions and specifications for engineering drawing.	K4
2	Construct the conic curves, involutes and cycloid.	K3
3	Solve practical problems involving projection of lines.	K4
4	Draw the orthographic, isometric and perspective projections of simple solids.	K4
5	Draw the development of simple solids.	K4

7.Course Code and Name : GE3271-ENGINEERING PRACTICES LABORATORY

	CO Statements	Knowledge Level
The main learning objective of this course is to provide hands on training to the students in		
1	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used incommon household wood work.	K2
2	Wiring various electrical joints in common household electrical wire work.	K2
3	Welding various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments Make a tray out of metal sheet using sheet metal work.	K2
4	Soldering and testing simple electronic circuits, Assemble and test simple electroniccomponents on PCB.	K4

8.Course Code and Name: BM3271 - BIOSCIENCES LABORATORY

	CO Statements	Knowledge Level
At the end of the course, the student will be able to		
1	Understand the Biochemistry laboratory functional components	K2
2	Have a sound knowledge of qualitative test of different biomolecules.	K2
3	Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample	K2
4	Have a sound knowledge of separation technology of proteins and amino acids	K1
5	Student can perform practical experiments on staining Processes	K1

9.Course Code and Name: GE3272-COMMUNICATION LABORATORY

	CO Statements	Knowledge Level
1	Speak effectively in group discussions held in formal/semi formal contexts.	K1
2	Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions	K2
3	Write emails, letters and effective job applications.	K2
4	Write critical reports to convey data and information with clarity and precision	K3
5	Give appropriate instructions and recommendations for safe execution of tasks	K2

SEMESTER 03

1.Course Code and Name : MA3351 - TRANSFORMS AND PARTIAL DIFFERENTIAL

	EQUATIONS	
	CO Statements	**Knowledge Level**
Upon successful completion of the course, students will be able to		
1	Understand how to solve the given standard partial differential equations.	K3
2	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications	K3
3	Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations	K3
4	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.	K3
5	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.	K3
2.Course Code and Name : BM3353- FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS		
	CO Statements	**Knowledge Level**
1	Analyze the characteristics of semiconductor diodes.	K2
2	Analyze and solve problems of Transistor circuits using model parameters.	K2
3	Identify and characterize diodes and various types of transistors.	K2
4	Analyze the characteristics of special semiconductor devices.	K2
5	Analyze the characteristics of Power and Display devices.	K2
3.Course Code and Name : BM3301 - SENSORS AND MEASUREMENTS		
	CO Statements	**Knowledge Level**
At the end of the course, the student will be able to		
1	Measure various electrical parameters with accuracy, precision, resolution.	K2
2	Select appropriate passive or active transducers for measurement of physical phenomenon.	K3
3	Select appropriate light sensors for measurement of physical phenomenon	K6
4	Use AC and DC bridges for relevant parameter measurement.	K3
5	Employ multimeter, CRO and different types of recorders for appropriate measurement.	K2
4.Course Code and Name : BM3352 - ELECTRIC CIRCUIT ANALYSIS		
	CO Statements	**Knowledge Level**
On successful completion of this course, the student will be able to		
1	Comprehend and design ac/dc circuits.	K2
2	Apply circuit theorems in real time	K3
3	Evaluate ac/dc circuits.	K2
4	Analyse the electrical circuits.	K2
5	Develop and understand ac/dc circuits.	K2

	5.Course Code and Name : BM3351 ANATOMY AND HUMAN PHYSIOLOGY	
	CO Statements	**Knowledge Level**
Upon successful completion of the course the student will be able to		
1	Identify and explain basic elements of human body	K3
2	Explain the functions of skeletal and muscular system	K3
3	Describe the structure, function of cardiovascular system and respiratory system	K3
4	Discuss the structure of digestive and excretory system.	K3
5	Describe the physiological process of Nervous and sensory system	K3
	6.Course Code and Name : CS3391 - OBJECT ORIENTED PROGRAMMING	
	CO Statements	**Knowledge Level**
On completion of this course, the students will be able to		
1	Apply the concepts of classes and objects to solve simple problems	K3
2	Develop programs using inheritance, packages and interfaces	K3
3	Make use of exception handling mechanisms and multithreaded model to solve real world problems	K3
4	Build Java applications with I/O packages, string classes, Collections and generics concepts	K3
5	Integrate the concepts of event handling and Java FX components and controls for developing GUI based applications	K3
	7.Course Code and Name : BM3361 - FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS LABORATORY	
	CO Statements	**Knowledge Level**
Upon completion of the course, students will be able to		
1	Experiment and determine the VI characteristics of given PN junction diode, Zener diode, Photo diode and Silicon Controlled Rectifier.	K4
2	Experiment and determine the Input & output characteristics of BJT	K4
3	Experiment and test half wave and full wave rectifier circuit using PN Junction diode and obtain the ripple factor, rectifier efficiency and experiment and test voltage regulation characteristics using Zener diode voltage regulator circuit.	K4
4	Experiment and test the given electric circuit using Kirchhoff's laws and obtain the mesh current & node voltage and obtain the load current for the given circuit using Superposition, Thevenin's, and Norton's and Reciprocity theorems.	K3
5	Construct and test RLC series and parallel circuits to compute the resonant frequency and bandwidth by plotting the frequency response.	K2
	8.Course Code and Name : BM3311 - SENSORS AND MEASUREMENTS LABORATORY	
	CO Statements	**Knowledge Level**
At the end of the course, the students will be able to		
1	Design and understand characteristics and calibration of various transducers	K2

2	Design and develop bridge circuits to find unknown variables..		K2
3	Select proper transducer for various applications.		K3
4	Understand various read out and display devices.		K3
5	design a measurement system for various applications		K3
9.Course Code and Name : CS3381 - OBJECT ORIENTED PROGRAMMING LABORATORY			
	CO Statements		**Knowledge Level**
On completion of this course, the students will be able to			
1	Design and develop java programs using object oriented programming concepts		K2
2	Develop simple applications using package, exceptions, multithreading, and generics concepts		K2
3	Create GUIs and event driven programming applications for real world problems		K2