

Noorul Islam Centre for Higher Education

(Deemed to be University u/s 3 of the UGC Act 1956)

Kumaracoil, Thuckalay, Kanyakumari District - 629 180

Accredited by NAAC with 'A' Grade

BM22B.E BIOMEDICAL ENGINEERING



Student Performance and Learning Outcomes

BM22B.E BIOMEDICAL ENGINEERING

Programme Outcome- PO	
PO-A	Students are familiarized with basic subjects of the Biomedical Engineering.
PO-B	Knowledge on the interdisciplinary subjects make them excel in the programme.
PO-C	Provides the solutions for their experiments through the theoretical knowledge.
PO-D	Based on the existing theory and principles, the problems will get new solution in adapting and incorporating the social ethics.
PO-E	The knowledge on the Electronics and their applications will get new solutions in adapting and incorporating the social ethics.
PO-F	Group assignments and projects will make them to understand and cooperate with co-workers.
PO-G	They can communicate well versed with the team members about the problems and solutions in an effective manner.
PO-H	In-plant training enables them to understand their roles and responsibilities as a professional Biomedical Engineer in society.
PO-I	To design Biomedical devices to support the needy people.
PO-J	Making innovative devices and concepts will make them as professional engineers.
PO-K	Designing a medical device for the living things in concern with Medical and Social ethics.
PO-L	The innovations must be reliable, cost effective and reachable to all sectors of the society.
PO-M	Motivating the students to acquire updated knowledge and innovations will make them continuous learner.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1	Ability to understand diagnosis and therapy related equipment and to use software tools, mathematics, science and engineering for precise diagnosis and therapeutic applications.
PSO2	Able to troubleshoot the faulty medical equipment used in healthcare industry.
PSO3	Able to make measurements on and interpret data from living systems and address the problems associated with the interaction between living and non-living materials and systems.
PSO4	Apply various bio signal and image processing techniques to solve real time problems in medical field.
PSO5	Ensure that medical equipment is well-maintained, properly configured and safely functional.
PSO6	Follow safety code and standards.
PSO7	Achieve appropriate skills for employment.
PSO8	An ability to develop healthcare information system for automation and remote access
PSO9	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
PSO10	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Sl.No	Subject Code	Subject Name
SEMESTER II		
1.	EG2102	Technical English – II
2.	MA2102	Engineering Mathematics – II
3.	BS2103	Environmental Science
4.	ME2201	Engineering Graphics
5.	PH2201	Physics for Electronics Engineering
6.	BM2201	Fundamentals of Biomedical Engineering
7.	ME2272	Manufacturing Processes Laboratory - I
8.	BM2271	Fundamentals of Biomedical Engineering Laboratory
SEMESTER IV		
9.	MA2206	Random Process
10.	EC2206	Digital Electronics
11.	EC2227	Communication Engineering & Networking
12.	BM2204	Pathology and Microbiology
13.	BM2205	Bio Sensors and Transducers
14.	BM2206	Bio-Control Systems
15.	EC2274	Digital Electronics Laboratory
16.	BM2273	Pathology and Microbiology Laboratory
17.	BM2274	Bio Sensors and Transducers Laboratory
Course Code : BM12		
SEMESTER VI		
18.	IT1212	Cyber Security
19.	BM1215	Medical Image Processing
20.	BM1216	Communication Engineering and Networking
21.	BM1217	Medical Imaging Techniques
22.	BM12B2	Artificial Organ
23.	BM12B7	Biomedical Waste Management
24.	BM1280	Medical Image Processing Lab
25.	BM1281	Medical Imaging Equipments Lab
26.	BM1282	Biomedical Engineering Lab
SEMESTER VIII		
27.	BM12B6	Tissue Engineering & R-DNA Technology
28.	BM1221	Bio-Fluids and Dynamics
29.	BM12C2	Telemedicine
30.	BM12P5	PROJECT WORK –PHASE II

Course Outcomes	
EG2102 TECHNICAL ENGLISH II	
CO1	The student will be able to improve their vocabulary relating to Engineering and technology and use articles and prepositions effectively in sentences.
CO2	Understand grammatical terms like phrase, adverbs, derivatives, relative pronouns etc and thereby enhance their linguistic competency
CO3	Acquire the essential writing skills relating to CV/Resume writing, e-mail writing and the essential components of essay writing
CO4	Learn the essentials of writing, format of letter writing and the forms involved in letter writing formal and informal letter.
CO5	Learn English Phonetics like vowels, diphthongs and consonants and intonations which will be instrumental in learning

MA2102 ENGINEERING MATHEMATICS -II	
CO1	The students will be familiar to solve differential equations of first order, second order, etc.
CO2	Learn about the basic ideas of complex variable theory
CO3	Understand and apply various theorems of complex integration
CO4	Learn various theorems and applications of vector calculus
CO5	Learn to solve differential equations using Laplace Transform method, which is easier to handle the problems that are being investigated so as to enable the students to apply them with confidence in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.

BS2103 ENVIRONMENTAL SCIENCE	
CO1	Understand about general aspirants of environment and about natural resources.
CO2	Learn about various types of ecosystem and biodiversity.
CO3	Understand the causes, effects and control measures of pollution, natural disasters and learn the waste disposal methods.
CO4	Understand the various social issues related to environment and the role of an engineer to tackle them.
CO5	Learn about the relation between human population and environment

ME2201 ENGINEERING GRAPHICS	
CO1	After learning the course the students should be able to Interpret engineering drawings using fundamental technical mathematics.
CO2	Construct basic and intermediate geometry
CO3	Improve their visualization skills so that they can apply these skills in developing new products
CO4	Improve their technical communication skill in the form of communicative drawings
CO5	Comprehend the theory of projection

PH2201 PHYSICS FOR ELECTRONICS ENGINEERING

CO1	At the end of the course, the students will understand the physics of photonics,
CO2	Learn about lasers, fiber optics
CO3	Understand the physics, principles and applications of conducting and semiconducting materials.
CO4	Understand the physics, principles and applications of superconducting, magnetic materials
CO5	Learn the physics, principles and applications of dielectric materials

BM2201 Fundamentals of Biomedical Engineering

CO1	Understand the fundamentals and history of Biomedical Engineering. Remember the anatomy and physiology of human body.
CO2	Understand the basics of medical instrumentation system and the use of microprocessors and microcontrollers in medicine.
CO3	Remember and understand the source of various bioelectric signals and their medical application.
CO4	Understand the basic concepts and fundamentals of X ray, MRI and Ultrasound imaging.
CO5	Understand the recent advancements in the field of Biomedical Engineering.

BM2271 – Fundamentals of Biomedical Engineering Lab

CO1	To understand different components of blood.
CO2	To identify the blood group and clotting.
CO3	To understand the medical devices applied in measurement of body parameters.
CO4	To understand the working of different types of sensors, transducers and probes.
CO5	Knowledge on temperature sensing devices.

ME2272 Manufacturing process laboratory I

CO1	Understands the important of casting. Machining
CO2	Develop the knowledge about usage of machining and handling cost
CO3	Enable the students for manufacturing the components
CO4	Increase the imagination into reality as a product
CO5	Increase skill to prepare a project report

MA2206 RANDOM PROCESS

CO1	Understand the fundamentals of probability concepts,
CO2	Apply the standard distributions in different problem which can describe real life phenomena.
CO3	Learn to solve problems with two dimensional random variables
CO4	Understand about different random processes with examples.
CO5	To acquire skills in the basic characteristic features of queuing system and in analyzing queuing models.

EC2206 DIGITAL ELECTRONICS

CO1	To understand and examine the structure of various number systems and its application in digital design.
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CO2	To understand the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
CO3	Understanding of the fundamental concepts and techniques used in digital electronics.
CO4	The ability to identify and prevent various hazards and timing problems in a digital design
CO5	The ability to understand, analyze and design various combinational and sequential circuits

EC2232 – Communication Engineering and Networking	
CO1	Understand the basic concepts of communication engineering, different blocks in communication system and the need for modulation in transferring information.
CO2	Distinguish between different amplitude modulation schemes with their advantages and disadvantages.
CO3	Analyze generation and detection of FM signals, comparison between amplitude and angle modulation and understand the concept of PAM,PWM,PPM.
CO4	Understand the need for sampling analog signal and will be able to obtain the BER of different digital modulation techniques, differentiate various pulse modulation technique.
CO5	Familiarize with basic networking concepts,terminology,concepts of TCP/IP model,circuit and packet switching.

BM2205 Biosensors and Transducers	
CO1	Understand the purpose of measurement, the methods of measurements and errors associated with the measurements.
CO2	Know the principle of transduction, classifications and characteristics of different transducers and study its biomedical applications.
CO3	Understand the principles and working of various photoelectric and piezoelectric sensors.
CO4	Understand the role of transducers in measuring bioelectric potentials and to analyze the different types of biopotential and reference electrodes.
CO5	Remember and understand the concepts, types, working and practical applications of important biosensors.

BM2206BIO-CONTROL SYSTEMS	
CO1	Understand system concept and different mathematical techniques applied in analysing any given system.
CO2	Learn to do the analysis of given system in time domain and frequency domain.
CO3	Learn the techniques of plotting the responses in both domain analysis.
CO4	Apply these analysis to study the biological systems.
CO5	Understand system concept and different mathematical techniques applied in analysing any given system.

BM2204 Pathology and Microbiology	
CO1	Describe the normal homeostatic mechanisms and the pathological process in their derangement and the effects on human systems. Discuss the concepts of cell injury and pathological and immunological responses produced thereby in different tissues and organs and the body's capacity for healing. Describe the concept of neoplasia with reference to the etiology, morphological features, diagnosis and prognosis in different tissues and organs of the body.
CO2	Describe the concept of hemodynamic disorders, thromboembolic disease and shock and their clinical application. Recognise and interpret the common hematological disorders and the investigations, blood banking as well as cytological procedures.
CO3	Discuss the epidemiology, gross and microscopic features, clinical presentation and diagnostic techniques associated with different diseases in different organ systems to the extent needed for the understanding of disease processes and their clinical significance.
CO4	Explain the etiology, pathogenesis, pathological effects and clinicopathological correlation of common infectious and non-infectious diseases. Demonstrate basic Knowledge and understanding of the immune system in health and disease.
CO5	Perform and interpret the basic bed-side clinical pathology procedures on blood and urine samples.

BM2274 Bio Sensors and Transducers Laboratory	
CO1	Understand the principle of various types of sensors and transducers used in measurements.
CO2	Evaluation of resistance, capacitance and inductance using bridge circuits.
CO3	Analyze the characteristics of temperature transducers.
CO4	Analyze the characteristics of displacement transducers.
CO5	Understand the various types of biosensors and their medical applications.

BM2273 Pathology and Microbiology Laboratory	
CO1	Principles which underlies sterilization of culture media, glassware and plastic ware to be used for microbiological work.
CO2	Principles of a number of analytical instruments which the students have to use during the study and also later as microbiologists for performing various laboratory manipulations.
CO3	Handling and use of microscopes for the study of microorganisms which are among the basic skills expected from a practicing microbiologist.
CO4	They also get introduced a variety of modifications in the microscopes for specialized viewing.
CO5	Several separation techniques which may be required to be handled later as microbiologists.

EC2274 Digital Electronics Laboratory	
CO1	To acquire the basic knowledge of digital logic levels.
CO2	Application of knowledge to understand digital electronics circuits.
CO3	To prepare students to perform the analysis and design of various digital electronic circuits.
CO4	The ability to understand, analyze and design various combinational and sequential circuits.
CO5	To develop skill to build, and troubleshoot digital circuits.

IT1212 Cyber Security	
CO1	Understand the principles of computer organization and communication also discuss about the architecture in OS
CO2	Study about the information security fundamentals and apply them in e-commerce.
CO3	Remember and understand the security threats and test the programming bugs in the computing systems
CO4	Understand the security principles and apply the skills and tools for the computing system
CO5	Apply the cyber laws, ethics in cyber-forensic tools in computing systems in social networks

BM1215 Medical Image Processing	
CO1	The student will acquire digital image fundamentals
CO2	Know about the different image types and image file format
CO3	Intensity transformations and spatial filtering can be understood by applying to various images
CO4	Familiar with image restoration techniques
CO5	To get knowledge in segmentation methods and edge linking

BM1216 – Communication Engineering and Networking	
CO1	Understand the basic concepts of communication engineering, different block in communication system and the need for modulation in transferring information.
CO2	Distinguish between different amplitude modulation schemes with their advantages and disadvantages, analyze generation and detection of AM and FM signals, Concept of PAM,PWM,PPM.
CO3	Understand the need for sampling analog signal and will be able to obtain the BER of different digital modulation techniques, differentiate various pulse modulation technique.
CO4	Familiarize with basic networking concepts, terminology, concepts of TCP/IP model, circuit and packet switching.
CO5	To implement routing and congestion control algorithms.

BM1217 MEDICAL IMAGING TECHNIQUES	
CO1	The students will understand the different modes of medical recordings.
CO2	The students will know about radio isotopic imaging, understand the need for radionuclides.
CO3	The students will learn about NMR imaging.
CO4	The students can understand the mathematics of image formation and image processing.
CO5	The students will learn about image enhancement and other requirements.

BM12B2 Artificial Organ	
CO1	Students will learn about the need for artificial organ and they will learn about the steps involved in the design of artificial organs.
CO2	Understand the design of artificial heart, type of valve prosthesis and their properties. Gain knowledge about circulation assist devices.
CO3	Familiarize the students about the artificial lungs and blood gas exchange devices and know the comparison between artificial and natural lungs.
CO4	Understand the concept involved in the design of artificial kidney, types of dialysis and artificial

	pancreas.
CO5	Understand the process of plasmapheresis and classify the characteristics of blood substitutes and also understand the concept of artificial liver.

BM12B7 BIOMEDICAL WASTE MANAGEMENT	
CO1	Understand the introduction of healthcare waste and its types, major and minor categories of biomedical waste, concepts of color coding and how to dispose the biomedical waste.
CO2	Understand how to dispose the biomedical waste in proper methods and diseases caused due to the disposal of biomedical waste in an improper methods.
CO3	Understand the basic types of infections acquired from hospital and how to prevent that also monitoring and control cross infections and how to control that types of infections.
CO4	Understand the treatment technologies for wastes and their types, treatment process method and technology for wastes.
CO5	Understand and learn the laws of biomedical waste handling from the world health organization and disposal of biomedical waste products, packing, transportation, storage policies and laws of healthcare waste management.

BM1281 MEDICAL IMAGING EQUIPMENTS LAB	
CO1	The students will be familiar with various imaging equipment.
CO2	The students will understand the similarity and difference in components of medical equipment's
CO3	The students will learn the detectors used in imaging.
CO4	The students will understand the importance of gamma camera in imaging.
CO5	The students will understand the various sources used in imaging equipments.

BM 1280 Medical Image Processing Lab	
CO1	Know the basic image processing operation in image processing tool box
CO2	Apply various image enhancement techniques to medical images
CO3	Apply LP and HP filtering in CT and MRI images
CO4	Analyse the performance of Wiener filter and inverse Wiener filter in various images
CO5	Obtain various edge detective techniques

BM1282 Biomedical Engineering Lab	
CO1	Understand and implement isolation techniques in designing biomedical instruments.
CO2	Measure and Analyze biosignal waveforms in diagnostic point of views.
CO3	Design and analyze the characteristics of Biopotential amplifiers.
CO4	Measure ON-Time & OFF-Time delay of a waveform using Timer circuit.
CO5	Understand & describe the basic operation of biomedical Equipments.

BM1221 Bio-Fluids and Dynamics	
CO1	Understand the basic concepts of fluids and dynamics.
CO2	Learn about types of fluid flow and how to measure viscosity of a fluid.
CO3	Learn various concepts related to boundary layer.
CO4	Study about the dynamics of blood flow in blood vessels.
CO5	Understand cardiovascular fluid dynamics.

BM12C2 TELEMEDICINE	
CO1	Know the history of Telemedicine
CO2	Understand the types of information and antennae types
CO3	Study different methods of data exchange
CO4	Understand the data security systems and its standards
CO5	Know the legal aspects and ethical aspects of Telemedicine

BM12B6 Tissue Engineering & R-DNA Technology	
CO1	Know the types and applications of stem cells.
CO2	Understand the technique for basic growth and differentiation of tissues. Learn methods for the growth of tissues and organs.
CO3	Acquire knowledge of central dogma of molecular biology and rDNA technology.
CO4	Study the techniques of Recombinant DNA technology.
CO5	Acquire the various methods of genetic transformation of living systems.

BM12P5 PROJECT WORK –PHASE II	
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilising a systems approach.
CO4	Conduct an engineering project
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.