B.M.S. COLLEGE OF ENGINEERING, BENGALURU - 19

(Autonomous College under VTU)

DEPARTMENT OF MEDICAL ELECTRONICS ENGINEERING

B.M.S. COLLEGE OF ENGINEERING

DEPARTMENT OF MEDICAL ELECTRONICS ENGINEERING

INSTITUTE VISION & MISSION

INSTITUTE VISION

Promoting Prosperity of mankind by augmenting human resource capital through quality Technical Education & Training

INSTITUTE MISSION

Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society.

DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To promote quality education in Medical Electronics Engineering for the health and well-being of humankind through teaching and research platforms.

DEPARTMENT MISSION

M1: To impart knowledge and skills necessary for professional development of graduates in Medical Electronics Engineering.

M2: To provide continuous up gradation of technical education with strong academic progression.

M3: To propagate creativity, responsibility, commitment and leadership qualities and exhibit professional ethics and values.

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Program Educational Objectives (PEOs)

PEO1	*Graduates of Medical Electronics will build careers in healthcare and allied fields*
PEO2	*Graduates will adapt to the state of art technologies through lifelong learning, will effectively communicate and work in a team*
PEO3	*Graduates will pursue higher studies and research.*

Programme Specific Outcomes (PSOs)

PSO1	*Investigate, Implement and demonstrate various applications of analog and digital electronic subsystems in designing and building biomedical instrumentation systems*
PSO2	*Specify, architect and prototype health-care solutions by applying signal and medical image processing techniques on modern hardware and software platforms*
PSO3	*Design, develop and verify processes, algorithms and computer programs for medical purposes.*

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3rd Semester

Course	Course outcomes
19ES3GCECA	CO1: Formulate equations based on physical laws and analyze the steady state behaviour of complex electric networks
	CO2: Apply the knowledge of mathematics and graph theory to the solution of complex electrical networks
	CO3: Apply mathematical and analytical techniques to analyze transient behaviour of networks.
	CO4: Analyze and model two port networks based on its parameters
	CO5: Engage in independent study using modern tools as an individual and as a team- member to simulate the electrical circuits for the relative comparison with theoretical values.
	CO6: Prepare a technical document and present the same on the simulated electrical circuits
19ES3CCAEC	CO1: Ability to define, understand and explain the structure, V-I characteristics, working and applications of analog electronic components like diodes, Bipolar Junction Transistors (BJTs) and MOSFETs
	CO2: Ability to apply the knowledge of KVL and KCL to obtain voltage /current/waveform at different points in analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers.
	CO3: Ability to analyze analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers, feedback amplifiers etc. to obtain voltage /current/waveform at different points for given specifications.
	CO4: Ability to conduct experiments using analog electronic components and electronic instruments to function as switch, regulator, clippers, clampers, small signal amplifiers, oscillators, power amplifiers
	CO5: Ability to implement a mini-project and demonstrate the given problem using suitable analogelectronic components
19ES3CCDEC	CO1: Ability to understand, define and explain the fundamental concepts of Digital circuits
	CO2: Ability to apply the knowledge of simplification methods to optimize a Digital circuit
	CO3: Ability to analyze digital circuits and arrive at suitable conclusions
	CO4: Ability to design a digital circuit for given specifications
	CO5: Ability to conduct experiments using digital ICs for a given application/problem statement
19ML3ESHPM	CO1: Interpret the interplay between different organ systems and how organs interact to maintain biological equilibrium in the face of a variable and changing environment.
	CO2: Utilize anatomical terminology to identify and analyze the physiology and physics of human system
	CO3: Analyze the impact of various diseases affecting the functioning of human organ systems.
	CO4: Analyze human organ systems using mathematical models developed based on their working principles.
	CO5: Assess the functioning of different organ systems in the human body.

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Course	Course outcomes
19ES3GCSAM	***CO1:*** *Apply the knowledge of science and engineering fundamentals to realize sensor based measurement systems.*
	CO2: *Analyze engineering problems and performance characteristics in order to arrive at suitable techniques for the measurement of non-electrical quantities using direct or complex sensors.*
	CO3: *Design sensors and solutions to meet the specified measurement needs, considering the nature and properties of measured quantities.*
	CO4: *Work with sensors and measurement systems both individually and in teams, document the activity and communicate the outcome to an engineering community.*

4th Semester

19ML4PCPCS	***CO1:*** *Apply the knowledge of engineering and mathematics to develop models for classical and physiological control systems.*
	CO2: *Identify and analyse the time-domain response of conventional and physiological control systems.*
	CO3: *Design and Investigate the stability of control systems using frequency analysis techniques.*
	CO4: *Analyze the complex problems in physiological control systems through parametric and nonparametric identification methods*
	CO5: *Implement the control theory concepts using modern tools working in a team and write reports of the same.*
	CO6: *Function effectively to communicate as an individual to present the report of the implemented work in a team.*
19ES4CCLIC	***CO1:*** *Apply the knowledge of electronic engineering fundamentals to comprehend linear integrated circuits based systems*
	CO2: *Interpret and analyze the effects of DC and AC limitations of Operational Amplifiers*
	CO3: *Implement linear integrated circuits in the areas of power sourcing, signal generation and conditioning, and analog communication*
	CO4: *Design and develop analog sub-circuits for linear and non-linear applications*
	CO5: *Experiment and document the test results of various applications of linear integrated circuits, working both independently and in teams.*
19ES4GCMCS	***CO1:*** *Understand the concepts of 8051 microcontroller architecture, assembly and embedded C programming*
	CO2: *Apply the learnt concepts of 8051 microcontroller to solve the problems using assembly and embedded C programming.*
	CO3: *Identify the IDE to conduct experiments*
	CO4: *Debug/analyze the code in assembly and embedded*
	CCO5: *Engage in independent study/ self-study as an individual and as a team- member to design, an open ended experiment on applications of microntrollers for medical electronics*
	CO6: *Prepare a technical document on the open ended experiment considering ethics, safety and sustainability of the process or product thereon*

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Course	Course outcomes
19ES4CCSAS	*CO1: Ability to define, understand, and explain various types of signals, systems, their time and frequency domain representation and their realization.*
	CO2:Ability to classify signals and systems, obtain the output for LTI systems using the time domain and the frequency domain representation, obtain the frequency domain representation of LTI systems using various transforms.
	CO3: Ability to analyse the given specifications for systems for causality, stability, linearity, time invariance physical realizability.
	CO4: Ability to design LTI systems for the given response specifications in an efficient manner.
	CO5: Ability to make an effective oral presentation or report writing on contribution of signal processing in various engineering aspects.
19ML4PCDIN	*CO1:Ability to apply knowledge of mathematics science and engineering fundamentals in designing, analysing and/ working of biomedical circuits and instruments.*
	CO2: Understand the health, safety, Environmental and ethical issues while designing/working with a diagnostic equipment.
	CO3:Ability to work, document and present as an individual and as a team-member to design, formulate and implement experiments using modern equipments & tools.
	CO4:To develop and analyze schematic models of various bio- chemical measurement systems.
	CO5: Ability to understand the diagnostic equipment through case study for different diseases through references.

5th Semester

Embedded Systems Design with ARM 19ML5PCESD	*CO1: Apply the knowledge of electronics engineering, communication protocols to design embedded systems*
	CO2: Develop assembly language programs by applying knowledge of the architectural features and instructions of ARM Cortex M3
	CO3: Evaluate performance of real time operating systems by applying knowledge of multitasking principles
	CO4: Demonstrate understanding of ARM Cortex M3 concepts to conduct experiments using the assembly and Embedded C programming.
	CO5: Develop embedded C programs to demonstrate understanding of GPIO concepts and communication protocols through interfacing peripherals with Cortex M3 microcontroller
19ML5PCTIE	*CO1: Ability to apply knowledge of mathematics science and engineering fundamentals in designing, analysing and/ working of biomedical circuits and instruments*
	CO2: Understand the health, safety, Environmental and ethical issues while Designing/working of Therauptic equipment.
	CO3: Ability to work, document and present as an individual and as a team-member to design, formulate and implement experiments using modern equipment's & tools.

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Course	Course outcomes
19ML5PCTIE	*CO4: Ability to present in a group and document the findings or suggestions for the problems in the current techniques, modern tools and computing practice to improve technology in Health care instruments through hospital visits for lifelong learning.*
	CO5:Ability to understand the Therapeutic equipments through case study for different diseases through references
Digital Signal Processing 19ES5CCDSP	*CO1: Apply knowledge of Mathematics and Engineering to understand Sampling and Reconstruction of signals from the given samples.*
	CO2: Identify and analyse a problem and formulate the computing requirements to determine the spectrum of the given signals.
	CO3: Implement the processes of FFT to reduce the computational complexity and to increase the speed.
	CO4: Understand and formulate algorithms using the Multirate signal processing for sampling rate conversion in speech and other signal analysis.
	CO5:An ability to use current techniques and modern tools to improve the Medical data analysis and present, document the same.
19ML5PCPMI	*CO1: Apply the knowledge of mathematics and science to the solutions of complex problems in medical imaging modalities.*
	CO2: Identify, formulate and analyse a problem in medical imaging applications to arrive at substantiated conclusions.
	CO3: Analyse the biological effects of electromagnetic fields in humans for health safety issues.
	CO4: Apply professional ethics and responsibilities to meet the public health safety issues for sustainability through hospital visit (field survey) working in a team.
	CO5: Comprehend the published reports for the selected imaging modality and prepare the document of the same combined with the field survey working in a team.
	CO6: Function effectively to communicate as an individual to present the prepared document in a team.
	CO3: To realize the important basic properties and requirements for biomaterials and compare the mainstream biomaterials currently used for medical applications
	CO4:Identify the suitable material and manufacturing methods for bio implant applications with considerations of health risk and economic aspects.
	CO5: To understand the design and structural issues related to medical devices that are used in restoring function to load bearing tissues
19ML5PWMP1 Mini Project 1	*CO1 Apply the knowledge of science and medical electronics engineering to provide solutions for human-health related problems*
	CO2: Analyze and identify biomedical engineering problems based on literature survey and need analysis.
	CO3: Develop solutions for relevant biomedical engineering problems with appropriate consideration of public health, safety and society.
	CO4: Design experimental techniques/ simulation models and interpret the data conclusively
	CO5:Use modern tools and resources in developing health-care solutions needing their applications

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Course	Course outcomes
19ML5PWMP1 Mini Project 1	*CO6: Apply reasoning based on the contextual knowledge of the design problem statement and assess societal, health and safety issues*
	CO7:Demonstrate the knowledge of a sustainable solution in the context of society
	CO8: Apply biomedical ethics and responsibilities while working on project work
	CO9: Function both individually and in diverse teams requiring multidisciplinary approaches
	CO10:Comprehend, prepare effective reports and make clear presentations to an engineering community
	CO11:Demonstrate the knowledge of project management and financial requirements of a project work
	CO12:Exhibit self-reliance and life-long learning skills to align to the new trends

6th Semester

Medical Image Processing 19ML6PCMIP	*CO1: The ability to understand concepts of digital image representation, processing and objectives of biomedical image analysis and CAD.*
	CO2: The ability to apply algorithms in digital image processing for medical image enhancement restoration segmentation and feature extraction
	CO3: The ability to conduct experiments for medical image analysis
	CO4: Develop Graphical user interface based mathematical models to understand image enhancement and segmentation algorithms
	CO5: Engage in self-study as an individual and a team-member to design and implement an open ended experiment for medical image segmentation
19ML6PCMDD	*CO1: Ability to Identify and analyse unmet clinical need and its requirements to solve the identified need.*
	CO2: Ability to Search, analyse and document clinical practice, engineering science and relevant literature in order to determine the need for further research and development in a chosen clinical area.
	CO3: Ability to develop a sustainable business plan, including market overview, regulation strategies for health & safety of individuals and intellectual property (IP) strategies
	CO4: Understand medical device design engineering and manufacturing process by avoiding common quality pitfalls in turn learning project management (PERT, Critical Path, etc).
	CO5: Ability to develop a virtual product of given medical device comprising of requirement analysis, Risk Analysis and management, High level design, usability analysis, verification and validation and present the findings in a team.
Bio-Medical Signal Processing 19ML6PCBSP	*CO1: Ability to apply knowledge of mathematics, science and engineering to develop solutions for biomedical signal processing concepts.*
	CO2: Ability to analyze a problem and formulate appropriate solution for biomedical signal processing
	CO3: An ability to design experiments in biomedical signal and analyze computer-based process to meet desired needs in healthcare.CO4: Ability to work, document and present as an individual and as a team-member to design formulate and implement experiments using modern tools.

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Course	Course outcomes
19ML6PCBSP	*CO5. Implement the concepts practically in groups; perform an open ended experiment/mini-project. Present and document the same.*
19ML6PWMP Mini Project 2	*CO1: Apply the knowledge of science and medical electronics engineering to provide solutions for human-health related problems*
	CO2: Analyze and identify biomedical engineering problems based on literature survey and need analysis.
	CO3: Develop solutions for relevant biomedical engineering problems with appropriate consideration of public health, safety and society.
	CO4: Design experimental techniques/ simulation models and interpret the data conclusively
	CO5: Use modern tools and resources in developing health-care solutions needing their applications
	CO6: Apply reasoning based on the contextual knowledge of the design problem statement and assess societal, health and safety issues
	CO7: Demonstrate the knowledge of a sustainable solution in the context of society
	CO8: Apply biomedical ethics and responsibilities while working on project work
	CO9: Function both individually and in diverse teams requiring multidisciplinary approaches
	CO10: Comprehend, prepare effective reports and make clear presentations to an engineering community
	CO11: Demonstrate the knowledge of project management and financial requirements of a project work
	CO12: Exhibit self-reliance and life-long learning skills to align to the new trends

7th Semester

19ML7PCQCR Quality control and regulatory aspects in Medical Devices	*CO1: Understand the requirements of Quality Assurance, Regulatory Compliance and Regulations of Medical Standards.*
	CO2: Apply and Analyse Medical Standards Requirements and Compliance.
	CO3: Apply the concepts of quality assurance and control aspects for the medical device development.
	CO4: Implement medical regulatory and safety standards related to biomedical devices submission.
	CO5: In a group, study, present and submit the report on medical regulatory and safety standards related to specific biomedical device
19ML7PWMP3 Mini Project 3	*CO1: Apply the knowledge of science and medical electronics engineering to provide solutions for human-health related problems*
	CO2: Analyze and identify biomedical engineering problems based on literature survey and need analysis.
	CO3: Develop solutions for relevant biomedical engineering problems with appropriate consideration of public health, safety and society.
	CO4: Design experimental techniques/ simulation models and interpret the data conclusively
	CO5: Use modern tools and resources in developing health-care solutions needing their applications

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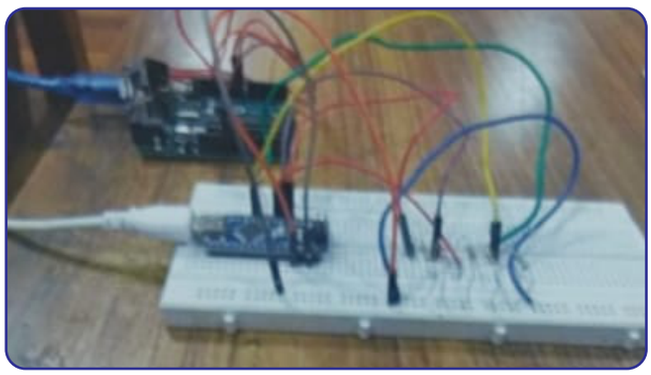
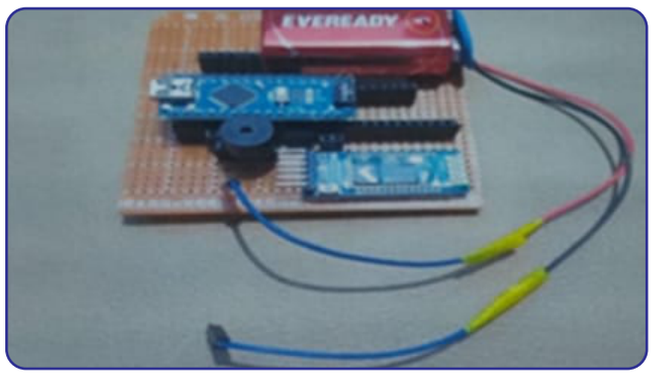
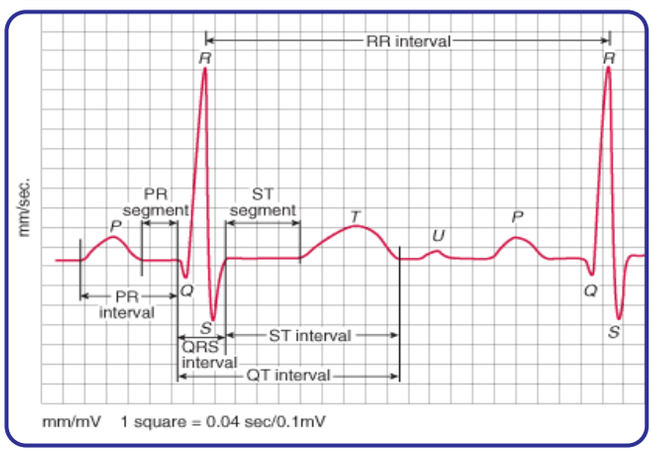
Course	Course outcomes
19ML7PWMP3 Mini Project 3	*CO6: Apply reasoning based on the contextual knowledge of the design problem statement and assess societal, health and safety issues*
	CO7: Demonstrate the knowledge of a sustainable solution in the context of society
	CO8: Apply biomedical ethics and responsibilities while working on project work
	CO9: Function both individually and in diverse teams requiring multidisciplinary approaches
	CO10:Comprehend, prepare effective reports and make clear presentations to an engineering community
	CO11:Demonstrate the knowledge of project management and financial requirements of a project work
	CO12:Exhibit self-reliance and life-long learning skills to align to the new trends

8th Semester

Major Project 19ML8PWMPJ	*CO1: Apply the knowledge of science and medical electronics engineering to provide solutions for human-health related problems*
	CO2: Analyze and identify biomedical engineering problems based on literature survey and need analysis.
	CO3: Develop solutions for relevant biomedical engineering problems with appropriate consideration of public health, safety and society.
	CO4: Design experimental techniques/ simulation models and interpret the data conclusively
	CO5:Use modern tools and resources in developing health-care solutions needing their applications
	CO6: Apply reasoning based on the contextual knowledge of the design problem statement and assess societal, health and safety issues
	CO7:Demonstrate the knowledge of a sustainable solution in the context of society
	CO8: Apply biomedical ethics and responsibilities while working on project work
	CO9: Function both individually and in diverse teams requiring multidisciplinary approaches
	CO10:Comprehend, prepare effective reports and make clear presentations to an engineering community
	CO11:Demonstrate the knowledge of project management and financial requirements of a project work
	CO12:Exhibit self-reliance and life-long learning skills to align to the new trends
Internship Seminar 19ML8PCISR	*CO1: engage in internship in an engineering domain, and comprehend theprofessional norms of the organization*
	CO2: Identify the key engineering, management, science, mathematics concepts, being transformed to a successful organization
	CO3: identify the community that benefit from the product
	CO4: Identify and comprehend the professional norms and the model for sustainable development of the organization
	CO5: Identify the skills/concepts from various disciplines, and able to perform as a member of the multidisciplinary team
	CO6: prepare the project report on the internship visualizing need for life long learning from this internship.







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75 Years of Dedicated Service In Technical Education

PLATINUM JUBILEE YEAR - 2016