Dr. Ambedkar Institute of Technology

Department of Medical Electronics Engineering

The enclosed documents are verified and approved.

A.P.

HOD

Course Outcomes

III Semester

18ML31	ANALOG ELECTRONIC CIRCUITS
CO1	Design biasing circuits MOSFETS
CO2	Classify feedback amplifiers and power amplifiers
CO3	Determine the cut off frequencies for practical transistor amplifiers
CO4	Illustrate the procedure & working of construction of FET, MOSFET
CO5	Draw equivalent circuit models for BJTs and MOSFET
CO6	Differentiate the amplifier and switch functionality of MOSFETs

18ML32	LOGIC DESIGN and VHDL
CO1	Simplify the Boolean equation and build logical circuits.
CO2	Design combinational circuits
CO3	Design shift registers, synchronous/ asynchronous counters
CO4	Draw state diagram for Melay & Moore Models
CO5	Write & simulate VHDL programs using the software tool Xilinx-ISE

18ML33	MEDICAL SCIENCE
CO1	understand and explain the structural and functional anatomy of the Epithelial tissue & Connective tissue
CO2	understand the generation and transmission of action potential within the cells
CO3	understand and explain anatomy and physiology of, cardiovascular, respiratory, nervous, and digestive systems
CO4	understand the characteristics of skeletal system, joints of bones and movements
CO5	Identify the factors affecting performance of the vital systems

18ML34	NETWORK ANALYSIS
CO1	Apply nodal/mesh analysis for any type of network
CO2	Analyse and solve transient behaviour of the network
CO3	Analyse any two port network and apply Laplace transform for any network.
CO4	Understand and apply network theorems
CO5	Simulate a given network using EDA Tool – pspice

18ML35	SENSORS AND MEASUREMENT
CO1	Identify and calculate standard errors for the measuring equipments
CO2	Operate and control the parameters of laboratory test equipments
CO3	Choose transducers and biosensors for a particular biomedical application
CO4	Classify the medical devices and maintain Medical device standards
CO5	Chart the procedures of clinical ethical committee and to follow the ethics

18ML36 OOPs AND DATA STRUCTURES	
CO1	Understand concepts of OOPs based language and also the concepts of data structures
CO2	Understand the concepts of constructors & destructors and write programs
CO3	Understand inheritance, overloading and to write programs
CO4	Write Programs on data structure using stacks & queue and linked list
CO5	Develop application programs using OOPS

18MLL37 ANALOG ELECTRONIC CIRCUITS LAB	
CO1	To design and test Recifiers Circuits
CO2	To design clipping and clamping circuits to generate
CO3	To design Oscillators
CO4	To Test the working of power amplifiers
CO5	To design & develop a system based on analog circuits

18MLL38 LOGIC DESIGN LAB	
CO1	Design and Verify basic combinational and sequential circuits
CO2	Design any given combinational and sequential circuits using logic gates and standard ICs.

IV SEMESTER

18ML41 MICROCONTROLLERS	
CO1	Compare & Differentiate different computer architectures
CO2	Identify the different addressing modes of 8051 & 8086
CO3	Write software programs using all the instructions of 8051
CO4	Design interface for ADC/DAC, LCD, Stepper & DC Motor and external memory with 8051
CO5	Incorporate the Timer, Interrupts and Serial Communication in developing application programs.

18ML42 COMMUNICATION SYSTEMS	
CO1	Understand the Amplitude and frequency modulation techniques
CO2	Understand and derive SNR for AM & FM
CO3	Understand digital modulation techniques
CO4	Applications of Communication in the field of telemedicine.

18ML43 SIGNALS & SYSTEMS	
CO1	Understand the signals and its properties, classify and perform different operations on them
CO2	Perform Continuous & Discrete convolution
CO3	Draw the block diagram representation of LTI Systems
CO4	Understand the properties of Fourier and Z Transform and solve problems
CO5	To solve LTI systems using the properties of Z Transform

18ML44	BIOMEDICAL INSTRUMENTATION
CO1	Understand the generation of bio electric signals, identify the basic components of a measuring system
CO2	Understand the working of electrical amplifiers & filters for acquiring and measuring the physiological parameters
CO3	Record ECG according to 5/12 lead standard system
CO4	Understand the principle of measurement of blood pressure, blood flow , body temperature and pulse rate
CO5	Understand the working and also the application of cardiac pacemakers & defibrillators
CO6	Understand the patient safety standards

18ML45	LINEAR IC's AND APPLICATIONS
CO1	Design basic and complex circuits using the fundamental knowledge of op-amp
CO2	Build various op-amp application circuits
CO3	Determine various comparators usage and waveform generation techniques
CO4	Design of filters and 555 Timer
CO5	Develop D-A and A-D converters

18MLL46	OOPs AND DATA STRUCTURE LAB
CO1	Write Programs using structures
CO2	Write Programs using functions
CO3	Write Program implementing data Structure

18MLL47	MICROCONTROLLER LAB
CO1	Write program based on 8051
CO2	Interface typical external hardware to 8051
CO3	Handle versatile tool: Keil IDE

18MLL48	LINEAR INTEGRATED CIRCUITS LAB
CO1	Design & Testing of linear circuits using opamp IC 741
CO2	Design & test Digital Communication Circuits Using 555
CO3	Build & test applications of 555 Timer IC
CO4	Realise different modules using Industry standard TI Board and develop application circuits

V SEMESTER

18ML51	DIGITAL IMAGE PROCESSING
CO1	Understand the basic image processing concepts such as relationship between pixels and color models
CO2	Implement image enhancement techniques in spatial & frequency domain
CO3	Understand and apply image segmentation techniques to any given image
CO4	Understand various degradation models and apply the image restoration techniques
CO5	Perform image compression using lossy and lossless techniques

18ML52	MEDICAL IMAGING SYSTEMS
CO1	Understand the different imaging modalities such as x-ray, CT, Ultrasound & MRI
CO2	Understand the reconstruction of images from above imaging modalities using different transforms.
CO3	Understand the properties of radio nuclides and its applications
CO4	Understand the medical image communication standard.
CO5	Explore the latest trends & happenings in the subject

18ML53	PHYSIOLOGICAL CONTROL SYSTEMS
CO1	Understand and develop mathematical modelling of mechanical & electrical systems.
CO2	Mathematically model the physiological systems & relate it to the engineering control system
CO3	Understand and determine the time domain parameters of first and second order system
CO4	Apply the different methods of stability analysis in time domain & frequency domain
CO5	Verify the systems using simulation tools such as MATLAB.

18ML54	DIGITAL SIGNAL PROCESSING
CO1	Understand the properties of DFT and interpret the frequency analysis of the sequences
CO2	Understand the FFT algorithm and derive the representation in the frequency domain
CO3	Design Butterworth IIR filter
CO4	Design FIR filters using different windowing techniques
CO5	Understand the practical realization of filters and the hardware resources

18ML551	EMBEDDED SYSTEMS & IOT APPLICATIONS
CO1	Design and development of embedded system using microcontroller 8051
CO2	Apply the programming skills of embedded C for any microcontroller
CO3	Understand TI -MSP430 processor and develop coding using the launch pad
CO4	Design & Develop interfacing applications using MSP 430
CO5	Understand the fundamentals of IOT protocols & IOT applications

18ML552	CLINICAL ENGINEERING
CO1	Understand the role and functions of clinical engineer in health care management
CO2	Understand the importance of clinical engineer in maintaining safety standards in a clinical environment
CO3	Apply management Principles in Health care
CO4	Prepare the framework for the maintenance & repair of medical devices
CO5	Understand the general approach for troubleshooting

18ML553	ARM PROCESSOR
CO1	Depict the organization, architecture, memory and operation of the ARM microprocessors
CO2	Employ the knowledge of Instruction set of ARM processors to develop basic Assembly Language Programs
CO3	Recognize the importance of the Thumb mode of operation of ARM processors
CO4	Describe the techniques involved in Exception and Interrupt handling in ARM Processors
CO5	Develop embedded C programs to interact with Built in Peripherals and employ the knowledge of operation of cache controller

18MLL57	BIOMEDICAL INSTRUMENTATION LAB
CO1	Measure the parameters, temperature, PH, Blood pressure using the transducers
CO2	Design & test instrumentation amplifier for physiological parameters
CO3	Record EEG, ECG signal & measure hearing threshold using the recorders available in the lab
CO4	Understand the working concepts of ultrasound transducers
CO5	Document the observations & time management & to work in a team

18MLL58	DIGITAL SIGNAL PROCESSING LAB
CO1	To Implement & verify the theoretical concepts of convolution, correlation and sampling theorem using the software tools MATLAB/ LABVIEW
CO2	To generate any given signal using MATLAB & LABVIEW
CO3	To design digital filters for a given specification using MATLAB & LABVIEW
CO4	Develop and demonstrate a simple application through Open end project
CO5	Document the observations & time management & to work in a team

18MLL59	BIO-MEDICAL DIGITAL SIGNAL & IMAGE PROCESSING LAB
CO1	To implement digital filters using acquired signals
CO2	To Compute frequency spectrum of ECG & EEG signals
CO3	To Implement image enhancement techniques
CO4	To implement image segmentation techniques
CO5	Design and develop any biomedical signal & image processing application using MATLAB
CO6	To maintain the document and finish the work in stipulated time

18MLE56	BIOMEDICAL ENGINEERING (IDE)
CO1	Interpret a typical biomedical measuring system, its constraints & precautions
CO2	Understand the principle of the origin of biomedical signals and devise systems for measurement
CO3	Understand the use of electrical & heat energy in surgical processes & apply the safety aspects in improving the design
CO4	Apply the principles of audiometers, ventilators, haemodialysis to evolve new devices
CO5	Understand the fundamentals of Ultrasound Imaging & Magnetic Resonance Imaging

VI SEMESTER

18ML61	BIOMEDICAL DIGITAL SIGNAL PROCESSING
CO1	Analyze and interpret EEG & EMG
CO2	Acquire EEG & interpret the models of sleep EEG
CO3	Design and develop Adaptive filters
CO4	Identify noise sources in ECG signal & apply filtering
CO5	Classify & detect abnormality in ECG signals

18ML62	LASERS AND FIBER OPTICS IN MEDICINE
CO1	Identify different lasers and its applications in diagnosis & therapy
CO2	Understand the fundamentals & principles of optical fibers
CO3	Understand the application of optical fibers in communication
CO4	Understand the principle of transmission of UV & IR through Optical fibers in clinical environment
CO5	Understand the clinical applications of fiber optic

18ML63	BIOMEDICAL EQUIPMENTS
CO1	Understand the working & application of clinical lab equipments such as blood gas analyzers, blood cell counters and surgical equipments
CO2	Understand the human hearing mechanism, identify the defects in hearing mechanism
CO3	Understand the functioning of breathing mechanism, ventilators
CO4	Understand the functioning of kidney and working of artificial kidney
CO5	Design & develop artificial organs such as ventilators & kidney and hearing aids

18ML64	MEDICAL PHYSICS
CO1	Understand the applications of heat and cold for diagnostic & therapeutic purpose
CO2	Understand the origin of electric signals within the body & therapeutic applications of electricity and magnetism
CO3	Understand the mechanisms of vital systems of human body by relating it to the fundamental concepts of physics
CO4	Understand the application of sound and light for diagnostic & therapeutic purpose
CO5	Suggest/device a suitable system depending upon the body condition.

18ML651	INFRARED IMAGING & APPLICATIONS
CO1	Identify the objectives and background of infrared imaging
CO2	Apply the temperature measurements for various applications
CO3	Demonstrate the working operation of IR Camera
CO4	Analyze the various thermography calibration procedure
CO5	Design of basic thermography imaging procedure for various clinical applications

18ML652	MEDICAL INFORMATICS
CO1	Understand the concepts of medical information systems
CO2	Develop Computerized Patient Record (CPR)System
CO3	Application of computers for data storage in clinical laboratory, medical imaging, education & decision making
CO4	Develop assistive aids for physically challenged
CO5	Understand the concepts of tele-surgery

18ML653	VLSI DESIGN
CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling
CO2	Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects
CO3	Demonstrate ability to design Combinational, sequential and dynamic logic circuits as per the requirements
CO4	Interpret Memory elements along with timing considerations
CO5	Interpret testing and testability issues in VLSI Design

18MLL67	OPERATION & TESTING OF MEDICAL DEVICES LAB
CO1	Understand the Practical use of equipments & its operating Procedures
CO2	Apply the latest trend in the technology and the state of the art technology
CO3	Develop an understanding of the global companies in the market their device specification & idea of cost of the products
CO4	Understand the safety standards and medical ethics
CO5	Understand and perform the procedures of trouble shooting & Calibration
CO6	Make effective presentation & documentation

18MLM68	MINIPROJECT
CO1	To build working prototype models based on their innovative ideas in the field biomedical applications
CO2	PCB designing software tools
CO3	The skills of soldering & testing
CO4	The ability to work in a group
CO5	To prepare documentation and convey their ideas through presentation

18MLE66	MEDICAL INFORMATICS (IDE)
CO1	Understand the concepts of medical information systems
CO2	Develop Computerized Patient Record (CPR)System
CO3	Application of computers for data storage in clinical laboratory, medical imaging, education & decision making
CO4	Develop assistive aids for physically challenged
CO5	Understand the concepts of tele-surgery

VII SEMESTER

18ML71	NEURAL NETWORK & MACHINE LEARNING
CO1	Understand the concepts neural network and different learning algorithms
CO2	Apply perceptron and multiple perceptron for classification
CO3	Apply the probabilistic models for data classification
CO4	Understand the concepts of CNN
CO5	Apply Deep Learning for classification through case studies
CO6	Apply software tools like MATLAB/Python

18ML72	MEDICAL DEVICES & REGULATIONS
CO1	Define the medical device, its processes encompassing safety and risk management
CO2	Identify the objectives and functions of FDA and EU
CO3	Analyze various medical device standards and regulations
CO4	Document the procedure in software quality system regulations
CO5	Implement test protocol for medical device testing

18ML73	BIO MECHANICS
CO1	Understand the concepts of bio-fluids
CO2	Understand the various viscoelastic models
CO3	Understand the concepts of respiratory mechanics
CO4	Understand the concept of orthopaedic mechanics
CO5	Understand the principles of various biomechanic measuring equipments

18ML741	BIOSENSORS AND BIOMEMS
CO1	Understand the characteristics of types of bio transducer
CO2	Understand the general applications of biosensors in medicine & health
CO3	Understand the biomaterials and fabrication of Bio-MEMS
CO4	Understand the principle of micro drug delivery system
CO5	Apply the Bio materials for major health issues

18ML742	REHABILITATION ENGINEERING
CO1	Understand the concept of rehabilitation and the role of rehabilitation team
CO2	Implement and suggest therapeutic exercise techniques
CO3	Understand aphasia and suggest different visual aids,hearing aids and writing aids
CO4	Design and develop orthotic and prosthetic devices
CO5	Differentiate between the different mobility aids

18ML743	PICTURE ARCHIVING AND COMMUNICATION STANDARDS
CO1	Explain the fundamental concepts of PACS and DICOM standards
CO2	Apply the various operations performed on digital image
CO3	Understand the architecture of a typical PACS and requirements for implementations
CO4	Apply display techniques for medical images
CO5	Apply the PACS in different domains of medical imaging and radiology

18ML751	BIOMATERIALS & ARTIFICIAL ORGANS
CO1	Understand the different biocompatible materials such as metallic, ceramic and polymers
CO2	Understand the biodegradable biomaterials
CO3	Identify different artificial implants and assistive devices for cardio-vascular system
CO4	Design of artificial organs such as heart, kidney and lung

18ML752	BIOMETRIC SYSTEMS
CO1	Identify the objectives and background of biometrics
CO2	Determine fingerprint identification techniques
CO3	Demonstrate knowledge engineering principles underlying face recognition
CO4	Analyze various speech features and models for speaker recognition system
CO5	Design of basic biometric system applications

18ML753	BIOMEDICAL NANOTECHNOLOGY
CO1	Understand the Nano scale structures using scientific and technological principles
CO2	Gain knowledge of various Nano scale fabrication and characterization techniques
CO3	Assess the present and ever-developing state-of-art biomedical nanotechnology in the areas of tissue engineering
CO4	Appraise the unique elements of nanostructured materials for biomedical applications

18MLL77	JAVA LAB
CO1	Acquired programming skills in Java and will be able to develop applications using Java

18MLP78	PROJECT PHASE I
CO1	Carry out the literature survey
CO2	Convert the ideas of their interest into a conceptual model
CO3	Interact with outside world in identifying a suitable problem
CO4	Prepare proposals and approach funding agencies

18ML761	MEDICAL DEVICES SAFETY & REGULATIONS (IDE)
CO1	Classify medical device, its processes encompassing safety and precautions
CO2	Identify the hazards in various modalities of imaging systems and adapt safety measures
CO3	Define the medical device, its processes and risk management
CO4	Identify the objectives and functions of FDA and EU
CO5	Analyze various medical device standards and regulations

VIII SEMESTER

18MLP81	PROJECT PHASE II
CO1	Realise innovative ideas into working models
CO2	Discuss ideas, plan and work in a peer team to develop a system
CO3	Design a cost effective model within the time
CO4	Interact with industry experts
CO5	Document and present the technical project report

18MLS82	SEMINAR
CO1	Read and interpret technical papers
CO2	Express the ideas and communicate clearly
CO3	Prepare Technical documentation