With effect from the academic year 2019-2020

SCHEME OF INSTRUCTION

B.E. (Biomedical Engineering)

IV - SEMESTER

With effect from the Academic year 2019-2020

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	ES 401 EC	Digital Electronics	3	1	0	4	30	70	4
2	PC 406 CE	Applied Mechanics	3	0	0	3	30	70	3
3	PC 401 BM	Biomedical Instrumentation	3	0	0	3	30	70	3
4	PC 402 BM	Transducers & Biosensors Engineering	3	0	0	3	30	70	3
5	PC 403 BM	Signals & Systems for Biomedical Engineers	3	1	0	4	30	70	4
6	PC 404 BM	Biomaterials	3	0	0	3	30	70	3
Practicals									
7	ES 451 EC	Digital Electronics Lab	0	0	2	2	25	50	1
8	PC 451 BM	Biomedical Instrumentation Lab	0	0	2	2	25	50	1
9	PC 452 BM	Virtual Instrumentation & Simulation Lab	0	0	2	2	25	50	1
Total			**18**	**2**	**6**	**26**	**255**	**570**	**23**

L : Lectures

T : Tutorials

P : Practical

CIE : Continuous Internal Evaluation

SEE : Semester End Examination

With effect from the academic year 2019-2020

ES 401 EC

DIGITAL ELECTRONICS

Instruction:	4 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE:	30 Marks
Credits:	4

Course Objectives:

- This course facilitates the students to study the properties for Boolean algebra and simplification of Boolean equations using K-maps.
- The digital circuits' classification is studied and the main elements of this classification are studied. Application of these circuits to build a basic computer is discussed.
- The students also learn about different types of memories and how they are programmed.
- The course also discuss about the basic applications of digital electronics like digital clock, frequency counter.

Course Outcomes:

1. Understand various codes and simplify Boolean equations using K-maps
2. Design basic data processing circuits
3. Applications of flip-flops
4. To build a basic computer architecture and memories
5. Build ADCs and DACs

UNIT-I

Codes: BCD, ASCII code, Excess-3 code, Gray code. Error detecting and error correcting codes. Combinational Logic Design: Boolean laws & theorems. Karnaugh Map-simplification of Boolean expressions- Sum of Products (SOP) form, Product of Sums (POS) form.

Logic Gates, Implementations of Logic Functions using gates, Realization of Boolean Expressions using universal gates.

UNIT-II

Arithmetic Circuits: Half adder, Full adder, Half subtractors, Full subtractors, Parallel binary adder, parallel binary Subtractor. Code-converters

Data processing circuits: Multiplexers, De-Multiplexers, Encoders-Priority Encoder, Decoders.

Digital Circuit Testing tools: Logic pulser, Logic probe, Current Tracer.

UNIT-III

Sequential circuits: Flip-flops-RS, D, JK and JK Master slave. Realizations of one flip flop using other flip flops.

Registers: Serial-in parallel-out, Serial-in Serial-out, parallel-in-serial-out parallel-in-parallel-out.

Counters: Asynchronous and synchronous counters, decade counters, ring counters.

Design of synchronous counters using excitation tables, Synchronous Up/Down counters.

UNIT-IV

Classification of memories – ROM – ROM organization – PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle – Timing wave forms , RAM Cell , Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using ROM, PLA, PAL.

Applications: Digital Clock, Frequency counter, Time measurement, Displays.

UNIT-V

Introduction to DAC, ADC: Sampling, Quantization, quantization noise, aliasing and reconstruction filtering, Specifications, DAC Conversion, Binary weighted Resistor DAC, R-2R Ladder DAC, Inverted (or) Current mode DAC, Sample and hold circuits,

ADC conversion, Types of ADCs: Direct Conversion ADC/Flash type ADC, Successive approximation ADC, Integrating ADCs, Sigma-Delta ADCs, Analog Multiplexers.

Suggested Reading:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Donald P.Leach & Albert Paul Malvino, *Digital Principles and electronic,* 5th Ed., Tata Mc. Graw Hill Publishing Co. Ltd., New Delhi, 2003
3. R. P. Jain, *Modern Digital Electronics,* 3rd Ed., Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2003

With effect from the academic year 2019-2020

PC 406CE

APPLIED MECHANICS

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE:	30 Marks
Credits:	3

PART A: SOLID MECHANICS

Course Objectives:

- Learn the concept of center of gravity and mass moment of inertia
- Understand the concept of stress, strain and elastic behavior of materials
- Know the shear force, bending moment and the bending stress distribution
- Understand the concept of fluid flow in statics, Kinematic, dynamics conditions
- Evaluate the flow properties in static and dynamic compressible and incompressible flow.

Course Outcomes:

1. Determine the center of gravity and mass moment of inertia of a solid
2. Apply the fundamental concepts of stress and strain
3. Analyze the structural members subjected to tension, compression, bending

UNIT – I

Center of Gravity and Mass Moment of Inertia: Pappu's theorems and its applications, center of gravity and mass moment of inertia of solids and composite bodies, radius of gyration.

UNIT – II

Simple Stresses and Strains: Types of stresses and strains, stress-strain curve for ductile material, deformation of prismatic bars under axial loads. Poisson's ratio, volumetric strain, elastic constants, compound bars and temperature stresses.

UNIT – III

Shear force and Bending Moment: Concepts of shear force and bending moment, shear force and bending moment diagram for cantilever, simply supported and overhanging beams subjected to concentrated and uniformly distributed loads, simple bending theory, bending stresses.

Suggested Reading:

1. D.S. Prakash Rao, *Strength of Materials - A Practical Approach*, University Press, 1999.
2. S.B. Iunarker, and R.I. Shah, *Applied Mechanics*, Charaotar Publishers, 2001.
3. G.H. Ryder, *Strength of Materials*, Macmill India Limited, Third Edition, 2002.
4. A. Pytel and F. I. Singer, *Strength of Materials*, Harper and RC, Fourth Edition, 1987.

e-Resources:

1. http://nptel.ac.in/
2. http://mhrd.gov.in/e-contents
3. http://spoken-tutorial.org/

PART B: FLUID MECHANICS

Course Objectives:

- Understand the basic properties of fluid flows
- Description of measurement techniques
- Illustrate the application of basic principles of fluids.

Course Outcomes:

1. Knowledge of fluid properties and types of flows.
2. Ability to apply Pressure – flow relationship for Non- Newtonian fluids
3. Capacity to apply the basic principles in the field of Bio-medical Engineering

Unit – I

Fluid Properties: Density, Viscosity, compressibility, and surface tension, conservation of mass and momentum, Bernoulli's Equation, measurement of pressure, stream lines, path lines, streak lines.
Flow stability and related characteristics (steady laminar flow, turbulent flow, flow development, viscous and turbulent shear stress), Boundary layer separation.

Unit – II

Rheology of blood, capillary viscometer using Poiseuille's law, Rotating cylinder Viscometer (coaxial cylinder viscometer). Pressure – flow relationship for Non-Newtonian fluids, power law fluid, Bingham plastic, Casson's fluid

Unit – III

Hydrostatics in circulation, Application of Bernoulli's equation (Total v/s Hydrostatic pressure measurement, Arterial Stenoses and Aneurysms, Cardia Valve Stenoses), Estimation of entrance length and its effect on flow development in arteries.

Suggested Reading:

1. Krishan B. Chandran , Ajit P. Yoganathan, and Stanley E. Rittgers,'*Bio-fluid Mechanics: The Human Circulation*', CRC Press, Taylor & Francis Group, New York, 2007
2. LeeWaite and Jerry Fine, '*Applied Bio-fluid Mechanics*', McGraw-Hill Publishing Co., New York, 2007
3. Clement Kleinstreuer, '*Bio-fluid Dynamics: Principles and Selected Applications*', CRC Press, Taylor & Francis Group, New York, 2006

With effect from the academic year 2019-2020

PC401BM

BIOMEDICAL INSTRUMENTATION

Instruction	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE:	30 Marks
Credits	3

Course Objectives:

- To introduce the students to the basic concepts of biomedical instrumentation.
- To familiarize the students with the instruments used to record biopotentials
- To introduce the students to different medical instruments and their applications

Course Outcomes: Students will be able to:

1. Understand the components of medical instruments
2. Comprehend the instruments for recording/measuring ECG and other cardiovascular parameters
3. Explain EEG and EMG recording systems
4. Understand the function of general medical instruments
5. Compare the working principles of analytical instruments

UNIT-I

Block diagram of a medical instrumentation system, Challenges faced with physiological measurements. Medical instrument specifications. Biopotential electrodes: Electrode-Electrolyte Interface, Half cell potential, Offset Voltage. External, Internal and Microelectrodes. Equivalent circuit and applications of biopotential electrodes. Basic requirements for the display and recording of Biopotential signals. Classification of recorders, PMMC writing systems. General features of ink-jet, thermo-sensitive and optical recorders. Array recorders. Cathode Ray Oscilloscope (CRO), Dual beam oscilloscope, Analog storage oscilloscope, Digital storage oscilloscope, Medical, Multibeam & Non-fade display systems.

UNIT-II

Electrocardiography: Block diagram and preamplifier circuit, Single channel& multi-channel ECG systems. Holter monitors-ECG and NIBP, Stress test systems. Blood Pressure measurement: Components and working principle of sphygmomanometer. Direct and indirect methods of Blood Pressure measurements. Electromagnetic and Ultrasonic techniques of Blood flow measurement. Phonocardiography- Origin of Heart Sounds, types of microphones for heart sound measurement. Contact and non-contact type of measurement.

UNIT-III

Electroencephalography: EEG-Block diagram and preamplifier circuit, electrodes and their placement. Lead configuration and general EEG graphs. Evoked potentials and their measurement. Filters for EEG rhythm analysis, Electromyography: Introduction to EMG signals. EMG-Block diagram and circuits. Electrodes and their placement. Nerve conduction velocity determination using EMG. Stimulators for EMG recording.

UNIT-IV

Working principle and types of Nebulizer, Suction apparatus. Fluid warmer, Fumigation, Oxygen concentrator. Blood Cell Counters-Microscopic and Automatic methods. Coulter Counter, Portable Coulter counters-Handheld and Point-of-Care testing. Automatic differential counting of cells. Oximeters-Ear, pulse, skin-reflectance and intra vascular types.

UNIT-V

Methods of chemical analysis. Absorption Photometry, emission photometry, Flurometry, Colorimeter, spectrophotometer, Flame photometer, Mass spectrophotometer, Electrophoresis, chromatography, blood gas analyzer, Electrolyte Analyser, Semi and fully automated analyzers. ELISA reader and ELISA washer.

Suggested Readings:

1. Webster J.G., *Medical Instrumentation Application and Design*. Houghton Mifflin, 2009.
2. Carr and Brown, *Introduction to Biomedical equipment technology*, 2011.
3. Khandpur R.S. *Hand Book of Biomedical Instrumentation*, Tata McGrawHill,2003.
4. Khandpur R.S. *Hand Book of Analytical Instrumentation*, Tata McGrawHill,2010.
5. John Enderle, Susan M. Blanchard, and Joseph Bronzino, *Introduction to Biomedical Engineering*, Second Edition, 2005.

With effect from the academic year 2019-2020

PC402BM

TRANSDUCER AND BIOSENSOR ENGINEERING

Instruction	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE:	30 Marks
Credits	3

Course Objectives:

- This course facilitates the students to understand the basic characteristics of transducer.
- They learn the classification of transducers such as temperature, pressure, displacement and piezoelectric transducers.
- Signal conditioning and processing, controllers, display, recording; direct digital control, programmable logic controllers, and PC based instrumentation.

Course Outcomes: Students will be able to:

1. Understand the concept of primary and secondary sensors and extending the principle used to measure various physiological parameters
2. to construct signal conditioning circuit for various transducers
3. to identify the precautionary measures while using capacitive transducers
4. to predict electrolyte concentration or gas Estimation in blood or serum
5. to extend these principles to MEMS based transducers and understand fabrication techniques

UNIT-I

Transducers and their classification: Instrument, block diagram of an instrument, Principles of transduction and measurement, Sensor Classification, Functional specifications of sensors; static and dynamic characteristics of measurement systems. Primary sensors, bimetals, Bellows, Bourdon tube, capsule, diaphragm, Medical applications.

UNIT-II

Resistive sensors: Potentiometers, Strain gages, RTDs, Thermistors, LDR. Signal conditioning. Wheatstone bridge, balance and deflection measurements. Instrumentation amplifier. Interference types and reduction. Shield grounding. Isolation amplifiers, Medical applications.

UNIT-III

Capacitive and inductive transducers: Reaction variation and electromagnetic sensors. Capacitive sensors, inductive sensors, LVDT, electromagnetic sensors. Signal conditioning, AC bridges, AC amplifiers, electrostatic shields, carrier amplifiers, phase-sensitive detectors, Medical applications.

UNIT-IV

Self-generating sensors: Thermoelectric sensors, thermocouples, piezoelectric sensors, photovoltaic sensors. Signal conditioning. chopper and low-drift amplifiers, Noise in op-amps. Digital sensors. Telemetry and data acquisition, Medical applications.

UNIT-V

Chemical transducers: Electrochemical transducers, Fiber optic chemical transducer. Chemical Transducers of Acoustic and Thermal Properties. Biosensors – Enzyme-based bio-sensors, Immuno Sensors, microbial sensors. Other sensors: Accelerometer transducers, Gyroscopes, Ph sensors, measurement of Conductivity, viscosity, conductivity, flow meters, Humidity, signal conditioning and Applications.

Suggested Reading:

1. Ramon Pallas-Areny and John G. Webster, *Sensors and signal conditioning*, John Wiley and Sons, 2001.
2. Tatsuo Togawa, Toshiyo Tamura & P. Ake Oberg, *Biomedical Transducers and Instruments*, CRC Press, Boca Raton, 1997.
3. Richard S.C. Cobbold, *Transducers for Biomedical Measurements: Principles and Applications*. John Wiley and Sons Inc., 1974
4. Electronic measurements and instrumentation by A K Sawhany

With effect from the academic year 2019-2020

ES403BM

SIGNALS AND SYSTEMS FOR BIOMEDICAL ENGINEERS

Instruction	4 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE:	30 Marks
Credits	3

Course Objectives:

- To Identify and use the following elementary signals: exponentials, sinusoids, complex exponentials, exponentially damped sinusoids step functions, impulses, sifting and time scaling properties of impulses.
- To evaluate the time domain signal corresponding to DTFS, FS, DTFT, and FT representations using the defining equations.
- To determine whether an input/output description for a system has the following properties: stability, memory, memory less, causality, invertibility (simple cases), time invariance, and linearity.
- To evaluate the convolution sum and integral given an input and the impulse response.

Course Outcomes: Students will be able to:

1. To understand and classify the Signals and Systems
2. to analyze the frequency components of signals by Fourier analysis
3. to evaluate the convolution integral and apply it for the system analysis
4. to apply the DFT and DTFT for discrete signals
5. to construct DIT FFT and DIF FFT algorithms for discrete signals for the frequency domain analysis

UNIT-I

Introduction signal and system, classification of signals, Energy and power signals, Periodic and Aperiodic signals, Even and odd signals, Impulse function, Unit step function, Ramp function, Rectangular function, constant function, Signum function, Right hand sided exponential function, and left hand sided exponential function, operations on signals, Types of systems, linear and Non-linear systems, Time variant and time invariant systems, Causal and non-causal systems, Invertible and non-invertible systems, stable and unstable systems.

UNIT-II

Fourier Series and Fourier transform Analogy between vector and signal, Signal representation by discrete set of orthogonal; functions, Exponential and trigonometric Fourier series, convergence, Dirichelet's conditions, the discrete Spectrum, limitations of Fourier series. The direct and inverse Fourier transform, continuous spectrum, Existence and properties of Fourier transform, Parseval's theorem, Fourier transform of periodic functions, Limitations of Fourier transform.

UNIT-III

LTI systems Convolution integral, Properties of convolution, convolution as summation, graphical method of convolution, Applications of convolution, Correlation, Auto correlation , Cross correlation, applications of correlation, Sampling of continuous time sampling, sampling theorem and problems, Nyquist rate, Aliasing effect, Reconstruction methods of signals.

UNIT-IV

DFT & DTFT The Discrete Fourier Transform: Discrete Fourier Transform, Properties of Discrete Fourier Transform. Linear convolution using Discrete Fourier Transform, Discrete Time Fourier Transform, Z transform, Properties of the region of convergence for the Z-Transform, Inverse Z Transform, Z transform properties, Realization of discrete time system-direct, cascade and parallel Forms.

UNIT-V

FFT Fast Fourier transform; Twiddle factor, properties of twiddle factor, decimation-in-time and decimation-in frequency. FFT algorithms for radix-2 case, in place computation, bit-reversal. Inverse FFT, Power Spectral Density estimation of signals and its applications.

Suggested Reading:

1. Alan V. Oppenheim and Willsky.Allan.S, *Signals and systems*, 2nd edition, PHI-2009.
2. Luis F Chaparro, *Signals and systems using MAT LAB*, Academic press, 2011.
3. Alan V. Oppenheim and Ronald W Schafer, *Digital Signal Processing*, PHI-2008.
4. A.Anand Kumar, *Signals and Systems*, 2nd edition, PHI Learning- 2012.
5. P.Ramesh Babu, *Digital Signal Processing*, Scitech publications private Ltd-2007.
6. Lathi B.P.Signals,*Systems.and communication*, BSP-2006.

With effect from the academic year 2019-2020

PC 404 BM

BIO MATERIALS

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE:	30 Marks
Credits:	3

Course Objectives:

- To understand the need and properties of the biomaterials.
- To understand the properties, biocompatibility issues and applicationsof various classes of biomaterials.
- To understand the biomaterials-tissue interactions.

Course Outcomes: The students will be able to:

1. list the properties and Engineering requirements of biomaterials
2. compare the properties and applications of various types of biomaterials
3. assess the tissue and blood compatibility of biomaterials
4. to choose proper biomaterial for soft tissue replacements
5. describe the application of materials in hard tissues replacement and their fixation

UNIT – I

Properties of Biomaterials: Biomaterial–definition and need, Types of Biomaterial, Requirements of an ideal biomaterial, Biocompatibility.

Characterization of materials – Mechanical, chemical, thermal, electrical, optical and other properties.

UNIT – II

Materials used as biomaterials and their properties: Properties of metallic biomaterials – stainless steels, Co-based alloys, Ti and Ti–based alloys, Ni-Ti alloys.

Properties of Ceramic biomaterials -Aluminum Oxides, Calcium Phosphate, Glass ceramics and carbons.

Properties of Polymeric biomaterials–Polyamides, Polyethylene, Polypropylene,Polyacrylates, Poly Vinyl Chloride. Properties of composite biomaterials and biological/natural materials.

UNIT – III

Tissue response to biomaterials and testing of biomaterials: Inflammation, wound–healing and foreign body response, systemic toxicity and hypersensitivity, Blood compatibility, Carcinogenicity, implant–associated infection. In-Vitro and In-Vivo assessment of tissue compatibility and testing of blood–materials interaction. Degradation of metals, polymers and ceramics in general and in the biological environment.

UNIT – IV

Soft tissue replacements: Sutures, Surgical tapes and Staples, Tissue Adhesives, Percutaneous Devices, Artificial Skin, Maxillofacial implant, Ear and Eye Implants, Fluid Transfer Implants. VascularImplants, Heart Valve Implants, Heart and Lung Assist Devices, Dialysis Membrane, Drug delivery systems. Burn Dressings, Skin substitutes, Artificial Cartilage.

UNIT – V

Hard tissue replacements: Wires, Pins, Screws, Fracture Plates-Cortical and Cancellous Bone Plates. Intra-medullary devices, spinal fixation devices.Lower extremity Implants, Upper Extremity Implants, Endosseous Tooth Implants–Subperiosteal and staple /Transosteal implants, Interface of orthopedic implants. Bone-cement fixation, Porousingrowth (Biological) fixation, Direct bonding between bone and implant, Interference and passive fixation.

Suggested Reading:

1. JoonB.Park and RodericS.Lakes, *Biomaterials – An introduction* Plenum Press, 2nd Edition,1992.
2. Buddy D.Ratner, Allan S. Hoffman, Frederick, J.Schoen and Jack E. Lemons, *Biomaterials Science – An Introduction to materials in Medicine*, Academic Press, 1996.
3. John Enderle, Susan Blanchard and Joseph Bronzino, I*ntroduction to Biomedical Engineering*, 2nd Edition, Elsevier Academic Press, 2009.
4. Roger Narayan, *Biomedical Materials*, Springer, 2009.
5. NPTEL Video lecture: *Introduction to Biomaterials.*

With effect from the academic year 2019-2020

ES 451 EC

DIGITAL ELECTRONICS LABORATORY

Instruction	3 Periods per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	25 Marks
Credits	2

Course Objectives:

- Analyze and design dc and switching circuits.
- Analyze and design combinational logic circuits.
- Analyze and design sequential circuits.

Course Outcomes: the students will be able to:

1. Demonstrate the truth table of various expressions and combinational circuits using logic gates.
2. Design, test and evaluate various combinational circuits such as adders, subtractors, multiplexers and de-multiplexers.
3. Construct flips-flops, counters and shift registers.
4. Simulate BCD 7-Segment Display.
5. Design and implement multivibrators using IC 555.

I. List of Experiments:

1. Clippers and Clampers - Series and Parallel
2. Astable, Monostable and Bistable Multivibrators
3. Logic Gates-AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR
4. Half Adder, Full Adder, Half Subtractor, Full Subtractor
5. Flip Flops-SR, JK, D, T, JK-Master Slave
6. A/D and D/A converters
7. Multiplexers and Demultiplexers
8. Shift register-Series/Parallel-in to Series/Parallel-out
9. CMOS-TTL and TTL-CMOS interfacing
10. BCD-7 segment Display, DPM
11. PLL and Voltage Controlled Oscillator
12. Counters-Decade, Binary, Divide-by-N

II. Mini Project and Design exercises:

Mini project is to be executed batch-wise. Design exercises are to be carried out individually.

With effect from the academic year 2019-2020

PC 451 BM

BIO- MEDICAL INSTRUMENTATION LAB

Instruction	2 Periods per week
Duration of SEE:	2 Hours
SEE:	50 Marks
CIE:	25 Marks
Credits	1

Course Objectives:

- To introduce the students to the basic concepts of biomedical instrumentation.
- To familiarize the students with the instruments used to record biopotentials
- To introduce the students to different medical instruments and their applications

Course Outcomes: Students will be able to:

1. Learn the operation and characteristics of transducers through experiments.
2. See and identify the components of medical instruments
3. Operate and maintain the ECG and other equipment
4. Handle EEG and EMG recording systems
5. Understand the function of general medical instruments

1. Operation of Various transducers

A. Linear Variable Differential Transformer (LVDT)
B. Strain Gauge Experiment
C. Potentiometric Transducer as a displacement Transducer
D. Light Dependent Resistor (LDR) as a displacement Transducer
E. Peizo electric Transducer as a pressure transducer
F. Temperature Transducers
    a) Resistive temperature detector (RTD)
    b) Thermister
    c) Thermocouple
G. Capacitive Transducer
    a) Linear Displacement Transducer
    b) Angular Displacement Transducer
H. Indirect Measurement of Blood Pressure
    a) Oscillometry method
    b) Auscultatory method
    c) Palpatory method
I. Tuning Fork experiment to test the Hearing ability
J. Body mass Index Experiment

2. Operation of various medical Instruments

a) ECG Recorder
b) Multi-channel Data acquisition system(Polygraph)
c) EEG monitoring system
d) Bedside monitor
e) Treadmill Test
f) Pulse Oximeter
g) pH Meter
h) Conductivity meter
i) Colorimeter

With effect from the academic year 2019-2020

PC 452 BM

VIRTUAL INSTRUMENTATION & SIMULATION LAB

Instruction	3 Periods per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	25 Marks
Credits	2

Course Objectives:

- To introduce the students to the basic concepts of Mat lab and Labview.
- To familiarize the students with the implementation of filters
- To introduce the students to different medical instruments and their implementation in lab view and mat lab.

Course Outcomes: Students will be able to:

1. Learn the operation and characteristics of filters through experiments.
2. Analysis the signals of medical instruments
3. Design the filters and analyze transforms
4. Design medical instruments using Lab view
5. Extraction and Analysis of EEG, EMG & ECG Signals

Virtual Instrumentation Lab using MatLab

1. Implementation in Mat Lab
    a) Generation of basic signals.
    b) Linear and circular convolution
    c) Realization of FIR and IIR filters
    d) Finding DFT, IDFT, STFT, WT of given sequence
    e) Plotting the power spectral density.
2. Computation of convolution and correlation sequences.
3. Noise reduction techniques.
4. Design of IIR and FIR Filter
5. PSD Estimation

Labview based Instrumentation Lab

1. Introduction to LabVIEW and Data Acquisition
2. Simulation of Biosignals Using Labview
3. Design of a Bio Signal Logger.
4. Design of an Analog ECG Signal Generator
5. Acquisition of Bio potentials using Biosignals
6. Time domain and Frequency Domain Measurement of Real Time Biosignals.
7. Spectrum analysis of ECG and PCG signal
8. Design of Heart Rate Analyzer
9. Extraction of Brain Waves from EEG
10. Design of a Demand Pacemaker using LabVIEW
11. GPIB Communication using LabVIEW
12. Instrumentation of an amplifier to acquire an ECG Signal
13. Signal Processing of an ECG signal and measuring the Heart Rate
14. Implementation of Digital Filter to remove noise in biosignals
15. Spectrum analysis of Noisy and pure Biosignal
16. Acquire, Analysis and Present an EEG using Virtual Instrumentation
17. Extraction and Analysis of Brainwaves from an EEG Signal
18. Biofeedback system on EMG
19. Acquisition of PCG signal.