With effect from the academic year 2017-2018

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (BIOMEDICAL ENGINEERING)

BM: SEMESTER - V

S. No	Course Code	Course Title	Scheme of Examination		L	T	P	Hrs/ Wk	Credits
			CIE	SEE					
1.	PC501BM	MPMC in Medical Applications	30	70	3	1	0	4	3
2.	PC502BM	Biomedical Equipment-I	30	70	3	0	0	3	3
3.	PC503BM	Calibration of Medical Equipment	30	70	3	0	0	3	3
4.	PE-I*	Professional Elective-I	30	70	3	1	0	4	3
5.	PE-II*	Professional Elective-II	30	70	3	0	0	3	3
6.	BS501MT	Statistics and Numerical Methods	30	70	3	1	0	4	3
	Practicals								
7	PC551BM	MPMC Lab	25	50	0	0	3	3	1
8.	PC552BM	Medical Instrument Design & Calibration Lab	25	50	0	0	3	3	1
9.	PW561BM	Mini Project	25	50	0	0	0	3	2
Total			**255**	**570**	**18**	**03**	**06**	**30**	**22**

PE-I* # Professional Elective-I:

PE501BM Biological Control Systems
PE502BM Bioinformatics

PE-II* # Professional Elective-II:

PE503BM Nanotechnology for medical applications
PE504BM Biomaterials and Applications

With effect from the academic year 2017-2018

PC501BM

MICROPROCESSORS AND MICROCONTROLLERS IN MEDICAL APPLICATIONS

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination:	70 Marks
Sessionals :	30 Marks
Credits:	3

OBJECTIVES:

- ✓ Understand the architecture of 8085 microprocessor and 8051 microcontroller
- ✓ Program the 8085 microprocessor and 8051 microcontroller using suitable techniques
- ✓ Interface sensors to 8085 and 8051

OUTCOMES:

- ✓ Select a microprocessor or microcontroller suitable to the application.
- ✓ Perform the detailed hardware design of an 8085 microprocessor or an 8051 microcontroller system.
- ✓ Develop microprocessor and microcontroller based systems for various medical sensors.

UNIT I

8085 Microprocessor: Architecture, Instruction cycle, basic timing diagrams, Addressing Modes, Instruction Set, Memory and I/O interfacing, interrupts, I/O ports and data transfer concepts**.** Introduction to 8086, Architecture, Memory segmentation.

UNIT II

Peripheral Interfacing: Programmable peripheral interface chip (8255), Programmable communicator chip (8251), Programmable Internal timer chip (8253), Programmable interrupt controller (8259), DMA (8257) controller.

UNIT III

Programming of 8085 Microprocessor: General Programs, debugging of Programs, interfacing with 8085- ADC, DAC, seven Segment display, stepper motor, traffic control, digital multiplexer, digital demultiplexer, square wave generation using micro processor

UNIT IV

8051 Microcontroller**:** Architecture, Internal and External Memories, Counters and Timers, Register Set, Synchronous and Asynchronous Serial Communication, Interrupts, Instruction Set, Basic C Programming in 8051 Microcontroller.

UNIT V

Interfacing of medical sensor circuits: Carbon dioxide and oxygen sensors, respiration, force, flow, differential voltage and current probes and humidity sensors. Features, Specifications and their interfacing.

Suggested Reading:

1. Kenneth J. Ayala, *the 8051 Microcontroller-Architecture, Programming and Applications, 2nd Ed*., Penram International Publishing, 2005.
2. D.V. Hall, *Microprocessors and Interfacing, Programming and Hardware,* Tata Mc-Graw Hill, 1999.
3. Goankar R.J**,** *Microprocessor architecture, programmable and applications with the 8085, 6th edition, 2013.*

With effect from the academic year 2017-2018

PC502BM

BIOMEDICAL EQUIPMENT -I

Instruction:	3 Periods per week
Duration of University Examination:	3 Hours
University Examination:	70 Marks
Sessional:	30 Marks
Credits:	3

OBJECTIVES:

- ✓ State the Physiological reasons for using a particular piece of Biomedical Equipment.
- ✓ Describe the operating principles of a wide range of biomedical equipment.

OUTCOMES:

- ✓ Perform tests to assess the performance and safety of various Equipments.
- ✓ Learn the maintenance of biomedical equipment.

UNIT-I

Critical physiological parameters to be monitored. Intensive coronary care unit layout.
Assist devices of the heart: Principles of external counter pulsation techniques. Intra-aortic Balloon pump. Prosthetic heart valves, Mechanical and tissue Valves. Types of mechanical valves: Ball and Cage, tilting disc and Bileaflet valves. Types of tissue valves: Homografts or Allografts (human cadaver) and Heterografts or Xenografts (Porcine or Bovine). Testing of prosthetic heart valves.

UNIT-II

Cardiac Pacemakers: Need for a Pacemaker, Types-Asynchronous, Synchronous, External and implantable. Asynchronous pacemakers: Working principle, block diagram.
Synchronous / Demand Pacemaker: Modes of triggering-ventricular triggered and atrio-ventricular synchronized pacemaker, Programmable pacemaker. Implantable Pacemaker: Technical and qualitative requirements of power supplies, lead wires and electrodes, packaging. Microprocessor based implantable pacemaker, Rate responsive pacemaker.

UNIT-III

Defibrillators: Need for Defibrillators, D.C. Defibrillator, Need for Synchronous Defibrillators, Types of electrodes and their features, Types of Waveforms, Automatic/Advisory External Defibrillators (AED), Implantable defibrillators.
Cardioverters: Working principle. Defibrillator analyzers.

UNIT-IV

Heart lung Machine: Governing principles. Qualitative requirements. Functional details of Bubble, Thin Film and membrane-type of blood oxygenators. Respiratory measurements: Principles and techniques of impedance Pnuemography and pneumotachograph. Ventilators: Artificial Ventilation, Types of ventilators, Modern Ventilators, High frequency Ventilators, Humidifiers, Nebulizers and Aspirators.

UNIT-V

Haemodialyzer: Artificial Kidney, Dialyzers, Membranes for Haemodialysis, Haemodialysis Machine, Monitoring circuits for hemodialysis machine, Portable Kidney Machines.
Lithotriptors: Need for Lithotriptor, First Lithotriptor Machine, Modern Lithotriptor Systems, Extra-corporeal shock-wave Therapy.

Suggested Reading:

1. John G. Webster, "*Medical Instrumentation-Application and Design*", John Wiley and sons Inc., 3rd Ed., 2003
2. Khandpur R.S., *Hand Book of Biomedical Instrumentation*, Tata Mc.Graw Hill Pub Co.Ltd., 2nd ed., new Delhi, 2003
3. Joseph J. Carr ad John M. Brown, *Introduction to Biomedical Equipment Technology*, Pearson Education, 2001
4. Gerald E. Miller, *Artificial Organs*, Morgan and Claypool, 2006

With effect from the academic year 2017-2018

PC503BM

CALIBRATION OF MEDICAL EQUIPMENT

Instruction:	3 Periods per week
Duration of University Examination:	3 Hours
University Examination:	70 Marks
Sessionals:	30 Marks
Credits:	3

COURSE OBJECTIVES:

- ✓ Perform calibration tests to assess the performance and safety of medical Equipment.
- ✓ Learn the maintenance of biomedical equipment.
- ✓ Learn about Quality concepts, Management system and NABL accreditation

OUTCOMES:

- ✓ Learn the calibration of biomedical equipment.
- ✓ Learn the standards of NABL and NABH Accreditations

UNIT I

General Metrology: Global metrology scenario, Measurement units, Measurement standards, Measurement traceability. Measurement Units: Base SI units, Derived SI units, SI multipliers and conversions, Fundamental constants, Common measurements.

UNIT II

Measurement Systems: Measurement methods, Measurement data & characteristics of measurements, T&ME specifications, Primary error sources, Measurement systems and capabilities, Measurement assurance programs.

UNIT III

Calibration Systems: Calibration procedures & methods Industry practices & regulations Control of calibration environment, Calibration processes Calibration processes contd., Manual & automated calibration. Calibration results &reporting, Records & records management.

UNIT IV

Technical & Applied mathematics: Scientific and engineering, notation, English/Metric conversions, Ratios. Linear interpolation and extrapolation, Rounding, truncation, and significant figure, Number bases, Volume and area, Angular conversions, Graphs and plots.

QC tools applied statistics: Basic statistical tools, Common distributions, Descriptive statistics Sampling issues.

UNIT V

Uncertainty: Uncertainty management Uncertainty components Estimation of uncertainty Evaluation of uncertainty Reporting uncertainty

Quality Systems & Standards: Quality concepts Management system ISO/IEC 17025 NABL accreditation

Suggested Reading:

1. Jay L. Bucher, *The Metrology Handbook,* ASQ Quality press, 2004
2. Christian Elbert, *Calibration Technology* (Basics, reference instruments for pressure and temperature, professional calibration) 2nd ed., 2013.
3. Mike Cable, *Calibration : A Technician's Guide,* Instrumentation systems and Automation Society, 2005

With effect from the academic year 2017-2018

BS501MT

STATISTICS AND NUMERICAL METHODS

(B.M.E)

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination:	70 Marks
Sessionals :	30 Marks
Credits:	3

OBJECTIVES:

- ✓ To introduce Laplace Transforms and their applications.
- ✓ To introduce a few numerical methods to solve certain type of problems.
- ✓ To introduce basic statistical methods like curve fitting, correlation and regression.
- ✓ To provide the knowledge of probability distributions like normal, Poisson and tests of significance.

OUTCOMES:

- ✓ At the end of the course students will be able
- ✓ To solve differential equations using Laplace transforms
- ✓ To find numerical solution of algebraic, transcendental equations and ordinary differential equations.
- ✓ To apply various probability distributions to solve practical problems, to estimate unknown parameters of populations and apply the tests of hypotheses.
- ✓ To Perform regression analysis and to compute and interpret the coefficient of correlation

UNIT –I

Laplace transforms: Introduction of Laplace transforms, sufficient condition for existence of Laplace transform, Laplace transform of Derivatives, Laplace transform of integrals, Translation theorems (I & II shifting theorems), Differentiation of Laplace transform (Multiplication by t), Integration of Laplace transform(Division by t), convolution theorem, Solving initial value problems using Laplace transform

UNIT-II

Numerical methods: Solution of Algebraic and Transcendental equations**:** Bisection method, Newton-Raphson method, Solution of linear system of equations: Gauss elimination method, Gauss- Seidel iteration method, Interpolation: Lagrange's interpolation, Newton's divided difference interpolation, Newton's Forward and Backward difference interpolations, Numerical differentiation, Numerical solutions of ordinary differential equations : Taylor's series method, Euler method, Runge-Kutta method of 4^{th} order.

UNIT-III

Basic Statistical Measures: Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion, variance, standard deviation, Basics of probability, addition theorem on probability, Bayes theorem and its applications.

UNIT-IV

Random variables and Distributions: Density functions, mathematical expectation, expected values, Normal, Poisson, chi-square distributions .Tests of Significance: Testing of Hypothesis, Type-I, Type-II error, F-Test, t- Test, Chi-Square Test.

UNIT- V

Curve fitting: Curve fitting by method of least squares**,** correlation and regression, types of correlations, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, equal ranks, equations to the lines of regression.

Suggested Reading:

1. Advanced Engineering Mathematics- R.K.Jain & S.R.K.Iyengar, 4th Edition, Narosa Publications.
2. Higher Engineering Mathematics-Dr.B.S.Grewal, 43th Edition.
3. Kreyszig E, Advanced Engineering Mathematics, 8 th Edition, John Wiley & Sons Ltd, 2006.
4. S.C Gupta & Kapoor: Fundamentals of Mathematical statistics, Sultan chand & sons, New Delhi.

With effect from the academic year 2017-2018

PE501BM

BIOLOGICAL CONTROL SYSTEMS

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination:	70 Marks
Sessionals :	30 Marks
Credits:	3

OBJECTIVES:

- ✓ To study system concept and different mathematical techniques applied in analyzing any given system.
- ✓ To learn to do the analysis of given system in time domain and frequency domain.
- ✓ To develop an understanding of the fundamental principles behind control of various biological systems.
- ✓ To apply these analysis to study the biological systems.

STUDENT LEARNING OUTCOMES:

- ✓ Analyze the concepts that are generally useful in all other engineering disciplines.
- ✓ Apply quantitative approaches for the analysis of physiological system.
- ✓ Ability to create simple models of physiological systems.
- ✓ Ability to understand complex physiological models.

UNIT-I

Open and closed loop systems. Mathematical models of physical systems. Transfer functions. Block diagram algebra. Signal flow graphs. Feedback characteristics of control systems. Control systems and components. DC and AC servomotors.

UNIT-II

Standard test signals. Time response of first order and second order systems. Design specifications of second order systems. Proportional controller. Proportional derivative controller. Proportional-Integral controller, Proportional-Integral-Derivative controller

UNIT-III

Performance indices of control systems. Necessary conditions for stability. Hurwitz and Routh stability criteria. Relative stability. Frequency response analysis, Correlation between time and frequency response, Bode plots. Stability in frequency domain. Nyquist stability criteria.

UNIT-IV

Difference between general control systems and physiological control systems, examples of positive and negative feedback physiological control systems. Body temperature Regulation. Blood glucose regulation. Pupil Control System. Visual Fixation System. Oculo-motor System,

UNIT-V

Muscle stretch reflex, skeletal muscle Servo-mechanism.

Cardiovascular Control Systems-Regulation of heart rate, blood pressure and cardiac output. Respiratory Control system-Chemical regulation of ventilation, Cheyne Stokes breathing

Suggested Reading:

1. NagrathI.J and Gopal M., *Control Systems Engineering*, 3rd Ed, New Age Publishers, 2002
2. Michael C. Khoo, *Physiological Control Systems-Analysis, Simulation and Estimation*, IEEE Press, 2000
3. Suresh R. Devasahayam, *Signals and Systems in Biomedical Engineering*, Springer Science & Business Media, 2012.

With effect from the academic year 2017-2018

PE502BM

BIOINFORMATICS

Instruction:	3 Periods per week
Duration of University Examination:	3 Hours
University Examination:	70 Marks
Sessionals:	30 Marks
Credits:	3

OBJECTIVES:

- ✓ To give students an introduction to the basic techniques of bioinformatics.
- ✓ Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems.

OUTCOMES:

- ✓ The students will be able to describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge
- ✓ The students will be able to explain the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming.
- ✓ The students will be able to predict the secondary and tertiary structures of protein sequences.

UNIT I

Prediction of protein molecular function and structure: Primary sequence of a protein and its analysis, Secondary, Tertiary and quaternary structures and their prediction methods, Fold recognition methods, Homology /comparative modeling of proteins, Energy calculations, local and global minimization, Energy Minimizations: Conjugate, steepest and Powell , Molecular dynamics and simulation studies.

UNIT II

Algorithms: Algorithms and complexity, Biological algorithms, computer algorithms, The change problem, Correct, incorrect algorithms, Recursive algorithms, Iterative, recursive algorithms, Fast and slow algorithms, Big-O notation, Algorithm designing techniques- Exhaustive search, Branch-and-bound algorithms, Dynamic programming, Divide-and-conquer algorithms, Randomized algorithms, Gibbs sampling.

UNIT III

Computer algorithms for prediction of protein structures. DNA Sequence Comparison, Algorithms for alignment of sequences and structures of proteins and protein families, PAM, BLOSUM, Bayesian modeling and networks, Probabilistic models or Hidden Markov models, Needleman Wunch and Smith Waterman algorithms, Global sequence alignment, Scoring alignments, Local sequence alignment, Alignment with gap penalties. Multiple alignment, Gene prediction-Statistical and Similarity-based approaches. Spliced alignment.

UNIT IV

Genetic algorithms: Genetic algorithms for the prediction of multiple sequence alignment, Gene expression analysis, Hierarchical clustering, K-Means clustering, clustering and corrupted cliques. Evolutionary trees- Distance-based tree reconstruction, Reconstructing trees from additive matrices, Evolutionary trees and hierarchical clustering. Character-based tree reconstruction- Small parsimony problem, large parsimony problem.

UNIT V

Neural Networks: Biological neurons and neural networks. Networks of artificial neurons. Learning in single layer and multi-layer perceptrons. Back-propagation. Radial basis function networks: Algorithms and applications. Committee machines. Self-organizing maps: algorithms and applications. Learning vector Quantization. Machine Learning, Statistical learning, Decision trees. Inductive logic programming, Computation learning, Un-supervised learning, temporal difference learning, Delayed reinforcement learning, Explanation based learning.

Suggested Reading:

1.Bioinformatics – *Sequence and Genome Analysis*. David W. Mount.
2.Beale and T.J. Jackson, *Introduction to Neural Networks*, IOP Publishing Company, 1990.
3.Baeck, D.B. Fogel and Z. Michalewicz, *Genetic Algorithms*, IOS Press, 1997.

With effect from the academic year 2017-2018

PE503BM

NANO TECHNOLOGY FOR MEDICAL APPLICATIONS

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

OBJECTIVES:

- ✓ To learn about basis of nanomaterial science, preparation method, types and application.
- ✓ To know about Drug delivery and tracking systems

OUTCOMES:

- ✓ Will familiarize about the science of nanomaterials
- ✓ Will familiarize about the science of nanomedicine
- ✓ Will develop knowledge in characteristic nanomaterial

UNIT-I Introduction to Nanotechnology

Nano materials: Definition, Characteristics and Properties of Nano materials. Fullerness and carbon forms.

UNIT-II Introduction to Nanotechnology

Nanoparticles and Colloids, structure and bonding in nanoparticles, Nanomaterials fabrication by Bottom-up and Top- down approaches, Classification of nanodevices based on the characteristics, Quantum dots and their properties.

UNIT-III Carbon nanotubes

Carbon nanoparticles, types of carbon nanotubes, single-walled, multi-walled, torus, Nano bud, properties of carbon nanotubes, and synthesis by Arc discharge, laser ablation, chemical vapor deposition techniques

UNIT-IV Nanomedicine

Drug delivery to cells using nanotubes and nanowires, Quantum Dots for drug discovery and imaging, Quantum Dots and gold nanoparticles for cancer treatment, Nanoparticle mediated gene therapy, Growth of neurons on Nanomaterials, Nanomaterials for brain protection and repair, Nanorobotics for surgery

UNIT-V Nano molecular imaging

Medical use of Nanomaterial, Drug delivery systems. Cancer treatment and Surgery. Drug tracking systems. Targeted drug delivery systems.
Applications of Nanomaterials in Medical imaging. Neuro-electronic interfaces.

Suggested Books:

1. Lynn E. Foster, Foreword by George Allen, Foreword by Joe Lieberman, Nanotechnology: Science, Innovation, and Opportunity, *Nanomedicine: Basic Capabilities*, Vol. 1 by Robert A. Freitas Jr. 1999 Rev
2. NeelinaMalsch, *Biomedical nanotechnology* by CRC press release, Malsch Techno Valuation, Utrecht, The Netherlands
3. GeroDecher, Joseph B. Schlenoff, *Multilayer Thin Films*, Wiley-VCH Verlag GmbH & Co. KGaA, 2003
4. David S. Goodsell, *Bionanotechnology: Lessons from Nature*, Wiley-Liss, 2004.
5. Kenneth J. Klabunde, *Nanoscale Materials in Chemistry*, John Wiley & Sons, Inc., 2001

With effect from the academic year 2017-2018

PE504BM

BIO MATERIALS AND APPLICATIONS

Instruction:	3 Periods per week
Duration of University Examination:	3 Hours
University Examination:	70 Marks
Sessionals:	30 Marks
Credits:	3

OBJECTIVES:

- ✓ To understand the need and properties of the biomaterials.
- ✓ To understand the properties, biocompatibility issues and applications of various classes of biomaterials.
- ✓ To understand the biomaterials-tissue interactions.
- ✓ To understand the various soft tissue and hard tissue replacements.

OUTCOMES:

- ✓ Describes the material science and Engineering requirements related to biomaterials.
- ✓ Describes the application of materials in replacements of soft and hard tissues.
- ✓ Knowledge to use the techniques, skills for engineering practice.
- ✓ Knowledge of contemporary issues and testing of biomaterials.

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. Vascular Implants, 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, Porous in growth (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 2017-2018

PC551BM

MICROPROCESSORS AND MICROCONTROLLERS IN MEDICAL APPLICATIONS LAB

Instruction:	3 Periods per week
Duration of University Examination:	3 Hours
University Examination:	50 Marks
Sessionals:	25 Marks
Credits:	1

1. Basic Assembly Programs in 8085 microprocessor and 8051 microcontroller.

   a) 8-bit Arithmetic operations (Addition, Subtraction, Multiplication, Division)

   b) 16-bit Arithmetic operations (Addition, Subtraction, Multiplication, Division)

   c) Moving an array from one memory location to another.

   d) Arranging an array in ascending and descending order.

   e) Maximum and Minimum values pickup from an array.

   f) Program to generate delays.

2. Interfacing with 8085 microprocessor and 8051 microcontroller

   a) Serial Communication with PC interface.

   b) 7-segment display.

   c) Analog to Digital Converter.

   d) Matrix keyboard.

   e) LCD display.

   f) Digital to Analog Converter.

   g) Stepper motor.

   h) DC- motor.

   i) Interrupt based application.

Note: Minimum of 10 experiments to be performed.

With effect from the academic year 2017-2018

PC552BM

MEDICAL INSTRUMENT DESIGN AND CALIBRATION LAB

Instruction:	3 Periods per week
Duration of University Examination:	3 Hours
University Examination:	50 Marks
Sessionals:	25 Marks
Credits:	1

List of Experiments

1. ECG Recorder.
2. EEG monitoring system.
3. Pulse Oximeter.
4. Conductivity meter.
5. Syringe pump Experiment.
6. Audiometry to find the Hearing ability of the subjects.
7. Ultrasound Diathermy.
8. Shortwave Diathermy.
9. Spirometry to test the capacity of Human lungs.
10. Nerve conduction Velocity Experiment.
11. Recording of Evoked potentials.
12. Pacemaker simulator.

Calibration of Medical equipment using following Analyzers

1. Infusion Pump Analyzer.
2. Vital Sign Monitor.
3. Electrical Safety Analyzer.
4. Gas Flow Analyzer.

Note: Minimum of 10 experiments to be performed.

With effect from the academic year 2017-2018

PW561BM

MINI PROJECT

Instruction:	3 Periods per week
Duration of University Examination:	3 Hours
University Examination:	50 Marks
Sessionals:	25 Marks
Credits:	2

Mini Project and Design exercises:

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