V SEMESTER

Sub Title : CONTROL SYSTEMS		
Sub Code: ML51	**No of Credits : 4=3:2:0(L-T-P)**	**No of lecture hours/week : 3+2=5**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:65**

COURSE OBJECTIVES:

1. To discuss the mathematical modeling of systems.
2. To discuss reduction of block diagram and signal flow graph.
3. Learn the time response of feedback control systems.
4. Learn the different methods of stability analysis (in time domain and frequency domain).

UNIT No	Syllabus Content	No of Lecture Hours	No of Tutorial Hours
1	**Modeling of Systems:** The control system, Mathematical models of physical systems – Introduction, Differential equations of physical systems – Mechanical systems, Friction, Translational systems (Mechanical accelerometer, Levered systems excluded), Rotational systems, Electrical systems, Analogous systems.	**6**	**4**
2	**Block diagrams and signal flow graphs:** Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded).	**6**	**4**
3	**Time Response of feedback control systems**: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. **MATLAB Exercise (Practice only) :** **Time domain Analysis of first order and second order system**	**8**	**4**
4	**Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh- stability criterion, Relative stability analysis; More on the Routh stability criterion. **Root–Locus Techniques**: Introduction, The root locus concepts, Construction of root loci.	**9**	**6**

5	**Stability in the frequency domain:** Mathematical preliminaries, Nyquist Stability criterion, (Inverse polar plots excluded), Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded). **Frequency domain analysis:** Introduction, Correlation between time and frequency response, Bode plots, All pass and minimum phase systems. **MATLAB Exercise (Practice only) :** **Verifying the parameters computed for numerical examples using MATLAB for Root locus, Bode Plot and Nyquist Plot**	**10**	**8**

Note1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5 And simulation experiments using MATLAB

COURSE OUTCOMES: The students will be able to

CO1: Understand and develop mathematical modeling of mechanical & electrical systems.
CO2: Simplify and derive overall transfer function for block diagram & signal graph representation of systems.
CO3: Calculate 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.

Cos	Mapping with Pos
CO1	PO1,PO3,
CO2	PO3
CO3	PO1
CO4	PO3,
CO5	PO5, PO12

TEXT BOOK :

1**. Control Systems Engineering**, J. Nagarath and M.Gopal, New Age International (P) Limited, Fourth edition ,2005.

REFERENCE BOOKS:

1. **Modern Control Engineering ,** K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002.
2. **Concepts of Control Systems,** P. S. Satyanarayana; Dynaram publishers, 2001.
3. **Control Systems Principles and Design,** M. Gopal, TMH, 1999.
4. **Feedback control system analysis and synthesis,** J. J. D'Azzo and C. H. Houpis, McGraw Hill, International student Edition.

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: BIOMEDICAL INSTRUMENTATION		
Sub Code: ML52	**No. of Credits : 3=3: 0: 0(L-T-P)**	**No of lecture hours/week :03**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:39**

COURSE OBJECTIVES: Is to make the student understand

1. The human physiology, anatomy and evolution of bio signals.
2. The concepts of bio signal transducers and measurement.
3. The working of all major biomedical equipments.
4. The safety of biomedical devices.

Unit No	Syllabus Content	No of Hours
1	**FUNDAMENTAL CONCEPTS:** Sources of biomedical signals, Basic medical instrumentation system, performance requirements of medical instrumentation systems, General constraints in design of medical instrumentation systems. Bioelectric Signals and Electrodes: Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrodes for ECG, Electrodes for EEG, Electrodes of EMG. EOG, EGG,	**8**
2	**BIO AMPLIFIER**: Need for bio amplifier- single ended bio amplifier-right leg driven ECG amplifier, Band Pass filtering, isolation amplifiers-transformer and optical isolation- isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference	**7**
3	**BIOMEDICAL RECORDERS:** Electrocardiograph-block diagram description, ECG leads, Artefacts, Vectorcardiograph, Phonocardiograph, Electroencephalograph, Electromyograph, measurement of heart rate, measurement of pulse rate, blood pressure measurement, measurement of temperature, measurement of respiratory rate.	**10**
4	**OXIMETERS:** Oximetry, ear oximeter, pulse oximeter, skin reflectance oximeter and intravascular oximeter. Cardiac Output Measurement-indicator dilution, dye dilution. Blood Flow Meters Electromagnetic blood flow meters, Ultrasonic blood flow meters, NMR blood flow meters.	**8**
5	**CARDIAC PACEMAKERS AND DEFIBRILLATORS:** Need for cardiac pacemaker, External pacemaker, Implantable pacemaker, Types of Implantable pacemakers, Programmable pacemaker, Rate-responsive pacemakers. DC defibrillator, Implantable defibrillators. **PATIENT SAFETY:** Electric shock hazards, Leakage currents, macro shock, micro shock hazards and preventions, safety codes and analyzer. safety & precautions	**6**

Note1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOMES: On completion of this course the student will be able to

CO1: Understand the generation of bio-electric signals, identify the basic components of a measuring system
CO2: Understand the working of electrical amplifiers and 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 pace makers & defibrillators
CO6: Understand the patient safety standards

COs	**Mapping with POs**
CO1	PO1,PO2,PO3
CO2	PO3,PO4, PO6, PO7
CO3	PO3,PO4, PO6, PO7
CO4	PO3, PO4, PO6, PO7
CO5	PO3, PO4, PO6, PO7
CO6	PO8

TEXT BOOK:

1. **Handbook of Biomedical Instrumentation**, R.S.Khandpur, Tata McGraw Hill, 2nd Edition, 2003.
2. **Medical Instrumentation Application and Design, John G WebsterJohn Wiley and Sons, New York 2004**

REFERENCE BOOK:

1. **BIOMEDICAL TRANSDUCERS AND INSTRUMENTS**, Tatsuo Togawa, Toshiyo Tamura and P. Ake Oberg, CRC Press, 1997.
2. **Biomedical Instrumentation and Measurement** , Leslie Cromwell, Fred J Weibell and Erich A. Pfeiffer, Prentice-Hall India Pvt. Ltd.
3. **Introduction to Biomedical Equipment Technology** , Joseph J Carr and John M Brown , Pearson Education ,4th Edition , 2001 .

CHAIRMAN/BOS **DEAN (ACADEMIC)** **CHAIRMAN/ACADEMIC COUNCIL**

Sub Title : PHYSIOLOGICAL CONTROL SYSTEMS		
Sub Code: ML53	**No of Credits :3=3: 0: 0(L-T-P)**	**No of lecture hours/week : 3**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:39**

COURSE OBJECTIVES:

1. To study various concepts of Engineering control system.
2. To distinguish physiological and engineering control system.
3. To learn mathematical modeling of the physiological system.
4. To learn the time domain and frequency domain analysis applied to physiological system.
5. To identify and optimization of physiological control system.

UNIT No	Syllabus Content	No of Hours
1	**INTRODUCTION TO PHYSIOLOGICAL CONTROL SYSTEMS** Preliminary considerations, Historical Background, System analysis, Physiological systems-A simple example, Differences between engineering & physiological control systems, The science of modeling.	6
2	**MATHEMATICAL MODELING** Generalized system properties, Models with combination of system elements, Linear models of Physiological systems, Distributed Vs Lumped parameter models, Linear systems & superposition principle, Laplace transforms & transfer functions, Impulse response & linear convolution, state space analysis.	8
3	**STATIC ANALYSIS OF PHYSIOLOGICAL SYSTEMS** introduction, open loop Vs closed loop, determination of steady state operating point, regulation of cardiac output, regulation of glucose, chemical regulation of ventilation. **TIME DOMAIN ANALYSIS OF LINEAR CONTROL SYSTEMS** Linearized respiratory mechanics, open & closed loop transient responses for 1^{st} & 2^{nd} order models, Impulse & step response descriptors, transient response analysis. Simulink experiments on modeling physiological systems	10
4	**FREQUENCY DOMAIN ANALYSIS OF LINEAR CONTROL SYSTEMS** Steady state responses to sinusoidal inputs, Graphical representation of frequency response, frequency response model of a circulatory control, frequency response of glucose-insulin regulation. **STABILITY ANALYSIS – LINEAR APPROACHES** stability & transient responses, root locus plots, routh-hurwitz stability criterion, stability analysis of pupillary light reflexes. Simulink experiments on Physiological Systems	9

5	**IDENTIFICATION OF PHYSIOLOGICAL CONTROL SYSTEMS** basic problems in physiological system analysis, non-parametric & parametric identification methods, Problems in parameter estimation, Identification of closed loop systems, identification under closed-loop conditions.	6

Note 1: Assignment-1. from unit 1, and 2 and 3
Asssignment-2 from unit 3, 4 and 5 and report on simulation experiments

COURSE OUTCOMES: On completion of the course the students will be able to

CO1: Mathematically model the physiological systems & relate it to the engineering control system
CO2: Analyze parameters in both time and frequency domain
CO3: Analysing & optimizing different PCS
CO4: Modelling and analysis of physiological systems using Simulink software

Cos	Mapping with Pos
CO1	PO1,PO2,PO6
CO2	PO3,PO4, PO6, PO7
CO3	PO3, PO4, PO6, PO7
CO4	PO5, PO12

TEXT BOOK

1. **Physiological Control Systems – Analysis, Simulation & Estimation**, Michael C Khoo, Wiley IEEE press.

REFERENCE BOOKS

1. **Biological Control System Analysis** by Milsum John, McGraw Hill
2. **Control Theory and Physiological Feedback Mechanism** by William Baltimore

CHAIRMAN/BOS **DEAN (ACADEMIC)** **CHAIRMAN/ACADEMIC COUNCIL**

Sub Title: **DIGITAL SIGNAL PROCESSING**		
Sub Code: ML54	**No of Credits : 4= 4: 0: 0(L-T-P)**	**No of lecture hours/week :4**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES :Is to make the student understand

1. The Discrete Fourier Transform
2. The Fast Fourier Transform
3. FIR and IIR Filters
4. Design of Digital filters
5. The concepts of DSP Processors

Unit No	Syllabus Content	No of Hours
1	**DISCRETE FOURIER TRANSFORM: INTRODUCTION**, definition of DFT, properties of DFT, circular convolution, linear convolution using DFT.	**10**
2	**FAST FOURIER TRANSFORM: INTRODUCTION**, decimation in time FFT algorithm, computational efficiency, decimation in frequency algorithm.	**10**
3	**FIR FILTER DESIGN:** Introduction, different types of windows- rectangular, Bartlett, Hanning, Hamming, Black Mann, and Kaiser windows, design of FIR filters using above windows, frequency sampling design, comparison of IIR & FIR digital filters. **ANALOG FILTER DESIGN:** Introduction, Butterworth filters, Chebyshev filters, general filter forms	**12**
4	**DESIGN OF IIR DIGITAL FILTER:** Introduction of filters, design of IIR digital filter through analog filters, impulse invariant transformations, bilinear transformations, design of digital Butter worth & Chebyshev filters, frequency transformation. comparison of IIR & FIR digital filters. **REALISATION OF DIGITAL SYSTEMS:** Introduction, Block diagram and signal flow graph,basic IIR filter structures (Direct forms I & II), cascade and parallel realisations, basic FIR filter structures (Direct forms I & II), and linear phase FIR structures	**12**
5	**Wavelet Transform**: Introduction to wavelet transforms and its biomedical application **DSP Processor:** Introduction to General purpose DSP Processor TMS 320C6713: architecture , addressing modes.	**8**

Note1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOMES: The student will be able to

CO1: Understand the properties of DFT, FFT and solve problems.
CO2: Design IIR and FIR filters.
CO3: Understand and explore DSP processor TMS 320C6713.
CO4: Distinguish between wavelet transforms and other transforms such as DFT

COs	Mapping with POs
CO1	PO1,PO2,PO3
CO2	PO1,PO2,PO3
CO3	PO1, PO2,PO3
CO4	PO1, PO2,PO3

TEXT BOOKS:

1. **Digital Signal Processing,** Proakis and Manolakis, Prentice Hall of India , 3rd Edition.
2. **Time frequency and wavelet applications in biomedical signal processing,** Metin Akay, IEEE Wiley Press.

REFERENCE BOOKS:

1. Digital Signal Processing, S K Mitra, Mc Graw-Hill, 4th Edition.
2. Theory and Application of DSP, Rabinar L R and Gold B, Prentice Hall of India, 1999.
3. Introduction to digital signal processing, Johnson, Prentice Hall of India ,1999.
4. Digital Signal Processing,Alan V Oppenheim, Prentice Hall of India.
5. DSP using Matlab, Prokis & Ingle , Cengage Learning, 1st edition.
6. TMS Processors Manual

CHAIRMAN/BOS DEAN(ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

ELECTIVE I (GROUP A)

Sub Title: EMBEDDED SYSTEMS & IOT		
Sub Code: ML551	**No of Credits : 4= 4:0: 0(L-T-P)**	**No of lecture hours/week :4**
Exam Duration : 3 hours	**CIE + Assignment + SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES :To make the student learn

1.The concepts of embedded programming in the context of 8051
2 .Design constraints of 8051 for embedded applications
3. Embedded C
4. TI Processor- MSP 430

Unit No	Syllabus Content	No of Hours
1	**Review of 8051** Introduction The external interface of the Standard 8051, Reset requirements, Timers, Interrupts, Serial interface, Power consumption **Introduction to Embedded Systems** Embedded system, Choice of processor, programming language and operating system, Conclusions **Reading Switches** Introduction, Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), Example: Counting goats, Conclusions	12
2	**Adding Structure to the Code** Introduction, Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example conclusions	8
3	**Meeting Real-Time Constraints** Introduction, Creating 'hardware delays' using Timer 0 and Timer 1, Example: Generating a precise 50 ms delay, Example: Creating a portable hardware delay, The need for 'timeout' mechanisms, Creating loop timeouts, Example: Testing loop timeouts, Example: A more reliable switch interface, Creating hardware timeouts, Example: Testing a hardware timeout,	10

4	**Internet of Things** Embedded Systems-an overview, features. Networked Embedded System- types and overview, wireless communication standards-zigbee, Bluetooth & Wi-Fi. OSI & TCP/IP model in a nutshell. Introduction to the Internet and understand how internet works. Introduction to Smart Objects or Things. **IOT applications** IOT- understand what IOT is and discuss its application in health-care systems- Patient Monitoring & diagnostics, Home healthcare & Personal care & Fitness. Case Study: Wireless Patient Monitor system. Application Design: Design of IOT based pulse oximeter, block diagram, concepts of analog front end, signal process and Wi-Fi integration.	**12**
5	**Case Study:** Intruder Alarm System: State diagram representation, program **MSP430G2553:** Block diagram and study. **MSP EXP 430 G2 Launch Pad –** components. **Examples-** LED control using a switch, serial communication	**10**

Note 1: No questions on Review portions from Unit 1

Note 2: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOMES: The student will be able to
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: Understand the fundamentals of IOT

Cos	Mapping with Pos
CO1	PO3,PO4,
CO2	PO3,PO4,
CO3	PO3,PO4,PO5,PO12
CO4	PO5, PO12

TEXT BOOKS:

1. Embedded C - Michael J. Pont, 2nd Ed., Pearson Education, 2008
2. TI- MSP430 Launch Pad Manual

REFERENCE BOOKS:

1. **PICmicro MCU C-An introduction to programming**, The Microchip PIC in CCS C - Nigel Gardner
2. **Getting Started with Internet of Things**- CunoPfister, 2011
3. **Interconnecting Smart Objects with IP**- J. P Vasseur, Adam Dunkels, 2010

CHAIRMAN/BOS DEAN(ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: CLINICAL ENGINEERING		
Sub Code: ML552	**No of Credits : 4= 4: 0: 0(L-T-P)**	**No of lecture hours/week :4**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES :To make the student

1. To understand the role of clinical engineer and importance of clinical engineering.
2. To learn the hospital managerial skills in all aspects.
3. The routine maintenance safety and other issues of medical devices.

Unit No	Syllabus Content	No of Hours
1	Definition, role of clinical engineering within the hospital organization, major functions of a clinical engineering department, flowchart and model of a clinical engineering department, computerized maintenance and management system, clinical information systems, picture archiving and communication systems (PACS).	**10**
2	Duties and responsibilities, clinical engineer as consultant, clinical engineer as investigator and expert witness. patient safety and clinical engineers, accident investigation, electromagnetic interference, WMTS interference issues.	**11**
3	Technology evaluation, strategic technology planning, technology and alternatives, risks, hazards, and clinical efficacy, conceptual needs analysis, testing laboratory and engineering evaluation, technical specifications and other requirements.	**10**
4	Management engineering in health care, cost effectiveness and productivity, personnel management, medical technology assessment process, in-house clinical and technical evaluations, planning strategies, quality.	**10**
5	Medical technology management practices, health care strategic planning utilizing technology assessment, vendor and service management, medical device research and design, maintenance and repair of medical devices, medical device troubleshooting, safety standards and regulations.	**11**

Note1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOMES: The student will be able to

CO1: Understand the role of clinical engineer in health care management.
CO2:Understand the importance of clinical engineer in maintaining safety standards in a clinical environment
CO3: understand the maintenance and repair of medical devices and also medical device research and design

COs	Mapping with POs
CO1	PO2,PO6,PO9,PO10,PO11
CO2	PO6,PO7,PO8,PO9,PO10,PO11
CO3	PO2,PO3,PO4,PO6,PO7,PO8,PO9,PO10,PO11,PO12

TEXT BOOK:

1. Joseph Dyro B.S. **Clinical Engineering Handbook, Elsevier Academic Press, 2004.**

REFERENCE BOOKS:

1. Yadin David, **Clinical Engineering, Principles and Applications in Engineering Series, CRC Press, 2003.**
2. Michael Nowicki, **The Financial Management of Hospitals and Healthcare Organizations, Blackwell Publishing Ltd, 2004.**

CHAIRMAN/BOS DEAN(ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: ARM PROCESSOR		
Sub Code: ML553	**No. of Credits : 4**	**No of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours: 52**

COURSE OBJECTIVES: To Study

1. The architecture of ARM Processor
2. The different Instruction Set
3. Interrupt Handling
4. C Programming for ARM Processor
5. Memory Organisation

UNIT No	Syllabus Content	No. of Hours
1	**ARM Embedded Systems** Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware - AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications. **ARM Processor Fundamentals** ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions.	**10**
2	**Introduction to the ARM Instruction set:** Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution.	**10**
3	**Introduction to the THUMB instruction set:** Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions. **Efficient C Programming:** Overview of C Compilers and optimization, Basic C Data types, C looping structures.	**10**
4	**Exception and Interrupt Handling:** Exception Handling-ARM Processor Exceptions and Modes, Vector Table, Exception Priorities, Link Register Offset, Interrupts- Interrupt Latency, Basic Interrupt Stack design and implementation, Interrupt Handling Scheme- Non nested Interrupt Handler, Nested Interrupt Handler, Reentrant Interrupt Handler, Prioritized Simple Interrupt Handler, Prioritized Standard Interrupt Handler, Prioritized Direct Interrupt Handler, Prioritized Grouped Interrupt Handler. **Embedded Operating Systems:** Fundamental Components, SLOS Directory Layout, Memory Interrupts and Exceptions handling, scheduler, Context Switch, Device Driver Framework.	**12**

5	**CACHES:** The memory Hierarchy and caches memory-caches and memory management units, Cache Architecture-basic architecture of caches memory, basic operation of cache controller, the relationship between cache and main memory. **Memory Management Units:** Moving from an MPU to an MMU**,** Virtual memory Working-Defining regions using pagers, multitasking and the MMU, Memory organization in a virtual memory system, page tables translational look aside buffer.	**10**

Note1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOME :The students would have learnt to

1. Depict the organization, architecture, bus technology, memory and operation of the ARM microprocessors
2. Employ the knowledge of Instruction set of ARM processors to develop basic Assembly Language Programs
3. Recognize the importance of the Thumb mode of operation of ARM processors and develop C programs for ARM processors
4. Describe the techniques involved in Exception and Interrupt handling in ARM Processors and understand the fundamental concepts of Embedded Operating Systems
5. Develop embedded C programs to interact with Built in Peripherals
6. Design, analyze and write programs using RTOS (Micro C/OS) on ARM based development

COs	**Mapping with POs**
CO1	PO2, PO3,PO5
CO2	PO2, PO5, PO12
CO3	PO3, PO5, PO12
CO4	PO3, PO5, PO12
CO5	PO3, PO5, PO12
CO6	PO3, PO5, PO12

TEXT BOOKS:

1. Andrew N Sloss, **Dominic System and Chris Wright**," **ARM System Developers Guide**", Elsevier, Morgan Kaufman publisher, 1st Edition, 2008/,ISBN:1558608745.

REFERENCE BOOKS:

1. David Seal, "**ARM Architecture Reference Manual", Addison- Wesley, 2nd Edition, 2009**
2. Furber S, "**ARM System on chip Architecture", Addison Wiley, 2nd Edition 2008**
3. Rajkam, **"Embedded System", Tata McGraw-Hill Publishers, 2nd Edition, 2008**

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: MEDICAL ELECTRONICS LAB		
Sub Code: MLL56	**No of Credits :1.5= 0: 0: 1.5(L-T-P)**	**No of lecture hours/week :03**
Exam Duration : 3 hours		**Exam Marks : 50**

COURSE OBJECTIVES: The student will understand

1. The transducer principle, type,measurement of physiological parameter
2. The bio signal measurement
3. Medical Instrumentation such as X- ray, Ultrasound, Recorders

UNIT No	Syllabus Content
1	Study of anatomy modules **-** Skeletal system, Brain, heart and ear.
2	Plotting the characteristics & Determination of parameters of: .Resistive strain gage
3	Plotting the characteristics & Determination of parameters of: Photoelectric transducer
4	Plotting the characteristics & Determination of parameters of: Temperature transducers: Thermocouple / Thermistor.
5	Plotting the characteristics & Determination of parameters of: LVDT.
6	Determination of characteristics of: (a) Polarized electrode; (b) Non-polarized electrode
7	Design and study the characteristics of optical isolation amplifier.
8	Design & Testing of: (a) DC amplifier (b) Chopper amplifier.
9	Measurement of pulse-rate using Photoplethysmography.
10	Design of Instrumentation amplifier using Opamp
11	Recording of ECG: (a) Determination of time & amplitude of QRS complex, (b) Calculation of Heart Rate, (c) Determination of Cardiac Vector.
12	Study of simulators: ECG, EEG, EMG.
13	Measurement of Blood Pressure using Sphygmomanometer & Digital meter.
14	Study of :(a) Ultrasound transducers & Ultrasonic blood flow meters, (b) X-ray

COURSE OUTCOMES: Awareness about biomedical engineer professional ethics.

CO1: Study of medical electronics laboratory provides the knowledge of measurements of physiological parameters. Hospital training provides thorough knowledge of the practical application of the medical instruments and working.

COs	Mapping with POs
CO1	PO6,PO7,PO8,PO9,PO10,PO11,PO12

CHAIRMAN/BOS **DEAN (ACADEMIC)** **CHAIRMAN/ACADEMIC COUNCIL**

Sub Title: DIGITAL SIGNAL PROCESSING LAB		
Sub Code: MLL57	**No of Credits:1.5= 0:0:1.5(L-T-P)**	**No of lecture hours/week :03**
Exam Duration : 3hours	**Exam Marks : 50**	

COURSE OBJECTIVES: To make the students

1. Verify sampling theorem, linear & circular convolution, and correlation
2. To implement and verify FFT algorithm.
3. Realization of FIR and IIR filter.
4. Familiarize with programming of DSP Processor

UNIT No	Syllabus Content
1	Representation and display of basic sequences.
2	Verify the Sampling theorem.
3	Determine linear convolution, Circular convolution and Correlation of two given sequences. Verify the result using theoretical computations.
4	Computation and verification of FFT of a sequence.
5	Determine the linear convolution and correlation of two given point sequences , using FFT algorithm..
6	Display of original sequence along with operation on sequence like shifting, folding, time scaling and multiplication.
7	Compute DTFS, DTFT of a sequence.
8	Realization and design of FIR filter for a given specification and verification for (a) LP
9	Design and test FIR filter using Windowing method (Hamming window and Kaiser window) for the given order and cut-off frequency.
10	Realization of design of IIR filter for a given specification and verification.
11	Convolution, FIR filters using DSP Processor TMS32C6713.

COURSE OUTCOMES: The students would have learnt

CO1:To write programs for all DSP operations both in MATLAB and also DSP processor TMS32C6713

CO2:Open end project will ensure that the student is capable of developing any DSP application

COs	Mapping with POs
CO1	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10,PO11,PO12
CO2	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10,PO11,PO12

CHAIRMAN/BOS **DEAN (ACADEMIC)** **CHAIRMAN/ACADEMIC COUNCIL**

VI SEMESTER

Sub Title: MEDICAL PHYSICS		
Sub Code: ML61	**No of Credits:4=4:0:0(L-T-P)**	**No of lecture hours/week :04**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES: This course analyzes the human body from the basic principles of physics. Principles derived in physics are applied directly to the human body.

1. To describe effects of heat and cold in medicine, and energy metabolism in human body.
2. To describe effects of physics of lung and breathing mechanism.
3. To discuss the pumping action of the heart and how the blood pressure changes occur.
4. To discuss the electrical conduction system of the nerves in the brain, the heart and the eyes, application of low and high frequency electricity in medicine, magnetism in medicine
5. To discuss how the ultrasound is helpful in Medicine, physics of ear and hearing to know about how light is helpful in Medicine.

UNIT No	Syllabus Content	No of Hours
1	**Heat and cold in medicine:** Introduction, physics basis of heat and temperature, thermography and temperature scales, mapping of body's temperature, heat therapy, use of cold in medicine, cryosurgery and safety aspects. **Energy, work, power and pressure:** Conservation of energy in the body, energy changes in the body, work and power, heat losses from the body, measurement of the pressure in the body, pressure inside skull ,eye ,digestive system, skeleton & urinary bladder, hyperbaric oxygen therapy.	**12**
2	**Physics of lung and breathing:** Introduction, the air ways, blood & lung interaction, measurement of lung volumes, pressure air flow volume relationship of the lungs .Physics of alveoli, breathing mechanism, air-way resistance, work of breathing, physics of some common lung diseases.	**8**
3	**Physics of cardiovascular system:** Introduction to cardiovascular system, major components of cardiovascular system, oxygen and carbon-di-oxide exchange in the capillary system, work done by the heart, blood pressure and its measurements, transmural pressure, Bernoulli's principle applied to cardiovascular system, blood flow laminar & turbulent ,heart sounds, physics of some cardiovascular diseases.	**8**

4	**Electricity within the body:** The nervous system & neurons ,electrical potential of nerves, electromyogram, electrocardiogram, electroencephalogram,electroretionogram,electrooculogram,magneto cardiogram & magnet encephalogram, electric shock ,high frequency and low frequency electricity in medicine, magnetism in medicine.	**12**
5	**Sounds in medicine**: General properties of sound, body of drum, the stethoscope, ultrasound picture of the body, ultrasound to measure motion, physiological effects of ultrasound in therapy, the production of sound. **Physics of ear and hearing:** The outer ear, middle ear and the inner ear, sensitivity of ears, testing hearing, deafness & hearing aids. **Light in medicine:** Measurement of light and its units, application of visible light in medicine, application of UV and IR in medicine**.**	**12**

Note 1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3,4 and 5

COURSE OUTCOMES: At the end of the course the students will be able to

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.

COs	**Mapping with POs**
CO1	PO1,PO2,PO4,PO8
CO2	PO1,PO2
CO3	PO1,PO2,PO4,PO8
CO4	PO1,PO2,PO3,PO4
CO5	PO1,PO2,PO3,PO4

TEXT BOOK:

1. **Medical Physics**, John R. Cameron and James G. Skofronick, John Wiley & Sons 1978.

REFERENCE BOOK:

1. **Physics of the Human Body,** Herman I.P., Springer.

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: MEDICAL IMAGING SYSTEMS		
Sub Code: ML62	**No of Credits:4= 4:0:0(L-T-P)**	**No of lecture hours/week :04**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES:

1. To understand fundamentals of x-ray and its generation and biological effects.
2. To study different x-ray diagnostic methods.
3. To study CT imaging concepts, fundamental of Magnetic resonance imaging..
4. To study fundamentals of ultrasound and working different ultrasound techniques.
5. To study the principles of Radionuclide imaging.

UNIT No	Syllabus Content	No of Hours
1	**X-RAY IMAGING:** Fundamentals of X-ray – Electromagnetic radiation, Interactions between X-rays and matter, Intensity of X-ray beam, Attenuation, Generation and Detection of X-rays – X-ray generation, X-ray generators, Filters, Beam restrictors and grids, Intensifying screens, fluorescent screens, and image intensifiers, X-ray detectors, X-ray image characteristics – Spatial resolution, Image noise, Image contrast, Receiver operating curve (ROC), Biological effects of ionizing radiation.	**8**
2	**X-RAY DIAGNOSTIC METHODS:** Conventional X-ray radiography, Fluoroscopy, Angiography, Mammography and Xeroradiography, Image subtraction. **COMPUTED TOMOGRAPHY:** Conventional tomography, Computed tomography – Radon Transform (Projections) and Fourier Slice theorem, Algorithms for image reconstruction: parallel and Fan beam data, Spiral CT. Recent developments – Digital radiography.	**10**
3	**ULTRASOUND IMAGING:** Fundamentals of acoustic propagation - Stress strain relationship, Characteristic impedance, Intensity, Reflection and refraction, Attenuation, absorption & scattering, Doppler effect, Generation and detection of Ultrasound-Piezoelectric effect, Ultrasonic transducers, **ULTRASONIC DIAGNOSTIC METHODS :**Pulse echo systems-Amplitude mode (A-mode), Brightness mode (B-mode), Motion mode (M-mode), Constant depth mode (C-mode), Doppler methods, Duplex imaging, Tissue characterization, Colour Doppler flow imaging, Image characteristics – Ultrasonic texture or speckle, Speckle reduction, Compensation of phase aberration, Biological effects of ultrasound.	**13**

4	**RADIONUCLIDE IMAGING:** Introduction, Fundamentals of Radioactivity – Nuclear particles, Nuclear activity and half-life, Units of measuring nuclear activity, Specific activity, Interaction of nuclear particles and matter, Attenuation of Gamma radiation, Radionuclides, Generation & Detection of Nuclear Emission – Radionuclide generators, nuclear radiation detectors, Collimators, Radionuclide imaging systems- Gamma Camera, SPECT, PET. **BASICS OF MAGNETIC RESONANCE IMAGING:** fundamentals of nuclear magnetic resonance- Angular momentum, magnetic dipole moment, magnetization, Larmor frequency, Rotating frame of reference and RF magnetic field, Free induction decay (FID), Fourier spectrum of the NMR signal, Spin density, Relaxation times, Pulse sequences.	**13**
5	**MRI SYSTEM & IMAGING METHODS :**magnetic field gradients, NMR Coil/Probe, Transmitter, Receiver, Data acquisition. Imaging Methods- Introduction, slice selection, frequency encoding, phase encoding, Spin-Echo imaging- Gradient echo imaging, Characteristics of MRI images- spatial resolution, image contrast. Biological effects of magnetic fields- Static magnetic fields, Radio-frequency fields, Gradient magnetic fields, Imaging safety, Functional MRI.DICOM Standards **Mandatory** assignments/seminars on latest developments in each of the modalities.	**8**

Note2: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3,4 and 5

COURSE OUTCOMES: On the completion of the course the students will be able to
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

COs	**Mapping with POs**
CO1	PO1,PO6,PO7, PO12
CO2	PO1,PO6,PO12
CO3	PO5,PO12
CO4	PO6,PO8,PO12
CO5	PO10,PO11, PO12

.

TEXT BOOKS:

1. **Principles of Medical Imaging**, Kirk Shung, Michael B. Smith and Banjamin Tsui, Academic Press, 1992.
2. **Handbook of Biomedical Instrumentation**, R.S.Khandpur, Tata McGraw Hill, 2nd Edition, 2003.
3. **Fundamentals of Medical Imaging**, Paul Suetens, Cambridge University Press, 2002.

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: BIOMEDICAL EQUIPMENTS		
Sub Code: ML63	**No of Credits :4= 4: 0: 0(L-T-P)**	**No of lecture hours/week :04**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES:

1. To study spectrophotometer, clinical flame photometer.
2. To study different blood gas analyzers
3. To study different types of Audiometers
4. To understand the working principle of surgical diathermy.
5. To study haemodialysis and different ventilators

UNIT No	Syllabus Content	No of Hours
1	**CLINICAL LABORATORY INSTRUMENTS:** Medical diagnosis with clinical tests, spectrophotometry-components, clinical flame photometer, ion-selective electrode based analyzers.	**8**
2	**BLOOD GAS ANALYZERS:** Acid-base balance, blood pH measurement, measurement of blood pCO2, measurement of blood pO2, intra-arterial blood gas monitoring, complete blood gas analyzer. **BLOOD CELL COUNTERS**: Types of blood cells, Coulter counter, automatic recognition and differential counting of cells.	**10**
3	**AUDIOMETER AND HEARING AIDS:** Mechanism of hearing, measurement of sound, basic audiometer, pure-tone audiometer, speech audiometer, audiometer system Bekesy, evoked response audiometer system, hearing aids-digital hearing aid, cochlear implants.	**10**
4	**INSTRUMENTS OF SURGERY:** Principles of surgical diathermy, surgical diathermy machine, automated electro-surgical systems, electrodes used with surgical diathermy, safety aspects in electro- surgical units, surgical diathermy analyzer. **PHYSIOTHERAPY AND ELECTROTHERAPY EQUIPMENTS:** High frequency ,heat therapy, short wave diathermy, microwave diathermy, ultrasound therapy unit, electro diagnostic therapeutic apparatus, pain relief through electrical stimulation ,bladder and cerebral stimulators.	**12**
5	**HAEMODIALYSIS MACHINE:** Function of kidney, artificial kidney, dialyzer, membranes for hemodialysis, portable kidney machine. **VENTILATORS:** Mechanics of respiration, artificial ventilation, ventilators, types of ventilators, ventilator terms, classification of ventilators, pressure volume flow diagrams, modern ventilators, high frequency ventilators, humidifiers, nebulizers and aspirators	**12**

Note1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3,4 and 5

COURSE OUTCOMES: On the completion of the course the students will be able to

CO1: Understand the working principle of biomedical equipments such as clinical test equipments, blood gas analyzer, blood cell counter and surgical equipments.
CO2: Identify the hearing defects and suggest a suitable hearing aid.
CO3: Understand and design the artificial organs such as kidney and lungs.
CO4: Explore the latest trends and happening in the subject

COs	Mapping with POs
CO1	PO1,PO2,PO3,PO4, PO6,PO7
CO2	PO1,PO2,PO3,PO4, PO6,PO7
CO3	PO3,PO7,PO8, PO12
CO4	PO10, PO12

TEXT BOOK:

1. **Handbook of Biomedical Instrumentation** – by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003

REFERENCE BOOK:

1. **Biomedical Instrumentation and Measurement** – by Leslie Cromwell, Fred J Weibell and Erich A. Pfeiffer, Prentice-Hall India Pvt. Ltd.

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: LASERS AND FIBER OPTICS IN MEDICINE		
Sub Code: ML64	**No. of Credits : 3=3: 0: 0(L-T-P)**	**No of lecture hours/week :03**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:39**

COURSE OBJECTIVES:

1. To study the production of lasers, its properties and types.
2. To study the effects of laser-tissue interaction.
3. To know the need for optic fibers and its applications in Medicine.
4. To gain knowledge regarding fiber fabrication and fiber bundles.
5. To study the basic principle of endoscopy, its uses in diagnosis and therapeutic field.

UNIT No	Syllabus Content	No of Hours
1	**INTRODUCTION:** Historical background. Medical Lasers: Introduction, Laser physics-fundamentals, principles, advances, Medical Lasers-fundamentals, principles(co2, Nd-YAG, eximer, dye - lasers), advances(semiconductor laser, free electron laser, Miscellaneous laser techniques). Medical Laser Systems-fundamentals, principles. Laser safety-fundamentals.	**07**
2	**APPLICATIONS OF LASERS IN THERAPY & DIAGNOSIS:** Introduction, laser assisted diagnosis and therapy-fundamentals, interaction of laser beams and materials-principles (except 3.3.4). Laser interaction with tissue-principles; laser assisted diagnostics-principles, applications of lasers in diagnosis and imaging-advances, laser surgery and therapy-principles-photo thermal & photomechanical mechanisms, thermal interaction between laser and tissue-advances.	**08**
3	**SINGLE OPTICAL FIBERS :** Introduction, historical background ,Introduction to OFC**,** block diagram of OFC, analog link and digital link, optical fibers-fundamentals, light transmission in optical fibers-principles, optical properties of optical fibers-advances, fabrication of optical fibers-principles, optical fibers for UV, visible, IR light-principles, power transmission through optical fibers-principles, modified fiber ends and tips-principles, fiber lasers-advances.	**08**
4	**OPTICAL FIBER BUNDLES:** Introduction, non-ordered fiber optic bundles for light guides-fundamentals & principles, ordered fiber optic bundles for imaging devices-fundamentals & principles, fiber scopes and endoscopes-fundamentals, fiber optic imaging systems-advances.	**07**
5	**CLINICAL APPLICATIONS OF FIBER OPTIC LASER SYSTEMS:** Endoscopy: Introduction, endoscopic imaging systems-fundamentals, principles, advances, endoscopic diagnostics-advances, endoscopic therapy-fundamentals, endoscopic ultrasound imaging-principles. Introduction, fiber optic laser systems in cardiovascular disease (except 9.2.6), flow diagram for laser angioplasty & photodynamic therapy.	**09**

<u>Note1</u>: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOMES: On the completion of the course the students will be able to

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 applications of fiber optic laser in imaging systems.

COs	Mapping with POs
CO1	PO1,PO2, PO3, PO4, PO6, PO7
CO2	PO1,PO2
CO3	PO3,PO7
CO4	PO3, PO4, PO6, PO7

TEXT BOOK:

1. **Lasers and Optical Fibers in Medicine** , Abraham Katzir, Academic Press, 1998.

REFERENCE BOOKS:

1. **Therapeutic Lasers – Theory and practice** , G.David Baxter, Churchill Livingstone Publications.
2. **Medical Lasers and their safe use,**David H Shiney, Stephen and L.Trokel, Springer, Springer Verlag publications.
3. **Elements of fiber optics**, S.L.Wymer, Regents PHI.
4. **Biomedical Electronics and Instrumentation**, S.K.Venkata Ram Galgotia publications.

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

ELECTIVE II (Group B)

Sub Title : BIOMECHANICS		
Sub Code: ML651	**No of Credits :4= 4: 0: 0(L-T-P)**	**No of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES: Understand the mechanical aspects of human motion:

1. Quantitative and qualitative analysis of human motion and performance.
2. Use physical laws of motion to solve problems of human motion.
3. Understand the relationship between mechanical properties and anatomical functions.
4. Understand how biomechanical principles can be applied to examine human activities such as sport and orthopaedic rehabilitation.

UNIT No	Syllabus Content	No of Hours
1	**BIO-FLUID MECHANICS:** Newton's laws, stress, strain, elasticity, Hook's-law, viscosity, Newtonian Fluid, Non-Newtonian fluid, viscoelastic fluids. Vascular tree. Relationship between diameters, velocity and pressure of blood flow, Resistance against flow **FLOW PROPERTIES OF BLOOD:** physical, Chemical and Rheological properties of blood Apparent and relative viscosity. Blood viscosity variation: Effect of shear rate, hematocrit, temperature and protein contents of blood. Casson's Equation. Problems associated with extra corporeal blood flow	13
2	**BIOVISCOELASTIC FLUID:** Viscoelasticity, Viscoelastic Models: Maxwell, Voigt and Kelvin Models Response to harmonic variation. Use of viscoelastic models. Bio-Viscoelasticfluids : Protoplasm. mucus, saliva, semen, synovial fluids. Rheology of blood in microvessels: Fahreus·Lindqulst effect and inverse effect, hematocrit in very narrow tube.	7
3	**CARDIAC MECHANICS:** Cardiovascular system. Mechanical properties of Blood vessels: arteries, arterioles, capillaries, veins, Blood flow: laminar and turbulent. Physics of cardiovascular diseases. Prosthetic heart valves and replacements. **RESPIRATORY MECHANICS:** Alveoli mechanics, Interaction of blood and lung P-V curve of lung. Breathing mechanism. Airway resistance. Physics of lung diseases.	13
4	**SOFT TISSUE MECHANICS:** Pseudoelasticity, non-linear stress-strain relationship, visco elasticity. Structure, function and mechanical properties of skin, ligaments and tendons. **ORTHOPEDIC MECHANICS:** Mechanical properties of cartilage. Diffusion properties of articular, cartilage, Mechanical properties of bone. Kinetics and Kinematics of joints, Lubrication of joints. Fundamental concepts of Gait	13
5	Measuring principles of Cutometer, Durometer. Electrodynamometer, Microindentometer & Ballistometer.	6

Note1: Unit 3 & Unit 4 will have internal choice
Note2: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOMES: On the completion of the course the students will be able to

CO1: Understand the linear kinematics and dynamics, projectile motion and conservation of angular momentum..
CO2: To solve problems incorporating vectors, kinematics and dynamics
CO3: Understand the concepts of various human system mechanics
CO4: Understand the principles of various biomechanic measuring equipments.

COs	**Mapping with POs**
CO1	PO1,PO2,PO3,PO4
CO2	PO2,PO3,PO4
CO3	PO1,PO4, PO6, PO7
CO4	PO1,PO4,PO7

TEXT BOOKS:

1. **Biomechanics, Mechanical Properties of Living Tissues,**Y.C Fung,Springer Verlag, Edition2, 1993.
2. **Introduction to Biomechanics of Joints & Joint Replacement Mechanical Engg,** D.Dowson, V Wright publication, 1987.
3. **The Biomedical Hand Book**,Joseph.D.Bronzino ,CRC Press, 2nd Edition,2000.

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: MEDICAL INFORMATICS		
Sub Code: ML652	**No of Credits :4= 4: 0: 0(L-T-P)**	**No of lecture hours/week :04**
Exam Duration : 3 hours	**CIE+Assignment+SEE =45+5+50=100**	**Total no of contact hours:52**

COURSE OBJECTIVES: To make the student learn

1. Identify the fundamentals medical informatics
2. Develop practical health care applications using suitable database management system
3. Utilise knowledge, skills and concepts on health information technology
4. Apply principles of information security, ethics and policy information
5. Assesses existing information exchange system standards
6. Analyse and develop project, manage strategies health information technology

UNIT No	Syllabus Content	No of Hours
1	Medical Informatics: Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues, Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Cloud computing: Introduction, cloud computing in medical applications	**12**
2	Computerised Patient Record : Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.	**12**
3	Computers in Clinical Laboratory and Medical Imaging: Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computerized ECG, EEG and EMG, Computer assisted medical imaging- nuclear medicine, ultrasound imaging ultrasonography-computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance	**9**
4	Computer Assisted Medical Decision-Making**:** Neuro computers and Artificial Neural Networks application, Expert system – General model of CMD, Computer – assisted decision support system-production rule system, cognitive model, semester networks , decisions analysis in clinical medicine-computers in the care of critically patients-computer assisted surgery-designing	**10**
5	Recent Trends in Medical Informatics: Virtual reality applications in medicine, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, computer aids for the handicapped, computer assisted instrumentation in Medical Informatics - Computer assisted patient education and health - Medical education and health care information	**9**

Note 1: **Assignment-1 from unit 1 and 2.**
Asssignment-2 Based on industry expert talk on cloud computing, recent trends in medical informatics

COURSE OUTCOMES: On the completion of the course the students will be able to
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

Cos	Mapping with Pos
CO1	PO1,PO6,PO7,PO8
CO2	PO2,PO3,PO5
CO3	PO1,PO2,PO7,PO12
CO4	PO10, PO12
CO5	PO1,PO2,PO7,PO12

TEXT BOOKS:

1. **Medical Informatics**, Mohan Bansal, T M H, 2003 .
2. **Introduction to Bioinformatics** , T. K. Attwood & D. J. Parry-Smith, Pearson Education Low Price Edition, 2004.

REFERENCES:

1. **Computers In Medicine Progress In Medical Informatics**, R. D. Lele, TMH, 2005.

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: BIOMEDICAL NANOTECHNOLOGY		
Sub Code: 653	**No. of Credits : 4**	**No of lecture hours/week : 4**
Exam Duration : 3 hours	**CIE+ Assignment +SEE =45+5+50=100**	**Total no of contact hours: 52**

COURSE OBJECTIVES: To Study

1. **The role of nanotechnology in biomedicine**
2. **Drug Delivery using nanotechnology**
3. **Applications on nanotechnology**

UNIT No	Syllabus Content	No of Hours
1	**Introduction:** Converging Technologies: Nanotechnology and Biomedicine, Nanotechnology and Nanobiomedicine, Toward Biomolecular Medicine, Drug Synthesis and Delivery, Implants and Prosthesis, Diagnostics and Screening, Nanotechnology Platforms for Biomedicine.	10
2	**Nanotechnology and Trends in Drug Delivery Systems with Self-Assembled Carriers:** Introduction, Drug Delivery Systems since the 1980s, Chemical System Engineering and Nanotechnology, Toward Development of Drug Delivery Systems with Bionanotechnology, Self-Assembly and Self-Organization, Nanoparticles and Nano-Sized Spaces, Quantum Dot (Semiconductor Nanoparticle), Safety of the Human Body and the Environment processes	10
3	**Implants and Prostheses:** Introduction, Biomaterials, Biological Processes, Wound Healing Processes, Macrophages, Biomaterial Interface Processes, Foreign Body Reaction, Nanotechnology in Implantology, Current Nanofabrication Methods, Lithography, Colloidal Resists, Self-Assembly Systems, Soft Lithography, Biometric Approaches.	10
4	**Nano-Enabled Components and Systems for Biodefense:** Introduction, Sensor Component of Nano-Enabled Biodefense, Nano-Enabled Sensors for Monitoring Exposures, Nano-Enabled Sensors for Monitoring Airborne Exposures, Nano-Enabled Sensors for Monitoring Contact Exposures, Nanoscale Components of Sensing Systems, Nanolithography of Biological Molecules and Sensing Materials, Nanoparticle Arrays on Surfaces, Functional Three-Dimensional Nanostructures.	10

5	**Nanobiology in Cardiology and Cardiac Surgery:** Diagnostic Applications of Nanobiology and Nanotechnology: Molecular Imaging of Angiogenesis, Cellular Imaging, Artificial Molecular Receptors, Fluid Acceleration Sensors, Therapeutic Applications, Targeted Anti-proliferative Drug Delivery/ Prevention of Restenosis after Percutaneous Revascularization, Smart Drugs, Nanorobotics. **Applications of Nanobiology/Nanotechnology in Cardiological and Cardiosurgical Practice:** Applications in the Therapy of Myocardial Ischemia, Nanotechnological Applications in Trauma / Bleeding / Wound Healing in Cardiac Surgery, Nanotechnology and Aortic Surgery.	**12**

Note1: Assignment-1 from unit 1 and 2.
Asssignment-2 from unit 3, 4 and 5

COURSE OUTCOMES: On Completion of this course the students will be able to:
1. Identify the role of nanotechnology in the field of biomedical engineering.
2. Discuss recent trends of nanotechnology in drug delivery systems.
3. Comprehend the processes involved in implants and prosthesis using nanotechnology.
4. Illustrate Nano-Enabled Components and Systems used for Biodefense.
5. Enumerate Nano biological application in cardiology and cardiac surgery.

COs	Mapping with POs
CO1	PO2, PO3, PO4
CO2	PO2, PO3, PO4
CO3	PO2, PO3, PO4
CO4	PO2, PO3, PO4
CO5	PO2, PO3, PO4
CO6	PO2, PO3, PO4

TEXT BOOKS:

1. **Biomedical Nanotechnology by edited** Neelina H. Malsch; CRC Press, Taylor & Francis Group
2. **Nanoscale Technology in Biological Systems** edited by Ralph S. Greco, Fritz B. Prinz, R. Lane Smith; CRC Press

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: SIGNAL PROCESSING LAB USING LABVIEW		
Sub Code: MLL66	**No of Credits :1.5= 0:0:1.5(L-T-P)**	**No of lecture hours/week :03**
Exam Duration : 3 Hours		**Exam Marks : 50**

COURSE OBJECTIVES:

The course is designed to make the student familiarise with the software tool Lab VIEW. The basic concepts of signal processing and DSP operations are implemented using Lab VIEW.

Sl. No	Contents
	Getting started with Labview
1	To add, multiply, subtract and divide two numeric inputs.
2	To evaluate an expression.
3	To realize code converters, half adder, full adder
4	To illustrate the use of for loop, while loop and delays.
5	To create vi for array and matrix manipulation.
6	To illustrate the use of formula node, Mathscript.
	Signal Processing.
1	To display step, ramp, exponential, sine, cosine, square signal.
2	To perform linear convolution, correlation.
3	To calculate FFT of a signal.
4	To calculate power spectral density of a signal.
5	To perform low pass, high pass and band pass filtering.
6	To perform filtering using window technique.

COURSE OUTCOME:

CO1:The student will develop the proficiency in Lab VIEW and learn to implement DSP operations in Lab VIEW

COs	Mapping with POs
CO1	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10,PO11,PO12

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title: PHYSIOLOGICAL LAB		
Sub Code: MLL67	**No of Credits :1.5= 0:0:1.5(L-T-P)**	**No of lecture hours/week :03**
Exam Duration : 3 hours		**Exam Marks : 50**

COURSE OBJECTIVES:
The course is meant to provide the student a comprehensive study of bio medical signals, involving real time bio signal acquisition, telemetry and analysis. The student will also learn to design required physiological variable converting into bioelectrical signals.

Unit No	Syllabus Content
	Experiments using Power Lab and LabVIEW/Lab chart Transducers and Instrumentation Bio Amplifier and interfacing with MPU/ computer
1	Real Time data Acquisition and Analysis of: ECGs.
2	Recording of EMG using module
3	Recording of EEG using the module
4	Blood Pressure (BP) Amplifier using module
5	Determination of latency and conduction velocity using EEG amplifier and EMG stimulator.
6	Audiometer: Measurement of Hearing threshold using Audiometer and plot its characteristics.
7	Testing of: Resistance bridge using amplifier for thermistor.
8	Testing of sensors: temperature, PCG, force /pressure.
9	Testing of: PIR motion detector (displacement).
10	Testing of sensors and amplifier: ultra sound, phono sensor.
	Study experiments
11	Study and usage of Automatic defibrillators.
12	Study of lung and cardiovascular models.
	Telemetry of bio signals
13	Optical fibre communication link – biotelemetry

COURSE OUTCOME: The student will be able to
CO1: Carry out experiments on real time physiological signals using built in systems.
CO2: Do experiments realising telemedicine principles

COs	Mapping with POs
CO1, CO2	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10,PO11,PO12

CHAIRMAN/BOS DEAN (ACADEMIC) CHAIRMAN/ACADEMIC COUNCIL

Sub Title : JAVA LAB		
Sub Code: MLL68	**No. of Credits:2=0: 0:2(L-T-P)**	**No of lecture hours/week :04**
Exam Duration : 3 hours	**Exam Marks : 50**	

COURSE OBJECTIVES

To enable the students learn the fundamentals of programming language Java and also develop programming skills in Java

1	Simple Java Programs to illustrate the data operators
2	Program for string reversal
3	Program for demonstration of control statements
4	Program for demonstrating constructors
5	Program for demonstrating Overloading and overriding
6	Program for demonstrating multilevel Inheritance
7	Program for exception handling (try & catch methods and nested try statement and)
8	Program for demonstration of multi threading : Implementing runnable & extends, producer-consumer problem synchronization
9	Program for demonstrating event handling
10	Developing Applet program

COURSE OUTCOME: The students will be able to

CO1: Write programs in Java and will be able to develop applications using Java

COs	**Mapping with POs**
CO1	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10,PO11,PO12

CHAIRMAN/BOS **DEAN (ACADEMIC)** **CHAIRMAN/ACADEMIC COUNCIL**

Sub Title: MINIPROJECT		
Sub Code: MLP69	**No of Credits : 00:00:2**	**No of lecture hours/week : ---**
Exam Duration : 3 hours	**Exam Marks : 50**	

COURSE OBJECTIVES: To enable the students to come up with their own innovative ideas and realize it.

Note:

- Mini project should be carried by a group of 3 or 4 and not more than 4 in a group.
- PCB soldering and Testing
- Evaluation should be based on the presentation ,demonstration, viva-voce and final report.

COURSE OUTCOME: The students will be able to

CO1: Solder, assemble and test the circuit
CO2: Develop a product related to medical applications
CO3: Work in a team, make group presentation and write reports

COs	Mapping with POs
CO1	PO1,PO2,PO3,PO4,
CO2	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10,PO11,PO12
CO3	PO10,PO11,PO12

CHAIRMAN/BOS **DEAN (ACADEMIC)** **CHAIRMAN/ACADEMIC COUNCIL**