Bachelor of Technology - Biomedical Engineering

Syllabus - First Semester

INTRODUCTION TO COMPUTERS AND PROGRAMMING IN C

Course Code:BME2104 **CreditUnits : 03**

Course Objective:
The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction
Introduction to computer, history, von-Neumann architecture, memory system (hierarchy, characteristics and types), H/W concepts (I/O Devices), S/W concepts (System S/W & Application S/W, utilities). Data Representation: Number systems, character representation codes, Binary, octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage unit.

Module II: Programming in C
History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

Module III: Fundamental Features in C
C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types (automatic, register etc.), predefined processor, Command Line Argument.

Module IV: Arrays and Functions
One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations.
Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.

Module V: Advanced features in C
Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments.
Strings and C string library.
Structure and Union. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments.
File Handling.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- "ANSI C" by E Balagurusamy
- YashwantKanetkar, "Let us C", BPB Publications, 2nd Edition, 2001.
- Herbert Schildt, "C: The complete reference", Osbourne Mcgraw Hill, 4th Edition, 2002.
- V. Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995.

References:

- ***Kernighan & Ritchie, "C Programming Language", The (Ansi C Version), PHI, 2nd Edition.***
- ***J. B Dixit, "Fundamentals of Computers and Programming in 'C'.***
- P.K. Sinha and Priti Sinha, "Computer Fundamentals", BPB publication.

PROGRAMMING IN C LAB

Course Code:BME2109 **CreditUnits : 01**

Software Required: Turbo C

Course Contents:

- C program involving problems like finding the nth value of cosine series, Fibonacci series. Etc.
- C programs including user defined function calls
- C programs involving pointers, and solving various problems with the help of those.
- File handling

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Second Semester

BIOLOGY FOR ENGINEERS

Course Code:BME2204 **CreditUnits : 02**

Course Objective:
To enable the students understand the basic biological mechanisms from the perspective of engineers and understand basic organisation of organisms , cell functions.

Course Contents:
Module I: From Atoms to Organisms
The Cell : Basic Unit of Life , Molecular Components of Cells , Gene expression , Protein Structure and Function , Cell Metabolism , Homeostasis , External response of cells , Cell Reproduction , Cell Differentiation.

Module II: Molecular Design of Life
Biochemistry and Genomic Revolution , DNA illustrates between form and function, Chemical Bonds in Biochemistry , Protein Synthesis

Module III: Catalytic Strategies
Proteases: Speed up a reaction , Enzyme Inhibitor , Highly specific DNA cleavage reactions – Necleoside Monophosphate Kinases , Hydrolysis , phosphoryl group exchange , metabolism , anabolism and catabolism , photosynthesis , carbon fixation , biology energy production .

Module IV: Mechanochemistry
Conversion of chemical energy to mechanical work , ATP synthase structure , Power Stroke ,Bacterial flagellar motion , proton motive force , sodium motive force , Chimeric Kinesin Motors , chimeric myosin motors.

Module V: Sensory and Immuno Systems
General principles of cell signalling , Cellular basis of immunity , antibodies and their properties , T cells and their structure .

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

Text & References:

- J.M.Berg , J.L.Tymosezko and L.Sryer., Biochemistry , W.H.Freeman Publications
- Student Companion to accompany , Biochemistry , Fifth Edition – Richard I.Gumport
- Frank H.Deis, Nancy Counts Gerber , Roger E.Koeppe, II Molecular motors
- Alberts, 2003 Molecular biology of the cell
- Lodish, 2004 Molecular Cell biology

OBJECT ORIENTED PROGRAMMING USING C++

Course Code:BME2205 **CreditUnits : 03**

Course Objective:
The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Course Contents:

Module I: Introduction
Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts: Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module II: Classes and Objects
Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module III: Inheritance
Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hiérarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module IV: Polymorphism
Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module V: Strings, Files and Exception Handling
Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

Text & References:

Text:

- A.R. Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997
- R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.
- "Object Oriented Programming with C++" By E. Balagurusamy.
- Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.

References:

- Parasons, “Object Oriented Programming with C++”, BPB Publication, 1999.
- Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication, 2002.
- YashwantKanethkar, “Object Oriented Programming using C++”, BPB, 2004

OBJECT ORIENTED PROGRAMMING USING C++ LAB

Course Code:BME2209 **CreditUnits : 01**

Software Required: Turbo C++

Course Contents:

- Creation of objects in programs and solving problems through them.
- Different use of private, public member variables and functions and friend functions.
- Use of constructors and destructors.
- Operator overloading
- Use of inheritance in and accessing objects of different derived classes.
- Polymorphism and virtual functions (using pointers).
- File handling.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab

Syllabus - Third Semester

ANALOG ELECTRONICS-I

Course Code:BME2302 **Credit Units: 03**

Course Objective:
This course builds from basic knowledge of Semiconductor Physics to an understanding of basic devices and their models. This course builds a foundation for courses on VLSI design and analog CMOS IC Design.

Course Contents:
Module I: Semiconductor Diode and Diode Circuits
Different types of diodes: Zener, Schottky, LED, Zener as voltage regulator, Diffusion capacitance, Drift capacitance, the load line concept, half wave, full wave rectifiers, clipping and clamping circuits.

Module II: Bipolar Junction Transistor
Bipolar junction transistor: Introduction, Transistor, construction, transistor operations, BJT characteristics, load line, operating point, leakage currents, saturation and cut off mode of operations. Bias stabilization: Need for stabilization, fixed Bias, emitter bias, self bias, bias stability with respect to variations in $I_{co,}$ V_{BE} &β, Stabilization factors, thermal stability.

Module III: Small signal Analysis of transistor and Multistage Amplifier
Hybrid model for transistors at low frequencies, Analysis of transistor amplifier using h parameters, emitter follower, Miller's theorem, THE CE amplifier with an emitter resistance, Hybrid π model, Hybrid π Conductance and Capacitances, CE short circuit current gain, CE short circuit current gain with R_L Multistage amplifier: Cascading of Amplifiers, Coupling schemes(RC coupling and Transformer coupling)

Module IV: Field Effect Transistors
Field effect transistor (JFET, MOSFET): volt-ampere characteristics, small signal model –common drain, common source, common gate, operating point, MOSFET, enhancement and -depletion mode, Common source amplifier, Source follower

Module V: Feedback Amplifiers
Feedback concept,Classification of Feedback amplifiers, Properties of negative Feedback amplifiers, Impedance considerations in different Configurations, Examples of analysis of feedback Amplifiers.

Module VI: Power amplifiers
Power dissipation in transistors,difference with voltage amplifiers, Amplifier classification (Class A, Class B, Class C, Class AB) class AB push pull amplifier, collector efficiency of each, cross over distortion.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Robert F. Pierret: Semiconductor Device Fundamentals, Pearson Education.
- Millman and Halkias: Electronic Devices and circuits, Tata McGraw.
- Boylestad: Electronic Devices and Circuits, Pearson Education.

SIGNALS AND SYSTEMS

Course Code: BME2304 **Credit Units: 03**

Course Objective:
The objective of the course is to provide knowledge of Signals and Systems to students of ECE. This Course includes good insight of types of signals and types of systems, various operations performed on them through the use of Fourier series, Fourier transform, z transform.

Course Contents:
Module I: Signals and Systems
Introduction of signals and systems; classification of signal, continuous time and discrete time signals, operations performed on them, even and odd signals, periodic and non periodic signals, deterministic and random signals, energy signals, power signals, elementary signals: impulse, step, ramp and exponentials, classification of systems.

Module II: LTI system
Response of LTI system for continuous and discrete time systems, Impulse response, Step response, properties of continuous LTI and discrete LTI systems, LTI systems described by differential and difference equation, analysis of LTI Systems, interconnection of systems.

Module III: Fourier series
Representation of continuous time periodic signal, properties of continuous time Fourier series, representation of discrete time periodic signals, convergence of the Fourier series, properties of discrete time Fourier series, Fourier series and LTI systems.

Module IV: Fourier Transform
Continuous time Fourier transform, properties of continuous time Fourier transform, discrete time Fourier transform, properties of discrete time Fourier transform; applications; Bandwidth determination of signals and systems.

Module V: z-Transform
Definition of z-transform, region of convergence, properties of z-transform, first order system, second order system, inverse z-transform, analysis of LTI system using z-transform.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References
Text:
- Alan.V Oppenheim, Signals and Systems, 4th Edition 2007, Pearson Prentice Hall Publication.
- K.M. Soni, Signals and Systems; 3rd Edition, S.K. Kataria & Sons Publication.
- P.RameshBabu, Signal and Systems, 3rd Edition, Scitech Publications (INDIA) Pvt. Ltd.

References:
- Simon Haykin, Signals and Systems, 2nd Edition, Willy Publications.
- B.P.Lathi, Linear Systems & Signals, 2nd Edition, Oxford Publication.
- Roberts, Fundamentals of Signals and Systems, TMH Publication.

MEDICAL IMAGING TECHNIQUES

Course Code: BME2305 **Credit Units: 03**

Course Objective:
To enable students to understand techniques used in imaging in the medical profession, the artefacts and other problems experience in doing so .

Course Contents:
Module I:
Ultrasonics : Medical imaging modalities – Ultrasonic –Physics of ultrasound – Principles of image formation – Capture and display, principles of A-Mode, B-Mode, M-Mode. scan converters, frame grabbers. Single line and multi line monitoring of ultrasound displays.

Module II:
X-ray imaging: Principles and production of soft X- rays and hard x rays**,** Details of radiographic and fluoroscopic images in X-Ray systems. Screen-film and image intensifier systems-different generation of x-rays

Module III:
CTscanning : Evolution of CT Machines – CT image formation – Conversion of X-Ray data into scan image. Mathematicaldetails of various algorithms. Spiral CT, Transverse Tomography, CT Angiography

Module IV:
Magnetic resonance imaging: Image acquisition in magnetic resonance imaging – T1, T2, proton density weighted images, spin-echo technique and spin relaxation technique. Artifacts in imaging. Various types of pulse sequences for fast acquisition of imaging. NMR spectroscopy

Module V:
PET Scanner-Principles, SPECT, Computer techniques in fast acquisition – Data manipulation Principles of Digital subtraction angiography. Electronic radiography, picture storage and archiving systems in medical imaging, Infrared imaging,- Thermography, Clinical applications of thermography, liquid crystal thermography

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Webb, S., *The Physics of Medical Imaging*, AdernHilger, Bristol & Philadelphia.
- Hay.B.A. Edtd., *Medical Images, Formation*, Perception and Measurement, John Wiley.
- Rabiner and Gold, *Digital Signal Processing*,
- A.C. KAK, Principles of Computed Tomography, IEEE Press, New York

HUMAN ANATOMY AND PHYSIOLOGY-I

Course Code: BME2351 **Credit Units: 03**

Course Objective:
To provide students a basic understanding of the human body structure and functioning. Students will be able to relate basic human body systems and life processes, name the major body systems and their functions, understand the anatomy of various body systems.

Course Contents:
Module I:
Basic cell structure , various cell organelles and their functions , Tissue- their types , structure and function , structure and function of skin , Different types of muscles and their function , General description of bones , their structure and function , types of joints and their structure and function .

Module II:
Cell , cell membrane , polarisation and repolarisation , resting membrane potential , Nernst equation , Donnans equilibrium , Goldman equation action potential and its proapagation , synaptic transmission.

Module III
Blood, Lymph and circulation: blood composition, properties and function. Structure and functions of RBCs, WBCs and platelets , Blood types , Homeostasis , Immune mechanisms , Lymph., Heart position , structure and functions , Heartbeat , electrical excitation , Einthovens triangle , Cardiac and peripheral regulation , blood pressure and its regulation , blood flow and its regulation.

Module IV
Respiratory System: position and functions. Mechanics of respiration, Lung volumes and capacities, Gas exchange between lungs and tissues, regulation of respiration. Digestive system: Different parts of digestive system, functions of each organ, digestion of proteins, carbohydrates, fats, vitamins and minerals.

Module V
Osteology , Bone , brief introduction to different bones in skull , vertebral column , upper extremity , hands , lower extremity , foot .

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text and References

- Guyton A.C and J.E. Hall , " Text book of Medical Physiology " Harcourt India Pvt. Ltd.
- Principles of Human Anatomy and Physiology , Tortora , Wiley
- Ganong W.F. " Review of Medical Physiology" , Prentice Hall
- Gray's Anatomy for Students - Gray's Anatomy by A. Wayne Vogl, Richard Drake, Adam W. M. Mitchell

ANALOG ELECTRONICS LAB-I

Course Code:BME2306 **Credit Units: 01**

Course Contents:

1. To study and plot the characteristics of a junction diode.
2. To study Zener diode I-V characteristics.
3. To study diode based clipping and clamping circuits.
4. To study half wave, full wave and bridge rectifier with filters.
5. To study the input and output characteristics of a transistor in its various configurations (CE and CB).
6. To study and plot the characteristics of a JFET in its various configurations.
7. To study and plot the characteristics of a MOSFET in its various configurations.
8. To study various types of Bias Stabilization for a transistor.
9. To study the gain and plot the frequency response of a single stage transistor amplifier.
10. To measure gain and plot the frequency response of double stage RC coupled amplifier.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

SIGNALS AND SYSTEMS LAB

Course Code:BME2308 **Credit Units: 01**

Course Contents:

1. To Study auto correlation of two signals .
2. To study convolution of two sequences .
3. To study cross correlation of two sequences .
4. To study impulse response .
5. To study z transform of a a) sinusoidal signal , b) step function
6. To compare fourier and z transform of a signal.
7. To study convolution theorem in time and frequency domain

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

CIRCUITS AND SYSTEMS

Course Code:BME2302 **Credit Units: 03**

Course Objective:
The course intends to make the students proficient in analyzing circuits. At the completion of the course, the student should be able to construct and interpret block diagrams and signal flow graphs of control systems and to use basic methods of determining their stability.

Course Contents:
Module I: Graph Theory and Network equations
Graph of a network, Trees, Co-trees and loops, Cut set matrix, Tie set matrix, number of possible trees of a graph, duality, Loop Analysis and Node Analysis.

Module II: Analysis of circuits using classical Method
Time and Frequency domain analysis of RL, RC and RLC circuits, Linear constant coefficient differential equation.

Module III: Signals and Laplace Transforms
Unit step signal, Ramp signal, impulse signal, Laplace transformations and its properties, Gate function, Inverse Laplace transformations, Application of Laplace Transforms in circuit analysis.

Module IV: Network Theorems
Reciprocity theorem, Superposition theorem, Thevenin's and Norton's theorems, Millman's theorem, Maximum power transfer theorem, Compensation theorem, Tellegan's theorem.

Module V: Two port Network & Network Functions
Introduction, two port z-, y-, T-, h-parameters, Inter-relations among parameters, Condition for reciprocity and symmetry, Interconnections of two port networks, Driving point and transfer functions, Poles, Zeros and necessary condition for driving point and transfer function,.

Module VI: Network Synthesis
Hurwitz polynomial, Positive real functions, synthesis of LC, RC, RL immittance functions.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- M.E. Valkenburg, "Network analysis", PHI.
- D. R. Choudhary, "Networks and Systems", New Age International.
- K.M. Soni, 2009, "Circuits and Systems", VIII Edition, S.K. Kataria & Sons Delhi.

References:
- Bhise, Chadda, Kulshreshtha, "Engineering network analysis and filter design", Umesh Publication.
- F.F. Kuo, "Network Analysis and Synthesis", Wiley India Pvt. Ltd.

DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS

Course Code:BME2311 **Credit Units: 03**

Course Objective: To enable students to learn about various biomedical equipments used in the medical scenario, their working and uses helping students to understand the vast spectrum over which biomedical solutions can be applied.

Course Objective:
To offer overall idea about the application of ultrasonic and diathermy principles in clinical applications and transmission of bio-signals using telemetry techniques. Understand sources of leakage current and method of monitoring it.

Course Contents:
Module I : ULTRASONIC TECHNIQUES FOR DIAGNOSIS
Basic principles of Echo technique, display techniques A, B, M modes, Echo cardiograms, Echo ***encephalogram, Ultrasonic applied as diagnostic tool in ophthalmology, obstetrics and gynecology***

Module II: PATIENT MONITORING AND BIOTELEMETRY
Patient monitoring system – ICU, post operative, ICCU, single channel telemetry, multi-channel telemetry, frequency allotment, radio pill. Transmission of Bio signals over telephone lines.

Module III: DIATHERMY
Clinical applications of electrotherapy, short wave diathermy, ultrasonic diathermy, microwave diathermy, surgical diathermy unit, IR lamps, UV lamps.

Module IV: SPECIAL DIAGNOSTIC TECHNIQUES
Principles of Cryogenic technique and application, Endoscopy, Laproscopy, Thermography.

Module V: PATIENT SAFETY
Sources of leakage current, Micro and Macro shock, monitoring circuits, earthing schemes. Electro Magnetic interference to medical electronic Equipment – Sources of EMI, EMI effects, EMI to Biomedical sensors and ECG equipment.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Khandpur R.S, *Handbook of Biomedical Instrumentation*, Tata McGraw-Hill, New Delhi, 1997.
- John G. Webster, *Medical Instrumentation Application and Design*, John Wiley and sons, New York, 1998.
- Joseph J. Carr and John M. Brown, *Introduction to Biomedical equipment techn*ology, John Wiley and sons, New York, 1997.

NEURAL NETWORK AND FUZZY LOGIC

Course Code: BME2312 **Credit Units: 02**

Course Objective:
To learn to design of Neural network and Fuzzy Logic Controllers for various applications. Acquire basic understanding of the various algorithms involved in Neural Networks & Fuzzy

Course Contents:
Module I:
Motivation for the development of Neural Network – Artificial Neural Network – Biological Neural Networks – Typical Architectures – Setting Weights – Common Activation Functions – McCulloch Pitts Neuron: Architecture, Algorithm, Application – Simple neural networks for classification: Architecture, Biases and Threshold, Linear separability – Hebb Net Algorithm and application – perceptron learning convergence theorem – delta rule.

Module II:
Back propagation –architecture –algorithm-derivation of learning rules –number of hidden layers-learning factors-Hopfield neural net : architecture – algorithm –applications.

Module III:
Neural network based on competition: fixed- weight competitive nets- kohonenself organizing maps and applications. Adaptive Resonance theory: Basic architecture and operation. Neural controller for a temperature process.

Module IV:
Basic concepts of fuzzy sets – Relational equation – fuzzy logic control – fuzzification – defuzzification –knowledge base – Decision making logic –membership functions – rule base.

Module V:
Fuzzy logic controller: functional diagram, membership functions: triangular, trapezoidal- scale factors. Fuzzificatoin: membership value assignments using intuition –knowledge base. Defuzzification: max membership principle – centeroid method – weighted average method –rule. Choice of variables-derivation of rules- case study: fuzzy logic controller design for a temperature process

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Timothy J.Ross, *Fuzzy logic with Engineering Applications*, McGraw Hill, New york, 1996.
- Kosko.B, *Neural Network and fuzzy systems*- o\prentice Hall of India Pvt. Ltd., New Delhi, 1992.
- Robert .J.Schalkoff, *Artificial Neural networks*, McGraw Hill,Singapore, 1998
- LaureneFausett, Fundamentals of Neural Networks, Prentice Hall, New Jersey, 1994.
- Driankov D., Helledorn H., M.Reinframe, *An Introduction to fuzzy control* , Narosa publishing Co.,New Delhi, 1996

NEURAL NETWORK AND FUZZY LOGIC LAB

Course Code:BME2313 **Credit Units: 01**

List of Experiments

- To study about MATLAB and learn basic matrix operations.
- Write program to draw straight line, circle and sine functions.
- Study of Biological Neural Network & Artificial Neural Network
- How the weight and bias value affect the output of neuron.
- How weight and bias values are able to represent a decision boundary in feature space.
- Implementation of logic gate (AND, OR, NOT, NAND, NOR) using McCulloh-pitts model.
- How the choice of activation function affects the output of neuron. Experiment with following function: binary threshold and sigmoid function.
- Write a program to implement single layer perception algorithm..
- To Study Fuzzy Logic
- To study and analysis of Fuzzy vs Crisp logic.
- Write the program to implement various Fuzzy set operations (complement , union, intersection etc.)
- Implementation of fuzzy relations (Max-Min Composition)

Modes of Evaluation: Quiz/Assignment/ Seminar/Written Examination
Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Fourth Semester

HUMAN ANATOMY AND PHYSIOLOGY-II

Course Code:BME2401 **Credit Units: 04**

Course Objective:
To provide students a more detailed understanding of the human body and its systems.

Course Contents:
Module I:
Renal system : parts of the renal system , its structure and function , formation and composition of urine. Endocrine System and Reproductive system : basic knowledge of endocrine glands , functions of male and female reproductive parts and contraception .

Module II:
Nervous system : Basic functions and structure of CNS , ventricles and CSF , ANS. Organs of vision , hearing , taste and smell . Mechanism of sight , colored vision , hearing , relex action and reflex arc .

Module III:
Detailed understanding of cardiovascular system , systemic and pulmonary circulation , cardiac impulse. Artificial respiration , spirometry , alimentary system : all organs of the digestive system

Module IV
Anatomical joints : their classification on the basis of function and anatomy , synovial joints , arthritis , joint replacement.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References

- Guyton A.C and J.E. Hall , " Text book of Medical Physiology " Harcourt India Pvt. Ltd.
- Principles of Human Anatomy and Physiology , Tortora , Wiley
- Ganong W.F. " Review of Medical Physiology" , Prentice Hall
- Gray's Anatomy for Students - Gray's Anatomy by A. Wayne Vogl, Richard Drake, Adam W. M. Mitchell

DIGITAL ELECTRONICS

Course Code:BME2408 **Credit Units: 02**

Course Objective:
This course is an introduction to the basic principles of digital electronics. At the conclusion of this course, the student will be able to quantitatively identify the fundamentals of computers, including number systems, logic gates, logic and arithmetic subsystems, and integrated circuits. They will gain the practical skills necessary to work with digital circuits through problem solving and hands on laboratory experience with logic gates, encoders, flip-flops, counters, shift registers, adders, etc. The student will be able to analyze and design simple logic circuits using tools such as Boolean Algebra and Karnaugh Mapping, and will be able to draw logic diagrams.

Course Contents:
Module I: Boolean Functions
Analog & digital signals, AND, OR, NOT, NAND, NOR, XOR & XNOR gates, Boolean algebra, DeMorgan's theorems, Implementation of logical function using only NAND/NOR gates, 1`s complement and 2`s complement, BCD to Gray and Gray to BCD code conversion, Standard representation of logical functions (SOP and POS forms), K-map representation and simplification of logical function up to five variables, don't care conditions, XOR & XNOR simplifications of K-maps, Tabulation method.

Module II: Combinational Circuits
Adders, Subtractors, Implementation of full adder using half adder, full subtractor using half subtractor, Multiplexer, de-multiplexer, decoder & encoder, code converters, 1 & 2 bit comparators, BCD to seven segment decoder/encoder, Implementation of logic functions using multiplexer/de-multiplexer and decoder, Implementation of 16×1 MUX using 4×1 MUX, 4×16 decoder using 3×8 decoder etc., logic implementations using PROM, PLA & PAL.

Module III: Sequential Circuits
Difference between combinational and sequential circuits, Latch, Flip-flops: SR, JK, D & T flip flops – Truth table, Excitation table, Conversion of flip-flops, set up and hold time, race around condition, Master Slave flip flop, Shift registers: SIPO, PISO, PIPO, SIPO, Bi-directional, 4-bit universal shift register; Counters: Asynchronous/ripple & synchronous counters – up/down, Ring counter, sequence detector.

Module IV: Logic families & data converters
Logic families: Special characteristics (Fan out, Power dissipation, propagation delay, noise margin), working of RTL, DTL, TTL, ECL and CMOS families; Data converters: Special characteristics, ADC – successive approximation, linear ramp, dual slope; DAC – Binary Weighted, R-2R ladder type.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- MorisMano : Digital Design, Pearson Education.
- R. P. Jain: Digital Electronics, Tata McGraw Hill.
- Thomas L. Floyd: Digital Fundamentals, Pearson Education.
- Malvino and Leech: Digital Principles & Applications, Tata McGraw Hill.

BIOINSTRUMENTATION

Course Code:BME2451 **Credit Units: 03**

Course Objective:
To enable the student to understand the working and construction of various equipments used in the medical field .

Course Contents:
Module I:
Transducers and Reference electrodes: Classification of transducers , temperature transducers , displacement transducer , pressure tranducer , catheter transducer , photoelectric transducer , piezoelectric transducer . po2 electrodes , membrane electrodes , blood gas analysis , Ion specific electrodes .

Module II :
ECG : electrodes and conversion of ionic potentials to electric potential , ECG instrumentation amplifiers , driven right leg circuitry.Introduction and characteristics of bio signals (EEG , ECG , EMG) . , removal of artefacts , event detection and correlation analysis of ECG signals .

Module III :
Respiration measurement using electrical impedance plethysmography : electrical impedance changes during breathing , 2 and 4 electrode measurement , 4 electrode technique .

Module IV :
Oxygen saturation using pulse oximetry : optical characteristics of oxygenated and deoxygenated blood , principles of pulse oximetry , circuits of pulse oximetry , constant current source , current – voltage converter , amplifiers .

Module V :
Non invasive blood pressure measurement : theory and circuitry of method using Korotkoff sounds and method based on oscillometry .

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Leslie Cromwell , Fred J. Weibell , Erich A Pfeiffer , Biomedical Instrumentation and Measurements , PHI , 2nd Edition , 2004.
- R.S. Khandpur , Handbook of Biomedical Instrumentation , Tata McGraw Hill 2004 .
- John G.Webster , Medical Instrumentation : Application and Design, 3rd Edition , John Wiley & Sons , New York , 1998 .

BIOINSTRUMENTATION LAB

Course Code:BME2403 **Credit Units: 01**

Course Contents:

- Study of pulmonary function analyzer using spirogram.
- To study finger tip oximeter.
- Designing of instrumentation amplifier.
- Designing of notch filter.
- To study voltage regulator IC 7805, 7809, 7812 series.
- To determine Bradycardia and Tachycardia using ECG Training Kit.
- To determine heart rate using ECG simulator Kit.
- Circuitry explanation for patient leakage current.
- To determine balancing condition for thermistor using wheat stone bridge.
- Study of pressure changes using strain gauge.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

DIGITAL ELECTRONICS LAB

Course Code:BME2409 **Credit Units: 01**

List of Experiments:

1. To verify the truth tables of NOT, OR, AND, NOR, NAND, XOR, XNOR gates.
2. To obtain half adder, full adder using gates and verify their truth tables.
3. To obtain half subtractor, full subtractor using gates and verify their truth tables.
4. To implement control circuit using multiplexer.
5. To convert BCD code into excess 3 code and verify the truth table.
6. To verify the truth tables of RS, D, JK and T flip- flops.
7. To implement and verify 3-bit bi-directional shift register.
8. To design and study asynchronous/ripple counter.
9. To design and study synchronous counter.
10. To design and study a sequence detector.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

FUNDAMENTALS OF INTERNET

Course Code:BME2406 **Credit Units: 02**

Course Objective:
The course provides introduction to internet and a deep insight into the basics of internet, world wide web, security risks over internet, basics of various languages used over internet. With this course students would be able to know the basics of each and every introductory internet and computer features which would prove to be very helpful throughout their degree, and would prove helpful in understanding other related subjects also.

Course Contents:
Module-I:Internet Basics
Introduction to Internet, History of Internet, Internet Working, Modes of Connecting to Internet, Internet Service Providers(ISPs), Differentiate between Internet, Intranet and Extranet, Protocol, Internet address, IP addressing, standard address, domain name, DNS, internet tool, TCP/IP and UDP, OSI reference model.

Module-II: Electronic Mail
Introduction to E-mail, advantages and disadvantages of e-mails, structure of an e-mail address, message components, message composition, mailer features, Internal working of E-mail, E-mail management, MIME types, Newsgroups, mailing lists, chat rooms, secure-mails, SMTP,POP, PICO, Pine, Gopher.

Module-III: World Wide Web
Introduction to www, Miscellaneous Web Browser details, searching www: Search engines and meta search engines, search fundamentals, search strategies, working of search engines, Telnet, FTP, HTTP, Introduction to Browser, Coast-to-coast surfing, HTML, Web page installation and setup , Basics of HTML, formatting & hyperlink creation. Using and installing Plug-ins.

Module-IV: Introduction to Languages and Servers
Basics of java script language, Client/Server Side Programming in java script, Using Forms and data entry using java script, XML and DHTML basics, Creating Static and dynamic web pages.
Web Servers: PWS, IIS, Apache, Advantages and limitations of using these servers.

Module-V: Privacy and security
Introduction to security over internet,Network Attacks, security and privacy levels, security policy, virus worms anddTrozan horses, Cryptography: Encryptionand Decryption techniques, SecureWeb document, Digital Signatures, Firewalls and its types, IDS.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- Fundamentals of the Internet and the World Wide Web, Raymond Greenlaw and Ellen Hepp – 2001, TMH
- Internet & World Wide Programming, Deitel,Deitel& Nieto, 2000, Pearson Education

References:
- Complete idiots guide to java script,. Aron Weiss, QUE, 1997
- AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003

FUNDAMENTALS OF INTERNET LAB

Course Code:BME2410 **Credit Units: 01**

List of Experiments:

- Learn working of web browser and domain names.
- Study various E-Mail options.
- Steps to prepare and use Group-Ids and Mail Boxes.
- Study working of File Transfer Protocol.
- Planning webpage content.
- Prepare a webpage using basic HTML tags.
- Design a webpage showing various header tags and paragraph tag.
- Design a webpage showing Time-Table using table tag.
- Design a webpage showing table consisting of images.
- Design a webpage having different kinds of links.
- Create a login form with two text fields called "login" and "password". When user enters "Amity"as a user name and "university" as a password it should be redirected to a Welcome.HTML page or toSorry.HTML in case of wrong username/password.
- Design a webpage using frame tag.
- Design a webpage with multiple web forms.
- Study of various CSS .
- Design a webpage using CSS.
- Design a webpage for entering the student details with all the validations applied on it.
- Design a static website for University/Hospital/BookShop etc.
- Study of Java Script.
- Design a Digital Clock using Java Script.
- Working with Java Script and creation of dialogue boxes using alert, confirm and prompt methods.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ANALOG ELECTRONICS-II

Course Code:BME2407 **Credit Units: 03**

Course Objective:
The purpose of this course is to introduce the student to the application of semiconductor devices in linear analog circuits. To insure the usefulness of the course material to both computer engineers and electrical engineers, the course stresses circuit designs using the operational amplifier.

Course Contents:

Module I: Building Blocks of Analog ICs
Differential amplifier, Op-amp Model, op-amp DC & AC parameters, virtual ground, Current mirrors, Active loads, Level shifters and output stages.

Module II: Operational amplifiers
Introduction, open loop and closed loop configuration, op-amp parameters (input offset current, output offset current, i/p bias current, CMRR, PSRR, null adjustment range, etc,) Inverting and non-inverting configuration, voltage gain of inverting and non inverting configurations.

Module III: Linear & Non Linear Wave shaping
Adders, Voltage to current, current to voltage Converter, Integrators, Differentiators**,** Voltage follower (voltage buffer), summer, subtractor, Comparators, log/antilog circuits using Op-amps, precision rectifiers

Module IV: Waveform Generations
Damped and undamped oscillations, Barkhausen criterion for sustained oscillation.Tank circuit generator Astable multi Vibrators, OTA-C Oscillators, Crystal oscillator**.**Types of oscillators: LC-Hartley and Colpitts, RC-RC phase shift and Wien bridge oscillator, Basics of tuned Amplifiers, Voltage Controlled Oscillator.

Module V: Active RC Filters & Applications of Linear Circuits
Idealistic & Realistic response of filters (LP, BP, and HP), Butter worth & Chebyshev approximation filter functions, LP,BP,HP and All pass, Notch Filter, Operational transconductance amplifier (OTA)-C filters.

Module VI: Applications of IC Analog Multiplier & Timer
IC phase locked loops, 555 Timer, IC voltage regulators-(fixed, variable) 78xx, 79xx series and adjustable.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Richard C. Jaeger: Microelectronic Circuit Design
- Adel S. Sedra and K. C. Smith: Microelectronic Circuits
- RamakantGaekwad: Operational Amplifiers
- Rolf Schaumann and Mac E. Van Valkenburg: Design of Analog Filters
- D. Roy Choudhury and Shail B. Jain: Linear Integrated Circuits

LASER SYSTEMS

Course Code:BME2411 **Credit Units: 03**

Course Objective:
The course focuses on fundamentals and emphasizes a physical intuitive interpretation of laser and fiber optic phenomena and their applications. Lasers are essential to an incredibly large number of applications. Today, they are used in bar code readers, compact discs, medicine, communications, sensors, materials processing, computer printers, data processing, 3D-imaging, spectroscopy, navigation, non-destructive testing, chemical processing, color copiers, laser "shows", and in the military.

Course Contents:
Module I:
Introduction to fiber optics: Basic fiber link, applications, principles of light: Introduction, EM spectrum, internal & external reflections, Snell' slaw, optical fiber numerical aperture, Fresnel reflection.

Module II:
Optic fiber & its properties: Introduction, Basic fiber construction, propagation of light, modes of operation, refractive index profile, types of fibers, dispersion, data rate and bandwidth, attenuation, losses. Connectors, Splices & Couplers: Introduction, splices: mechanical, fusion, protection of splice, connectors: SMA, STC, bionic etc, coupling: passive, Stan, TEE types. Optical sources & Photo Detectors: Introduction: creation of photons, LED, ILD, photo detectors: introduction, PIN photodiode, avalanche photodiode, photodiode parameters, detector noise, speed of response, SNR.

Module III:
Modulation scheme for fiber optics transmission: Introduction, digital modulation, analog modulation schemes, multiplexing.

Module IV:
Laser Systems: Introduction, types of lasers: Solid state lasers, Gas lasers, Dye lasers, Lasers used in medical practice: Ruby laser, CO2 laser, Nd-Y AG laser and related solid state laser. Laser -Tissue Interaction: Terminology : spectral band designations, energy & power, irradiant & radiant exposure, fluency, thermal diffi1sion fibers & contact tips, Types of laser-tissue interactions

Module V:
Laser Application in Medical Therapy: Introduction, application in general surgery, dermatology, ophthalmology, cardiovascular & chest surgery, dentistry, neuro surgery, otolaryngology& head and neck surgery, tumor surgery, gynecologic laser

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Therapeutic Lasers -Theory and practice by G. David Baxter, Churchill Livingstone publications.
- Medical Lasers and their safe use by David H Shiney, Stephen and L. Trokel, Springer-Verlag publications.
- Elements of fiber optics by S. L. Wymer, Regents-Prentice Hall publications.
- Biomedical Electronics & Instrumentation by S. K. Venkata Ram, Galgotia publications
- Laser and optical fibers in medicine by Katzer and Abraham, Academicpress publications
- An Introduction to optical fibers by A. M. Cherin, McGraw Hill publications

Syllabus - Fifth Semester

MICROPROCESSOR SYSTEMS

Course Code:BME2501 **Credit Units: 04**

Course Objective:
This course deals with the systematic study of the Architecture and programming issues of 8085-microprocessor family. The aim of this course is to give the students basic knowledge of the above microprocessor needed to develop the systems using it.

Course Contents:
Module I: Introduction to Microcomputer Systems
Introduction to Microprocessors and microcomputers, Study of 8 bit Microprocessor, 8085 pin configuration, Internal Architecture and operations,interrupts, Stacks and subroutines, various data transfer schemes.

Module II: ALP and timing diagrams
Introduction to 8085 instruction set, advance 8085 programming, Addressing modes, Counters and time Delays, Instruction cycle, machine cycle, T-states, timing diagram for 8085 instruction.

Module III: Memory System Design & I/O Interfacing
Memory interfacing with 8085. Interfacing with input/output devices (memory mapped, peripheral I/O), Cache memory system. Study of following peripheral devices 8255, 8253, 8257, 8259, 8251.

Module IV: Architecture of 16-Bit Microprocessor
Difference between 8085 and 8086, Block diagram and architecture of 8086 family, pin configuration of 8086, minimum mode & maximum mode Operation, Bus Interface Unit, Register Organization, Instruction Pointer, Stack & Stack pointer, merits of memory segmentation, Execution Unit, Register Organization.

Module V: Pentium Processors
.Internal architecture of 8087, Operational overview of 8087, Introduction to 80186, 80286, 80386 & 80486 processors, Pentium processor (P-II, P-III, P-IV).

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Ramesh. S. Gaonkar, "Microprocessor architecture Programming and Application with 8085" Penram International Publishing, 4th Edition
- B. Ram, "Fundamentals of microprocessors and microcomputer" Dhanpat Rai, 5th Edition.]
- Douglas V Hall.
- M. Rafiquzzaman, "Microprocessor Theory and Application" PHI – 10th Indian Reprint.
- Naresh Grover, "Microprocessor comprehensive studies Architecture, Programming and Interfacing" Dhanpat Rai, 2003.
- Gosh," 0000 to 8085" PHI.

CLINICAL ELECTRICAL SAFETY AND HAZARDS

Course Code:BME2510 **Credit Unit: 02**

Course Objective:
The objective of the course is to provide a brief knowledge of Clinical Electrical Hazards, safety standards and Safety procedures. Curriculum introduces students with safety testing method and equipment.

Course Contents:
Module-I
Clinical Electrical Hazard: Introduction to electrical safety; Various effect of current flowing from one contact point to another: Sensitivity Limits, Let-go current, Muscles Contraction, Suffocation, Cardiac fibrillation, Burn; Difference between Macro-shocks and Micro-shocks.

Module-II
Electrical Safety: Leakage Current, Electric isolation techniques, Basic electrical safety test;
Electrical Safety standards: Instrument Class, Patient applied parts, terminology used in IEC 60601.1; Standardisation Organizations: NFPA, AAMI, UL, CSA; Electrical Safety Testing: Electrical Safety Procedure, Electrical Safety Analyzer;

Module-III
Type of Test: Physical Test, electrical Safety Analyzer Setup, Ground Wire Resistance, Insulation Test, Equipment Leakage Current (Direct, Differential, Alternative), Patient Applied part leakage current, Leads Isolation Test/Mains applied part Leakage

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Electrical Safety Handbook by John Cadick, P.E.,, Mary Capelli-Schellpfeffer, M.D., M.P.A.,, Dennis K. Neitzel, C.P.E.,, Al Winfield, Publisher: McGraw-Hill
- Electrical Safety Practice and Standards: CRC Press Publication

CLINICAL SCIENCES AND DEVICES

Course Code : BME2511 **Credit Unit: 02**

Course Objective:
The objective of the course is to provide a brief knowledge of various common diseases and their investigations.

Course Contents:
Module-I
Basis of Common Disease and Clinical Investigation:
Diabetes, Hypertension, Rheumatic Heart Disease, Ischemic Heart Disease, Asthma, Equipments – Automatic Clinical Analyzer- Principle and functions.

Module-II
Cardiology:
Cardiac Cycle, normal and abnormal ECG, Cardiac Pacing, Heart Rate monitor, Cardiac catheterization, Heart Lung Machine, Fibrillation- Atrial and Ventricular, Equipments- Cardiac Pacemakers, external and Internal Types, leads, waves, Pattern analysis.

Module-III
Coronary care Devices:
Coronary stents, Angiography, Angioplasty, laser equipments for Plaque removal, Arrhythmia monitors.

Module-IV
Sensory Devices:
Intraocular Lens

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Physiology of the Heart, Arnold M Katz
- Biomedical Instrumentation: application and Design: J G Webster
- An Introduction to biomedical equipment technology : Carr and Brown
- Handbook of Biomedical Instrumentation : R. S Khandpur
- Biomedical Instrumentation and Measurements: Cromwell

TISSUE ENGINEERING

Course Code:BME2551 **Credit Units: 03**

Course Objective:
To enable students to understand the principles of tissue engineering and learn the basics of cell culture, tissue culture, scaffolding, types of bioreactors and mass transfer reactions.

Course Contents:
Module I: Principle of Tissue Engineering
Cell culture: Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization. Requirements, principles and key issues in Tissue Engineering.

Module II: Biomaterials for Tissue Engineering
Scaffold and transplant: Engineering biomaterials for tissue engineering, extracellular matrix, scaffold fabrication, modification. Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology, stems cells: introduction, haematopoiesis.

Module III: Bioreactors
Different bioreactors, their classification, configuration and design. Molecular biology aspects: Cell signalling molecules, growth factors, hormone and growth factor signalling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

Module IV: Mass Transfer
Cryopreservation of cells and tissues, Transport in biological system, Mass transport through cell membranes, Mathematical modelling of mass transfer in engineered tissues

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Clemens van Blitterswijk, Tissue Engineering, Academic Press, 2008
- Principles of tissue engineering, Robert. P.Lanza, Robert Langer & William L. Chick,Academic press.
- The Biomedical Engineering –Handbook, Joseph D. Bronzino, CRC press.
- Tissue Engineering, B. Palsson, J.A. Hubbell, R.Plonsey& J.D. Bronzino, CRC- Taylor &Francis

MICROPROCESSOR SYSTEMS LAB

Course Code: BME2504 **Credit Units: 01**

List of experiments:

1) Write at least three different programs for addition of two 8 bit numbers assuming carry may or may not be generated.

2) Write at least three different programs for subtraction of two 8 bit numbers assuming borrow may or may not be generated.

3) Write two different programs for 16 bit addition, one using instruction DAD and another without using instruction DAD.

4) Write assembly language program for 8 bit multiplication and division.

5) To study, understand, interface and two peripheral devices with 8085.

6) Any three programs using 8085 based on block of data.

7) Using 8086 write an ALP to add list of 10 given numbers.

8) Using 8086 write an ALP to sum the numbers from 1-100.

9) Using 8086 write an ALP to count negative numbers from a given list of 10 numbers.

10) Using 8086 write an ALP to check number of vowels in a given string.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

TISSUE ENGINEERING LAB

Course Code: BME2505 **Credit Units: 01**

List of Experiments

- Sterilization experiment for tissue culture lab ingredients including culture medium, equipment, and other important components.
- Preparation and sterilization of various types of culture medium for tissue engineering lab
- Cultivation of microorganism to understand various growth techniques and parameters
- Basic techniques for the cellular growth and harvesting
- Experimental methods to evaluate various parameters associated with the DNA quality and Quantity
- Transformation of microorganism by calcium chloride methods
- Fabrication and design of scaffolds by using Salt Leaching methods
- Fabrication and design of scaffolds by using Gas foaming methods
- Seeding, cultivation, and analysis of scaffolds by using human cultured cells

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

SUMMER INTERNSHIP EVALUATION-I

Course Code: BME2535 **Credit Units: 03**

Methodology:
Practical training is based on the theoretical subjects studied by students. It can be arranged within the college or in any related industrial unit. The students are to learn various industrial, technical and administrative processes followed in the industry. In case of on-campus training the students will be given specific task of fabrication/assembly/testing/analysis. On completion of the practical training the students are to present a report covering various aspects learnt by them and give a presentation on same.

Examination Scheme:

Feedback from industry/work place	20
Training Report	40
Viva	15
Presentation	25
Total	**100**

JAVA PROGRAMMING

Course Code: BME2506 **Credit Units: 03**

Course Objective:
The objective is to impart programming skills used in this object oriented language java.
The course explores all the basic concepts of core java programming. The students are expected to learn it enough so that they can develop the web solutions like creating applets etc.

Course Contents:

Module I
Concepts of OOP, Features of Java, How Java is different from C++, Data types, Control Statements, identifiers, arrays, operators. Inheritance: Multilevel hierarchy, method overriding, Abstract classes, Final classes, String Class.

Module II
Defining, Implementing, Applying Packages and Interfaces, Importing Packages. Fundamentals, Types, Uncaught Exceptions, Multiple catch Clauses, Java's Built-in Exception.

Module III
Creating, Implementing and Extending thread, thread priorities, synchronization suspending, resuming and stopping Threads, Constructors, Various Types of String Operations. Exploring Various Basic Packages of Java: Java. lang, Java. util, Java.i.o

Module IV
Event handling Mechanism, Event Model, Event Classes, Sources of Events, Event Listener Interfaces
AWT: Working with Windows, AWT Controls, Layout Managers

Module V
Applet Class, Architecture, Skeleton, Display Methods.
Swings: Japplet, Icons, labels, Text Fields, Buttons, Combo Boxes.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- JAVA The Complete Reference by Patrick Naughton & Herbert Schild, TMH
- Introduction to JAVA Programming a primar, Balaguruswamy.

References:
- "Introduction to JAVA Programming" Daniel/Young PHI
- Jeff Frentzen and Sobotka, "Java Script", Tata McGraw Hill,1999

JAVA PROGRAMMING LAB

Course Code:BME2508 **Credit Units: 01**

Software Required: JDK1.3

Assignments will be provided for the following:

- Java programs using classes & objects and various control constructs such as loops etc, and data structures such as arrays , structures and functions
- Java programs for creating Applets for display of images and texts.
- Programs related to Interfaces & Packages.
- Input/Output and random files programs in Java.
- Java programs using Event driven concept.
- Programs related to network programming.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

DIGITAL CIRCUITS AND SYSTEMS

Course Code: BME2507 **Credit Units: 03**

Course Objective:
This course builds on the course Digital Circuits and Systems - Hardware development language VHDL is introduced; the usage of the same to implement the systems is dealt in detail.

Course Contents:

Module I: Design of Sequential circuits
SR, JK, T and D flip flops and their timing diagrams with delay, characteristic table, characteristic equation and excitation tables. Design of Finite State Machines: Mealy and Moore type using next state tables, state diagrams, state minimization, state encoding: minimum bit change and hot one encodings. Comparative cost and delays of different implementations and their optimization and timing diagrams, Asynchronous and synchronous sequential circuits Static Timing Analysis –setup, hold time, clock skew, clock period Data paths, FSMs with datapaths, ASM charts

Module II: Basics of VHDL
Introduction and Basic Design Units of VHDL, Writing Entities for Digital circuits like decoders, registers etc, Scalar Data types and Operations: Object types: constants, variables, signal and files. Data Types: scalar, integer, floating, physical, enumeration, type declarations, subtypes, expressions and operators for various types.
Sequential statements: If, case, Null, Loop, Exit, Next statements, while loops, For loops, Assertion and report statements
Composite Arrays: arrays, Array aggregates, unconstrained array types, strings, Bit vectors, Standard Logic Arrays, array operations and records

Module III: VHDL Programming
Behavioral Modeling: process statements, variable and signal assignments, inertial and transport delay models, signal drivers, multiple and postponed processes
Dataflow Modeling: Concurrent signal assignment, multiple drivers, block statement
Structural Modeling: component declaration, component instantiation, resolving signal values, and configuration: basic configuration, configuration for structural modeling, mapping library entities.
Generics, generic (AND, NAND, OR, NOR, XOR and XNOR) gates, functions and subprograms, packages and libraries.

Module IV: Synthesis: mapping statements to gates
Writing a test bench, converting real and integers to time, dumping and reading from text file
Vhdl modeling of basic gates, half and full adder AOI, IOA, OAI, multiplexes, decoders (dataflow, behavioral and structural modeling), three state driver, parity checker, D, T, JK and SR flip flops, flip flops with preset and clear, modeling for multiplexer, priority encoder, ALU etc, modeling regular structures, delays, conditional operations, synchronous logic, state machine modeling, Moore and Mealy machines, generic priority encoder, clock divider, shift registers, pulse counter etc

Module V: Overview of the following
PLD devices, PROM, PAL, PLA, CPLD, EPLD GAL, FPGA, DRAM etc and their applications, FPGA programming, Design exercises ASIC design using CAD tools

Examination Scheme:

Components	HA	V/S/Q	CT	AT	ESE
Weightage (%)	7	8	10	5	70

Text & References:

- Daniel Gajski: Principles of Digital Design
- Bhasker: A VHDL Primer 3/e
- Pedroni: Circuit Design with VHDL
- Perry: VHDL: Programming by examples K. Skahill, VHDL for programmable Logic

DIGITAL CIRCUITS AND SYSTEMS LAB

Course Code:BME2509 **Credit Units: 01**

List of Experiments

To implement VHDL code for

1. 2, 3, 4 inputs AND, OR, XOR and XNOR gates and testing their simulation with signals.
2. Half adder, full adder and full subtractor. Also trying out other simple combinatorial circuits like AOI, IOA, OAI.
3. D and T, flip-flops.
4. JK and SR flip-flops.
5. 2 to 4 and 3 to 8 decoders.
6. 2 to 1, 4 to 1 and 8 to 1 multiplexers.
7. a register.
8. 2 to 1, 4 to 2 and 8 to 3 priority encoders.
9. 8 bit tri state drivers.
10. 9 input parity checker.
11. 1 bit, 4 bit 8 bit comparators.
12. Adding and subtracting 8 bit integers of various types.
13. Clock divider
14. shift register
15. Pulse counters.
16. VHDL Design examples of Moore machine, Mealy machine, generic gate inputs and delays.
17. VHDL code examples of structural modeling showing binding.

Experiments based Field Programmable Gate Array (FPGA) Programming

18. Implementation of all the above VHDL experiments using FPGA.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

CONTROL SYSTEMS

Course Code: BME2503 **Credit Units: 03**

Course Objective:
The basic objective of this course is to provide the students the core knowledge of control systems, in which time & frequency domain analysis, concept of stability.

Course Contents:

Module I: Input / Output Relationship
Introduction of open loop and closed loop control systems, mathematical modeling and representation of physical systems (Electrical Mechanical and Thermal), derivation of transfer function for different types of systems, block diagram & signal flow graph, Reduction Technique, Mason's Gain Formula.

Module II: Time – Domain Analysis
Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants in unity feedback control systems, error criteria, generalized error constants, performance indices, response with P, PI and PID Controllers.

Module III: Frequency Domain Analysis
Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode Plots),gain and phase margins, relative stability, Correlation with time domain, constant close loop frequency responses, from open loop response, Nyquist Plot.

Module IV: Concept of Stability
Asymptotic stability and conditional stability, Routh – Hurwitz criterion, Root Locus plots and their applications. Compensation Techniques:Concept of compensation, Lag, Lead and Lag-Lead networks, design of closed loop systems using compensation techniques. P, PI, PID controllers.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- Dr. N.K Jain, 2005,"Automatic Control System Engineering", Dhanpat Rai Publication.
- J. Nagrath& M. Gopal, 2000, "Control System Engineering", New Age International.

References:
- M, K. Ogata, 2002, "Modern Control Engineering, PHI.
- B. C. Kuo, 2001, "Automatic Control system, Prentice Hall of India.

CONTROL SYSTEMS LAB

Course Code:BME2512 **Credit Units: 01**

List of Experiments

1. Study and draw

a) Step response of open Loop system (linear 1st order, 2nd order

b) Step response of closed loop systems (1st order)

2. Study and draw temperature control system the open loop response and closed loop response with different values of gains

3. Study of operations and characteristics of a stepper motor

4. To Study a D.C. motor speed control system.

5. Performance evaluation and design of PID controller.

6. Study of microprocessor control of a simulated linear system.

7. To design a suitable cascade compensator for the given system and verify the resulting improvement.

8. Note: three experiments in MATLAB have to be performed in the slot of MATLAB.

Using MATLAB obtain the unit-step response and unit impulse response of the following system:

$$\frac{C(s)}{R(s)} = \frac{16}{s^2 + 1.6s + 16}$$

9. For a 2nd order transfer function using MATLAB

a) Bode Plot

b)Root locus plot

c)Nyquist plot.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Sixth Semester

MICROCONTROLLER AND ITS BIOMEDICAL APPLICATIONS

Course Code : BME2601 **Credit Units: 04**

Course Objective:
To enable students to understand the concept and functioning of microcontrollers and how they can be used in biomedical designs.

Course Contents:
Module I:
8051, Comparison with microprocessor, pin diagram explanation, internal diagram 8051.

Module II:
Instruction Set: Addressing mode, data transfer instruction, logical, arithmetic instruction, bit instruction, branching instruction.

Module III :
Timers: Mode of timers, simple programming, generation of square wave. **8051** connection to RS 232
Interrupts: Interrupt priority in 8051, generation of waveforms using interrupt, serial interface using interrupt.

Module IV:
Interfacing of memory, intelligent LCD, 8255, ADC, DAC, LED display.

Module V:
Applications: Introduction to DSP processor, Applications of microcontrollers and computers in biomedical engineering, microcontrollers in embedded biomedical applications

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Micro controllers & its applications by B.S. Chhabra, Dhanpat Rai Pub. Co., India
- 8051mC, Scott Mackenizie, PHI, Englewood Cliffs, New Jersey.
- MykePredko,'Programnming& Customizing the 8051 Microcontroller,' Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
- 8051 m C Architecture Programming & Applications, K.J. Ayata: Penram International Publishers, India.
- S.K. VenkataRam,'Advanced Microprocessor & Microcontrollers, Luxmi Pub. Pvt. Ltd., New Delhi

ARTIFICIAL ORGANS AND REHABLITATION ENGINEERING

Course Code : BME2602 **Credit Units: 04**

Course Objective:
To make students well versed with prosthetics and engineering solution for various impairments.

Course Contents:
Module I:
Introduction to artificial organs , biomaterials , inflammation , rejection , correction . Rheological properties of blood , blood viscosity , effect of shear rate , haematocrit , temperature and protein contents . Cassonequation , flow of blood thorugh blood vessels , problems of extracorporeal blood flow.

Module II:
Artificial kidney , kidney filtration , artificial waste removal , haemodialysis , equation of artificial kidney and middle molecule hypothesis . Types of heamodylsers : flat plate , coil type and hollow fibre . Mass transfer analysis in dialyser , regeneration of dialysate , membrane configuration .

Module III:
Artificial heart lung machine : brief explanation of gas exchange , artificial heart lung devices , Oxygenators : bubble , film oxygenators and membrane oxygenator . Liver support system , artificial pancreas , blood and skin .

Module IV:
Audiometry : air conduction , bone conduction , masking , functional diagram of audiometer . Wheeled mobility : categories of wheelchairs , wheelchair structure and component design , ergonomics of wheelchair propulsion , power wheelchair electrical systems .

Module V:
Rehabilitation Engineering : Impairments , disabilities and handicaps , engineering concepts in sensory and motor rehabilitation . Rehab for locomotion , vision , speech and hearing . Artificial limbs , prosthetic heart valves . Externally powered and controlled prosthetics . Spinal rehabilitation and Marcus study .

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- RobbinsonC.J.,Rehabilitation engineering . CRC press 1995
- Gerald E.Miller , Artificial Organs , Morgan & Claypool Publishers ,2006.
- BronzinoJoseph , Handbook of biomedical engineering . CRC 2nd edition ,1999
- R.S. Khandpur , Handbook of biomedical instrumentation . Tata McGraw Hill Publishers
- BallabioE.et.al , Rehabilitation engineering . IOS press 1993

PHYSIOLOGY CONTROL SYSTEM AND SIMULATION MODELLING

Course Code:BME2603 **Credit Units: 04**

Course Objective:
To enable students to understand the mathematical equations concerning the physiology of human body and compartment modelling of the body.

Course Contents:
Module I:
State variables , state equations , state transition equation, properties of transition matrix, relationship between state equations and higherorder differential equations, state equation and transfer function, characteristics equation,Eigen values & Eigen vector

Module II:
Introduction to biological control systems ,Introduction, Dynamic systems and their control, modelling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open & close loop systems instability, automatic aperture control.

Module III:
Mathematical modeling of the system: Thermo regulation, Thermoregulation of cold bloodedness& warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples, mathematical model of the controlled process of the body

Module IV:
Modeling the body as compartments, behavior in simple compartmental system, pharmacokinetic model, multi compartmental system, distribution and accessibility of body water & tissue compartments, basis for zero order & first order chemical kinetic behaviour in the biological system.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Automatic control systems: By Benjamin C Kuo.
- Control system Engineering: By I. J .Nagarath. & M. Gopal.
- Bio- Medical Engineering Principles By: David. 0. Cooney , Michel Deckker INC
- Biological control systems: John H Milsum Mc Graw Hill 1966.
- The Application Of Control Theory Of A Physiological System by Howard T Milhorn Sounders Publication

HOSPITAL VISIT AND CLINICAL NEED ASSESSMENT-I

Course code : BME2604 **Credit Units : 02**

Methodology

Each student must spend 3 hours per week or 6 hours every two weeks observing and shadowing a doctor in a hospital environment. The visits will be organised by ASET. Students will be exposed to practical implementation of biomedical engineering.
Students will be required to identify some key clinical needs in the hospitals and come up with a biomedical engineering solution for the same.

Students will have to present their findings and solutions in the form of a presentation at the end of the term.

Examination Scheme:

Feedback from hospital	20
Report	40
Presentation	40
Total	**100**

BIOMECHANICS

Course Code : BME2651 **Credit Units: 03**

Course Objective:
To enable students to understand the basics of bone movement , gait analysis and mechanics of bone and muscles

Course Contents:
Module I:
Joint motion: relative position of two bones meeting at a joint , description of a rigid body , degrees of freedom , euler angles , rotation matrices, rotation angle anatomical directions , anatomical planes.

Module II :
Inverse Dyanamics to calculate resultant force and momentum within the body link segment models , intersegmental force and moment ,

Module III:
Human Gait analysis , gait cycle , angular kinematics of hip , knee and ankle , force plates and ground reaction force , gait abnormalities .

Module IV:
Structure and composition of bone , microstructure of bone , skeletal muscle , mechanism of muscle contraction , force length and force celocity relationships , basic muscle models , tendons and ligaments , their basic mechanical models , injuries and factors affecting biomechanical properties , Cartilage , viscoeleasticity and viscoelastic models .

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Basic biomechanics of the musculoskeletal system (M Nordin and VH Frankel; Lea&Febiger, London 1989)
- Biomechanics of the musculo-skeletal system (BM Nigg, W Herzog (eds); John Wiley & Sons, Chichester 1994)
- Biomechanics and motor control of human movement (DA Winter; John Wiley &Sons, Chichester 1990)
- Bones and Joints: A Guide for Students. Christine Gunn. Churchill Livingstone,Edinburgh 1996 (3rd ed.)
- Principles of Human Anatomy. G.J. Tortora. Harper & Row, New York, 1983 (3rd ed.)
- Clinical Anatomy for Medical Students. R.S. Snell. Little, Brown, and Company,Boston 1995.
- Bones: Structure and Mechanics. J.D. Currey, Princeton University Press, 2002.
- Clinical Anatomy for Medical Students. RS Snell. Little, Brown and Co., Boston 1995
- Gray's Anatomy. R. Warwick and P.L. Williams, eds. Longman, 1973(35th ed.)
- Muscles, Reflexes, and Locomotion. TA McMahon. Princeton University Press, 1984
- Hazelman, B., Riley, G. and Speed, C. (eds.) Soft tissue rheumatology.Oxford University Press, 2004
- Chapter 2 in Basic biomechanics of the musculoskeletal system
- (2nd edn.) Nordin, M. and Frankel, V.H. (eds.) Lea &Febiger, Philadelphia.

BIOMECHANICS LAB

Course Code: BME2605 **Credit Units: 01**

List of Experiments

- Biceps Force versus Perpendicular Load
- Biceps Force versus Weight
- Triceps Force versus Perpendicular Load
- Biceps Curl
- Biceps Force versus Shoulder Angle, Constant Elbow Angle
- Biceps Force versus Elbow Angle, Constant Forearm Orientation
- Triceps Extension
- Rotational Inertia of the Forearm
- Complex Movements: Curling Lift, Passing Lift, and Free Throw

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

BASIC PATHOLOGY AND MICROBIOLOGY

Course Code :BME2606 **Credit Units: 03**

Course Objective:
Introducing the fundamentals of pathology and microbiology through the study of cell structure, inflammation tumors, different disease diagnosis, microscopy, characterisation of micro organism, diseases caused by them and their control

Course Contents:
Module I:
Normal cell structure
Normal cell structure – Cell degeneration and regeneration – Inflammations. Neoplasia – Classification,Difference between benign and malignant tumours – Ethiology of tumours – Spread of tumours

Module II :
Microbiological techniques
Tissue processing – Histokinates – Block making – Microtomes and knives. Cryostat – Frozen section. Basicstain and special stains (fat, iron stains, PAS).

Module III :
Diseases diagnosis methods
Diagnosis of diseases by immunological and molecular methods – role of computers in disease diagnosis

Module IV :
Microscopy
Microscope – Light Microscopy, Phase contrast microscopy, Electron microscopy, Bacterial Cell structure**,**Growth, development and differentiation.
Microbial diseases
Sterilization, Diseases caused by bacteria, fungi and viruses and their control by using drugs**.**

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Robbins.S.L. and Ramzi.S.C., Pathologic *Basis of Diseases* , W.B. Saunders Co.
- Prescot, Harley and Klein, *Microbiology* ,Tata McGraw Hill Publications, Fifth Edition, 2003.
- Michael.J.Pelczar.J.R.,E.C.S.Chan and Noel.R.Krieg., *Microbiology*, McGraw Hill Publications.
- Ananthanarayanan.R and JayaramPanicker.C.R., *Text Book of Microbiology* , Orient Longman

HOSPITAL MANAGEMENT SYSTEM

Course Code : BME2607 **Credit Units: 03**

Course Objective:
To enable the students to be well versed with the working, regulations and management of a hospital environment.

Course Contents:

Module I:
Classification of hospital & architecture: General hospital, specialized hospital, primary health care – their role and functions. Aspects of hospital services – inpatient, outpatient and emergency. Location and environment of hospital, Hierarchy of medical and paramedical staff & their functions and responsibilities. Modern Hospital Architecture- space in a hospital building, design of ward, intensivecare units, air conditioning, plumbing & sanitation, gas supply, waste disposal, cleaning, dietary,sterilizing, laundry, storage and operation theatre systems, Radiology, Central labs, Blood banks,OPD, Casualty, etc

Module II :
Air conditioning & gas supply systems: Air conditioning and refrigeration systems for small and large areas. Air changes, filtering and sterility.Deodourization, disinfection, dehumidification andcryogenic systems. Centralized supply of air, oxygen, nitrous oxide & vacuum - Principle of production of liquid oxygen. Management lifts fire fightingequipments.

Module III :
Hospital engineering & Management: Definition of biomedical Engineering, clinical engineering &hospital engineering. Importance of BME department – servicing and maintenance, testing, acceptance& maintenance protocols, Computerized preventive maintenance planning, MROs. Training of men for medical equipments preventive and periodical maintenance procedures. Preparation of estimates, specifications, tender details etc. Importance of ISO 9000 Certificates - Obtaining ISO certificates in hospitals.Proposed protocols. Necessity for standardization, FDA, AERB, Joint Commission of Accreditation of hospitals, ICRP and other standard organization, methods to monitor the standards

Module IV :
Hospital Information system: Role of database in HIS. Need of Networking in HIS. Overview of Networking, topologies and its configuration.Structuring medical records to carry out functions likeadmissions, discharges, treatment history etc.Computerization in pharmacy &billing.Automatedclinical laboratory systems & radiology information system. Need for evolving health policy, healthorganization in state, health financing system, health education, health insurance, health legislation

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- P.E.Stanley, Handbook of hospital safety, CRC Press (UNIT II)
- Arun Kumar, Hospital Management, Anmol Publications Pvt. Ltd., Jan 2000 , 1st.ed (UNITS IV & V)

- Harold E. Smalley, "Hospital Management Engineering – A guide to the improvement of hospital management system", PHI
- Sharma, Essentials for Hospital Support Services and Physical Infrastructure, 1/e, Jaypee Medical Publishers 2003
- Hospital Engineering And Facilities Management 2007 - Report, Fifth official report of the Internationa l Federation of Hospital Engineering (IFHE), January 2007
- Gupta, Kant, Chandrashekhar, Satpathy, Modern Trends in Planning and Designing of Hospitals Principles and Practice with CD-ROM, Jaypee Medical publishers, 1/e, 2007
- Sakharkar, Principles of Hospital Administration and Planning, Jaypee Medical publishers 1/e, Reprint 2004

Syllabus - Seventh Semester

MEDICAL IMAGE PROCESSING

Course Code: BME2751 **Credit Units: 03**

Course Objective:
To enable students to understand techniques used in imaging in the medical profession , the artefacts and other problems experience in doing so .

Course Contents:
Module I:
Digital image fundamental: Elements of digital image processing systems, Elements of Visual perception, Image sampling and quantization, Some Basic relationships between pixels, Matrix and Singular Value representation of discrete images

Module II:
Image transforms1DDFT, 2D DFT, Cosine, Sine Hadamard, Haar, Slant, KL transform and their properties

Module III:
Image enhancement: Histogram – Modification and specification techniques, Enhancement by point processing Image smoothening, Image sharpening, generation of spatial masks from frequency domain specification, Homomorphic filtering, and color image processing.

Module IV:
Image segmentation: spatial feature extraction, transforms features , segmentation techniques , analysis techniques, application of matlab for digital image processing.

Module V:
Run length, Huffman coding, arithmetic coding , Pixel coding, transform coding, JPEG Standard, predictive techniques, Application of image processing techniques in thermography , SPECT, PET images.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Rafael C., Gonzalez and Richard E. Woods, *Digital Image Processi*ng, Pearson Education Asia, 2001
- Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall of India, 1997
- William K. Pratt, *Digital Image Processing*, John Wiley, NJ, 1987.
- Albert Macouski, *Medical Imaging systems*, Prentice Hall, New Jersey.1983.
- Sid Ahmed M.A., *Image Processing Theory, Algorithm and Architectures*, McGraw Hill, 1995.

BIOTRANSPORT PHENOMENEON AND BIOFLUIDS

Course Code: BME2701 **Credit Units: 04**

Course Objective:
To enable students to understand the fluid mechanics of the human body, laminar and non laminar flow, aneursyms and biomedical solutions.

Course Contents:
Module I:
Introduction to fluid mechanics, heat and mass transfer, Physical, chemical and rheological properties of blood

Module II:
Cardiovascular system , blood circulation , systemic and pulmonary flow , structure of arteries , veins and capillaries , cerebral aneurysm , laminar flow vs non laminar flow , Dean Number , Reynolds number and Womersley number , Newtonian vs Non Newtonian fluids , Navier Stokes equation .

Module III:
Renal system , structure of kidney , structure of nephron , urine formation , haemodialysis , types of haemodialysers .

Module IV:
Cerebrospinal fluid, shunts, heart lung machine, heart pumps.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- David O. Cooney, An introduction to fluid, heat & mass transport process- Principles, Vol.1,Marcel Dekker Inc., New York, 1976.
- EdwinN. Lightfoot, Transport phenomena and living systems – Biomedical aspects of momentum and mass transport, John Wiley, 1974
- Ronald L. Fournier, Basic transport phenomena in biomedical engineering, Taylor Francis,1998.

HOSPITAL VISIT AND CLINICAL NEED ASSESSMENT-II

Course Code: BME2702 **Credit Units : 02**

Methodology

Each student must spend 3 hours per week or 6 hours every two weeks observing and shadowing a doctor in a hospital environment. The visits will be organised by ASET. Students will be exposed to practical implementation of biomedical engineering.
Students will be required to identify some key clinical needs in the hospitals and come up with a biomedical engineering solution for the same.

Students will have to present their findings and solutions in the form of a presentation at the end of the term.

Examination Scheme:

Feedback from hospital	20
Report	40
Presentation	40
Total	**100**

MEDICAL IMAGE PROCESSING LAB

Course Code: BME2703 **Credit Units: 01**

List of Experiments

1. Write program to read and display digital image using MATLAB
2. Write a program to perform convolution operation for 1D and 2D data in MATLAB
3. To write and execute programs for image arithmetic operations
4. To write and execute programs for image logical operations
5. To write and execute program for geometric transformation of image
6. To understand various image noise models and to write programs for image restoration
7. Write and execute programs to remove noise using spatial filters
8. Write and execute programs for image frequency domain filtering
9. Write a program in MATLAB for edge detection using quick mask
10. Write a program in MATLAB for histogram calculation and equalization.
11. Write and execute programs of image manipulation Zoom and Shrink
12. To process image using image processing toolbox

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

TELEMEDICINE

Course Code: BME2707 **Credit Units: 03**

Course Objective: To enable students to understand the upcoming technological advancements in remote medicine.

Course Contents:

Module I:

Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system-Methods of telemetry – Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry standards.

Module II: Supervised Learning

Clinical network, Clinical parameters, Cardiology, Dermatology, Tele-radiology, EMI emergency Medicine, Gastroenterology, Homecare, Neurology, Oncology, Ophthalmology, Mental health, Telerehabilitation, Tele-pathology & Tele-surgery.

Module III:

Use of computers in distance mode of healthcare delivery, Web technology, Satellite communication systems; hypertext, voice & image transfer protocols, Medical image scanning, Data compression and Transfer, Capturing of medical signals, Analog to digital conversion, Video conferencing, Remote sensing, Rural primary setups, Referral and Super speciality centers, Societal medico legal aspects, Networking (local, national & global).

Module IV:

Video conferencing hardware/software, Video production, Editing and Broadcasting, Tele-medical workstations, DSL equipments, Cable modem, POTS line, Fast switches ethernet, Fiber optic equipment, Router, Hubs, Monitoring devices, Vital sign monitoring devices, Respiratory monitoring devices, Neurological monitoring devices, Video scopes, Robotics and virtual reality devices

Module V:

Legal and ethical issues, Duty of care, Malpractice and liability, Licensure and accreditation, Security and confidentiality, Ethical standards, Intellectual property rights

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- B.D. Gupta, "Introducing Telemedicine (Applications, challenges, needs and benefits,components and infrastructure)"
- A.C. Norris, "Essentials of Telemedicine and Telecare"
- Marlene Maheu, Pamela Whitten, Ace Allen, "E-health, Telehealth and Telemedicine"
- Marilyn J. Field, Telemedicine: A Guide to Assessing Telecommunications for Health Care,National Academic Press, 1996
- Charles J. Amlaner (Author), David W. Macdonald (Author), A Handbook onBiotelemetry and Radio Tracking, Pergamon Press; 1st edition (January 1, 1980

SOFT COMPUTING

Course Code: BME2708 **Credit Units: 03**

Course Contents:

Module-I:

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence: Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

Module-II:

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Delta rule. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA.

Module-III:

Counter propagation network:-Architecture, functioning & characteristics of counter Propagation network, Hop field/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications.

Module-IV

Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system : fuzzy propositions, formation, decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making.

Module-V

Genetic algorithm: Fundamental, basic concepts, working principle, encoding, fitness function ,reproduction, Genetic modelling : Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator ,Generational Cycle ,Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Reference Books:

- S, Rajasekaran& G.A. VijayalakshmiPai, Neural Networks, Fuzzy Logic &GeneticAlgorithms, Synthesis & applications, PHI Publication.
- Rich E and Knight K, Artificial Intelligence, TMH, New Delhi.
- Bose, Neural Network fundamental with Graph , Algo.&Appl, TMH
- Kosko: Neural Network & Fuzzy System, PHI Publication

SUMMER INTERNSHIP EVALUATION-II

Course Code: BME2735 **Credit Units: 03**

Objective:
There are certain phases of every Intern's professional development that cannot be effectively taught in the academic environment. These facets can only be learned through direct, on-the-job experience working with successful professionals and experts in the field. The internship program can best be described as an attempt to institutionalize efforts to bridge the gap between the professional world and the academic institutions. Entire effort in internship is in terms of extending the program of education and evaluation beyond the classroom of a university or institution. The educational process in the internship course seeks out and focuses attention on many latent attributes, which do not surface in the normal classroom situations. These attributes are intellectual ability, professional judgment and decision-making ability, inter-disciplinary approach, skills for data handling, ability in written and oral presentation, sense of responsibility etc.

Guidelines
In order to achieve these objectives:

- **Each student will be allotted a supervisor** for proper guidance.
- **Student will first submit details of company, external guide, project title to coordinator/supervisor as per given schedule.**
- For internal assessment purpose, students will submit an industry feedback and a progress report.
- Student will maintain a file (**Internship File/Project Report**) which he/she will submit after completion of internship. **Further, coordinator will provide NTCC project guidelines and sample to help in preparation of file.** The Internship File aims to encourage students to keep a personal record of their learning and achievement throughout the Programme. It can be used as the basis for lifelong learning and for job applications. Items can be drawn from activities completed in the course modules and from the workplace to demonstrate learning and personal development. The File will assess the student's analytical skills and ability to present supportive evidence, whilst demonstrating understanding of their organization, its needs and their own personal contribution to the organization.

The **layout guidelines** for the Project Report

1. File should be in the following specification
- A4 size paper
- Spiral Binding
- **Font**

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

- **Margins**

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

- **Line Spacing**

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

- **Tables and Figures**

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

- **Drawings**

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

- **Equations**

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

2. Report Size: The maximum number of pages of the Report should be preferably between 50-80 pages.

3. Report Layout: The report should contain the following components
Front Page
Declaration
Student Certificate (University)
Certificate (Company)
Acknowledgement
Abstract
Contents
List of Figures
List of Tables
Company Profile (optional)
Chapters
Appendices(optional)
References / Bibliography

The above components are described below:
1. **The Title Page**-- Format will be given by coordinator/supervisor.
2. **Declaration by the Students-**This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.
3. Certificate-This is page number (ii). It is given by the Institute. The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).
4. Company Certificate: This is a certificate, which the company gives to the students.

5. Contents-This is page number (iii). The table of Contents should be titled just Contents (not Table of Contents). Try to fit it into one or two pages.
6. Acknowledgement-This is page number (iv). Keep this brief and avoid using informal language. This page must be signed by the candidate.
7. Abstract and **Keywords-**This is page number (v). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.
8. Company Profile: A Company Profile corresponds to a file with company-specific data. Company data can be stored there and included in a booking when needed.
9. **Chapters**—Introduction, Literature Review/Background Study etc. as given by coordinator/supervisor.
10. **References / Bibliography** --This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE INTERNSHIP FILE

Continuous Internal Assessment consists of topic relevance, progress report and industry feedback on company letterhead. Final Assessment includes viva, presentation, execution and report marks.

Examination Scheme:

Components	**IF**	**PR**	**R**	**E**	**V**	**FP**
Weightage	20	20	15	15	15	15

V – Viva, IF – Industry Feedback, FP – Final Presentation, R – Report, PR-Progress Report, E-Execution

INDEPENDENT STUDY

Course Code: BME2709 **Credit Units: 02**

This is an elective, self-directed course to investigate aemergingareasof IT and Computer Science like Mobile Operating System, Cloud Computing, or from Current Research Areas etc. The primary goal of the course is to provide students with research exploration of a specific topic of interest to the individual student under the advisement of an instructor who will monitor and critique the student's progress.

Independent study provides students with the opportunity to work one-on-one with a Faculty on a particular topic. The student and faculty should discuss the aims and content of the study and present the proposal to Head of Department. The independent study proposal should include the study's title, theme, readings, work to be submitted, and syllabus. Faculty and student should meet for a minimum number of 2 hours per week. Student will give a seminar after completion of study.

TERM PAPER

Course Code: BME2731 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject. The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

Guidelines for Term Paper

The procedure for writing a term paper may consist of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of Materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazine articles, news stories, periodicals, scientific journals etc.

3. Collecting the Notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the Paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the First Draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main idea.

6. Editing &Preparing the Final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include

only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.

b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Term papers should be composed of the following sections:

1) Title page
2) Table of contents
3) Introduction
4) Review
5) Discussion&Conclusion
6) Bibliography
7) Appendix

Generally, the introduction, discussion, conclusion and bibliography part should account for a third of the paper and the review part should be two thirds of the paper.

Discussion

The discussion section either follows the results or may alternatively be integrated in the results section. The section should consist of a discussion of the results of the study focusing on the question posed in the research paper.

Conclusion

The conclusion is often thought of as the easiest part of the paper but should by no means be disregarded. There are a number of key components which should not be omitted. These include:

a) summary of question posed
b) summary of findings
c) summary of main limitations of the study at hand
d) details of possibilities for related future research

Bibliography

From the very beginning of a research project, you should be careful to note all details of articles gathered. The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography. The key to a good bibliography is consistency. Choose a particular convention and stick to this.

Bibliographical Conventions:

Monographs

Crystal, D. (2001), Language and the internet, Cambridge: Cambridge University Press

Edited Volumes

Gass, S/Neu, J. (eds.) (1996), Speech acts across cultures, Challenges to communication in a second language, Berlin/ NY: Mouton de Gruyter.

[(eds.) is used when there is more than one editor; and (ed.) where there is only one editor. In German the abbreviation used is (Hrsg.) for Herausgeber].

Edited Articles

Schmidt, R./Shimura, A./Wang, Z./Jeong, H. (1996), Suggestions to buy: Television commercials from the U.S., Japan, China, and Korea. In: Gass, S./Neu, J. (eds.) (1996), Speech acts across cultures. Challenges to communication in a second language, Berlin/ NY: Mouton de Gruyter: 285-316.

Journal Articles
McQuarrie, E.F./Mick, D.G. (1992), On resonance: A critical pluralistic inquiry into advertising rhetoric. Journal of consumer research 19, 180-197.

Electronic book
Chandler, D. (1994), Semiotics for beginners [HTML document]. Retrieved on [5.10.01] from the World Wide Web, http://www.aber.ac.uk/media/Documents/S4B/.

Electronic Journal Articles
Watts, S. (2000) Teaching talk: Should students learn 'real German'? [HTML document], German as a Foreign Language Journal [online] 1, Retrieved [12.09.00] from the World Wide Web, http://www.gfl-journal.com/

Other Websites
Verterhus, S.A. (n.y.), Anglicisms in German car advertising. The problem of gender assignment [HTML document], Retrieved on [13.10.01] from the World Wide Web, http://olaf.hiof.no/~sverrev/eng.html

Unpublished Papers
Takahashi, S./DuFon, M.A. (1989), Cross-linguistic influence in indirectness: The case of English directives performed by native Japanese speakers. Unpublished paper, Department of English as a Second Language, University of Hawai'i at Manoa, Honolulu

Unpublished Thesis/ Dissertations
Möhl, S. (1996), Alltagssituationen im interkulturellen Vergleich: Realisierung von Kritik und Ablehnung im Deutschen und Englischen. Unpublished MA thesis, University of Hamburg
Walsh, R. (1995), Language development and the year abroad: A study of oral grammatical accuracy amongst adult learners of German as a foreign language. Unpublished PhD dissertation, University College Dublin

Appendix
The appendix should be used for data collected (e.g. questionnaires, transcripts, etc.) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Examination Scheme:

Dissertation:	75
Viva voce	25
Total:	**100**

PROJECT

Course Code: BME2732 **Credit Units: 02**

Methodology

Topics of project are to be based on the latest trends, verifying engineering concepts /principals and should involve elementary research work. The projects may involve design, fabrications, testing, computer modeling, and analysis of any engineering problem. On completion of the practical training the students are to present a report covering various aspects learnt by them and give a presentation on same.

Guidelines for Project File

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critically analyzed by the faculty guide and corrected by the student at each stage.

Project File

The Project File may be a very useful tool for undertaking an assignment along-with a normal semester, an exploratory study, sponsored projects, a project undertaken during summer period or any other period where the researcher is not working with a company/organization. The project/ assignment may also be a part of the bigger research agenda being pursued by a faculty/ institution/ department

The project file is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. This file may be considered in continuous assessment.

In general, the file should be comprehensive and includes:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated objectives;
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen and may be useful to document for future reference.

Layout Guidelines for the Project File

- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Assessment of the Project File

Essentially, the assessment will be based on the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The Project should fulfill the following assessment objectives:

- Range of research methods used to gain information

- Execution of research
- Data analysis (Analyse Quantitative/ Qualitative information)
- Quality Control
- Conclusions

Assessment Scheme:

Continuous Evaluation:
40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation:
60% (Based on the documentation in the file, final report layout, analysis and results, achievement of objectives, presentation/ viva)

Syllabus - Eighth Semester

PROJECT-DISSERTATION

Course Code: BME2837 **Credit Units: 08**

Methodology

Topics of project are to be based on the latest trends, verifying engineering concepts /principals and should involve elementary research work. The projects may involve design, fabrications, testing, computer modeling, and analysis of any engineering problem. On completion of the practical training the students are to present a report covering various aspects learnt by them and give a presentation on same.

Guidelines for Project File and Project Report

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critically analyzed by the faculty guide and corrected by the student at each stage.

Project File

The Project File may be a very useful tool for undertaking an assignment along-with a normal semester, an exploratory study, sponsored projects, a project undertaken during summer period or any other period where the researcher is not working with a company/organization. The project/ assignment may also be a part of the bigger research agenda being pursued by a faculty/ institution/ department

The Project File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. This file may be considered in continuous assessment.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated objectives;
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen and may be useful to document for future reference.

Project Report

The Project Report is the final research report that the student prepares on the project assigned to him. In case of sponsored project the lay out of the project could be as prescribed by the sponsoring organization. However, in other cases the following components should be included in the project report:

- **Title or Cover Page**
  The title page should contain Project Title; Student's Name; Programme; Year and Semester and Name of the Faculty Guide.

- **Acknowledgement(s)**
  Acknowledgment to any advisory or financial assistance received in the course of work may be given. It is incomplete without student's signature.

- **Abstract**
  A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project. It should not exceed more than 1000 words.

- **Table of Contents**
  Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**
  Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Materials and Methods**
  This section should aim at experimental designs, materials used (wherever applicable). Methodology should be mentioned in details including modifications undertaken, if any. It includes organization site(s), sample, instruments used with its validation, procedures followed and precautions.

- **Results and Discussion**
  Present results, discuss and compare these with those from other workers, etc. In writing this section, emphasis should be laid on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.
  Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary, do not write in "point" form.
  While presenting the results, write at length about the the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be in congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion rather, it should lead to generalization of data on the chosen sample.
  Results and its discussion should be supporting/contradicting with the previous research work in the given area. Usually one should not use more than two researches in either case of supporing or contradicting the present case of research.

- **Conclusion(s) & Recommendations**
  A conclusion should be the final section in which the outcome of the work is mentioned briefly.
  Check that your work answers the following questions:
  - Did the research project meet its aims (check back to introduction for stated aims)?
  - What are the main findings of the research?
  - Are there any recommendations?
  - Do you have any conclusion on the research process itself?

- **Implications for Future Research**

This should bring out further prospects for the study either thrown open by the present work or with the purpose of making it more comprehensive.

- **Appendices**
  The Appendices contain material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References**
  References should include papers, books etc. referred to in the body of the report. These should be written in the alphabetical order of the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

  Examples
  For research article
  Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia coli* O157: H7. *ClinMicrobiol Infect*, **8** (suppl 1): 116–117.
  For book
  Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Layout Guidelines for the Project File & Project Report

- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Assessment of the Project File and the Project Report

Essentially, the assessment will be based on the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The Project should fulfill the following assessment objectives:

- Range of Research Methods used to oASEin information
- Execution of Research
- Data Analyses (Analyse Quantitative/ Qualitative information)
- Quality Control
- Conclusions

Assessment Scheme:

Continuous Evaluation:

40% (Based on punctuality, regularity of work, adherence to plan and methodology,refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation:

60% (Based on the Documentation in the file, Final report layout, analysis andresults, achievement of objectives, presentation/ viva)

INTRODUCTION TO MEDICAL PHYSICS

Course Code:BME2802 **Credit Units: 03**

Course Objective: The purpose of the course is to understand the concepts and methods of physics in the diagnosis and treatment of human disease. The student will learn the application of physics in the area of medicine, the advantages and drawbacks of the therapeutic or investigative techniques in the biomedical field.

Course Contents:

Module I: Atomic physics

Definition of atom , periodic system of elements, mechanical properties of atom, emission of light and its frequencies. Electromagnetic spectra, Interaction with Living cells: Target theory, single hit and multi target theory, cellular effects of radiation, DNA damage, depression of Macro molecular synthesis, Chromosomal damage.

Module II: Principles of nuclear physics

Natural radioactivity, Decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Radionuclides used in Medicine and technology

Module III: Fundamental physics of radiology

Radioactivity materials , Production of X-ray, Effects of X-rays, Interaction of X-ray and Gamma rays with matter. Somatic Effect of Radiation: Radio sensitivity protocol of different tissues in human, LD 50/30 effect of radiation on skin, blood forming organs, lenses of eye, embryo and Endocrinal glands.

Module IV:

Genetic effect of radiation

Threshold of linear dose effect, relationship, factors affecting frequency of radiation induced mutation, Gene controlled hereditary diseases, biological effect of microwave and RF wave. Variation in dielectric constant and specific conductivity of tissues. Penetration and propagation of signals effects in various vital organs, Protection standards.

Module V: Photo medicine

Synthesis of Vitamin D in early and late cutaneous effects, Phototherapy, Photo hemotherapy, exposure level,hazards and maximum permissible exposures.

LASER PHYSICS – Characteristics of Laser radiation, Laser speckle, biological effects, laser safetymanagement.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- *Atoms, Molecules And Lasers* , by K P R Nair
- *Fundamental Physics Of Radiology* , by W. J Meridith& J.B Massey
- Moselly, *Non Ionising Radiation*, Adam HilgarBrustol 1988
- Branski.S and Cherski.P, Biological *Effects of Microwave*, Hutchinson & ROSS Inc. Strondsburg 1980

MEDICAL INFORMATICS

Course Code: BME2803 **Credit Units: 03**

Course Objective:
To give comprehensive idea about multimedia applications in medical field to develop educational / trainingpackages.To understand the component of virtual reality and virtual reality applications in medicine

Course Contents:

Module I: MEDICAL DATABASE IMPLEMENTATION
Medical data acquisition and database systems: PC based multi channel data acquisition system; storage, analysis and retrieval techniques

Module II: VISUAL BASIC
Visual programming concepts; visual Basic environment, tools and controls; Dynamic data exchange; VB based Medical information System

Module III: COMPUTERS IN SYSTEM DESIGN
Hospital Information System its design and functional characteristics; Principles and application of Artificial Intelligence, Pattern Recognition, Neural Network and Fuzzy Logic in Medicine

Module IV: MULTIMEDIA AND VIRTUAL REALITY APPLIED TO MEDICINE
Basic concepts of Multimedia; Design of Multimedia information systems; Components of virtual reality; Virtual reality applications in medicine

Module V : COMPUTERS IN MEDICAL RESEARCH
Medical Informatics and its levels; Design and development of educational packages on medical sciences; Integrated design concepts; Interactive multimedia, Virtual and digital libraries, Internet and its applications.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- R.D.Lele, *Computer in Medicine* , Tata McGraw-Hill, New Delhi, 1997
- Tay Vaughan, *Multimedia making it work*, Tata McGraw-Hill, New Delhi, 1997.
- Davis Chapman, *Teach Yourself Visual Basic 6 in 21 days* , New Delhi, 1997.
- .Harold Sackman, *Biomedical Information Technology*, Academic Press, New York, 1997.
- Mary BrthFecko, *Electronics Resources: Access and Issues* , Bowker and Saur, London, 1997