BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

Biomedical Engineering

3rd Semester

Theory Code	Subject	Contact Hours L-T-P	Credit
BSCM1205	Mathematics - III	3- 1- 0	4
PCBM4203	Human Anatomy-	3- 0- 0	3
BEEE2211	Network Theory	3- 1- 0	4
BECS2212	C++ & Object Oriented Programming	3- 0- 0	3
PCEC4201	Analog Electronics Circuits	3- 1- 0	4
HSSM3204 / HSSM3205	Engg. Economics & Costing / Organisational Behaviour	3- 0- 0	3
	Theory Credits		**21**
	Practical/ Sessional		
BEEE7211	Network & Devices Lab	1- 0- 3	2
BEES7212	C++ & Object Oriented Prog. Lab	0- 0- 3	2
PCEC7201	Analog Electronics Circuits Lab	0- 0- 3	2
	Practical/ Sessional Credits		**6**
	TOTAL SEMESTER CREDITS		**27**

4th Semester

Theory Code	Subject	Contact Hours L-T-P	Credit
BSCM1210	Mathematics - IV	3- 1- 0	4
HSSM3205 / HSSM3204	Organizational Behavior / Engg. Economics & Costing	3- 0- 0	3
PCBM4204	Engineering Physiology	3- 0- 0	3
PCBM4205	Biochemistry & Biophysics	3- 0- 0	3
PCEC4202	Digital Electronics circuits	3- 1- 0	4
BECS2208	Database Management System	3- 0- 0	3
	Theory Credits		**20**
	Practical/ Sessional		
PCBM7204	Engg Physiology Lab	1- 0- 3	2
PCEC7202	Digital Electronics Lab	0- 0- 3	2
BEEC7208	Data Base Management System Lab	0- 0- 3	2
HSSM7203	Communication & Interpersonal Skills for Corporate Readiness.	0- 0- 3	2
	Practical/ Sessional Credits		**8**
	TOTAL SEMESTER CREDITS		**28**

BSCM1205 **Mathematics - III**

Module-I **(18 hours)**

Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation
The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II **(12 hours)**

Complex Analysis:
Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,
Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Module –III **(10 hours)**
Power Series, Taylor's series, Laurent's series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:

1. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
   Reading Chapters: 11,12(except 12.10),13,14,15
2. B.V. Ramana, " Higher Engineering Mathematics", McGraw Hill Education, 2008
   Reading chapter: 18

Reference books:

1. E.B. Saff, A.D.Snider, " Fundamental of Complex Analysis", Third Edition, Pearson Education, New Delhi
2. P. V. O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

PCBM4203 Human Anatomy

Module -I (12 hours)

Skeletal system:

Types of bones, classification, Structure of bone , blood supply, Bones of appendicular And axial skeleton. Cartilage : Type, Structure in brief.

Joints:

Classification, structure of synovial joint , major joints of the limbs and Temporomandibular joint- in brief.

Muscle tissue:

Types, structure of skeletal muscle in brief, types of muscles, major muscle of the limbs and their actions.

Module-II (8 hours)

Brain

Parts, brain stem, ventricles, CSF, meninges, cranial nerves, (Names and functions only).
Spinal cord: Gross feature and structure in brief, spinal nerves, major nerve plexus in the body, and their branches, nerve ending and receptors.

Respiratory systems : Parts, Trachea, Lungs.

Module-III (10 hours)

Heart:

Structure of heart, Pericardium, Chambers, Blood supply (in brief), Major arteries and veins of the body

Lymphatic systems: Spleen: Organs in brief.

G.I.Tract : Parts. Stomach, Intestine, Liver, Pancreas.

Urinary system : Parts. Male and female reproductive organs. Endocrine glands.

Reference Books:

1. Anatomy and Physiology – Ross & Wilson , Churchill Livigstone publications.
2. CHARLES E.Tobin,Basic Human Anatomy,McGraw Hill,1980
3. Best and Taylor,The Living Body;B.I Publication,1980.
4. C. Tandan & Dr. Chandhramoli;Textbook of physiology for Dental studies.Dorpan Publications.
5. Gorden Sears, W.S & Winwood W.S;Anatomy & Physiology for Nurses,Revised edition.
6) Principles of Anatomy & Physiology – Tortora & Grabowski – Harper Collins College Publisher – latest edition

BEEE2211 **Network Theory**

MODULE- I (14 Hrs)

1. NETWORK TOPOLOGY: Graph of a network, Concept of tree, Incidence matrix, Tie-set matrix, Cut-set matrix, Formulation and solution of network equilibrium equations on loop and node basis.

2. NETWORK THEOREMS & COUPLED CIRCUITS: Substitution theorem, Reciprocity theorem, Maximum power transfer theorem, Tellegen's theorem, Millman's theorem, Compensation theorem, Coupled Circuits, Dot Convention for representing coupled circuits, Coefficient of coupling, Band Width and Q-factor for series and parallel resonant circuits.

MODULE- II (13 Hrs)

3. LAPLACE TRANSFORM & ITS APPLICATION: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Application of Laplace transform: Circuit Analysis (Steady State and Transient).

4. TWO PORT NETWORK FUNCTIONS & RESPONSES: z, y, ABCD and **h**-parameters, Reciprocity and Symmetry, Interrelation of two-port parameters, Interconnection of two-port networks, Network Functions, Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.

MODULE- III (13 Hrs)

5. FOURIER SERIES & ITS APPLICATION: Fourier series, Fourier analysis and evaluation of coefficients, Steady state response of network to periodic signals, Fourier transform and convergence, Fourier transform of some functions, Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response.

6. NETWORK SYNTHESIS: Hurwitz polynomial, Properties of Hurwitz polynomial, Positive real functions and their properties, Concepts of network synthesis, Realization of simple R-L, R-C and L-C functions in Cauer-I, Cauer-II, Foster-I and Foster-II forms.

Text Book:

1. Network Theory – P K Satpathy, P Kabisatpathy, S P Ghosh and A K Chakraborty – Tata McGraw Hill, New Delhi.

Reference Book(s):

2. Network Analysis – M E Van Valkenburg – Pearson Education.
3. Network Synthesis – M E Van Valkenburg – Pearson Education.
4. Network Analysis and Synthesis – Franklin F. Kuo – Wiley Student Edition.
5. Fundamentals of Electric Circuits – Alexander & Sadiku – Tata McGraw Hill.
6. Linear Circuits Analysis and Synthesis – A Ramakalyan – Oxford University Press.
7. Problems & Solutions in Electric Circuit Analysis – Sivananda & Deepa – Jaico Book.
8. Network Theory, Smarajit Ghosh, PHI.

BECS2212 C++ & Object Oriented Programming

Module I **(08 hrs)**

Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II **(16 hrs)**

Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.
Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.
Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.
Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.
Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III **(08 hrs)**

Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.
Template: template classes, template functions.
Namespaces: user defined namespaces, namespaces provided by library.

Text Books:

1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:

1. Big C++ - Wiley India
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
3. “C++ and Object Oriented Programming” – Jana, PHI Learning.
4. “Object Oriented Programming with C++ “- Rajiv Sahay, Oxford
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)
6. “Object Oriented Programming with C++”, David Parsons, Cengage Learning.

PCBM4201 **Analogue Electronics Circuit**

MODULE – I (12 Hours)

1. **MOS Field-Effect Transistor:** Principle and Physical Operation of FETs and MOSFETs. P-Channel and N-Channel MOSFET, Complimentary MOS, V-I Characteristics of E- MOSFETS and D-MOSFETS, MOSFETS as an Amplifier and a Switch (4 Hours)
2. **Biasing of BJTs:** Load lines (AC and DC), Operating Points, Fixed Bias and Self Bias, DC Bias with Voltage Feedback, Bias Stabilization, Design Operation. (4 Hours)
3. **Biasing of FETs and MOSFETs:** Fixed Bias Configuration and Self Bias Configuration, Voltage Divider Bias and Design (4 Hours)

MODULE – II (17 Hours)

4. **Small Signal Analysis of BJTs:** Small-Signal Equivalent-Circuit Model, Graphical Determination of h-parameters Small Signal Analysis of CE, CC, CB Amplifier with and without R_E. Effect of R_S and R_L on CE Amplifier, Emitter Follower, Analysis of Cascade, Darlington Connection and Current Mirror Circuits using BJTs. (6 Hours)
5. **Small Signal Analysis of FETs:** Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifier with and without R_S. Effect of R_{SIG} and R_L on CS Amplifier, Analysis of Source Follower and Cascaded System using FETs. (6 Hours)
6. **High Frequency Response of FETs and BJTs:** Low and High Frequency Response of BJTs and FETs, The Unit gain – frequency (f_t), Frequency Response of CS Amplifier, Frequency Response of CE Amplifier, Multistage Frequency Effects, Miller Effect Capacitance, Square Wave Testing. (5 Hours)

MODULE – III (12 hours)

7. **Feedback and Oscillators:** Feedback Concepts, Four Basic Feedback Topologies, Practical Feedback Circuits, Feedback Amplifier Stability using Nyquist Plot, Basic Principle of Sinusoidal Oscillator, Wein-Bridge, Phase Shift and Crystal Oscillator Circuits. (4 Hours)
8. **Operational Amplifier:** Ideal Op-Amp, Differential Amplifier, Op-Amp Parameters, Slew rate, Non-inverting Configurations, Effect of Finite Open-loop and Closed-loop Gain, Differentiator and Integrator, Instrumentation amplifier, µA 741-Op-Amp . (5 Hours)
9. **Power Amplifier:** Classifications, Class-A and Class-B Amplifier Circuits, Transfer Characteristics, Power Dissipation and Conversion Efficiency of Power Amplifiers. (3 Hours)

Text Books:

1. Electronic Devices and Circuits theory, 9^{th}/10^{th} Edition, R.L. Boylestad and L.Nashelsky (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14), Pearson Education, New Delhi.
2. Microelectronics Circuits, 5^{th} Edition, International Student Edition Sedra and Smith (Selected portion of Chapter 2,4, 5, 6, 8, 13, and 14), Oxford University Press, New Delhi.

3. Electronic Devices and Circuits, 3rd Edition, Jimmie J. Cathey adapted by Ajay Kumar Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi. **(*For Problem Solving*)**

Reference Books:

1. Electronics Circuits Analysis and Design, 3rd Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Milliman's Electronics Devices and Circuits, 2nd Edition, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. Integrated Electronics: Analog and Digital Circuits and Systems, J. Milliman, C. Halkias, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Microelectronic Circuits: Analysis and Design, India Edition, M.H. Rashid, PWS Publishing Company, a division of Thomson Learning Inc.

HSSM3204 Engineering Economics & Costing

Module-I: **(12 hours)**

Engineering Economics – Nature and scope, General concepts on micro & macro economics. The Theory of demand, Demand function, Law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply. Determination of equilibrium price under perfect competition (Simple numerical problems to be solved). Theory of production, Law of variable proportion, Law of returns to scale.

Module-II: **(12 hours)**

Time value of money – Simple and compound interest, Cash flow diagram, Principle of economic equivalence. Evaluation of engineering projects – Present worth method, Future worth method, Annual worth method, internal rate of return method, Cost-benefit analysis in public projects. Depreciation policy, Depreciation of capital assets, Causes of depreciation, Straight line method and declining balance method.

Module-III: **(12 hours)**

Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)
Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

Text Books:

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.
2. M.D. Mithani, Principles of Economics.

Reference Books :

1. Sasmita Mishra, "Engineering Economics & Costing ", PHI
2. Sullivan and Wicks, " Engineering Economy", Pearson

3. R.Paneer Seelvan, " Engineering Economics", PHI
4. Gupta, " Managerial Economics", TMH
5. Lal and Srivastav, " Cost Accounting", TMH

HSSM 3205 **Organizational Behaviour**

Module I :

The study of Organizational Behaviour : Defination and Meaning, Why Study OB
Learning – Nature of Learning, How Learning occurs, Learning and OB.
Foundations of Individual Behaviour : Personality – Meaning and Defination, Determinants of Personality, Personality Traits, Personality and OB.
Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.

Module II :

Organizational Behaviour Process : Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness, Groups in Organizations – Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-making Managerial Implications, Effective Team Building. Leadership-Leadership & Management, Theories of Leadership-Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Followership, How to be an effective Leader, Confict-Nature of Conflict and Conflict Resolution. An Introduction to Transactional Analysis (TA).

Module-III :

Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management-Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organisational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.

Text Books :

1. Keith Davis, Organisational Behaviour, McGraw-Hill.
2. K.Aswathappa, Organisational Behaviour, Himalaya Publishing House.

Reference Books :

1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
2. Pradip N. Khandelwal, Organizational Behaviour, McGraw-Hill, New Delhi.
3. Uma Sekaran, "Organizational Behaviour", TATA McGraw-Hill, New Delhi.
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma" Organizational Behaviour" , TATA McGraw- Hill.
5. D.K. Bhattachayya, "Organizational Behaviour", Oxford University Press
6. K.B.L.Srivastava & A.K.Samantaray, "Organizational Behaviour" India Tech

BEEE7211 **Network and Devices Lab**

Select any 8 experiments from the list of 10 experiments

1. Verification of Network Theorems (Superposition, Thevenin, Norton, Maximum Power Transfer).
2. Study of DC and AC Transients.
3. Determination of circuit parameters: Open Circuit and Short Circuit parameters.
4. Determination of circuit parameters: Hybrid and Transmission parameters.
5. Frequency response of Low pass and High Pass Filters.
6. Frequency response of Band pass and Band Elimination Filters.
7. Determination of self inductance, mutual inductance and coupling coefficient of a single phase two winding transformer representing a coupled circuit.
8. Study of resonance in R-L-C series circuit.
9. Study of resonance in R-L-C parallel circuit.
10. Spectral analysis of a non-sinusoidal waveform.

BECS7212 **C++ & Object Oriented Programming Lab**

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using static polymorphism.(1 class)
4. Programs on dynamic polymorphism.(1 class)
5. Programs on operator overloading.(1 class)
6. Programs on dynamic memory management using new, delete operators.(1 class)
7. Programs on copy constructor and usage of assignment operator.(1 class)
8. Programs on exception handling .(1 class)
9. Programs on generic programming using template function & template class.(1 class)
10. Programs on file handling.(1 class)

PCBM7201 **Analog Electronics Circuit Lab**

List of Experiments

(At least 10 out of 13 experiments should be done)

1. BJT bias circuit – Design, assemble and test.
2. JEET/MOSFET bias circuits – Design, assemble and test.
3. Design, assemble and test of BJT common-emitter circuit – D.C and A.C performance: Voltage gain, input impedance and output impedance with bypassed and un-bypassed emitter resistor.
4. Design, assemble and test of BJT emitter-follower – D.C and A.C performance: A.C. voltage gain, input impedance and output impedance.
5. Design, assemble and Test of JFET/MOSFET common-source and common-drain amplifiers – D.C and A.C performance: Voltage gain, input impedance and output impedance.
6. Frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response.
7. Differential amplifiers circuits: D.C bias and A.C operation without and with current source.
8. Study of Darlington connection and current mirror circuits.
9. OP-Amp Frequency Response and Compensation.
10. Application of Op-Amp as differentiator, integrator, square wave generator.
11. Square wave testing of an amplifier.
12. R.C phase shift oscillator/Wien-Bridge Oscillator using OP-Amp/Crystal Oscillator.
13. Class A and Class B Power Amplifier.

BSCM1210 **Mathematics – IV**

Module-I **(20 hours)**

Numerical methods:
Approximation and round of errors, Truncation error and Taylor's series
Roots of equation: The bisection method, the false-position method, fixed point iteration, the Newton-Raphson method, Muller's method
Linear algebraic equation: LU decomposition, the matrix inverse, Gauss-Seidel method
Interpolation: Newton divided difference interpolation, Lagrange Interpolation, Newton's forward and backward interpolation.
Numerical integration: The trapezoidal rule, The Simpson's rules, Gauss quadrature
Ordinary differential equation: Euler's method, Improvement of Euler's method, Runge-Kutta methods

Module-II **(10 Hours)**

Probability:
Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson and Hypergeometric distributions, Normal distribution, Distribution of several random variables.

Module-III **(10 Hours)**

Mathematical Statistics:
Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Chi square test for goodness of fit , Regression Analysis, Fitting Straight Lines, Correlation analysis.

Text books:

1. S. C. Chapra and R. P. Canale, " *Numerical methods for Engineers*", Fifth Edition, McGraw Hill Education
   Reading Chapters : 2, 3(3.1, 3.2), 4(4.2, 4.3), 5(5.1, 5.2, 5.3), 6(6.4), 9(9.1, 9.2), 10(10.2), 13(13.1,13.2,13.5), 16(16.1, 16.2), 17(17.3), 20(20.1, 20.2, 20.3)

2. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
   Reading Chapters: 22, 23(except 23.5 and 23.8)

Reference books:

1. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", Seventh Edition, Thomson/CENGAGE Learning India Pvt. Ltd
2. P. V.O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

PCBM4204 **Engineering Physiology**

Module-1 :(12 HOURS*)* **Introductory Lecture** :-(1 HOUR)

1. Basic functional concept of the body as whole & contribution of individual systems & their inter-dependence for achieving the goal.
2. Electrical properties of the Neurons. Electrical potentials, their nature, origin and propagation of AP and Non- propagatory potentials (Generator Potential, Receptor Potential).
3. Ionic currents, conductance and capacitance properties of excitable membranes. Basic idea on cable properties and core conductor theory. Velocity of conduction of Action Potential and factors influencing it. Compound Action Potentials. Equivalent electrical circuit diagram for neural membranes.
4. Muscle physiology in general. Functional difference between smooth, cardiac and skeletal muscle types. Muscles as energy transducer. Force-velocity and Load-Tension relationships. EPPs and EPSP, IPSP and MEPPs. Excitation, contraction coupling mechanism, Role of $Ca^{++.}$

Module – 2: **(12 Hours)**

1. Respiratory pathways (upper and lower). Mechanism of respiration, feedback control mechanism of respiration.
2. Nephron structure and functions, counter current exchange mechanism. Voiding of urine, Reflex Control, Bladder Plasticity and Urine Volume relationship.
3. Body Temperature Regulation and role of Hypothalamic Thermostat. Responses to cold and warm environment. Thermo neutral range & Lethal Temperature concepts.
4. Blood as Newtonian fluid –Its physical properties. Haemodynamics, Blood pressure and its measuring techniques.
5. Feedback control of BP. Role of heart as pump. Regulation of cardiac pump – Extrinsic, Intrinsic factors, Auto regulation. Starling's Law. Pacemaker potentials. ECG – Its gross normal features. Means of recording.

Module -3: (12 Hours)

1. Hormones: classification, second messenger hypothesis, sources, half life, effective concentration, feed back control, & molecular mechanism of peptide & steroids hormones.
2. Receptors. The role of transducers. General and specific functional characteristics of Receptors Classification, Receptor Potential, Amplification and Propagation to CNS. Sound as stimulus. Quality of Sound.
3. Pitch, Loudness, SPL, Auditory receptor, genesis of potential change in the Internal ear. Mechanism of Hearing.
4. Optics of the EYE. Camera principles applied to the eye. Accommodation, Purkinje Shift, Electroretinogram (ERG), Electroocculogram (EOG).
5. Electroencephalography (EEG) – its basic principles. Electro-corticogram (ECOG). Neuro-physiological and Bioelectrical basis of Learning and Memory.

Reference Books:

1) Concise Medical Physiology By Chauduri
2) Anatomy and Physiology – Ross & Wilson, Churchill Livigstone publications.
3) Principles of Anatomy & Physiology – Tortora & Grabowski – Harper Collins College Publisher – latest edition

4) J Gibson, Modern Physiology & Anatomy for Nurses; Black-well Scientific Publishers, 1981

PCBM4205 Biochemistry & Biophysics

Part A- Biochemistry

Module I (10 Hours):

Chemical Nature, Properties, Structure and classification of different classes of Biomacromolecules like Proteins, Nucleic Acid & Lipids.

Composition & properties of the cell membrane, membrane transports, Kinetics and energetics of active transport, permeability Coefficient & partition coefficient & transport enzymes.

Enzymes: Chemical nature, Broad classification, M-M-Kinetics, Isozymes and Allosteric enzymes, Isolation techniques & Spectrophtometric assay of enzyme activity.

Module II (10 Hours):

Intermolecular bonds, weak & strong bonds, bond energies, structural stability of macromolecules. Temperature & reaction rates, Q10, & Arrhenius equation, Glycolysis, TCA cycle, ATP Synthesis. Recombinant DNA, Transcription & Translation, Reverse Transcription, Replication.

Part B – Biophysics

Module III (16 Hours):

Bioelectrical Phenomena: Membrane Potential**,** Local and propagator types, Diffusion potential, phase boundary potentials, Generator Potentials, Monophonic as Biphasic Action Potentials (AP). Properties & Propagation of AP, factors influencing propagation of AP. Electrical properties of excitable membranes, Membrane Capacitance, Resistance, conductance, equivalent electrical circuit diagram for excitable membranes & pacemaker potentials.

Electrical activity of brain (EEG) different wave forms, & their characteristics, Electrical Activity of Heart (ECG) , Eelctro-RetinoGram(ERG) ,Electro-Occologram (EOG) ,Receptor potentials, Stimuli, Electrical stimulus, strength-duration relationship, Dielectric properties of Bio-membrane, Space Constant & Time Constant for excitable membrane.

Ionizing radiations, U-V & I-R radiations, radioisotopes & their use in biomedical research, Radioactive decays, Half life period, Half Value Layer, Linear Energy Transfers (LET), Relative Biological Efficiency (RBE) and Interaction of radiation with-matter.

Reference Books:

Biophysics:

1) Radiation Biophysics, Second Edition - by Edward L. Alpen - Academic Press; 2 edition (January 15, 1998)

2) Bio-Physics – Roland Glaser- Springer; 2nd printing edition (November 23, 2004)

3) The Biomedical Engineering Hand Book- 3rd Ed- (Biomedical Engineering Fundamentals) - Joseph D. Bronzino – CRC –Tylor-Francis – 2006 (Section- III – Bio-Electrical Phenomena)

Biochemistry:

4) Lehninger Principles of Biochemistry, Fourth Edition - by David L. Nelson & Michael M.Cox , - W. H. Freeman; 4 edition (April 23, 2004)

5) Fundamentals of Biochemistry: Life at the Molecular Level - by Donald J. Voet , Judith G. Voet & Charlotte W. Pratt. - Wiley; 2 edition (March 31, 2005)

PCBM4202 **DIGITAL ELECTRONICS CIRCUITS**

MODULE – I (11 Hours)

1. **Number System:** Introduction to Binary Numbers, Data Representation, Binary, Octal, Hexadecimal and Decimal Number System and their Conversion. (2 Hours)
2. **Boolean Algebra and Logic Gates:** Basic Logic Operation and Identities, Algebraic Laws, NOR and NAND Gates, Useful Boolean Identities, Algebraic Reduction, Complete Logic Sets, Arithmetic Operation using 1's and 2`s Compliments, Signed Binary and Floating Point Number Representation. (4 Hours)
3. **Combinational Logic Design:** Specifying the Problem, Canonical Logic Forms, Extracting Canonical Forms, EX-OR Equivalence Operations, Logic Array, K-Maps: Two, Three and Four variable K-maps, NAND and NOR Logic Implementations. (5 Hours)

MODULE – II (15 Hours)

4. **Concepts in VHDL:** Basic Concepts, Using a Hardware Description Language, Defining Module in VHDL, Structural and Combinational Modelling, Binary Words, Libraries, Learning VHDL. (4 Hours)
5. **CMOS Logic Circuits:** Voltages as Logic Variables, Logic Delay Times: Output Switching Times, Propagation Delay, Fan-In and Fan-out, Extension to other Logic Gate.

   C-MOS Electronics, MOSFETS, The NOT Function in C-MOS: Complimentary Pairs and the C-MOS Invertors, Logic Formation Using MOSFETS: the NAND and NOR Gate, C-MOS Logic Connection, Complex Logic Gates in C-MOS: 3-input Logic Gates, A general 4-input Logic Gate, Logic Cascades. (6 Hours)
6. **Introduction to VLSI:** Introduction, Lithography and Patterning, MOSFET Design Rules, Basic Circuit Layout, MOSFET Arrays and AOI Gates, Cells, Libraries, and Hierarchical Design, Floor Plans and Interconnect Wiring. (5 Hours)

MODULE – III (16 hours)

7. **Logic Components:** Concept of Digital Components, An Equality Detector, Line Decoder, Multiplexers and De-multiplexers, Binary Adders, Subtraction and Multiplication. (5 Hours)
8. **Memory Elements and Arrays:** General Properties, Latches, Clock and Synchronization, Master-Slave and Edge-triggered Flip-flops, Registers, RAM and ROMs, C-MOS Memories. (6 Hours)
9. **Sequential Network:** Concepts of Sequential Networks, Analysis of Sequential Networks: Single State and Multivariable Networks, Sequential Network Design, Binary Counters, Importance of state machine. (5 Hours)

Text Books:

1. A First Course in Digital System Design: An Integrated Approach, India Edition, John P. Uyemura, PWS Publishing Company, a division of Thomson Learning Inc.
2. Digital Systems – Principles and Applications, 10th Edition, Ronald J. Tocci, Neal S. Widemer and Gregory L. Moss, Pearson Education.
3. Digital Design, Robert K. Dueck, CENGAGE Learning**.**

Reference Books:

1. Digital Principles and Applications, 6th Edition, Donald P. Leach, Albert Paul Malvino and Goutam Saha, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Digital Fundamentals, 5th Edition, T.L. Floyd and R.P. Jain, Pearson Education, New Delhi.

3. Digital Electronics, Principles and Integrated Circuit, Anil K. Jain, Wiley India Edition.
4. Digital Design, 3rd Edition, Moris M. Mano, Pearson Education.

BECS2208 Database Management System

Module I : (10 hours)

Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages. Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II : (12 hours)

Relation Query Languages, Relational Algebra and Relational Calculus, SQL.

Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.

Query Processing Strategy.

Module III: (10 hours)

Transaction processing: Recovery and Concurrency Control. Locking and Timestamp based Schedulers.
Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques

Text Books:

1. Database System Concepts by Sudarshan, Korth (McGraw-Hill Education)
2. Fundamentals of Database System By Elmasari & Navathe- Pearson Education

References Books:

(1) An introduction to Database System – Bipin Desai, Galgotia Publications
(2) Database System: concept, Design & Application by S.K.Singh (Pearson Education)
(3) Database management system by leon &leon (Vikas publishing House).
(4) Fundamentals of Database Management System – Gillenson, Wiley India
(5) Database Modeling and Design: Logical Design by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau, "", 4th Edition, 2005, Elsevier India Publications, New Delhi

PCBM7204 **Engineering Physiology Lab**

Experiment No. 1

1) Recording of skeletal muscle response to induced electrical stimulus.

- **a.** Determination of muscle Threshold for muscle.
- **b.** Twitch, Summation, Incomplete & complete Tetanus.

Experiment No. 2

1) Recording of the heart beat in Toad using Kymograph.

- **a.** Normal beats.
- **b.** Effects of Temperature.
- **c.** Effects of extracellular $Na^{+,}$ K^{+} and $Ca^{++.}$

2) Test for Myogenicity in isolated (denervated) heart.

Experiment No. 3

1) Quantitative estimation of glucose from blood using :

- **a.** Spectrophotometer.
- **b.** Colorimeter.

Experiment No. 4

1) Quantitative estimation of proteins using:

- **a.** Spectrophotometer.
- **b.** Colorimeter.

Experiment No. 5

1) Qualitative determinations:

- **a.** Proteins.
- **b.** Fructose.
- **c.** Glucose.
- **d.** Starch.

} ***(****From urine****)***

Experiment No. 6

1) Testing of hearing using tuning forks.

Experiment No. 7

1) **Measurement of Blood Pressure using Sphygmomanometer(s)** (Hg type, Anneuroid and Electronic types).
2) **Effects of exercise on BP.**

Experiment No. 8:

1) Hemoglobin Estimation
2) Study of Microscopes , its types & applications

Experiment No. 9

3) Blood Grouping

4) Peripheral Smear Study (D.C.)

PCBM7202 Digital Electronics Circuits Lab

List of Experiments:

(Atleast 10 experiments should be done, Experiment No. 1 and 2 are compulsory and out of the balance 8 experiments atleast 3 experiments has to be implemented through both Verilog/VHDL and hardware implementation as per choice of the student totaling to 6 and the rest 2 can be either through Verilog/VHDL or hardware implementation.)

1. Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates, use of Universal NAND Gate.
2. Gate-level minimization: Two level and multi level implementation of Boolean functions.
3. Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segment display.
4. Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number of Gates.
5. Design with multiplexers and de-multiplexers.
6. Flip-Flop: assemble, test and investigate operation of SR, D & J-K flip-flops.
7. Shift Registers: Design and investigate the operation of all types of shift registers with parallel load.
8. Counters: Design, assemble and test various ripple and synchronous counters - decimal counter, Binary counter with parallel load.
9. Memory Unit: Investigate the behaviour of RAM unit and its storage capacity – 16 X 4 RAM: testing, simulating and memory expansion.
10. Clock-pulse generator: design, implement and test.
11. Parallel adder and accumulator: design, implement and test.
12. Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce a 8-bit product.
13. Verilog /VHDL simulation and implementation of Experiments listed at Sl. No. 3 to 12.

BECS7208 Database Managements System Lab

1. Use of SQL syntax: insertion, deletion, join, updation using SQL. (1 class)
2. Programs on join statements and SQL queries including where clause. (1 class)
3. Programs on procedures and functions. (1 class)
4. Programs on database triggers. (1 class)
5. Programs on packages. (1 class)
6. Programs on data recovery using check point technique. (1 class)
7. Concurrency control problem using lock operations. (1 class)
8. Programs on ODBC using either VB or VC++. (1 class)

9. Programs on JDBC. (1 class)

10. Programs on embedded SQL using C / C++ as host language. (1 class)

HSSM7203 Communication & Interpersonal skills for Corporate Readiness Lab.

Lab **30 hours**

This course will focus on communication in professional (work-related) situations of the kind that BPUT graduates may expect to encounter on entering the professional domain.

Some typical forms of work-related communication, oral or written, are listed below. Practice activities for all four skills can be designed around these or similar situations.

1. Gaining entry into an organization

   i. Preparing job-applications and CVs
   ii. Facing an interview
   iii. Participating in group discussion (as part of the recruitment process)

2 In-house communication

a. Superior/ Senior ➔ subordinate / junior (individual ➔ individual / group)
   i. Welcoming new entrants to the organization, introducing the workplace culture etc.
   ii. Briefing subordinates / juniors : explaining duties and responsibilities etc.
   ii. Motivating subordinates / juniors ('pep talk')
   iii. Instructing/ directing subordinates/ juniors
   iv. Expressing / recording appreciation, praising / rewarding a subordinate or junior
   v Reprimanding / correcting / disciplining a subordinate/junior (for a lapse) ; asking for an explanation etc.

b. Subordinate / Junior ➔ Superior / Senior
   i. Responding to the above
   ii. Reporting problems / difficulties / deficiencies
   iii. Offering suggestions

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BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

Biomedical Engineering

5th SEMESTER				6th SEMESTER			
THEORY		*Contact Hours*		*THEORY*		*Contact Hours*	
Code	*Subject*	*L-T-P*	*Credits*	*Code*	*Subject*	*L-T-P*	*Credits*
HSSM3303	Environmental Engineering & Safety	3-0-0	3	HSSM3301	Principles of Management	3-0-0	3
	OR				OR		
HSSM3301	Principles of Management			HSSM3303	Environmental Engineering & Safety		
PCBM4302	Signals and Systems	3-0-0	3	PCBM4303	Biomedical Equipments	3-0-0	3
PCEC4301	Microprocessors	3-0-0	3	PCBM4304	Biomedical Signal Processing	3-0-0	3
PCBM4301	Elements of Biomedical Instrumentation	3-0-0	3	PCBM4305	Bio Mechanics	3-1-0	4
PCEI4301	Communication Systems Engineering	3-0-0	3		Professional Elective – II (*Any One*)	3-0-0	3
	Professional Elective – I (*Any One*)	3-0-0	3	PEBM5303	Clinical Science		
PEBM5301	Basic Clinical Science			PEBM5302	Biomaterials		
PEBM5306	Medical Informatics			PEBM5305	Medical Image Processing		
PEBM5304	Lasers & Fiber Optics in Medicine				Free Elective – I (*Any One*)	3-0-0	3
				PCCS4304	Operating System		
	Credits (Theory)		18	PEEC4304	Computer Network & Data Communication		
				PCEI4303	Control System		
	PRACTICALS/SESSIONALS				Credits (Theory)		19
PCBM7302	Signals and Systems Lab.	0-0-3	2		*PRACTICALS/SESSIONALS*		
PCEC7301	Microprocessor Lab.	0-0-3	2	PCBM7304	Biomedical Signal Processing Lab.	0-0-3	2
PCEI7301	Communication System Engineering Lab.	0-0-3	2	PCBM7303	Biomedical Equipment Lab.	0-0-3	2
				PCBM7305	Biomedical Instrumentation Design Lab.	0-0-3	2
	Credits (Practicals / Sessionals)		6		Credits (Practicals / Sessionals)		6
	TOTAL SEMESTER CREDITS		24		TOTAL SEMESTER CREDITS		25
	TOTAL CUMULATIVE CREDITS		135		TOTAL CUMULATIVE CREDITS		160

HSSM3303 ENVIRONMENTAL ENGINEERING & SAFETY

(3-0-0)

Module – I

Ecological Concepts: Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law. Chemistry in Environmental Engineering: Atmospheric chemistry, Soil chemistry. Noise pollution-Noise standards, measurement and control. Water Treatment: water quality standards and parameters, Ground water. Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Module – II

(a)Waste Water Treatment: DO and BOD of Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.

(b)Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

(c) Solid waste, Hazardous waste management, Solid Waste Management, Source classification and composition of MSW: Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous Waste Management, Hazardous waste and their generation, Transportation and treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing,

Module – III

Occupational Safety and Health Acts, Safety procedures, Type of Accidents, Chemical and Heat Burns, Prevention of Accidents involving Hazardous substances, Human error and Hazard Analysis. Hazard Control Measures in integratednsteel industry, Petroleum Refinery, L.P.G. Bottling, Pharmaceutical industry. Fire Prevention – Detection, Extinguishing Fire, Electrical Safety, Product Safety. Safety Management- Safety Handling and Storage of Hazardous Materials, Corrosive Substances, Gas Cylinders, Hydro Carbons and Wastes. Personal Protective Equipments.

Text Book :

1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering by Prof B.K. Mohapatra, Dhanpat Rai & Co Publication
3. Industrial Safety Management, L. M. Deshmukh, Tata McGraw Hill Publication.

Reference Books

1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
6. Industrial Safety Management and Technology, Colling. D A – Prentice Hall, New Delhi.

HSSM3301 **PRINCIPLES OF MANAGEMENT** (3-0-0)

Module I: Functions of Management

Concept of Management, Management as an Art or Science, The Process of Management, Managerial Skills, Good Managers are Born, not Made, Management is concerned with Ideas, Things and People, How a Manager Induces Workers to Put in Their Best, Levels and Types of Management, **Evolution of Management Thought**: Managerial Environment, The process of Management-Planning, Organizing, Directing, Staffing, Controlling.

Module II: Marketing Function of Management.

Modern Concept of Marketing, The Functional Classification of Marketing, Functions of a Marketing Management, Marketing Mix, Fundamental Needs of Customers, The Role of Distribution channels in Marketing, Advertising, Marketing, Consumerism and Environmentalism.

Module III: Financial Function & HRM Functions.

Financial Functions, Concept of Financial Management, Project Appraisal, Tools of Financial decisions making, Overview of Working Capital.

HRM Function of Management: Human Resource Management, Human Resource Development, Importance of HRM, Overview of Job Analysis, Job Description, Job Specification, Labour Turnover. Manpower Planning, Recruitment, Selection, Induction, Training and Development, Placement, Wage and Salary Administration, Performance Appraisal, Grievance Handling, Welfare Aspects.

Reference Books:

1. *Business Organization & Management, CR Basu, TMH*
2. *Business Organization & Management, Tulsia, Pandey, Pearson*
3. *Marketing Management, Kotler, Keller, Koshi, Jha, Pearson*
4. *Financial Management, I.M. Pandey, Vikas*
5. *Human Resource Management, Aswasthapa, TMH.*
6. *Modern Business Organisation & Management by Sherlekar, Himalaya Publishing House.*

PCBM4302 **SIGNALS & SYSTEMS** (3-0-0)

Module – I **(10 hours)**

Discrete-Time Signals and Systems:

Discrete-Time Signals: Some Elementary Discrete-Time signals, Classification of Discrete-Time Signals, Simple Manipulation; Discrete-Time Systems : Input-Output Description, Block Diagram Representation, Classification, Interconnection; Analysis of Discrete-Time LTI Systems: Techniques, Response of LTI Systems, Properties of Convolution, Causal LTI Systems, Stability of LTI Systems; Discrete-Time Systems Described by Difference Equations; Implementation of Discrete-Time Systems; Correlation of Discrete-Time Signals: Crosscorrelation and Autocorrelation Sequences, Properties.

Selected portions from Chapter 2 (2.1, 2.2, 2.3.1, 2.3.3, 2.3.4, 2.3.5, 2.3.6, 2.4, 2.5, 2.6.1, 2.6.2) of Textbook – I

Properties of Continuous-Time Systems:

Block Diagram and System Terminology, System Properties: Homogeneity, Time Invariance, Additivity, Linearity and Superposition, Stability, Causality.

Selected portions from Chapter 4 (4.2, 4.4) of Textbook – II

Module – II **(12 hours)**

The Continuous-Time Fourier Series:

Basic Concepts and Development of the Fourier Series, Calculation of the Fourier Series, Properties of the Fourier Series.

Selected portions from Chapter 8 (8.3, 8.4, 8.7) of Textbook – II

The Continuous-Time Fourier Transform:

Basic Concepts and Development of the Fourier Transform, Properties of the Continuous-Time Fourier Transform.

Selected portions from Chapter 10 (10.3, 10.6) of Textbook – II

Module- III **(13 hours)**

The Z-Transform and Its Application to the Analysis of LTI Systems:

The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Rational Z-Transforms: Poles and Zeros, Pole Location and Time-Domain Behavior for Causal Signals, The System Function of a Linear Time-Invariant System; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; The One-sided Z-Transform: Definition and Properties, Solution of Difference Equations.

Selected portions from Chapter 3 (3.1, 3.2, 3.3, 3.4.2, 3.4.3, 3.6.1, 3.6.2) of Textbook– I

The Discrete Fourier Transform: Its Properties and Applications:

Frequency Domain Sampling: The Discrete Fourier Transform; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties.

Selected portion from Chapter – 7 (7.1.2, 7.2.1, 7.2.2, 7.2.3) of Textbook – 1.

Text Books:

1. *Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.*
2. *Fundamentals of Signals and Systems - M. J. Roberts, TMH*

Reference Book:

1. Signals and Systems - P. R. Rao, TMH.
2. Signals and Systems – A Nagoor Kani, TMH
3. Signals and Systems by Chi-Tsong Chen, Oxford
4. Principles of Signal Processing and Linear Systems, by B.P. Lathi, Oxford.
5. Principles of Linear Systems and Signals, by B.p. Lathi, Oxford

PCEC4301 **MICROPROCESSORS** (3-0-0)

Module I:

Organization of Microprocessor

Introduction to the general concept of microprocessor organization, I/O sub-systems, programming the system, ALU, instruction execution, instruction word format, addressing modes, address/data/control bus, tristate bus, interfacing I/O devices, data transfer schemes, architectural advancements of microprocessor, evolution of microprocessors.

Module II:

Intel 8086- Hardware Architecture:

Introduction, Bus interface unit(BIU), Execution unit(EU), pin description, register organization, instruction pointer, data register, pointer and index registers, status register, stack, external memory addressing, bus cycle (minimum mode):memory or I/O read/write for minimum mode, clock generator Intel- 8284A, bidirectional bus trans-receiver 8286/8287, bus controller 8288, bus cycle memory read/write for minimum mode, 8086 system configuration (minimum mode as well as maximum mode), memory interfacing, interrupt processing; software interrupts, single step interrupt, non-maskable interrupt, maskable interrupt, interrupt priority, DMA, Halt State, Wait for Test state, comparison between 8086 an 8088.

Module III:

Instruction set and programming:

Programmer's model of Intel 8086, operand type, addressing modes 8086 assembler directives, instruction set, programming examples on data transfer group, arithmetic-logical groups, control transfer groups (loop and loop handling instruction), conditional and unconditional group, procedures and stack operations, string instructions.,branch program structure like IF-THEN-ELSE REPEAT-UNTIL and WHILE-DO,

I/O Interfacing ;

8-bit input- output port 8255 PPI, memory mapped i/o ports,8254 programmable Interval Timer, 8273 Programmable Direct Memory Access Controller, 8251 USART, 8279 Programmable Keyboard/Display Controller.

Text Books:

1.The 8088 and 8086 Microprocessors Programming, Interfacing, Softw, Hardware and Application; by Walter A. Triebel & Avtar Singh ; Pearson India.

2. Microprocessors and Interfacing; by Douglas V Hall ; McGraw Hill.

Reference Book:

1. Microprocessors and Micro controllers Architecture, programming and system Design 8085, 8086, 8051, 8096: by Krishna Kant; PHI.

2. The 8086 Microprocessor: Programming & Interfacing the PC- Kenneth J. Ayala, Delmar Cengage Learning, Indian Ed.

PCBM4301 ELEMENTS OF BIOMEDICAL INSTRUMENTATION

(3-0-0)

Module I (13 Hours)

(i) What is bioengineering: Engineering versus Science, Bioengineering, Biochemical Engineering, Biomedical Engineering, and Career Opportunities.

(ii) Medical Instrumentation: Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, use of microprocessors in medical instruments, PC based medical Instruments, general constraints in design of medical Instrumentation system & Regulation of Medical devices.

(iii) Bioelectrical Signals & Electrodes: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artifacts.

(Text Book-I-Chapter-0 , Text Book-II —Chapter-1, Text book-II- Chapter-2)

Module -II (14 Hours)

(iv) Electrodes for ECG: Limb Electrode, Floating Electrodes, Prejelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG.

(v) **Physiological Transducers:** Introduction to Transducers, Classification of Transducers, Performance characteristics of Transducers, Displacement, Position and Motion Transducers.

(Text book-II- Chapter-2 , Text Book-II, Chapter- 3)

Module –III (13 Hours)

(vi) **Physiological Transducers:** Strain gauge pressure transducers, Thermocouples, Electrical Resistance Thermometer, Thermister, Photovoltaic transducers, Photo emissive Cells & Biosensors or Biochemical sensor

(vii) Recording Systems: Basic Recording systems, General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling)

(Text Book-II, Chapter- 3, Text Book-II-Chapter-4)

Text Books:-

I- Introduction to Biomedical Engineering by Michael M. Domach, Pearson Education Inc,-2004

II- Hand Book of Biomedical Instrumentation-2nd Ed by R.S.Khandpur, Tata McGraw Hill, 2003.

Reference Books:

1) Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR & JOHN.M.BROWN (Pearson education publication)

(2) Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications

(3) Leslie. Cromwell – Biomedical instrumentation & measurements, 2e PHI

(4) Dr. M. Arumugam – Biomedical instrumentations, Anuradha Publishers

PCEI4301**COMMUNICATION SYSTEM ENGINEERING**(3-0-0)

MODUE-I

INTRODUCTION: Elements of an Electrical Communication System, Communication Channels and their Characteristics, Mathematical Models for Communication Channels
FREQUENCY DOMAIN ANALYSIS OF SIGNALS AND SYSTEMS: Fourier series, Fourier Transforms, Power and Energy, Sampling and Band limited signals, Band pass signals

MODULE-II

ANALOG SIGNAL TRANSMISSION AND RECEPTION: Introduction to modulation, Amplitude Modulation (AM), Angle Modulation, Radio and Television broadcasting

MODULE-III

PULSE MODULATION SYSTEMS: Pulse amplitude modulation, Pulse Time Modulation
PULSE CODE MODULATION: PCM system, Intersymbol interference, Eye patterns, Equalization, Companding, Time Division Multiplexing of PCM signals, Line codes, Bandwidth of PCM system, Noise in PCM systems, Delta Modulation (DM), Limitations of DM, Adaptive Delta Modulation, Noise in Delta Modulation, Comparison between PCM and DM, Delta or Differential PCM (DPCM), S-Ary System

Text Book:

1. John G.Proakis,M. Salehi, *COMMUNICATION SYSTEMS ENGINEERING*, 2nd ed. New Delhi,India: PHI Learning Private Limited, 2009.; Selected portion from Chapter 1,2 and 3 for module MODULE-I and MODULE-II of the course.
2. R.P Singh and S.D Sapre, *COMMUNICATION SYSTEMS Analog & Digital*, 2nd ed. New Delhi, India: Tata McGraw Hill Education Private Limited, 2009; Selected portions from Chapter 7 and 8 of the book for MODULE-III.

Reference Book:

PEBM5301**BASIC CLINICAL SCIENCE** (3-0-0)

Module I (14 Hours)

DIAGNOSTIC INVESTIGATIONS IN NEUROLOGY: Electroencephalography-methodology. Applications of Computerized axial tomography & Angiography in neurology, Pneumoencephalography, neuromuscular stimulation, Electromyography. Clinical applications. Clinical significance, Diseases of muscle, Motor neuron disorders, the electrical study of reflexes, the silent period, The F response, The H reflex, the axion reflexes. Disorders of neuromuscular transmission

CARDIOLOGY: Review of Heart structure and function, Cardiac cycle, various valves and their function, Cardio vascular measurements. Prosthetic devices, Heart lung machine applications and clinical significance. CVP and SWAN catheters.

Module II (13 Hours)

CARDIOLOGY: Electro cardiography:Source of ECG potentials: Dipole theory, Normal and abnormal ECG's. Diagnostic applications, interpretation of ECG. Cardiacpacing, Diagnostic indications. Criteria for selection. Therapeutic indications. Complications, Temporary pacing. Permanent pacing.

CARDIAC ASSIST DEVICES: Arterial and Ventricular fibrillation, application of cardiac assist devices, Cardiac catheterization. Echocardiography, Cine angiography, Treadmill Applications and Clinical significance

Module III (13 Hours)

CARDIAC ASSIST DEVICES: Diagnostic usage of ultrasound scanners. Doppler ultrasound measurement. Clinical significance. Open heart surgery grafts, bypass surgery. Instrumentation used for open-heart surgery, Organization of I.C.C.U Clinical aspects.

ANAESTHESIA: Different kinds of Anesthesia, uptake of Anesthetic gases and vapors, Pre-anesthetic care and preparation. Post-operative care, Laws of gases. Patient monitoring during surgery. Applications of Anesthesia Machine, Ventilators, Infusion Pumps, Syringe Pumps, Humidifiers & Neubulizers

Reference Books:

1) James G. Mcleod, Physiological Approach to Clinical Neurology, Butterworth-Heinemann Ltd, 3rd edition.

2). D.Goldstein, mehmet Oz, Cardiac Assist Devices, Blackwell Future, 2002.

3). Robert F Rushmer , Cardio vascular Dynamics.WB Saunders, 1976.

4) Ward's Anaesthesia Equipment – 4th Edition- Edited by C Ward, WB Saunders Company Limited-1992 (or the Latest Edition of the same book)

PEBM5306 **MEDICAL INFORMATICS** (3-0-0)

Module I (16 Hours)

Introduction: History, what is medical informatics, bioinformatics, contents of medical informatics, applications of medical informatics, progress & future of medical informatics, need for medical informatics education/training, medical informatics education courses/modules.

Hospital Management & Information System (HMIS):

Introduction, what is HMIS, Need for HMIS, Benefits of HMIS, Capabilities of HMIS, Development of HMIS, Steps in the development of HMIS, Functional area, Modules forming HMIS, Pre-requisites for HMIS, Why HMIS Fails, Factors affecting maintenance & development of HMIS, Advantages of HMIS.

Module II (12 Hours)

Knowledge Based Expert Systems (ES):

Introduction, Artificial Intelligence (AI), what is an Expert System (ES), Need for Expert System (ES), Knowledge Representation, Data Base Comparisons, Statistical Pattern Classification, Decision Analysis, Cognitive Models, Developmental Tools , Knowledge Engineering System (KES), Neural Networks and Advantages of Expert System (ES).

Module III (12 Hours)

Computer based Patient Records (CPR):

Introduction, What is CPR, Need for CPR, Strength & Weakness of Hand Written Records, CPR & Clinical decisions, Ideal features of CPR, Components and Functionality of CPR, Development Tools, CPR in Radiology

Text Book:

1) Medical Informatics- A Primer – Mohan Bansal – Tata McGraw Hill -2003

PEBM5304 **LASERS & FIBER OPTICS IN MEDICINE** (3-0-0)

Module –I (16 Hours)

Laser – Properties, Laser interaction with tissues, Photo medicine & Photo biology lasers used for medical applications-CO2, Ruby, Nd-YAG, Ar, Kr, He-Ne.

Optical fibers – Coherent and incoherent bundles, Light transmission and image transmission systems in rigid and flexible endoscopes.

Application of Lasers in Ophthalmology-laser refractor, laser accuracy testing, Laser treatment of Corneal ulcers, Laser Photo coagulators.

Module II (14 Hours)

Laser & Fiber optics in Dermatology.

Endoscopy: Bronchoscope, Gastroscope. Laser and Fiber optics applications in surgery.

Laser and Fiber optics applications in Dentistry – Laser Induced carrier inhibition, Laser effects on Dental soft tissues and Laparoscopic Instrumentation

Module III (10 Hours)
Standards, Potential Hazards of lasers, safety regulations and precautions. Medical surveillance.

Text Book:

1. Biomedical Aspects of the Laser, by Leon Goldman, Springer Verlag, 1967
2. Lasers in Medicine by H. K. Koebmer, John Wiley & Sons, 1980.

Reference Book:

1. Laser Applications in Medicine and Biology vol l, II, III Plenum Press, (1971 & 1974) by M. L. Wel Basht.
2. Laser Hand Book, Vol 11, Academic Press London (1972) by F. T. Arrechi
3. Introduction to Lasers and Their Applications by Oshea callen and Rhodes, Addison . Wesley- 1977.
4. Lasers in Photo medicine and Photo Biology by E. D. R. Pratesi & C. A Sacchi, Springer verlac 1980.

PCBM7302 **SIGNALS & SYSTEMS LAB** (0-0-3)

The following simulation exercise should be carried out in MATLAB or C programming.

1. Familiarization with MATLAB and generation of various types of waveforms (sine, cosine, square, triangular etc.).
2. Generation of various types of noise (uniform white, Gaussian, coloured etc.).
3. Circular convolution of two sequences in time domain.
4. Linear convolution of a sequence in time domain.
5. Circular correlation of two sequences in time domain.
6. Circular convolution of two sequences using DFT.
7. Circular correlation of two sequences using DFT.
8. Autocorrelation of a sequence and cross-correlation of two sequences.
9. DFT and IDFT of a sequence and verification using the inbuilt "fft" function in MATLAB.
10. Given the transfer function of a system i.e. $H(z) = a+bz^{-1}+cz^{-2}$ where a,b and c lies in the range [0 1] and an input sequence i.e. $x(n) = \{x_0, x_1, ..., x_N\}$, compute the output of the system.

Reference Book:

1. Edward W. Kamen and Bonnie S. Heck, “Fundamentals of Signals and Systems Using the Web and Matlab”, Third Edition, 2007, Pearson Education Inc.

PCEC7301 **MICRO PROCESSOR LAB** (0-0-3)

Equipment necessary:8086 training kit withWith minimum two line and 10 characters per line LCD displayOn-board single line/two pass assembler with all standard directives.ADC and DAC card.I/O port chipTimer Buffered standard portInterrupt controllerIBM PC Keyboard and Interface.Rs 232C Serial Interface.Standard MONITOR Program.PC based cross- assembler, editor, linker, binary code converter with up-load and down load facilities.50 MHZ DSO for measurement of timing diagram.Some interface cards like Stair case simulatorStepper motor control card with stepper motors.List of Experiments to be conducted.Part AStudy of 8086 kit and all the peripheral pin numbersDetail study of use of MONITOR program. Learn how to edit the program, assemble it and run it in all the different modes (GO, step and Break-point mode. (2 Periods)Simple Programs to understand operation of different set of instructions likePrograms related to data transfer groupRelated to different addressing modes.Flag manipulation.Simple programs related to Arithmetic, logical, and shift operation.Loop and Branch InstructionsString operations.Stack manipulation and subroutine program. (5 Periods)

At least seven of the following list of experiments.

1. Arranging a set of date in ascending and descending order.
2. Finding out the number of positive, negative and zeros from a data set. 3. transfer of data from one memory location to another memory location.
4. Searching the existence of a certain data in a given data set.
5. Gray – to – Binary and Binary – to – Gray conversion and BCD – to –Binary and Binary – to – BCD Conversion
6. Design a Up/down Counter.
7. Multiply two 8 Bit numbers using Successive addition and shifting method.
8. Add a series of unsigned 8- Bit data. Extend the experiment to add signed number and multi byte numbers.
9. Generate a Square wave and rectangular wave of given frequency at the output pin of 8255 chip.
10. Finding out 10‘s complement of a 4- digit BCD number.
11. Add a series of Decimal numbers.
12. Division of 8 Bit unsigned numbers by two. Division of a unsigned numbers by two.
13. Disassembling of the given 2 digit decimal number into two nibbles.
14. Generation of different types of analog signal using DAC.
15. Sampling of analog signal using ADC.
16. A small project work for construction of a display system/ real time digital clock.

PCEI7301 **COMMUNICATION SYSTEM ENGINEERING LAB** (0-0-3)

Analyze and plot the spectrum of following signals with aid of spectrum analyzer: Sine wave, square wave, triangle wave, saw-tooth wave of frequencies 1KHz, 10Khz, 50Khz, 100KKz and 1 MHz.

Experiment objective: Analysis of spectrum of different signals. Measurement of power associated with different harmonics in signals.

Equipment Required:

- Signal/ function generator- frequency range upto 1MHz, signal types: square, triangle, sinusoidal, saw-tooth, DC offset signal.
- Spectrum analyzer Upto 100MHz atleast

1. Analyze the process of frequency division multiplexing and frequency division de-multiplexing.

   Experiment objective: Demonstrate the process of multiplexing of signals in time and frequency domain.

   Equipment Required:

   - Frequency division multiplexing/ de-multiplexing experiment board.
   - CRO
2. Study and design of AM modulator and demodulator. (Full AM, SSB, DSBSC, SSBSC)

   Experiment objective: Demonstrate the process of modulation and demodulation using AM. Measure different parameters associated with modulated signals. Analyze the spectrum of modulated signals.

   Equipment Required:

   - AM modulator/ demodulator experimental board.
   - Function generator (sine, square, modulating signal), 1MHz maximum frequency
   - CRO - 20MHz, dual trace
   - Spectrum analyzer.
3. Study of FM modulation and Demodulation Techniques.

   Experiment objective: Demonstrate the process of modulation and demodulation using FM. Measure different parameters associated with modulated signals. Analyze the spectrum of FM modulated signals and compare with theoretical bandwidth.

   Equipment Required:

   - FM modulator/ demodulator experimental board.
   - Function generator (sine, square, modulating signal), 1MHz maximum frequency
   - CRO - 20MHz, dual trace
   - Spectrum analyzer.
4. Observer the process of PAM, quantization and determination of quantization noise.

   Experiment objective: Demonstrate the process of PAM, PWM and PPM. Measure the spectrum of the PAM, PPM and PWM signals.

Equipment Required:

- Experiment board for PAM/ PPM/ PWM signal generation and detection
- Multiplexing board
- CRO

5. Multiplex 2-4 PAM/ PPM and PWM signals.

   Experiment objective: Demonstrate the process of multiplexing in time domain.

Equipment Required:

- Experiment board for PAM/ PPM/ PWM signal generation and detection
- Multiplexing board

- CRO

6. Study the functioning of PCM and Delta modulator

Experiment objective: Demonstrate the process of PCM modulation and Delta modulation.

Equipment Required:

- Experiment board for PCM/ Delta Modulation/ Adaptive Delta Modulation generation and detection
- Signal generator
- CRO

7. Using MATLAB/ SCILAB generate a carrier and a modulating signal. Modulate the carrier using AM. Show the waveform in time domain and analyze its frequency spectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.
8. Using MATLAB/ SCILAB generate a carrier and a modulating signal. Modulate the carrier using FM. Show the waveform in time domain and analyze its frequency spectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.

- For experiment 7/8 MATLAB of current version/ scilab is required.
- Computer of good configuration

9. Using Lab-View software simulate AM modulation and demodulation system.
10. Using Lab-View software simulate FM modulation and demodulation system.

- For experiment 9/10 Lab-View of current version is required.
- Computer of good configuration

11. Design a receiver to demodulate and receive the signal from am AM radio station.
12. Design a receiver to demodulate and receive the signal from the local FM radio station.

- For experiment 11/12 following equipment is required
- CRO
- Components of assorted values.
- AM and FM receiver ICs.

Experiment objective (for simulation exercises): Verify the process of modulation and demodulation in simulation environment. Analyze frequency spectrum of the signal after modulation and demodulation. Observe the modulated and demodulated signals for different forms of modulation signal.

6th Semester

PCBM4303 **Biomedical Equipments** (4-0-0)

Module –I (14 Hours)

Cardiac Pacemakers:

Need for Cardiac Pacemaker, External Pacemaker, Implantable Pace maker, Types of Implantable Pacemakers, Ventricular Synchronous Demand Pacemaker, Programmable Pacemaker, and Rate-Responsive Pacemaker.

Cardiac Defibrillator:

Definition of Arrhythmia & different types of Arrhythmias, Need for defibrillator, DC Defibrillator, DC Defibrillator with synchronizer, Automatic-External Defibrillator (AED) and Cardioverter.

Ventilators:

Artificial Ventilation, Ventilators, Types of Ventilators, Ventilator Terms, Classification of Ventilators and Modern Ventilator.

(Text Book –I –Chapter – 25, 26 & 33)

Module II (10 Hours)

Instruments for Surgery:

Principle of Surgical Diathermy, Surgical diathermy machine, Automated Electrosurgical system and Electro Surgical Technique

Drug Delivery Systems:

Infusion Pumps, components of drugs infusion systems, Implantable Infusion Pumps, Drop rate counter type infusion pump, programmable volumetric infusion pump.

(Text Book –I- Chapter- 27 & 35)

Module –III (12 Hours)

Anesthesia Machine:

Need for Anesthesia, Delivery of Anesthesia, Anesthesia Machine- components & working principle, working principles of Humidifiers, Nebulizers.

Patient Monitoring Systems:

System Concepts, Cardiac Monitor, Selection of system parameters, Cardiac Monitor using digital memory, Bed side & Central Monitor systems.

(Text Book –I –Chapter 32 & 33 , Text Book –I- Chapter – 6)

Text Books:

1) Hand Book of Biomedical Instrumentation -2nd Ed- R.S.Khandpur, TMH – 2003.

Reference Books:

1) Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR & JOHN.M.BROWN (Pearson education publication)

(2) Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications

(3) Leslie. Cromwell – Biomedical instrumentation & measurements, 2e PHI

(4) Dr. M. Arumugam – Biomedical instrumentations, Anuradha Publishers

5) Ward's Anaesthesia Equipment – 4th Edition- Edited by C Ward, WB Saunders Company Limited-1992 (or the Latest Edition of the same book)

PCBM4304 **Biomedical Signal Processing** (3-0-0)

Module I (15 Hours)

Bio-Medical signals: The nature of bio-medical signals, Examples of biomedical signals: Action potential, Electroneurogram (ENG), Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), Event related potentials (ERPs), Electrogastrogram (EGG), Phonocardiogram (PCG), Carotid pulse (CP), Vibromyogram (VMG), Vibroarthrogram (VAG), Speech signals,

Objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, Computer –aided Diagnosis.

Sources of Artifacts: Physiological Interference, Stationary Verses Non-Stationary Processes, High Frequency Noise in ECG, Motion Artifacts in ECG, Power Line Interference in ECG, Maternal Interference in fetal ECG, Muscle Contraction Interference in VAG Signals.

(Text Book – I – Chapter 1& 3)

Module II (12 Hours)

Concurrent Couples & Correlated Processes:

Problem Statement, Illustration of the problem with case studies: The ECG & PCG, The PCG & Carotid Pulse, The ECG & Atrial Electrogram, Cardio-Respiratory Interaction, The EMG & Vibromayogram, The Knee Joint and muscle vibration signals, Applications: Segmentation of the PCG.

Removal of Artifacts: Adaptive Noise Canceller, Cancellation of 60 Hz (power line) interference in ECG, Canceling Donor-Heart Interference in Heart Transplant ECG, Cancellation of ECG signal from the electrical activity of chest muscle.

(Text Book – I – Chapter 2 & Text Book – II – Chapter 6)

Module III (13 Hours)

Removal of Artifacts: Canceling of Maternal ECG in fetal ECG, Cancellation of High Frequency noise in Electro-surgery.

Event Detection:

Problem Statement, The PQRS & T waves in ECG, First & Second Heart Sounds, EEG Rhythms, waves and transients. Derivative Methods for QRS Detection, The Pan-Tompkins Algorithm for QRS detection, Detection of the Dicortic Notch, Detection of P wave. Applications: ECG rhythm Analysis, Identification of heart sounds, Detection of Aortic components of second heart sounds

(Text Book – II – Chapter 6 & Text Book – I : Chapter 4)

Text Books:

1) Biomedical Signal Analysis – A case Study Approach- Rangaraj M. Rangayyan – John Willey & Sons Inc-2002.
2) Biomedical Signal processing – Principles & Techniques – D.C Reddy – Tata McGraw Hill Companies – 2005

PCBM4305 **Bio-Mechanics** (3-1-0)

Module I (14 Hours)

Blood Flow Mechanics: Introduction, Mechanics of Micro Vascular Blood Flow, Mechanics of Micro Vascular wall, Capillary Blood Flow, Arterial & Venous Blood Flow, Microvacsular Network: Structure & Hemodynamics, Regulation Neurohumoral & Local of Blood Flow.

Mechanics of Hematocytes: Introduction, Stress & Strain in 2 Dimensions, Basic Equation of Newtonian Fluid Flow. Red Cells: Size & Shape, Red cell Cytosol, Stress relaxation & Strain Hardening, Bending Elasticity. White cells: Size & Shape, Mechanical Behavior, Bending Rigidity, Apparent Viscosity.

Soft Tissue Mechanics: Structure of Soft Tissue: Cartilage, Tendon & Ligament. Muscle: Gross Morphology, Fiber Architecture, Sacromere.

Material Properties: Cartilage, Tendon, Ligament & Muscle

(Text Book –I – Chap – 59 ,Text Book –I – Chapter-60, Text Book –I : Chap- 48)

Module II (13 hours)

.**Muscle:** Types of Muscle Models, Muscle Force-Length Relationship, Muscle Force-Velocity Relationship.

Joint Lubrication: Introduction, Tribology, Friction, Wear & Surface damage, Lubrication, Hydrodynamic Lubrication theory, Boundary Lubrication.

Synovial Joint: Overview of structure with some examples. Theories on the lubrication of natural & normal synovial joints BioTriobology and Arthritis: Are there connections?

(Text Book –I: Chap- 48, Text Book –I: Chap- 50)

Module III (13Hours)

Exercise Physiology: Muscle Energetics, Cardiovascular Adjustments, Optimization, Thermal Response & Applications.

Human Mechanical Work: Exercise Biomechanics, Equilibrium, Muscular movement, Locomotion, Effect of Age, Effect of Exercise Training, Aerobic Exercise Training, Strength Training, Effects of Gender & Effects of Genetics.

- Text Book –I : Chap- 65 & 66

Text Book:

1) Biomedical Engineering Hand Book 3rd Edition (Biomedical Engineering Fundamentals) – Joseph D. Bronzino- CRC- Tylor & Francis-2006.

PEBM5303 **Clinical Science (3-0-0)**

Module I: (14 Hours)

Orthopedics: Structure of bone. Gross .microscopic, biochemical, Factures-types, Mechanism of Injury.Normal healing of Fractures, Treatment of Factures General Principles Closed methods, external fixation and internal fixation. Biomechanics of internal fixation and principles of external fixators. Bioengineering principles of internal fixation, intramedullary nails, plates, screws, Different Types of Joint replacements: Knee Joint, Hip Joint.

ENT: Audiometer-principles and Techniques Including foera & impedance, Hearing aids-functional Concepts, Ultrasonic binaural sensing aid for the blind, Measurement of noise, Noise Pollution.

Module – II (13 Hours):

ENT: Choclear implants- working principle, Electronystography, Laser in ENT,CYO in ENT, Study of different types of Scopies in ENT-Principles of scopy.

Radio therapy: Principles of radiation oncology and cancer radio therapy. Perspective, Radio sensitivity and radio resistance of tumors and Tissues, Classification of Tumors according to cell Radio sensitivity, Cell survival theory, Oxygen effect, Cell repair, Radio curability of tumors, Therapeutic ratio.

Module III (13 Hours)

Radio therapy: Normal Tissue tolerance dose, Modification of radiation response Physical, chemical and Biomedical modifiers

Radiation Protection: General principles & Materials, The Biological Effects of radiation: Prompt Personal Effects, Delayed Personal Effects, and Racial Effects. Permissible Doses, the Dose Levels, RBE, Dose Equivalent and REM, Maximum Permissible Doses and Body Burdens, Protective Measures & Materials, Primary & Secondary Barriers, the Film Badge

REFERENCE BOOKS:

1. John Crawford Adams, Outline of Orthopedics. Churchill Livingstone, 2001.
2. W.J. Meredith & J.B.Massey, Fundamental Physics of Radiology- 3rd Ed, Varghese Publishing House – 1992.
3. A short textbook of ENT diseases, by Bhargav, Usha publications
4. Diseases of ear, nose and throat, by P.I. Dhingra. 3e, Elsevier publications
5. Biomaterials –An Introduction 3rd Ed– Joon Park & R.S.Lakes- Springer- 2007 – some part of orthopedics is covered in this book.

PEBM5302 **Biomaterials** (3-0-0)

Module I (11 Hours)

Biomaterials: Definitions of Biomaterials & Biocompatibility, Classification of materials used in the body, performance of Biomaterials, Brief historical background of Biomaterials.

Characterization of Materials: Mechanical properties: Stress-Strain Behavior, Mechanical Failure: Static & Dynamic Failure, Friction & wear failure, Visco-Elastic material behavior.

(Text Book –I – Chapter I & III)

Module – II (13 Hours)

Properties of Biomaterials: Electrical Properties & Piezoelectricity, Optical Properties, X-ray Absorption, Acoustic & Ultrasound Properties, Density & Porosity Diffusion Properties.

Metallic Biomaterials: Introduction, Stainless steels, CoCr Alloys, Ti Alloys & Corrosion of metallic Implants

(Text Book –I –Chapter 4. Text Book –II – Chapter 1)

Module III (16 Hours)

Ceramic Biomaterials: Introduction, Non-absorbable materials like Alumina, Carbons & Zirconia . Biodegradable Ceramics like Calcium phosphate, Aluminum-Calcium-Phosphate (ALCAP) Ceramics, Coralline. Bioactive ceramics like Glass ceramics, Ceravital.

Polymeric Biomaterials: Introduction, Polymerization & Basic structure, Polymers used as Biomaterials: Polyvinylchloride (PVC), Polyethylene (PE), Polypropylene (PP) , Plolymethylmetacrylate (PMMA) and Ployesters.

Composite Biomaterials: Structure, Bounds & Properties, Anisotropy of Composites, Particulate Composites, Fibrous Composites & Porous Materials.

(Text Book –II – Chapter 2, 3 & 4)

Text Books:

1) Biomaterials –An Introduction, 3rd Ed– Joon Park & R.S.Lakes- Springer- 2007.
2) Biomaterials- Joyce Y.Wong & Joseph D. Bronzino – CRC Press- 2007

PEBM5305 **Medical Image Processing** (3-0-0)

Module – I (14 Hours)

INTRODUCTION: Origin of DIP, examples of fields that use DIP, Fundamentals of DIP, components of a DIP system.

DIGITAL IMAGE FUNDAMENTALS: Elements of visual perception, light and EM spectrum, a simple image formation model, image sampling and quantization, some basic relationships between pixels.

IMAGE ENHANCEMENT IN SPATIAL DOMAIN: Background, some basic gray level transformations, Histogram processing, enhancement using arithmetic and logic operations. Basic of spatial filtering, Smoothing spatial filters, sharpening spatial filters

Module –II (13 Hours)

IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN:

Background, introduction to FT and frequency domain, smoothing frequency domain filters, sharpening frequency domain filters, homographic filtering, additional properties of the 2-D FT, convolution and correlation theorems.

IMAGE COMPRESSION: Fundamentals, image compression models, elements of information theory, error free compression, run length coding, loss less predictive coding, lossy predictive coding, image compression standards, JPEG, video compression standards

Module –III (13 Hours)

IMAGE SEGMENTATION: Detection of discontinuities, point detection, line detection, edge detection, gradient operators, Laplacian, edge linking and Boundary detection, thresh-holding, region based segmentation.

IMAGE RECONSTRUCTION: Introduction, Fourier slice theorem, filtered back projection algorithm for parallel projection data, algebraic reconstruction technique.

TEXTBOOKS:

1. **Fundamentals of Digital Image Processing** - by Rafael. C.Gonzalez and Richard. E. Woods, 3 Edn, Pearson Education, 2002.
2. **Digital Image Processing** -by Anil K. Jain, 5th Indian Print, PHI, 2002.

REFERENCE BOOKS:

1. **Digital Image Processing** –by William K. Pratt, 3rd Edition, John Wiley & Sons Inc.
2. **Image Processing Analysis and Machine Vision** – by Milan
Sonka, Vadan Hlavac and Roger Boyle. 2nd Edition, Brooks/Cole Publishing Company / Thompson Learning, 1999.

PCCS4304 **OPERATING SYSTEM** (3-0-0)

MODULE-I **12 Hours**

INTRODUCTION TO OPERATING SYSTEM:

What is an Operating System? Simple Batch Systems, Multiprogramming and Time Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems.

Operating System Structures: Operating System Services, System components, Protection system, Operating System Services, system calls

PROCESS MANAGEMENT:

Process Concept, Process Scheduling, Operation on Processes, Interprocess communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

MODULE-II **12 Hours**

PROCESS COORDINATION: Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

MEMORY MANAGEMENT: Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

MODULE-III **11 Hours**

STORAGE MANAGEMENT:

File System Concept, Access Methods, File System Structure, File System Structure, File System Implementation, Directory implementation, Efficiency and Performance, Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, I/O System Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operation.

CASE STUDIES: The LINUX System, Windows XP, Windows Vista

TEXT BOOK:

1. **Operating System Concepts –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.
2. **Mordern Operating Systems –** Andrew S. Tanenbaum, 3rd Edition, PHI
3. **Operating Systems:** A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition

REFERENCE BOOK:

1. **Operating Systems –** Flynn, McHoes, Cengage Learning
2. **Operating Systems –** Pabitra Pal Choudhury, PHI
3. **Operating Systems –** William Stallings, Prentice Hall
4. **Operating Systems –** H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson

PEEC4304 Computer Network & Data Communication (3-0-0)

Module – I 12 Hrs

Overview of Data Communications and Networking.

Physical Layer : Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals.

Digital Transmission: Line coding, Block coding, Sampling, Transmission mode.

Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing : FDM , WDM , TDM ,

Transmission Media: Guided Media, Unguided media (wireless)

Circuit switching and Telephone Network: Circuit switching, Telephone network.

Module –II 12 Hrs

Data Link Layer

Error Detection and correction: Types of Errors, Detection, Error Correction

Data Link Control and Protocols:

Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC.

Point-to –Point Access: PPP

Point –to- Point Protocol, PPP Stack,

Multiple Access

Random Access, Controlled Access, Channelization.

Local area Network: Ethernet.

Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Token bus, token ring

Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

Module – III 12 Hrs

Network Layer:

Host to Host Delivery: Internetworking, addressing and Routing

Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6

Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service.

Application Layer :

Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th Ed

3. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed

Reference Book : .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed.
4. Data communication & Computer Networks: Gupta, Prentice Hall of India
5. Network for Computer Scientists & Engineers: Zheng, Oxford University Press
6. Data Communications and Networking: White, Cengage Learning

PCEI 4303 **CONTROL SYSTEMS** (3-0-0)

Module-I: (12 Hours)

Introduction: definition, automatic control, open loop, close loop, modern control, properties of transfer function, linear approximation of physical systems;

Mathematical Modeling: translational, rotational systems and their electrical analogy, mechanical coupling, liquid level systems, servo motors, sensors, magnetic amplifiers, stepper motor, synchors, block diagram, signal flow graph, gain formula.

Characteristic of Feedback Control: sensitivity of control system, parameter variation and disturbance of signal.

Module-II: (12 Hours)

Time Domain Analysis: typical test signals, transient analysis of second order systems, overshoot, damping, settling time and rise time, Analysis of multi-order control system with dominant poles, steady state error analysis, error confidents, generalised error series, transient analysis with derivative control, integral control and proportional control, rate feedback control, Routh Hurwitz stability criteria.

Root Locus Technique: Basic conditions for root loci, rules for construction, stability and conditional stability on root locus.

Module-III: (12 Hours)

Frequency Response Analysis: Bodes plot, frequency domain behaviour of control, gain margin and phase margin, Wp and Mp for second order system, stability criteria.

Nyquist Criteria: Stability criteria, conformal mapping, Cauchy's theorem, Nyquist stability criteria, conditionally stable system.

State variable Technique: state variable for continuous system, transfer function to state variable, state variable to transfer function, state transition matrix, time domain solution of single input single output system.

Text Book:

1. D Roy Choudhury, Modern Control Engineering, PHI, 2008. (Selected portions from Chapter 1, 2, 3, 4, 5, 6, 8, 9 and 11)

Reference Books:

1. K Ogata, Modern Control Engineering, PHI, 5th edition
2. I J Nagrath and M Gopal, Control system engineering; New Age International Publisher 2010.
3. R C Dorf and R H Bishop, Modern Control Systems; Pearson Education; 2009
4. R T Stefani, B Shahiana, C J Savant and G H Hostetter, Design of Feedback control System, Oxform University Press
5. B C Kuo, Automatic Control System; PHI; 7th Edition.

PCBM7304 Biomedical Signal Processing Lab

The Following Experiments to Be Conducted Using Matlab/C
Any 10 Experiments

1. Display of Static and Moving ECG
2. Detection of QRS complex
3. Auto-Correlation and Cross-Correlation of ECG signals
4. Convolution of 2 signals
5. Reduction of ECG signal using Turning Point algorithm
6. Reduction of ECG signal using AZTEC algorithm
7. Reduction of ECG signal using ADM coding
8. Reduction of ECG signal using SAPA algorithm
9. Adaptive filtering of corrupted ECG signal
10. DCT and IDCT of ECG signal
11. Down sampling of ECG signal
12. Up sampling of bio-medical signals
13. FFT and IFFT of ECG signals
14. LPF and HPF of ECG signals
15. Frequency response and phase response of FIR filter using KAISER window method

PCBM7303 Biomedical Equipment Lab (0-0-3)

Demonstration and/or study of working of the following biomedical equipments to understand the applications & technology involved in these equipments- using student training kits & simulators. One experiment should be based on acquisition of any one of the Bio-signals and to store in a computer with an A-D converter / computer interfacing card.

Any 10 of the following Equipments/devices to be studied

1. Baby incubator
2. Digital BP meter & Sphygmomanometer
3. Infusion pump.
4. Audio meter
5. Ventilator-
6. ECG –Machine-- with simulator
7. EMG – Machine-- with simulator
8. EEG-Machine - - with simulator
9. D.C. Defibrillator- with simulator
10. Pace Makers –Internal & External - with Simulator
11. Demonstration of different kinds of Electrodes for ECG, EEG, EMG Measurement
12. Phonocardiograph

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BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

Biomedical Engineering

7th SEMESTER				8th SEMESTER			
	THEORY	*Contact Hours*			*THEORY*	*Contact Hours*	
Code	*Subject*	*L-T-P*	*Credits*	*Code*	*Subject*	*L-T-P*	*Credits*
HSSM3404	Hospital Management.	3-0-0	3	PCBM4402	Medical Imaging Techniques	3-0-0	3
PCBM4401	Artificial Organs & Implants	3-0-0	3				
	Professional Elective – III (*Any One*)	3-0-0	3		Professional Elective – IV (Any One)	3-0-0	3
PEBM5401	Transducers & Instrumentation			PEEI5405	MEMS		
PCEC4401	VLSI Design (VLSI)			PEEC5405	Embedded Systems		
PEEL5401	Adaptive Signal Processing			PEBM5402	Virtual Instrumentation		
	Free Elective – II (*Any One*)	3-0-0	3		Free Elective – IV (*Any One*)	3-0-0	3
PEEI5401	Microcontroller & Applications			PECS5406	Digital Image Processing		
PCCS4401	Computer Graphics			PEEI5404	Analog VLSI design		
PEEC5415	Advance Communication Systems			FECE6405	Internet Technology and Application		
	Free Elective – III (*Any One*)	3-0-0	3		Free Elective – V (*Any One*)	3-0-0	3
PEEE5406	Soft Computing			PECS5410	Algorithms for Bioinformatics		
PECS5401	Artificial Intelligence			PECS5407	Wireless Sensor Network		
FEBM6401	Programming in Java			PEIT5403	Multimedia Systems		
		Credits (Theory)	15			Credits (Theory)	12
	PRACTICALS/SESSIONALS				*PRACTICALS/SESSIONALS*		
PCEC7401	VLSI Design Laboratory	0-0-3	2				
PEBM7401	Adaptive Signal Processing Laboratory						
PEBM7402	Transducers and Instrumentation Laboratory						
PCBM7401	Project	0-0-6	3	PCBM7403	Project (50% External Evaluation)	0-0-9	7
PCBM7402	Seminar	0-0-3	2	PCBM7404	Comprehensive Viva-Voce (External Evaluation)	0-0-0	3
		Credits (Practicals/Sessionals)	7			Credits (Practicals / Sessionals)	10
		TOTAL SEMESTER CREDITS	22			TOTAL SEMESTER CREDITS	22
		TOTAL CUMULATIVE CREDITS	182			TOTAL CUMULATIVE CREDITS	204

7th Semester

HOSPITAL MANAGEMENT (3-0-0)

Module –I (15 Hours)

Organization of the Hospital : Organizational Structure, Governance, Duties & Responsibilities of Governing Board, Management Structure, Duties, responsibilities & functions of CEO, CEO & his management team.

Classification of Hospitals – Primary Health Care Centre, General Hospital, Specialty Hospital, Teaching & Research Hospital- Their Role and Functions.

Planning the Hospital Building- General principles, General Features, Building Contracts & Contract Documents, Furnishing & Equipping the Hospital. The Design team & its role – The Architect, Engineers & Hospital Administers

Module –II (15 Hours)

Overview, Location, Design & Organization of the Following Departments: Emergency Services, Clinical Laboratories, Diagnostic Radiology, Surgical Department (OT), Intensive Care Units (ICU), Central Sterilization & Supply Department (CSSD).

Overview, Design, Location & Organization of the following Engineering services: Electrical Engineering, Civil Engineering, Maintenance Engineering, Air–Conditioning system, Centralized Medical Gas System, Information Technology (IT), and Telecommunication Engineering.

Module –III (10 Hours)

Clinical Engineering: Definition of Clinical Engineering, Evolution of Clinical Engineering, Hospital Organization & role of Clinical Engineering, Clinical Engineering programs, Major Functions of Clinical Engineering department.

Management & Assessment of Medical Technology: The Heath Care Delivery System, Strategic Technology planning, Technology Assessment, Equipment Acquisition & Deployment.

Text Books:

1) Hospital: Planning, Design & Management – G.D. Kunders, S.Gopinath, A, Katakam- Tata McGraw Hill -1998.
2) Biomedical Engineering Hand Book 3rd Edition (Medical Devices & Systems) – Joseph D. Bronzino- CRC- Tylor & Francis-2006.

ARTIFICIAL ORGANS & IMPLANTS (3-0-0)

Module I (18 Hours)

Introduction to Artificial Organ Design:

Substitutive Medicine, Out Look for replacement, Design Consideration, Evaluation process & basic concepts of Kidney & liver transplant

Cardiac Assist Devices Design: Steps in Engineering Design, Detailed steps in Engineering Design of artificial heart & circulatory assistive devices.

(Text Book –I – Section VI -Chapter -63 & Text Book III- Chapter 15)

Cardiac Valve Prostheses:

Brief history valve prostheses: Mechanical Valves & Tissue Valves. Current Types of prostheses, Tissue verses Mechanical valves, Medtronic-Hall-Tilting disc valve, St.Jude Medical Bileaflet valve, Carpentier Edwards Porcine valve (model 2625) , Hancock Modified Orifice Porcine valve (model 250), Carpentier-Edwards pericardial Valve (Model 2900), Implication of Thrombus Deposition, Durability : Wear, Fatigue, Mineralization and Current Trends in Valve Design.

(Text Book –I – Chapter – 64)

Module II (12 Hours)

Artificial Kidney: Brief Review of Structure & Function of Kidney, Changes in the Body Fluids in renal Diseases.

Principle of Dialysis in Artificial Kidney, Dialyzers: Parallel Flow Dialyzer, Coil-Hemodialzer, Hollow-Fiber Hemodialzer. Performance analysis of the dialzers, Block diagram description of Hemodialysis machine. (Text Book – II –Chapter 30)

Introduction to Design & working of Artificial Liver & Pancreas (Text Book –I)

Module III (10 Hours)

Implants: General concepts of Implants, classification of implants: Soft tissues replacements and Hard tissue replacements. Body Response to Implants: Cellular Response to Implants, Systemic Effects by Implants, Blood Compatibility & Factors affecting blood compatibility. Brief Study of Percutaneous & Skin implants, Ear & Eye Implants like Corneal Implants & Cochlear Implant.

(Text Book –III – Chapter – 10 & 11)

Text Books:

1) Biomedical Engineering Hand Book 3rd Edition (Tissue Engineering & Artificial Organs) – Joseph D. Bronzino- CRC- Tylor & Francis-2006.
2) Hand Book of Biomedical Instrumentation -2nd Ed- R.S.Khandpur - TMH 2003.
3) Biomaterials –An Introduction 3rd Ed– Joon Park & R.S.Lakes- Springer- 2007.

Professional Elective – III

TRANSDUCERS & INSTRUMENTATION (3-0-0)

Module –1 10 lectures
Elements of a general measurement system;
Static Characteristics: systematic characteristics, statistical characteristics, calibration;
Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, dynamic error in measurement systems. (Bentley: Chapters 1-4)

Module-2 14 lectures
Sensing elements: Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages.
Capacitive sensing elements: variable separation, area and dielectric;
Inductive sensing elements: variable reluctance and LVDT displacement sensors;
Electromagnetic sensing elements: velocity sensors,
Thermoelctric sensing elements: laws, thermocouple characteristics, installation problems, cold junction compensation.
IC temperature sensor
Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.
(Bentley: Sections 8.1 to 8.6; Ghosh: Section 10.3 to 10.4).

Module-3 10 lectures
Signal Conditioning Elements:
Deflection bridges: design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity
Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.
(Bentley: Sections 9.1 to 9.3; Ghosh: Sections 15.1 and 15.2) .

Text Books:
1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.
2. Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, 2009.
3. Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.

Reference Books:
1. Measurement Systems Application & Design- E.O.Doeblin (4/e),McGrawHill,International,NY.
2. Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.
3. Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.

VLSI DESIGN

Module – I **08 Hours**

Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles, Computer-Aided Design Technology.

Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts, The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full-Customs Mask Layout Design.

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.

(Chapter 1 to 3 of Text Book 1 and for Stick Diagram Text Book 2)

Module – II **14 Hours**

MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter.

MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion nMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).

(Chapter 5 to 7 of Text Book 1)

Module – III **18 Hours**

Sequential MOS Logic Circuits: Introduction, Behaviour of Bistable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop.

Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Non-volatile Memory, Flash Memory.

Design for Testability: Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring I_{DDQ} Test.

Text Books:

1. Sung-Mo Kang and Yusuf Leblebici, *CMOS Digital Integrated Circuits: Analysis and Design*, 3rd Edn., Tata McGraw-Hill Publishing Company Limited, 2003.
2. K. Eshraghian and N.H.E. Weste, *Principles of CMOS VLSI Design – a Systems Perspective*, 2nd Edn., Addison Wesley, 1993.

Reference Books:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, *Digital Integrated Circuits – A Design Perspective*, 2nd Edn., Pearson Education, 2003.
2. Wayne Wolf, *Modern VLSI Design System – on – Chip Design*, 3rd Edn., Pearson Education, 2003.
3. Debaprasad Das, *VLSI Design*, Oxford University Press, New Delhi, 2010.
4. John P. Uyemura, *CMOS Logic Circuit Design*, Springer (Kluwer Academic Publishers), 2001.
5. Ken Martin, *Digital Integrated Circuit Design*, Oxford University Press, 2000.

ADAPTIVE SIGNAL PROCESSING

Module – I **(10 Hours)**

Introduction: Adaptive Systems – Definition and characteristics, General properties, Open and Closed Loop Adaptations, Applications

The Adaptive Linear Combiner: Performance function, Gradient and Mean Square Error, Examples.

Module – II **(14 Hours)**

Theory of Adaptation with Stationary Signals: Properties of the Quadratic Performance Surface, Significance of eigen values, eigen vectors, coorelation matrix.

Searching the Proformance Surface: A simple gradient search algorithm, Stability and Rate of convergence, the learning curve

Gradient Estimation and its effects on Adoption: The performance penalty, Variance of the gradient estimate, Misadjustment.

Module – III **(16 Hours)**

Adaptive Algorithms and Structures: The LMS Algorithm, Convergence, learning Curve, Performanece analysis, Filtered X LMS algorithm,

Applications: Adaptive Modeling and System Identification using adaptive filter, Inverse Adaptive Modeling, Deconvolution, and equalization using adaptive filter, Adaptive Control Systems using Filtered X LMS Algorithm, Adaptive Noise Cancellation using Adaptive filter

Text Books :

1. Bernard Widrow and Samuel D. Stearns, *Adaptive Signal Processing*, Pearson Education, 2nd impression 2009.

Reference Book:

1. Simon Haykin, *Adaptive Filter Theory*, 4th Edn., Pearson Education.

MICROCONTROLLERS AND APPLICATIONS

MODULE: I (12 hours)

1. **Introduction to Microcontrollers:** Introduction, Microcontrollers and Microprocessors, History of Microcontrollers and Microprocessors, Embedded versus External Memory Devices, 8-bit and 16-bit Microcontrollers, CISC and RISC Processors, Harvard and Von Neumann Architectures, Commercial Microcontroller Devices.
2. **8051 Microcontrollers – Pin Description, Connections, I/O Ports and Memory Organization:** Introduction, MCS-51 Architecture, Registers in MCS-51, 8051 Pin Description, 8051 Connections, 8051 Parallel I/O Ports, Memory Organization.
3. **MCS-51 Addressing Modes and Instructions:** 8051 Addressing Modes, MCS-51 Instruction Set, 8051 Instructions and Simple Programs, Using Stack Pointer.
4. **8051 Assembly Language Programming Tools:** 8051 Assembly Language Programming, Development Systems and Tools, Software Simulators of 8051.
5. **MCS-51 Interrupts, Timer/Counters and Serial Communication:** Interrupts, Interrupts in MCS-51, Timers and Counters, Serial Communication.

MODULE: II (12 hours)

1. **Design with Atmel Microcontrollers:** Atmel Microcontrollers (89CXX and 89C20XX), Architectural Overview of Atmel 89C51 and Atmel 89C2051, Pin Description of 89C51 and 89C2051, Using Flash Memory Devices Atmel 89CXX and 89C20XX, Power Saving Options.
2. **Applications of MCS-51 and Atmel 89C51 and 89C2051 Microcontrollers:** Applications of MCS-51 and Atmel 89C51 and 89C2051 microcontrollers, Square Wave Generation, Rectangular Waves, Pulse Generation, Pulse Width Modulation (PWM), Staircase Ramp Generation, Sine Wave Generation, Pulse Width Measurement, Frequency Counter.
3. **Introduction to PIC Microcontrollers:** PIC Microcontrollers – Overview and Features, PIC 16C6X/7X, FSR (File Selection Register) [Indirect Data Memory Address Pointer], PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organization, PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter (ADC).
4. **Introduction to PIC PIC 16F8XX Flash Microcontrollers:** Introduction, Pin Diagram of 16F8XX, STATUS Register, OPTION_REG Register, Power Control Register (PCON), PIC 16F8XX Program Memory, PIC 16F8XX Data Memory, DATA EEPROM and Flash Program EEPROM, Interrupts in 16F877, I/O Ports, Timers.

MODULE: III (12 hours)

1. **Interfacing and Microcontroller Applications:** Introduction, Light Emitting Diodes (LEDs), Push Buttons, Relays and Latch Connections, Keyboard Interfacing, Interfacing 7-Segment Displays, LCD Interfacing, ADC and DAC Interfacing with 89C51 Microcontrollers.
2. **Industrial Applications of Microcontrollers:** Introduction, Measurement Applications, Automation and Control Applications.
3. **Advanced Programming and Math Calculations:** Introduction, Fixed-Point Numbers, Addition of two 16-bit Numbers, Unsigned 32-bit Addition, Subtraction of Two 16-bit Numbers, Conversion of 8-bit Signed Number into a 16-bit Signed Number, 16-bit Signed Addition, Binary to BCD Conversion, Square Root Calculations, Integration, Differentiation, Floating-Point Arithmetic.

Text Books:

1. Ajay V. Deshmukh, ***Microcontrollers* [*Theory and Applications*]**, TMH Ltd., New Delhi, 2005.

Reference Books:

1. M.A. Mazidi, J. G. Mazidi and R.D. McKinlay, ***The 8051 Microcontroller and Embedded Systems using Assembly and C***, 2nd Ed., Pearson Education, 2008.
2. Myke Predko, ***Programming and Customizing the 8051 Microcontroller***, TMH
3. Subrata Ghoshal, ***8051 Microcontroller Internals, Instructions, Programming and Interfacing***, Pearson Education, 2010.
4. Kenneth J. Ayala, ***The 8051 Microcontroller – Architecture, Programming and Applications***, 2nd Edition, Thomson Delmar Learning, 2004.
5. David Calcutt, Fred Cowan, Hassan Parchizadeh, ***8051 Microcontrollers – An Application based Introduction***, Elsevier Publications.
6. Myke Predko, ***Programming and Customizing the PIC Microcontroller***, TMH

7. John B. Peatman, ***Design with PIC Microcontrollers***, Pearson Education, 2005.
8. Han Way Huang, ***PIC Microcontroller***, Cengage Learning.
9. Martin Bates, ***PIC Microcontrollers***, 2nd Edition, Elsevier Publications.

ADVANCED COMMUNICATION SYSTEMS

MODULE – I: **(10 hrs)**

Data-Link Protocol and Data Communications Networks: Data-link Protocol Function, Character and bit Oriented Data Link Protocols. Asynchronous Data Link Protocols, Synchronous Data-Link Protocols, Synchronous Data –Link Control, High-Level Data Link Control, Public Switched Data Networks, CCITTX. 25, User-to-Network Interface Protocol. Integrated Services Digital Network (ISDN) (Chapter 23)

MODULE – II: **(15 hrs)**

Digital T-Carriers and Multiplexing :Time-Division Multiplexing (TDM); T1 Digital Carrier. North American Digital Hierarchy. Digital Carrier Line Encoding. T Carrier Systems, Digital Carrier Frame Synchronization. Bit Vrs Word Interleaving. Statistical TDM. Codecs and Combo Chips. FDM. AT & T's FDM Hierarchy. Composite Base band Signal . Formation of Master group. Wavelength Division Multiplexing (WDM) (Chapter 11)

Cellular Telephone Concepts: Mobile telephone service, Cellular Telephone, Frequency Reuse, Interefernce, Cell Splitting, Sectoring, Segmentation, and dualization, Cellular System Topology, Roaming and Hand ofs, Cellular Telephone Network Components, Cellular Telephone call Processing (Chapter 19)

Data Communication and Networking: Data Communication Network Architecture, Protocols, and standards, Layered Network Architecture, Introduction to GSM, GPRS, CDMA (Chapter 20)

MODULE – III: **(15 hrs)**

Satellite Communication: Introduction, Keepler's Law, Satellite Orbir\ts, geosynchronous satellites, Antenna Look Angles, Satellite Classifications, spacing and frequency allocation, Satellite Antenna Radiation patterns, Satellite System Link Models, Satellite System Parameters, Satellite System Link Equations, Link Budget (Chapter 25)

Satellite Multiple Accessing Arrangements: Introduction, FDM/FM Satellite Systems, Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Channel Capacity, Satellite Radio NavigationEstimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT (Chapter 26)

Text Book:

1. Electronic Communications Systems Fundamentals through Advanced by Wayne Tomasi; Pearson.

References:

1. Satellite Communication - by Timothy Pratt; Addison Wesley.

COMPUTER GRAPHICS

Module – I (10 hours)

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices.

Output Primitives: Line drawing Algorithms: DDA and Bresenham's Line Algorithm, Circle drawing Algorithms: Midpoint Circle Algorithm and Bresenham's Circle drawing Algorithm.

Two Dimensional Geometric Transformation: Basic Transformation (Translation, rotation, Scaling) Matrix Representation, Composite Transformations, Reflection, Shear, Transformation between coordinate systems.

Two Dimensional Viewing: Window-to- View port Coordinate Transformation.

Module –II (12 hours)

Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm).

Aliasing and Antialiasing, Half toning, Thresholding and Dithering, Scan conversion of Character.

Polygon Filling: Seed Fill Algorithm, Scan line Algorithm.

Two Dimensional Object Representation: Spline Representation, Bezier Curves and B-Spline Curves.

Fractal Geometry: Fractal Classification and Fractal Dimension.

Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation.

Projections: Parallel Projection and Perspective Projection.

Module –III (8 hours)

Visible Surface Detection Methods: Back-face Detection, Depth Buffer, A- Buffer, Scan- line Algorithm and Painters Algorithm.

Illumination Models: Basic Models, Displaying Light Intensities.

Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.

Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing.

Virtual Reality: Types of Virtual reality systems, Input and Output Virtual Reality devices.

Textbook

1. Computer Graphics with Virtual Reality System, Rajesh K.Maurya, Wiley-Dreamtech.
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

Reference Books

1. Computer Graphics Principle and Practice , J.D. Foley, A.Dam, S.K. Feiner, Addison, Wesley
2. Procedural Elements of Computer Graphics- David Rogers (TMH)
3. Computer Graphics: Algorithms and Implementations – D.P Mukherjee & Debasish Jana (PHI)

4. Introduction to Computer Graphics & Multimedia – Anirban Mukhopadhyay & Arup Chattopadhyay (Vikas)

Free Elective – III

SOFT COMPUTING (3-0-0)

MODULE-I (12 Lectures)

Introduction: Soft Computing Constituents and Conventional Artificial Intelligence, Neuro-Fuzzy and Soft Computing Characteristics.

Fuzzy Sets: Introduction, Basic Definitions and Terminology, Set Theoretic Operations, MF Formulation and Parameterization.

Fuzzy Rules & Fuzzy Reasoning: Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning.

Fuzzy Inference Systems: Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Other Considerations.

(BOOK-1:- Chap-1: 1.1 to 1.3, Chap-2: 2.1 to 2.4, Chap-3: 3.2 to 3.4 & Chap-4: 4.2 to 4.5)

MODULE-II (14 Lectures)

Neural Networks: Neuron Abstraction, Neuron Signal Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feed forward and Feedback, Salient Properties and Application Domains of Neural Networks, Multi-layered Network Architectures, Back-propagation Learning Algorithm, Practical Considerations in Implementing the BP Algorithm, Structure Growing Algorithms, Universal Function Approximation and Neural Networks, Applications of Feed Forward Neural Networks, Reinforcement Learning, Radial Basis Function Networks, Regularization Theory Route to RBFNs, Generalized Radial Basis Function Network, Learning in RBFNs, Associative Learning, Hopfield Network, Content Addressable Memory, Bidirectional Associative Memory, Self Organizing Feature Maps, Applications of the Self Organizing Map.

(BOOK-2:-Chap-3: 3.1 to 3.6, Chap-6: 6.1 to 6.2, 6.5 to 6.6 & 6.8 to 6.10, Chap-8: 8.4 to 8.7, Chap-10: 10.2 & 10.5 to 10.6 & 10.16 and Chap-12: 12.8 to 12.9)

MODULE-III (08 Lectures)

Regression & Optimization: System Identification: an Introduction, Least Squares Estimator, Geometric Interpretation of LSE, Recursive Least Squares Estimator.

Derivative-Free Optimization: Genetic Algorithms, Simulated Annealing, random Search, Downhill Simplex Search.

Adaptive Neuro-Fuzzy Inference Systems (ANFIS): ANFIS Architecture, Hybrid Learning Algorithm.

(BOOK-1:- Chap-5: 5.1, 5.3 to 5.5, Chap-7: 7.2 to 7.5 and Chap-12: 12.2 to 12.3)

TEXT BOOK:

1. "***Neuro-Fuzzy and Soft Computing***" By J.-S.R.Jang, C.-T.Sun & E. Mizutani, PHI
2. "***Neural Networks: A Classroom Approach***" By Satish Kumar, TMH Education

Reference Book:

1. "***Neural Networks Fuzzy Logic & Genetic Algorithms; Synthesis & Applications,*** *S.Rajasekaran & G.A. VijayaLaxmi Pai, Prentice Hall, India, May'2006- LakshmiPai*
2. Principle of Soft Computing, S.N. Sivanandan & S.N. Deepa, Wiley India Edition,2010.

ARTIFICIAL INTELLIGENCE

Module 1 **12Hrs**

What is Artificial Intelligence? AI Technique, Level of the Model,Problem Spaces, and Search: Defining the Problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs.Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis,**Knowledge Representation:** Representations and Mappings, Approaches to Knowledge Representation, **Using Predicate Logic**: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural Deduction.**Using Rules**: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.**Symbolic Reasoning Under Uncertainty**: Introduction to Nonmonotonic Reasoning, Logics for Nonmonotonic Reasoning, Implementation Issues, Augmenting a Problem-solver, Depth-first Search, Breadth-first Search.**Weak and Strong Slot-and-Filler Structures**: Semantic Nets, Frames, Conceptual DependencyScripts, CYC.

Module 2 **10Hrs**

Game Playing: The Minimax Search Procedure, Adding Alpha-beta Cutoffs, Iterative Deepening.**Planning**: The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical PlanningOther Planning Techniques.**Understanding**: What is Understanding, What Makes Understanding Hard?, Understanding as Constraint Satisfaction.**Natural Language Processing**: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking.

Module 3 **8Hrs**

Learning: Rote Learning, Learning by Taking Advice, Learning in Problem-solving, Learning from Examples: Induction, Explanation-based Learning, Discovery, Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning. **Expert Systems**: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Text Book:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009

References:

1. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010
2. S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

PROGRAMMING IN JAVA

Module – I **12 Hrs**

Introduction to Java and Java programming Environment. Object Oriented Programming.
Fundamental Programming Structure: Data Types, variable, Typecasting Arrays, Operators and their precedence.
Control Flow: Java's Selection statements (if, switch, iteration, statement, while, do-while, for, Nested loop).
Concept of Objects and Classes, Using Exiting Classes building your own classes, constructor overloading, static , final, this keyword .
Inheritance: Using Super to Call Super class constructor, Method overriding, Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance. The Object Class.
Packages & Interfaces : Packages, Access Protection, Importing package, Interface, Implementing Interfaces, variables in Interfaces, Interfaces can be extended.
Exception Handling: Fundamentals, Types Checked , Unchecked exceptions, Using try & catch, Multiple catch, throw , throws, finally, Java's Built in exceptions, user defined exception.

Module - II **12 Hrs**
Multi Threading: Java Thread Model, Thread Priorities, Synchronization, Creating a thread, Creating Multiple threads, Using isAlive ( ) and join ( ), wait () & notify ( ).
String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string.
Java I/O: Classes & Interfaces, Stream classes, Byte streams, Character streams, Serialization.
JDBC: Fundamentals, Type I, Type II, Type III, Type IV drivers.
Networking: Basics, Socket overview, Networking classes, & interfaces, TCP/IP client sockets, whois, URL format, URL connection, TCP/IP Server Sockets.

Module - III **12 Hrs**
Applets: Basics, Architecture, Skeleton, The HTML APPLET Tag, Passing Parameters to Applets, Applet context and show documents ().
Event Handing: Delegation Event model, Event Classes, Event Listener Interfaces, Adapter classes.
AWT: AWT Classes window fundamentals, component, container, panel, Window, Frame , Canvas, Creating a frame window in an Applet , working with Graphics , Control Fundamentals , Layout managers, Handling Events by Extending AWT components.
Core java API package, reflection, Remote method Invocation (RMI)
Swing: J applet, Icons & Labels, Text fields, Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees, Tables.
Exploring Java-lang: Simple type wrappers, Runtime memory management, object (using clone () and the cloneable Interface), Thread, Thread Group, Runnable.

Text Books:

1. Introduction to Java Programming: Liang, Pearson Education, 7th Edition.
2. Java The complete reference: Herbert Schildt, TMH, 5th Edition.

Reference Books:

1. Balguruswamy, Programming with JAVA, TMH.
2. Programming with Java*:* Bhave &. Patekar, Pearson Education.
3. Big Java: Horstman, Willey India, 2nd Edition.
4. Java Programming Advanced Topics: Wigglesworth, Cengage Learning.

5. Java How to Program: H.M. Deitel & Paul J. Deitel, PHI, 8th Edition

VLSI DESIGN LABORATORY

1. Design Entry and simulation of combinational logic circuits (8 bit adders, 4 bit multipliers, address decoders, multiplexers), Test bench creation, functional verification, and concepts of concurrent and sequential execution to be highlighted.
2. Design Entry and simulation of sequential logic circuits (counters, PRBS generators, accumulators). Test bench creation, functional verification, and concepts of concurrent and sequential execution to be highlighted.
3. Synthesis, P&R and Post P&R simulation for all the blocks/codes developed in Expt. No. 1 and No. 2 given above. Concepts of FPGA floor plan, critical path, design gate count, I/O configuration and pin assignment to be taught in this experiment.
4. Generation of configuration/fuse files for all the blocks/codes developed as part of Expt.1. and Expt. 2. FPGA devices must be configured and hardware tested for the blocks/codes developed as part of Expt. 1. and Expt. 2. The correctness of the inputs and outputs for each of the blocks must be demonstrated at least on oscilloscopes (logic analyzer preferred).
5. Design a schematic and simple layout for CMOS Inverter, parasitic extraction and simulation.
6. Design a schematic and simple layout for CMOS NAND gate, parasitic extraction and simulation.
7. Design a schematic and simple layout for CMOS NOR gate, parasitic extraction and simulation.
8. Design an ALU or a 4-bit Microprocessor with limited instructions.

SIGNAL PROCESSING LAB

1. Familiarization with the architecture of a standard DSP kit (Preferably TMS 320C6XXX DSP kit of Texas Instruments)
2. Generation of various types of waveforms (sine, cosine, square, triangular etc.) using MATLAB and DSP kit.
3. Linear convolution of sequences (without using the inbuilt conv. function in MATLAB) and verification of linear convolution using DSP kit.
4. Circular convolution of two sequences and comparison of the result with the result obtained from linear convolution using MATLAB and DSP kit.
5. (i) Computation of autocorrelation of a sequence, cross correlation of two sequences using MATLAB.
   (ii) Computation of the power spectral density of a sequence using MATLAB also implementing the same in a DSP kit.
6. Finding the convolution of a periodic sequence using DFT and IDFT in MATLAB.
7. (i) Implementation of FFT algorithm by decimation in time and decimation in frequency using MATLAB.
   (ii) Finding the FFT of a given 1-D signal using DSP kit and plotting the same.
8. Design and implementation of FIR (lowpass and highpass) Filters using windowing techniques (rectangular window, triangular window and Kaiser window) in MATLAB and DSP kit.
9. Design and implementation of IIR (lowpass and highpass) Filters (Butterworth and Chebyshev) in MATLAB and DSP kit.
10. (i) Convolution of long duration sequences using overlap add, overlap XXXXX using MATLAB.
    (ii) Implementation of noise cancellation using adaptive filters on a DSP kit.

Reference Books:

1. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.

2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage Learning.

TRANSDUCERS & INSTRUMENATION LAB

List of Experiment :
(Any five)

1. Study of a dc motor driven position control system
2. Study of speed torque characteristics of two phase ac servomotor and determination of its transfer function
3. Obtain the frequency response of a lag and lead compensator
4. To observe the time response of a second order process with P, PI and PID control and apply PID control to servomotor
5. To determine the transfer function of a system(network) using transfer function analyser.
6. To study and validate the controllers for a temperature control system
7. To study the position control system using Synchros

(Any five)

1. Measurement of unknown resistance, inductance and capacitance using bridges
2. To plot the displacement-voltage characteristics of the given LVDT
3. Measurement of temperature-voltage characteristics of J-type thermocouple
4. Use a strain gauge to plot the curve between strain applied to a beam and the output voltage
5. Study of resistance-voltage characteristics of Thermistors
6. To study on the interface of PLC with PC for data acquisition applications
7. Measurement of speed by using magnetic pick up

8th Semester

MEDICAL IMAGING TECHNIQUES (3-0-0)

Module I (15 Hours)

X-Ray Machines:

Basis of Diagnostic Radiology, Nature of X-rays, Properties of X-rays, Units of X-radiation, Production of X-rays : stationary anode tube & rotating anode tube.

X-Ray Machine: High Voltage Generation, High frequency Generator, High Tension Cable, Collimators & Grids, Exposure Time Systems, and Automatic Control.

Visualization of X-rays & Digital Radiography:

X-ray Films, X-ray Image Intensifier Television System, Dental X-ray machines, portable & mobile X-ray units, Digital Radiography, Flat Panel detector for Digital Radiography.

Module II (15 Hours)

Ultrasonic Imaging System: Physics of Ultrasonic waves, generation & detection of ultrasound, basic pulse-echo apparatus, brief description of different modes of scans like A-scan, M-mode, B-scan with its applications in medicine.

Computed Tomography Machine (CT):

Basic Principle of CT, System components: scanning system, Detector, Processing system, Viewing system, storing & documentation, Gantry geometry, Patient dose in CT Scan & Advantages of CT Scanning.

Module III (10 Hours)

MRI Machine & Gamma Camera:

Principles of NMR Imaging System, Basic NMR Components – Block Diagram Description, Advantages of NMR Imaging, The Gamma Camera – Block Diagram Description. Study of Working Principle of Emission CT, SPECT & PET scanners and Introduction to recent developments like Infrared Imaging, Ophthalmic Imaging, and Double headed CT & PET scanner.

Text Book:

Hand Book of Biomedical Instrumentation – 2nd Ed, R.S. Khandpur, Tata McGraw Hill- 2003.

Reference Books:

1) Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR & JOHN.M.BROWN (Pearson education publication)

(2) Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications

(3) Leslie. Cromwell – Biomedical instrumentation & measurements, 2e PHI

(4) Dr. M. Arumugam – Biomedical instrumentations, Anuradha Publishers

Professional Elective – IV

MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)

Module-I 14 Lectures

Overview of MEMS and Microsystems. (Chapter 1 of Text Book 1)

Micromachining Techniques: Silicon as material for micromachining, Photolithography, thin film deposition, doping, wet and dry etching, surface and bulk micromachining, Wafer bonding, packaging. (Chapter 3 and Section 8.2 of Text Book 1, Chapter 2 of Text Book 2)

Module II 10 lectures

Microsystem Modeling and Design: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. (Section 4.1 to 4.3 and 6.2.2 of Text Book 1, Section 3.4 of Text Book 2)

Module III 15 Lectures

MEMS Applications: Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Piezoelectric actuators. (Section 8.3 of Text Book 1 and Section 5.3 and 5.11 of Text Book 2)

Optical: Micro-lens, Micro-mirror, Optical switch (Section 7.5 to 7.7 of Text Book 2)

Radio frequency MEMS: Inductor, Varactor, Filter, Resonator. (Section 9.3 to 9.7 of Text Book 2)

Microfluidics: Capillary action, Micropumping, Electrowetting, Lab-on-a-chip. (Section 10.1 to 10.8 of Text Book 2)

Text Books:

1. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi, 2010.
2. N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi, 2007.

Reference Book:

1. T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.

EMBEDDED SYSTEMS

MODULE – I **10 Hours**

Embedded System: Understanding the Basic Concepts:

Introduction to Embedded System: Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems, 'Smart' running shoes from Adidas – The Innovative bonding of Life Style with Embedded Technology.

The Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components, PCB and Passive Components.

Characteristics and Quality Attributes of Embedded System: Characteristics of Embedded System, Quality Attributes of Embedded System.

Embedded Systems – Application and Domain Specific: Washing Machine – Application Specific Embedded System, Automotive – Domain Specific Example for Embedded System.

Hardware Software Co-Design and Program Modeling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language (UML), Hardware Software Trade-offs.

MODULE – II **12 Hours**

Design and Development of Embedded Product:

Embedded Hardware Design and Development: Analog Electronic Components, Digital Electronic Components, VLSI and Integrated Circuit Design, Electronic Design Automation (EDA) Tools.

Embedded Firmware Design and Development: Embedded firmware Design Approaches, Embedded firmware Development Languages, Programming in Embedded 'C'.

Real Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronisation, Device Drivers, How to choose an RTOS.

MODULE – III **14 Hours**

Design and Development of Embedded Systems:

An Introduction to Embedded System Design with VxWorks and MicroC/OS-II (μCOS-II) RTOS: VxWorks, MicroC/OS-II (μCOS-II).

Integration and Testing of Embedded Hardware and Firmware: Integration of Hardware & Firmware, Board Power up.

The Embedded System Development Environment: Integrated Development Environment (IDE), Types of files generated on cross-compilation, Disassembler/Decompiler, Simulators, Emulators & Debugging, Target Hardware Debugging, Boundary Scan.

Product Enclosure Design & Development: Product Enclosure Design Tools, Product Enclosure Development Techniques.

Embedded Product Development Life Cycle (EDLC): Definition and Objectives of EDLC, Different Phases of EDLC, EDLC Approaches (Modeling the EDLC).

Trends in the Embedded Industry: Processor Trends in Embedded System, Embedded OS Trends, Development Language Trends, Open standards, Frameworks and Alliances, Bottlenecks.

Text Book:

1. Shibu K.V., *Introduction to Embedded Systems*, TMH Private Limited, New Delhi, 2009.

Reference Book:

1. Peter Marwedel, *Embedded System Design*, Springer, 2006 http://ls12-www.cs.uni-dortmund.de/~marwedel/kluwer-es-book/
2. Wayne Wolf, *Computers as Components*, Morgan Kaufmann, 2001 http://www.ee.princeton.edu/~wolf/embedded-book
3. G. De Micheli, Rolf Ernst and Wayne Wolf, eds, Readings in Hardware/Software Co-Design, Morgan Kaufmann, Systems-on-Silicon Series Embedded
4. Frank Vahid and Tony D. Givargis, System Design: A Unified Hardware/Software Introduction, Addison Wesley, 2002.
5. Michael Barr, Programming Embedded Systems in C and C++, O'Reilly, 1999.

6. David E. Simon, An Embedded Software Primer, Addison Wesley, 1999.
7. Jack Ganssle, The Art of Designing Embedded Systems, Newnes, 2000.
8. K. Short, *Embedded Microprocessor System Design*, Prentice Hall, 1998.
9. C. Baron, J. Geffroy and G. Motet, *Embedded System Applications*, Kluwer, 1997.
10. Raj Kamal, *Embedded Systems – Architecture, Programming and Design*, Tata McGraw Hill Publishing Company Limited, New Delhi,

VIRTUAL INSTRUMENTATION

MODULE: I 10 hours

Introduction to Virtual Instrumentation: Computers in instrumentation, What is Virtual instrumentation (VI), History of VI, LabVIEW and VI, Conventional and graphical programming, Distributed systems.

Basics of LabVIEW: Components of LabVIEW, Owned and free labels, Tools and other palettes, Arranging objects, pop-up menu, Colour coding, Code debugging, Context sensitive help, Creating sub-Vis.

FOR and WHILE Loops: The FOR loop, The WHILE loop, Additional loop problem, Loop behaviour and interloop communication, Local variables, Global variables, Shift registers, Feedback, Autoindexing, Loop timong, Timed loop.

Other Structures: Sequence structures, Case structures, Formula node, Event structure.

Arrays and Clusters: Arrays, Clusters, inter-conversion of arrays and clusters.

MODULE: II 10 hours

Graphs and Charts: Waveform chart, Resetting plots, Waveform graph, Use of cursors, X-Y graph.

State Machines: What is a state machine? A simple state machine, Event structures, The full state machine, Notes and comments.

File Input/Output: File formats, File I/O functions, Path functions, Sample VIs to demonstrate file WRITE and READ, Generatinf file names automatically.

String Handling: String functions, LabVIEW string formats, Examples, Some more functions, Parsing of strings.

MODULE: III 16 hours

Basics of Data Acquisition: Classification of signals, Read-world signals, Analog interfacing, Connecting the signal to the board, Guidelines, Practical versus ideal interfacing, Bridge signal sources.

Data Acquisition with LabVIEW DAQmx and DAQ Vis: Measurement and automation explorer, The waveform data type, Working in DAQmx, Working in NI-DAQ (Legacy DAQ), Use of simple VIs, Intermediate VIs.

Interfacing with Assistants: DAQ assistant, Analysis assistant, Instrument assistant.

Interfacing Instruments: GPIB and RS232: RS232C versus GPIB, Handshaking, GPIB interfacing, RS232C/RS485 interfacing, Standard commands for programmable instruments, VISA, Instrument interfacing and LabVIEW.

Textbooks:

1. Sanjay Gupta and Joseph John, ***Virtual Instrumentation Using LabVIEW***, 2nd Edn., Tata McGraw-Hill, 2010, **ISBN-10:** 0-07-070028**-1**, **ISBN-13:** 978-0-07-070028-4.

Reference Books:

1. J.S.R. Jang, C.T. Sun, E. Mizutani, ***Neuro Fuzzy and Soft Computing***, PHI Pvt. Ltd, New Delhi.
2. F.M. Ham and I. Kostanic, ***Principles of Neuro Computing for Science and Engineering***, Tata McGraw Hill, New Delhi.
3. V.keeman, ***Learning and Soft Computing***, Pearson Education, New Delhi.
4. Jerome Jovitha, ***Virtual Instrumentation Using Labview***, PHI Learning,, 2010, **ISBN-10:** 8120340302, **ISBN-13:** 9788120340305, 978-8120340305.
5. Gary W. Johnson and Richard Jeninngs, ***LabVIEW Graphical Programming***, 4th Edn., McGrawHill, 2006.
6. J. Travis and J. Kring, ***LabVIEW for Everyone***, 3rd Edn., Prentice Hall, 2006.
7. Peter A. Blume, ***The LabVIEW Style Book***, Prentice Hall, 2007.

Free Elective – IV

DIGITAL IMAGE PROCESSING

Module: 1(12 hours)

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels, Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening (Chapt: 2 & 3 of Text book 1)

Module: 2(12 hours)

Filtering in the Frequency Domain: preliminary concepts, 2D DFT and its properties, basic filtering in the frequency domain, image smoothing and sharpening (Chapt: 4 of Text book 1)

Image Restoration and Reconstruction: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function (Chapt: 5 of Text Book 1)

Module: 3(12 hours)

Color Image Processing: color models, Color transformation (Chapt: 6 of Text book 1)

Wavelets and Multi-resolution Processing: multiresolution expansions, wavelet transforms in one and two dimension (Chapt: 7 of Text book 1)

Image Compression: Fundamentals, Some basic compression methods (Chapt: 8 of Text book 1)

Morphological Image Processing: Erosion and Dilation, opening and closing (Chapt: 9 of Text book 1)

Text Books:

1. R.C. Gonzalez, R.E. Woods, *Digital Image Processing*, 3rd Edition, Pearson Education
2. R C Gonzalez, Woods and Eddins, *Digital Image Processing using Matlab*, 2nd Edition, Tata McGraw Hill

Reference Books:

1. S.Sridhar, *Digital Image Processing*, Oxford University Press, 2011

ANALOG VLSI DESIGN

Module – I **10 Hours**

Introduction to Analog Design: General Concepts, Levels of Abstraction, Robust Analog Design

Single-Stage Amplifiers: Basic Concepts, Common-Source Stage, Common-Source Stage with Resistive Load, CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, Folded Cascode.

Differential Amplifiers: Single-Ended and Differential Operation, Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell. (Chapters 1, 3 and 4 of Text Book)

Module – II **12 Hours**

Passive and Active Current Mirrors: Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties.

Bandgap References: General Considerations, Supply-Independent Biasing, Temperature-Independent References, Negative-TC Voltage, Positive-TC Voltage, Bandgap Reference.

Operational Amplifiers: General Considerations, Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps, Gain Boosting, Comparison, Common-Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection. (Chapters 5, 11 and 9 of Text Book)

Module – III **14 Hours**

Frequency Response of Amplifiers: General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair.

Feedback: General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect of Loading, Two-Port Network Models, Loading in Voltage-Voltage Feedback, Loading in Current-Voltage Feedback, Loading in Voltage-Current Feedback, Loading in Current-Current Feedback, Summary of Loading Effects, Effect of Feedback on Noise.

Oscillators: General Considerations, Ring Oscillators, LC Oscillators, Crossed-Coupled Oscillator, Colpitts Oscillator, One-Port Oscillators, Voltage-Controlled Oscillators, Tuning in Ring Oscillators, Tuning in LC Oscillators, Mathematical Model of VCOs.

(Chapters 6, 8 and 14 of Text Book)

Text Books:

1. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, Tata McGraw-Hill Publishing Company Limited, 2002.

Reference Books:

1. P. Gray, P. Hurst, S. Lewis, and R. Meyer, *Analysis and Design of Analog Integrated Circuits*, 4th Edition, John Wiley, 2001.
2. Behzad Razavi, *Fundamentals of Microelectronics*, 1st Edition, John Wiley, 2008.

3. D. Holberg and P. Allen, *CMOS Analog Circuit Design*, Oxford University Press, 2002.
4. D. Johns and K. Martin, *Analog Integrated Circuit Design*, John Wiley, 1997.
5. K.R. Laker and W.M.C. Sansen, *Design of Analog Integrated Circuits and Systems*, McGraw-Hill, Inc., 1994.
6. A. Sedra and K.C. Smith, *Microelectronic Circuits*, 5th Edition, Oxford University Press, 2004.

INTERNET TECHNOLOGY AND APPLICATIONS

Module – I **(12 Hour)**

The Internet and WWW

Understanding the WWW and the Internet, Emergence of Web, Web Servers, Web Browsers, Protocols, Building Web Sites

HTML

Planning for designing Web pages, Model and structure for a Website, Developing Websites, Basic HTML using images links, Lists, Tables and Forms, Frames for designing a good interactive website

Module – II **(12 Hour)**

JAVA Script

Programming Fundamentals, Statements, Expressions, Operators, Popup Boxes, Control Statements, Try…. Catch Statement, Throw Statement, Objects of Javascript: Date object, array object, Boolean object, math object

CSS

External Style Sheets, Internal Style Sheets, Inline Style, The class selector, div & span tag

DOM

HTML DOM, inner HTML, Dynamic HTML (DHTML), DHTML form, XML DOM

Module – III **(12 Hour)**

CGI/PERL

Introduction to CGI, Testing & Debugging Perl CGI Script, Using Scalar variables and operators in Perl

Java Applet

Introduction to Java, Writing Java Applets, Life cycle of applet

Textbooks

1. Web Warrior Guide to Web Design Technologies, Don Gosselin, Joel Sklar & others, Cengage Learning

Reference Books

1. Web Programming: Building Internet Applications, Chris Bates, Wiley Dreamtech
2. Programming the World Wide Web, Robert W Sebesta, Pearson
3. Web Technologies, Uttam K Roy, Oxford
4. Web Technology: A developer perspective, Gopalan & Akilandeswari, PHI

Free Elective – V

ALGORITHMS FOR BIOINFORMATICS

Module 1 **8Hrs**

Introduction, Algorithms and Complexity: Biological Algorithms versus Computer Algorithms, Notations, Algorithm Design Techniques, Tractable versus Intractable Problems.
Molecular Biology Primer: Genes, Molecules, Structure of DNA, Proteins, Analysis. **Exhaustive Search**: Restriction Mapping, Impractical Restriction Mapping Algorithms, A Practical Restriction Mapping Algorithm, Regulatory Motifs in DNA Sequences, Profiles, The Motif Finding Problem, Search Trees, Finding Motifs, Finding a Median String.

Module 2 **8Hrs**

Greedy Algorithms: Genome Rearrangements, Sorting by Reversals, Approximation Algorithms, Breakpoints: A Different Face of Greed, A Greedy Approach to Motif Finding. **Dynamic Programming Algorithms**: The Power of DNA Sequence Comparison, The Change Problem Revisited, The Manhattan Tourist Problem, Edit Distance and Alignments, Longest Common Subsequences, Global Sequence Alignment, Scoring Alignments, Local Sequence Alignment, Alignment with Gap Penalties, Multiple Alignment, Gene Prediction, Statistical Approaches to Gene Prediction, Similarity-Based Approaches to Gene Prediction, Spliced Alignment. **Divide-and-Conquer Algorithms**: Divide-and-Conquer Approach to Sorting, Space-Efficient Sequence Alignment, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Subquadratic Time.

Module 3: **10Hrs**

Graph Algorithms: Graphs and Genetics, DNA Sequencing, Shortest Superstring Problem, DNA Arrays as an Alternative Sequencing Technique, Sequencing by Hybridization, SBH as a Hamiltonian Path Problem, SBH as an Eulerian Path Problem, Fragment Assembly in DNA Sequencing, Protein Sequencing and Identification, The Peptide Sequencing Problem, Spectrum Graphs, Protein Identification via Database Search, Spectral Convolution, Spectral Alignment.
Combinatorial Pattern Matching: Repeat Finding, Hash Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, Heuristic Similarity Search Algorithms, Approximate Pattern Matching, BLAST: Comparing a Sequence against a Database.

Text Book: No Indian Print is available.

References:

1) Neil C. Jones and Pavel A. Pevzner, An Introduction to Bioinformatics Algorithms, MIT Press, 2004.
2) Bioinformatics Algorithms, Techniques & Applications – Wiley Inter Science
3) Wing-Kin Sung, "Algorithms in Bioinformatics: A Practical Introduction", CRC Press (Taylor & Francis Group), 2009.
4) Ion Mandoiu, Alexander Zelikovsky, Bioinformatics Algorithms: Techniques and Applications Wiley, 2008.

WIRELESS SENSOR NETWORK

Unit I **8Hrs**

Sensor Network Concept: Introduction, Networked wireless sensor devices, Advantages of Sensor networks, Applications, Key design challenges.

Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

Unit II **8Hrs**

Localization and Tracking: Issues and approaches, Problem formulations: Sensing model, collaborative localization. Coarse-grained and Fine-grained node localization. Tracking multiple objects: State space decomposition.

Synchronization: Issues and Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

Unit III **14Hrs**

Wireless Communications: Link quality, shadowing and fading effects

Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.

Routing: Metric-based approaches, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing.

Sensor network Databases: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, the database perspective on sensor networks.

Security: Privacy issues, Attacks and countermeasures.

Text Books:

1. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.

References Books:

1. Networking Wireless Sensors: Bhaskar Krismachari, Cambridge University Press
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati , Springer.
3. Wireless Sensor Networks: Technology, Protocols, and Applications: Kazem Sohraby, Daniel Minoli, Taieb Znati , Wiley Inter Science.

MULTIMEDIA SYSTEMS

Module – I (10 hours)

Definition and Main properties of Multimedia System, Traditional Data streams characteristics, Characteristics of continuous media data based on time, space and continuity.
Sound/Audio: Basic sound concepts, MIDI devices and MIDI messages. Image: Digital image representation, Image Format, Graphics format, Computer Image Processing: Image Synthesis, Image Analysis and Image Transmission. Video: Video Signal Representation, Computer Video format, Television

Module –II (12 hours)

Data Compression: Source, Entropy and Hybrid Encoding, Some basic compression techniques, JPEG, MPEG, H.261, DVI.
Multimedia Operating Systems: Process Management-Realtime Scheduling System Model, Rate Monotonic & Earliest Deadline First Algorithm, Process Utilization, Multimedia File System Paradigm, Disk Scheduling.
Multimedia Communication Systems: Application Subsystem, Transport Subsystem, QOS and Resource Management.
Synchronization: Notion of Synchronization, Presentation Requirements, Reference model for Multimedia Synchronization, Synchronization Specification.

Module –III (10 hours)

Multimedia Authoring Tools, Multimedia Systems Frameworks: Multimedia Information System: Multimedia Information Model and Multimedia Distributed Processing Model. Multimedia Communication System: Multimedia Conferencing Model and Multimedia Network Model. QOS layer Architecture, Distributed Multimedia Systems: Features of Distributed Multimedia System, Types of Distributed Multimedia Application, QOS in Distributed Multimedia System.

Textbook

1) Multimedia: Computing, Communications & Applications, Ralf Steinmetz and Klara Nahrstedt, Pearson Education.
2) Multimedia Systems, P.K.Buford, Pearson Education

Reference Books

1) Fundamentals of Multimedia- Ze Nian and Mark S Drew (PHI)

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