G.B. TECHNICAL UNIVERSITY
LUCKNOW

Syllabus

B.TECH. BIOMEDICAL ENGINEERING

(Effective from Session 2011-12)

G.B. TECHNICAL UNIVERSITY, LUCKNOW
SYLLABUS & EVALUATION SCHEME FOR BIOMEDICAL ENGINEERING
(B.Tech. Course)
Year II, Semester III

S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EHU-301/ EHU-302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
2.	EAS-301/ EOE-031-EOE-038	Mathematics III/ Science based open Elective**	3	1	0	30	20	50	100	150	4
3.	EEC-301	Fundamentals of Electronics Devices	3	1	0	30	20	50	100	150	4
4.	EEC-302	Digital Electronics	3	1	0	30	20	50	100	150	4
5.	EEC-303	Electromagnetic Field Theory	3	1	0	30	20	50	100	150	4
6.	EEC-304	Fundamentals of Network Analysis & Synthesis	3	1	0	30	20	50	100	150	4
7.	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
8	EEC-351	Electronics Engineering Lab I	0	0	2	--	20	20	30	50	1
9.	EEC-352	Digital Electronics Lab-I	0	0	2	--	20	20	30	50	1
10.	EEC-353	PCB & Electronics Workshop	0	0	2	--	10	10	15	25	1
11.	GP-301	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	17	5	6	165	160	375	625	1000	26

* Human Values & Professional Ethics will be offered as compulsory Audit Course for which passing marks are 40% in theory & 50% in aggregate. Students will be required to audit it within the period of their study. There will not be carry over facility for this course and a failure student will be required to repeat this course.

****Science based open Elective**

EOE031/EOE041 Introduction to soft computing (Neural network, Fuzzy logic and Genetic algorithm)
EOE032/EOE042 Nano-sciences
EOE033/EOE043 Laser systems and applications
EOE034/EOE044 Space sciences
EOE035/EOE045 Polymer science and technology
EOE036/EOE046 Nuclear science
EOE037/EOE047 Material science
EOE038/EOE048 Discrete Mathematics

G.B. TECHNICAL UNIVERSITY, LUCKNOW
SYLLABUS & EVALUATION SCHEME FOR BIOMEDICAL ENGINEERING
(B.Tech. Course)
Year II, Semester IV

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.					
			L	T	P	CT	TA	Total	ESE		
THEORY SUBJECTS											
1.	EHU-402/ EHU-401	Industrial Sociology/Industrial Psychology	2	0	0	15	10	25	50	75	2
2.	EOE-041-EOE-048/ EAS-401	Science based open Elective**/ Mathematics III	3	1	0	30	20	50	100	150	4
3.	EEC-401	Electronic Circuits	3	1	0	30	20	50	100	150	4
4.	EBM-401	Human Anatomy & Physiology	3	1	0	30	20	50	100	150	4
5.	EEC-403	Electronic Instrumentation and Measurements	3	1	0	30	20	50	100	150	4
6.	EEC-404	Signals and Systems	3	1	0	30	20	50	100	150	4
7.	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
8.	EEC-451	Electronics Engineering lab II	0	0	2	--	20	20	30	50	1
9.	EBM-451	Anatomy & Physiology Lab	0	0	2	--	20	20	30	50	1
10	EEC-453	Measurement lab	0	0	2	--	10	10	15	25	1
11.	GP-401	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**17**	**5**	**6**	**165**	**160**	**375**	**625**	**1000**	**26**

****Science based open Elective**

EOE031/EOE041 Introduction to soft computing (Neural network, Fuzzy logic and Genetic algorithm)
EOE032/EOE042 Nano-sciences
EOE033/EOE043 Laser systems and applications
EOE034/EOE044 Space sciences
EOE035/EOE045 Polymer science and technology
EOE036/EOE046 Nuclear science
EOE037/EOE047 Material science
EOE038/EOE048 Discrete Mathematics

G.B. TECHNICAL UNIVERSITY, LUCKNOW
SYLLABUS & EVALUATION SCHEME FOR BIOMEDICAL ENGINEERING
(B.Tech. Course)
Year III, Semester V

S.No.	Course Code	Subject	Periods			Evaluation Scheme					Credit
			L	T	P	Sessional			ESE	TOTAL	
						CT	TA	TOTAL			
THEORY											
1	EHU-501	Engineering & Managerial Economics	3	1	0	30	20	50	100	150	3
2	EIC-501	Control System-I	3	1	0	30	20	50	100	150	4
3	EBM-501	Bioinstrumentation	3	1	0	30	20	50	100	150	4
4	EEC-501	Integrated Circuit	3	1	0	30	20	50	100	150	4
5	EBM-502	Micro-Processor & its Applications	3	0	0	15	10	25	50	75	3
6	EBM-503	Human Anatomy & Physiology	3	0	0	15	10	25	50	75	3
PRACTICAL /TRAINING/PROJECTS											
7	EBM-551	Bioinstrumentation Lab	0	0	2	10	10	20	30	50	1
8	EBM-552	Linear Integrated Circuit Lab	0	0	2	10	10	20	30	50	1
9	EBM-553	Microprocessor Lab	0	0	2	10	10	20	30	50	1
10	EIC-551	Control System Lab	0	0	2	10	10	20	30	50	1
11	GP-501	General Proficiency	-	-	-	-	-	50	-	50	1
		TOTAL								1000	26

G.B. TECHNICAL UNIVERSITY, LUCKNOW
SYLLABUS & EVALUATION SCHEME FOR BIOMEDICAL ENGINEERING
(B.Tech. Course)
Year III, Semester VI

S.No.	Course Code	Subject	Periods			Evaluation Scheme					Credit
			L	T	P	Sessional			ESE	TOTAL	
						CT	TA	TOTAL			
THEORY											
1		Elective I	3	1	0	15	10	25	50	75	3
2	EBM-601	Physiological Control System & Simulation Modeling	3	1	0	30	20	50	100	150	4
3	EBM-602	Microcontroller & Biomedical Applications	3	1	0	30	20	50	100	150	4
4	EBM-603	Biomedical Signal Processing	3	1	0	30	20	50	100	150	4
5	EHU-601	Industrial Management	3	0	0	30	20	50	100	150	3
6	EBM-604	Biomaterials	3	0	0	15	10	25	50	75	3
PRACTICAL/TRAINING/PROJECTS											
7	EBM-651	PCSM Lab	0	0	2	10	10	20	30	50	1
8	EBM-652	Microcontroller & its Application Lab	0	0	2	10	10	20	30	50	1
9	EBM-653	Biomedical Signal Processing Lab	0	0	2	10	10	20	30	50	1
10	EBM-654	Seminar	0	0	2	10	10	20	30	50	1
11	GP-601	General Proficiency				-	-	50	-	50	1
		TOTAL								1000	26

Elective I

EBM-011 Laser & Fibre Optics & Its Medical Applications.
EBM-012 Bioelectricity
EBM-013 Biomechanics
EEC-013 Advanced Semiconductor Devices

G.B. TECHNICAL UNIVERSITY, LUCKNOW
SYLLABUS & EVALUATION SCHEME FOR BIOMEDICAL ENGINEERING
(B.Tech. Course)
Year IV, Semester VII

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.					
			L	T	P	CT	TA	Total	ESE		
THEORY SUBJECTS											
1		Open Elective	3	1	0	30	20	50	100	150	4
2		Elective II	3	1	0	30	20	50	100	150	4
3	EBM-701	Biomedical Image Processing	3	1	0	30	20	50	100	150	4
4	EBM-702	Hospital Management System	3	1	0	30	20	50	100	150	4
5	EBM-703	Biotransport Phenomena	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
6	EBM-751	Biomedical Image Processing Lab	0	0	2	--	20	20	30	50	1
7	EBM-752	Medical System Lab	0	0	2	--	20	20	30	50	1
8	EBM-753	Industrial/Hospital Training	0	0	2	--	--	50	--	50	1
10	EBM-754	Project	0	0	2	--	--	50	--	50	1
11	GP-701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total								**1000**	**25**

Elective II

1. EBM-021 Bioinformatics
2. EBM-022 Artificial Organs & Rehabilitation Engineering
3. EBM-023 Therapeutic Equipments
4. EBM-024 Biomaterials

G.B. TECHNICAL UNIVERSITY, LUCKNOW
SYLLABUS & EVALUATION SCHEME FOR BIOMEDICAL ENGINEERING
(B.Tech. Course)
Year IV, Semester VIII

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.					
			L	T	P	CT	TA	Total	ESE		
THEORY SUBJECTS											
1		Elective III	3	1	0	30	20	50	100	150	4
2	EBM-801	Communication Engineering	3	1	0	30	20	50	100	150	4
3	EBM-802	Telemedicine	3	1	0	30	20	50	100	150	4
4	EBM-803	Artificial Intelligence & its Applications in Biomedical Engineering	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
5	EBM-851	Project	0	0	12	--	--	100	250	350	8
6	GP-801	General Proficiency	-	-	-	-	-	50	-	50	1
		Total								**1000**	**25**

Elective III

1. EBM-031 Advanced Biomedical Instrumentation
2. EBM-032 Tissue Engineering
3. EBM-033 Principles of Radio Diagnosis and Radio Therapy
4. EBM-034 Design and Modelling of Biomedical Systems

SEMESTER - III

EEC 301 FUNDAMENTALS OF ELECTRONICS DEVICES			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Crystal Properties and charge Carriers in Semiconductors: Elemental and compound semiconductor materials, crystal lattice structure, Bonding forces and energy bands in solids, charge carriers in semiconductors, carrier concentrations, drift of carriers in electric and magnetic fields.	1.1 to 1.2 3.1 to 3.4	8
II	Excess Carriers in Semiconductors: Optical absorption, luminescence, carrier life time and photo conductivity, diffusion of carriers.	4.1 to 4.3 and 4.4.1 to 4.4.4	8
III	Junction Properties: Equilibrium conditions, biased junctions, steady state conditions, reverse bias break down, transient and AC conditions. Metal semiconductor junctions.	5.2 to 5.5 5.7	10
IV	Transistors: Metal-semiconductor-field-effect-transistors (MESFET), Metal-insulator-semiconductor-field-effect-transistors (MISFET), Metal oxide semiconductor field effect transistor (MOSFET): Construction, Operation and characteristics of above devices. Bipolar junction transistors: Fundamentals of BJT operation, amplification with BJTs,	6.3.1 to 6.3.2, 6.4.1 to 6.4.2, 6.5.1 to 6.5.2 7.1 to 7.2	6
V	Some special devices: Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, light emitting materials. Tunnel Diode: degenerate semiconductors, IMPATT diode; The transferred electron mechanism: The GUNN diode. P-N-P-N diode, semiconductor controlled rectifier (SCR), bilateral devices: DIAC, TRIAC, IGBT.	8.1, 8.2.1, 8.2.3, 8.3, 8.4; 10.1 10.2 10.3.1, 10.3.2 11.1 to 11.3	8
Text Book: B. G. Streetman and S. Banerjee "Solid state electronics devices", 5th Edition, PHI.			
Reference Books:1. Alok Dutta, "Semiconductor Devices and circuits", Oxford University Press. 2. Donald A Neaman, "Semiconductor Physics and Devices Basic Principles" 3rd Ed. TMH			

EEC 302 DIGITAL ELECTRONICS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Digital system and binary numbers: Signed binary numbers, binary codes, cyclic codes, error detecting and correcting codes, hamming codes. Floating point representation Gate-level minimization: The map method up to five variable, don't care conditions, POS simplification, NAND and NOR implementation, Quine Mc-Clusky method (Tabular method).	1.6, 1.7, 7.4 3.1 to 3.7, 3.10	8
II	Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers	4.1 to 4.11	8
III	Synchronous Sequential logic: Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure. Registers and counters: Shift registers, ripple counter, synchronous counter, other counters.	5.1 to 5.5, 5.7 to 5.8 6.1 to 6.5	8
IV	Memory and programmable logic: RAM, ROM, PLA, PAL. Design at the register transfer level: ASMs, design example, design with multiplexers.	7.1 to 7.3, 7.5 to 7.7 8.4, 8.5, 8.10	8
V	Asynchronous sequential logic: Analysis procedure, circuit with latches, design procedure, reduction of state and flow table, race free state assignment, hazards.	9.1 to 9.7	8
Text Book: M. Morris Mano and M. D. Ciletti, "Digital Design", 4th Edition, Pearson Education			
Reference Books: 1. Hill & Peterson, "Switching Circuit & Logic Design", Wiley.			

EEC 303 ELECTROMAGNETIC FIELD THEORY			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Coordinate systems and transformation: Cartesian coordinates, circular cylindrical coordinates, spherical coordinates Vector calculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stoke's theorem, Laplacian of a scalar.	2.1 to 2.4 3.1 to 3.8	6
II	Electrostatics: Electrostatic fields, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses's Law – Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields. Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation and relaxation time, boundary condition. Electrostatic boundary value problems: Poission's and Laplace's equations, general procedures for soling Poission's or Laplace's equations, resistance and capacitance, method of images.	to 4.9 5.1 to 5.6, 5.8, 5.9 6.1, 6.2, 6.4 to 6.6	10
III	Magnetostatics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential. Magnetic forces, materials and devices: Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials, magnetic boundary conditions, inductors and inductances, magnetic energy.	7.1 to 7.7 8.1 to 8.9	8
IV	Waves and applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, displacement current, Maxwell's equation in final form. Electromagnetic wave propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plain waves in good conductors, power and the pointing vector, reflection of a plain wave in a normal incidence.	9.1 to 9.5 10.1, 10.3 to 10.8	8
V	Transmission lines: Transmission line parameters, Transmission line equations, input impedance, standing wave ratio and power, The Smith chart, Some applications of transmission lines.	11.1 to 11.6	8
Text Book: M. N. O. Sadiku, "Elements of Electromagnetics", 4th Ed, Oxford University Press.			
Reference Books: W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th Ed., TMH.			

EEC 304 FUNDAMENTAL OF NETWORK ANALYSIS & SYNTHESIS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Signal analysis, complex frequency, network analysis, network synthesis General characteristics and descriptions of signals, step function and associated wave forms, The unit impulse Introduction to network analysis, network elements, initial and final conditions, step and impulse response, solution of network equations,	1.1 to 1.4 2.1 to 2.3 5.1 to 5.5	10
II	Review of Laplace transforms, poles and zeroes, initial and final value theorems, The transform circuit, Thevenin's and Norton's theorems, the system function, step and impulse responses, the convolution integral. Amplitude and phase responses. Network functions, relation between port parameters, transfer functions using two port parameters, interconnection of two ports.	7.1 to 7.5 8.1 9.1 to 9.4	8
III	Hurwitz polynomials, positive real functions. Properties of real immittance functions, synthesis of LC driving point immittances, properties of RC driving point impedances, synthesis of RC impedances or RL admittances, properties of RL impedances and RC admittances.	10.2,10.3 11.1 to 11.5	8
IV	Properties of transfer functions, zeroes of transmission, synthesis of Y_{21} and Z_{21} with 1Ω terminations.	12.1 to 12.3	6
V	Introduction to active network synthesis Active Network Synthesis	Material available on UPTU website & 8.7 (Text Book 2)	8

Text Book:

[1] Franklin F. Kuo, "Network Analysis and synthesis", 2nd Edition, Wiley India Pvt Ltd.

[2] Behrouz Peikari, "Fundamentals of Network Analysis & synthesis", Jaico Publishing House, 2006.

Reference Books: M. E. Van Valkenberg, "Network Analysis", 2nd Edition, Prentice Hall of India Ltd.

PRACTICAL

EEC 351 ELECTRONICS ENGINEERING LAB I

Objective: To attain expertise in lab equipment handling and understanding the basic devices, their properties, characteristics in detail. Along with their practical usage in the circuit

2. **Study of lab equipments and components:** CRO, Multimeter, Function Generator, Power supply-Active, Passive Components & Bread Board.
3. **P-N Junction Diode**: Characteristics of PN Junction diode-Static and dynamic resistance measurement from graph.
4. **Applications of PN junction diode**: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor-use of filter- ripple reduction (RC Filter)-Clipper & Clamper
5. **Properties of junctions** Zener diode characteristics. Heavy doping alters the reverse characteristics. Graphical measurement of forward and reverse resistance.
6. **Application of Zener diode:** Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.
7. **Characteristic of BJT**: BJT in CB and CE configuration- Graphical measurement of h parameters from input and output characteristics. Measurement of A_v, A_I, R_o and R_i of CE amplifier with potential divider biasing.
8. **Characteristic of FET**: FET in common source configuration. Graphical measurement of its parameters gm, rd & m from input and output characteristics.
9. **Characteristic** of silicon-controlled rectifier.
10. **To plot** V-I Characteristics of DIAC.
11. **To draw** V-I characteristics of TRIAC for different values of Gate Currents.

EEC 352 DIGITAL ELECTRONICS LAB

Objective: To understand the digital logic and create various systems by using these logics.

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of V_{cc} and ground, verification of the truth tables of logic gates using TTL ICs.
1. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
2. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
3. Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.
4. Implementation of 4x1 multiplexer using logic gates.
5. Implementation of 4-bit parallel adder using 7483 IC.
6. Design, and verify the 4-bit synchronous counter.
7. Design, and verify the 4-bit asynchronous counter.
8. Mini Project.

EEC 353 PCB & ELECTRONICS WORKSHOP

Objective: To create interest in Hardware Technology.

1. Winding shop: Step down transformer winding of less than 5VA.
2. Soldering shop: Fabrication of DC regulated power supply
3. PCB Lab: (a) Artwork & printing of a simple PCB.
   Etching & drilling of PCB.
4. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.
5. Testing of regulated power supply fabricated.
6. Fabricate and test the audio amplifier circuit by using above power supply

SEMESTER - IV

EEC 401 ELECTRONIC CIRCUITS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	**Operational Amplifier:** Inverting and non-inverting configurations, difference amplifier, Effect of finite open loop gain and bandwidth on circuit performance, Large signal operation of op-amp.	2.2 to 2.6	8
II	**MOSFET:** Review of device structure operation and V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier	4.3 to 4.9 and 4.11	8
III	**BJT:** Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier.	5.3 to 5.9	8
IV	**Differential Amplifier:** MOS differential pair, small signal operation of the MOS differential pair, BJT differential pair, other non-ideal characteristic of the Differential amplifier (DA), DA with active load.	7.1 to 7.5	9
V	**Feedback:** The general feed back structure, properties of negative feed back, the four basic feed back topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier. **Oscillators:** Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator.	8.1 to 8.6 13.1 to 13.3	4+3
Text Book: A. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, 5th Ed.			
Reference Books: **1.** Neamen D A, "Electronics Circuits", 3rd Ed TMH **2.** Jacob Millman and Arvin Grabel, "Microelectronics", 2nd Ed TMH			

EBM 401 HUMAN ANATOMY AND PHYSIOLOGY

Unit-I

Basic cell Structure, various cell organelles and their function. Tissue, their types, structure and functions. Structure and function of Skin. Different types of muscles and their function. General description of types of bones, Structure and function of bones. General description of types of joints, structure and function.

Unit-II

Blood, Lymph and Circulation: Blood composition, properties and function. Structure and functions of red blood cells, white blood cells and platelets. Blood types.
Hemostasis. Immune mechanisms. Lymph.

Heart position, structure and functions. Origin of heart beat and electrical activity of the heart Arteries, capillaries and veins- structure and functions. Cardiac and peripheral circulation. Blood pressure and its regulation. Blood flow and its regulation. Dynamics of lymph flow.

Unit-III

Respiratory system: Part of the system, position and function. Mechanics of respiration. Lung volumes and capacities. Gas transport between the Lungs and tissues. Regulation of respiration. Respiratory adjustments in health and diseases.

Digestive system: Different parts of the digestive system. Structure and functions of these organs. Digestion of protein, carbohydrates, fats, vitamins and minerals.

Unit-IV

Renal system: Parts of the renal system-kidney, ureter, urinary bladder and urethra. Structure and function of the system. Formation and composition of urine.

Endocrine system and Reproductive system: Elementary knowledge of structure and function of endocrine glands. Functions of male reproductive organs, female reproductive organs and contraception.

Unit-V

Nervous system and special senses: Basic structure and function of central nervous systems. Receptor, neuron, synapse and reflexes. Ventricles and Cerebrospinal fluid. Autonomic nervous system. Organs of vision, hearing, taste & smell. Mechanism of vision, color vision, mechanism of hearing, tests & hearing, Physiology of olfaction & smell.

Books:

1. Guyton A.C. and J.E. Hall, "Text book of Medical Physiology" Harcourt India Pvt. Ltd.
2. Essential of Anatomy & Physiology; Seeley, MGH
3. Human Physiology & Anatomy; Marieb, Adison Wesley
4. Principles of Anatomy & Physiology; Tortora, Wiley
5. Ganong W.F. "Review of Medical Physiology" Prentise-Hall

EEC 403 ELECTRONIC INSTRUMENTATION AND MEASUREMENTS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, Other unit systems, dimension and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter,	1.1 to 1.7 2.1 to 2.5 3.1 to 3.4	8
II	Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, multimeter probes Digital voltmeter systems, digital multimeters, digital frequency meter system	4.1, 4.2, 4.4, 4.5, 4.7 6.1 to 6.3	8
III	Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter	7.1, 7.3, 7.4, 7.5 8.2 to 8.4, 8.9	8
IV	CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications	9.1, 9.3, 9.4, 9.5, 9.7, 9.9, 9.12 10.1, 10.3, 10.4, 10.5	8
V	Instrument calibration: Comparison method, digital multimeters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters	12.1, 12.2, 12.3 13.2, 13.4	8

Text Book: David A. Bell, "Electronic Instrumentation and Measurements", 2nd Ed., PHI , New Delhi 2008.

Reference Books:

1. Oliver and Cage, "Electronic Measurements and Instrumentation", TMH, 2009.
2. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Buterworth Heinmann), 2008.

EEC 404 SIGNALS AND SYSTEMS			3 1 0
Unit No.	Topics	Chapter/ Section	Proposed number of Lectures
I	**Signals:** Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one-dimensional/multi-dimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their inter-relationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables).	1.1 to 1.5	6
II	**Laplace-Transform (LT) and Z-transform (ZT):** (i) One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping	2.1 to 2.15	3+5
III	**Fourier Transforms (FT):** (i) Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT (ii) Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT	4.1 4.11; 5.1 to 5.7	6+4
IV	**Systems:** Classification, linearity, time-invariance and causality, impulse response, characterization of linear time-invariant (LTI) systems, unit sample response, convolution summation, step response of discrete time systems, stability. convolution integral, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density,	7.1 to 7.12; 9.2, 9.6 to 9.8	8
V	**Time and frequency domain analysis of systems** Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter	8.1-8.6; 8.8	10

Text Book: P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi

Reference Books:

1. Chi-Tsong Chen, `Signals and Systems', 3rd Ed., Oxford University Press, 2004
2. V. Oppenheim, A.S. Willsky and S. Hamid Nawab, 'Signals & System', Pearson Education, 2nd Ed., 2003.

PRACTICAL

EEC 451 ELECTRONICS ENGINEERING LAB II

Objective -To design and implement the circuits to gain knowledge on performance of the circuit and its application.

1. **Measurement of Operational Amplifier Parameters**-Common Mode Gain, Differential Mode Gain, CMRR, Slew Rate.
2. **Applications of Op-amp**- Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator
3. **Field Effect Transistors**-Single stage Common source FET amplifier –plot of gain in dB Vs frequency, measurement of, bandwidth, input impedance, maximum signal handling capacity (MSHC) of an amplifier
4. **Bipolar Transistors**- Design of single stage RC coupled amplifier –design of DC biasing circuit using potential divider arrangement –Plot of frequency Vs gain in dB. Measurement of bandwidth of an amplifier, input impedance and Maximum Signal Handling Capacity of an amplifier.
5. **Two stage Amplifier**. Plot of frequency Vs gain. Estimation of Q factor, bandwidth of an amplifier
6. **Common Collector Configuration-Emitter Follower** (using Darlington pair)-Gain and input impedance measurement of the circuit.
7. **Power Amplifiers**-Push pull amplifier in class B mode of operation –measurement of gain.
8. **Differential Amplifier** –Implementation of transistor differential amplifier .Non ideal characteristics of differential amplifier
9. **Oscillators** -Sinusoidal Oscillators- (a) Wein bridge oscillator (b) phase shift oscillator
10. **Simulation of Amplifier** circuits studied in the lab using any available simulation software and measurement of bandwidth and other parameters with the help of simulation software.

EBM 451 ANATOMY & PHYSIOLOGY LAB

1. Identification of fixed histological slides – nerve tissues (cerebellum, cerebral cortex, neurons, spinal cord, nodes of Ranvier, corneal cell space), renal tissues, blood vessels (artery & vein), skin, tongue, liver.
2. Hemoglobin estimation
3. Determination of blood pressure
4. Coagulation and bleeding time, sedimentation rate of RBCs
5. Blood film making & identification of different blood corpuscle.
6. ECG wave identification
7. Measurement of Total Count of RBC & WBC & Differential Count of WBC.
8. Determination of Blood Group (ABO; Rh).

EEC 453 MEASUREMENT LAB

1. Study of semiconductor diode voltmeter and its us as DC average responding AC voltmeter .
2. Study of L.C.R. bridge and determination of the value of the given components.
3. Study of distortion factor meter and determination of the % distortion of the given oscillator.
4. Study of the transistor tester and determination of the parameters of the given transistors.
5. Study of the following transducer (i) PT-100 trans (ii) J- type trans. (iii) K-type trans (iv) Presser trans
6. Measurement of phase difference and frequency using CRO (lissajous figure)
7. Measurement of low resistance Kelvin's double bridge.
8. Radio Receiver Measurements

SEMESTER - V

Unit	EIC 501 CONTROL SYSTEM I	Text Book/ Chapter	Proposed number of Lectures
I	Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams and signal flow graphs, Modeling of Physical systems: electrical networks, mechanical systems elements, equations of mechanical systems, sensors and encoders in control systems, DC motors in control systems.	1.1 to 1.3 3.1 to 3.2 4.1 to 4.6	8
II	State-Variable Analysis: Vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions.	5.1 to 5.6	8
III	Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, the unit step response and time-domain specifications, Steady-State error, time response of a first order system, transient response of a prototype second order system	7.1 to 7.6	8
IV	Stability of Linear Control Systems: Bounded-input bounded-output stability-continuous data systems, zero-input and asymptotic stability of continuous data systems, methods of determining stability, Routh Hurwitz criterion.	6.1 to 6.5	8
V	Frequency Domain Analysis: M_r *(resonant peak) and* ω_r *(resonant frequency)* and bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, Nyquist stability criterion, relative stability: gain margin and phase margin, stability analysis with the Bode plot	9.1to 9.11	10

Text Book: B.C. Kuo & Farid Golnaraghi, "Automatic Control Systems", 8th Edition, John Wiley India, 2008.

Reference Books:

1. William A. Wolovich, "Automatic Control Systems", Oxford University Press, 2010.
2. Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, "Control Systems" Schaums Outlines Series, 3rd Edition, Tata McGraw Hill, Special Indian Edition 2010.
3. I.J. Nagrath & M. Gopal, "Control System Engineering", New Age International Publishers

EBM 501 BIOINSTRUMENTATION

UNIT I

Transducers - Classification, selection of transducers, circuit based on transduction. Temperature transducers – Displacement transducer - Pressure transducer - catheter tip transducers. Photoelectric transducers - Flow transducers - Piezoelectric transducers and their applications, Biological receptors and receptor characteristics.

UNIT II

Reference electrodes, The pO_2 electrodes, Membrane electrodes, Blood gas analysis, Transcutaneous pO_2 and pCO_2 transducers, Fiber optic chemical transducer, Ion specific electrodes, Ionic content of blood, ISFET for glucose, urea.

UNIT III

Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes, Needle electrodes.

UNIT IV

Principle of dialysis, Artificial kidney, Types, function and working of dialysis, Performance analysis of dialysis, Membranes used for hemodialysis, Block diagram and working of hemodialysis machine, Portable kidney machine – working and flow diagram.

UNIT V

Physiological effects of electrical currents, macroshock and microshock, preventive measures to reduce shock hazards, Leakage current, isolation of patient circuits, safety of electrically susceptible patients, radiation hazards and safety, shielding, open ground problem and earthing methods.

TEXT BOOKS:

1. R. S. Khandpur, Biomedical Instrumentation Technology and Applications, McGraw-Hill Professional, 2004
2. Leslie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, “Biomedical Instrumentation and Measurements”, 2nd Edition, PHI, 2003. (UNIT I, III)
3. John G. Webster, Medical Instrumentation: Application and Design, 3rd edition, John Wiley & Sons, New York, 1998. (UNIT II)
4. Raja Rao, C, Guha, S.K, Principles of Medical Electronics and Biomedical Instrumentation, Orient Longman Publishers (2000) (UNIT V)

References:

1. R.Anandanatarajan, “Biomedical Instrumentation”, PHI Learning, 2009.
2. M. Arumugam, “Biomedical Instrumentation”, Anuradha Agencies Publishers, Vidayal Karuppar, 612 606, Kumbakonam, R.M.S: 1992

			3 1 0
	EEC 501 INTEGRATED CIRCUITS		
Unit	Topic	Chapter/ Section From Text [1]	Proposed number of Lectures
I	**Analog Integrated circuit Design: an overview:** Current Mirrors using BJT and MOSFETs, Simple current Mirror, Base current compensated current Mirror, Wilson and Improved Wilson Current Mirrors, Widlar Current source and Cascode current Mirror	5.6, 6.4, 6.5	
	The 741 IC Op-Amp: Bias circuit, short circuit protection circuitry, the input stage, the second stage, the output stage, and device parameters; D**C** Analysis of 741: Small Signal Analysis of input stage, the second stage, the output stage; Gain, Frequency Response of 741; a Simplified Model, Slew Rate, Relationship Between f_t and SR	10.1-10.6	8
II	**Linear Applications of IC op-amps:** An Overview of Op-Amp (ideal and non ideal) based Circuits V-I and I-V converters, generalized Impedance converter, simulation of inductors	2.2-2.7	
	Filters: First and second order LP, HP, BP BS and All pass active filters, KHN, Tow-Thomas and State Variable Biquad filters; Sinusoidal oscillators	11.4, 11.7, 12.1, 12.2	8
III	**Digital Integrated Circuit Design-An Overview**: CMOS Logic Gate Circuits**:**		
	13.2-13.3 Basic Structure CMOS realization of Inverters, AND, OR, NAND and NOR Gates		
	Latches and Flip flops**:** The Latch, The SR Flip-flop, CMOS Implementation of SR Flip-flops, A Simpler CMOS Implementation of the Clocked SR Flip-flop, D Flip-flop Circuits.	13.7	8
IV	**Non-Linear applications of IC Op-amps:** Log–Anti Log Amplifiers, Precision Rectifiers, Peak Detectors, Simple and Hold Circuits, Analog Multipliers and their applications. Op-amp as a comparator, Zero crossing detector, Schmitt Trigger, Astable multivibrator, Monostable multivibrator, Generation of Triangular Waveforms	12.1, 12.4, 12.5 12.9	8
V	**D/A and A/D converters**	10.9-10.11	8
	Integrated Circuit Timer: The 555 Circuit, Implementing a Monostable Multivibrator Using the 555 IC, Astable Multivibrator Using the 555 IC.	12.7	
	Phase locked loops (PLL): Ex-OR Gates and multipliers as phase detectors**,** Block Diagram of IC PLL, Working of PLL and Applications of PLL.	6.5 of Ref [2]	

Text Book:

[1] Sedra and Smith, "Microelectronic Circuits", 4th Edition, Oxford University Press. Reference Books:

[2] Michael Jacob, `Applications and Design with Analog Integrated Circuits', PHI, 2nd Edn, 2006

[3] Jacob Milliman and Arvin Grabel, "Microelectronics", 2nd Edition, TMH, 2008.

EBM 502 MICROPROCESSOR & ITS APPLICATIONS

UNIT1.
THE 8085 PROCESSOR:
Introduction to microprocessor, 8085 microprocessor: Architecture, instruction set.

UNIT2.
THE 8086 MICROPROCESSOR :
Architecture, block diagram of 8086, memory segmentation and physical address computations, program relocation, addressing modes, Pin Diagram and description of various signals instruction formats, Instruction Set , Assembler instruction format, Directives and Operators

UNIT3
INTERFACING DEVICE:
The 8255 PPI chip: DMA CONTROLLER (8237),

UNIT4
INTERRUPT AND TIMER:
8259 Programmable interrupt controller, Programmable interval timer chips (8253/8254).

TEXT BOOKS:
1.Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.
2 The Intel Microprocessors 8086- Pentium processor: Brey; PHI
REFERENCE BOOKS:
1. Microprocessors and interfacing: Hall; TMH
2. The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware & Applications : Triebel & Singh; PHI
3. Microcomputer systems: the 8086/8088 Family: architecture, Programming & Design: Yu-Chang Liu & Glenn A Gibson; PHI.
4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

EBM 503 HUMAN ANATOMY & PHYSIOLOGY

L T P: 3 1 0

ANATOMY:

Unit 1.

Structure & functions of cell. Polarization & depolarization of cell, Basic tissues & functions in brief.

Unit 2

Outline of structures of the following systems:

Cardiovascular system, Respiratory system, Alimentary system, Central Nervous system, Muscular System, Endocrine system Sense organs: Eye, Ear, Integument system (skin study)

PHYSIOLOGY:

Unit 3

Cardiovascular system,: Heart, conductive tissue of heart, cardiac cycle, heart valves, systemic & pulmonary circulation, Transmission of cardiac impulse, blood pressure. Respiratory system: respiration external (ventilation), Exchange in gases in the alveoli, Artificial respiration, Spirometer (Forced expiration volumes), peak flow meter. Alimentary system: all organs of the digestive system, other secretions & main functions.

Unit 4

Blood: composition of blood-blood cells & their functions. Cell counting, haemoglobin.
Excretory system: Structure of Nephron, formation of urine & function of kidneys, urinary bladder, urethra, internal/external sphincters.
Nervous system: different parts, their functions, Reflex action & reflex arc. Function of sympathetic nervous system. Nervous conduction & action potentials.

TEXT

1. Anatomy and physiology in health and illness by : Ross and Wilson (ELBS pub)
2. Human Physiology by A. Vander, J. Sherman and D. Luciante.
3. Basic Human theory By Charles E Tobin Mc Graw Hill.

BIOINSTRUMENTATION LAB

EBM-551 **L T P: 0 0 2**

LIST OF EXPERIMENTS

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

Important: Four Experiments should be added in above as per the requirement of the relevant subject.

LINEAR INTEGRATED LAB

EBM-552 **L T P: 0 0 2**

1. Measurement of Op-amp Parameters. (Open Loop Gain, Input offset Voltage, CMRR, Slew rate)
2. Determination of Frequency response of Op-Amp.
3. Precision Rectifier
4. Instrumentation Amplifier.
5. Open Loop operation of Op-amp -Comparators - Schmitt Trigger.
6. Astable & Monostable Operation Using 555.
7. IC Voltage Regulator.
8. Voltage Controlled Oscillator.
9. Phase Locked Loop.
10. Frequency Multiplier
11. A/D Converters & D/A Converters.
12. Second Order Active Filter- High Pass & Low Pass Realization

Important: Two Experiments should be added in above as per the requirement of the relevant subject.

MICROPROCESSOR LAB

EBM-553 **L T P: 0 0 2**

LIST OF EXPERIMENTS:

1.Study of 8085 Microprocessor kit.

2. Write a program using 8085 and verify for
a. Addition of two 8-bit numbers.
b. Addition of two 8-bit numbers (with carry).

3. Write a program using 8085 and verify for
a. 8-bit subtraction (display borrow)
b. 16-bit subtraction (display borrow)

4. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition or by bit rotation method.

5. Write a program using 8085 for division of two 8- bit numbers by repeated subtraction method and test for typical data.

6. Study of 8086 microprocessor kit.

7. Write a program using 8086 for finding the square root of a given number and verify.

8. Write a program using 8086 for copying 12 bytes of data from source to destination and

9. Write a program using 8086 and verify for:
a. Finding the largest number from an array.
b. Finding the smallest number from an array.

10. Write a program using 8086 for arranging an array of numbers in descending order.

11. Write a program using 8086 for arranging an array of numbers in ascending order and verify.

12. Write a program for finding square of a number using look-up table and verify. .

14. Write a program to control the operation of stepper motor using 8085/8086 Microprocessor and 8255 PPI.

EIC 551 CONTROL SYSTEM LAB

LTP : 002

1. DC SPEED CONTROL SYSTEM
   (a) To study D.C. speed control system on open loop and close loop.
   (b) To study of Transient performance, another time signal is added at the input of control Circuit.
   (c) To study how eddy current breaking is being disturbance rejected by close and open loop.
2. DC MOTOR POSITION CONTROL
   (a) To study of potentiometer displacement constant on D.C. motor position control.
   (b) To study of D. C. position control through continuous command.
   (c) To study of D.C. position control through step command.
   (d) To study of D.C. position control through Dynamic response.
3. AC MOTOR POSITION CONTROL
   (a) To study of A.C. motor position control through continuous command.
   (b) To study of error detector on A.C. motor position control through step command.
   (c) To study of A.C. position control through dynamic response.
4. MAGNETIC AMPLIFIER
   (a) To study Input / Output characteristic of a magnetic amplifier in mode (i) Saturable Reactor, (ii) Self Saturable Reactor.
5. SYNCHRO TRANSMITTER / RECEIVER
   (a) To study of Synchro Transmitter in term of Position v/s Phase and voltage magnitude with respect to Rotor Voltage Magnitude/Phase.
   (b) To study of remote position indication system using Synchro-transmitter/receiver.
6. PID CONTROLLER
   (a) To observe open loop performance of building block and calibration of PID Controls.
   (b) To study P, PI and PID controller with type 0 system with delay.
   (c) To study P, PI and PID controller with type 1 system.
7. LEAD LAG COMPENSATOR
   (a) To study the open loop response on compensator.
   (c) Close loop transient response.
8. LINEAR SYSTEM SIMULATOR
   (a) Open loop response
   (i) Error detector with gain, (ii) Time constant, (iii) Integrator
   (b) Close loop system
   (I) First order system (II) Second order system (III) Third order system
9. Introduction to MATLAB (Control System Toolbox), Implement at least any two experiment in MATLAB.
   a. Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox.
   b. Determine transpose, inverse values of given matrix.
   c. Plot the pole-zero configuration in s-plane for the given transfer function.
   d. Determine the transfer function for given closed loop system in block diagram representation.
   e. Plot unit step response of given transfer function and find peak overshoot, peak time.
   f. Plot unit step response and to find rise time and delay time.
   g. Plot locus of given transfer function, locate closed loop poles for different values of k.
   h. Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.
   i. Plot bode plot of given transfer function.
   j. Plot bode plot of given transfer function and find gain and phase margins
   k. Plot Nyquist plot for given transfer function and to compare their relative stability
   l. Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

SEMESTER – VI

EBM 601 PHYSIOLOGY CONTROL SYSTEM AND SIMULATION MODELLING

L T P: 3 1 0

Unit 1.
Introduction to state variable analysis of control systems: -Introduction to state variable concept, definition of state variables, matrix representation of state equation, state transition equation, properties of transition matrix, relationship between state equations and higher order differential equations, state equation and transfer function, characteristics equation, Eigen values & Eigen vectors.

Unit 2.
Transformation to phase variables canonical forms of state variables, controllability canonical form, observability canonical form Jordan canonical form, controllability of linear system, observability of linear system relationship among controllability, observability and transfer function.

Unit 3.
Introduction to biological control system: Introduction, Dynamic systems and their control, modeling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open & close loop systems instability, automatic aperture control.

Unit 4.
Mathematical modeling of the system: Thermo regulation, Thermoregulation of cold bloodedness & warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples, mathematical model of the controlled process of the body.

Unit 5.
Modeling the body as compartments, behavior in simple compartmental system, pharmacokinetic model, multi compartmental system. distribution and accessibility of body water & tissue compartments, basis for zero order & first order chemical kinetic behavior in the biological system.

Unit 6.
Biological receptors: -Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Respiratory model & systems, Neuromuscular model, Cardiovascular control system.

TEXT

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

EBM 602 MICROCONTROLLER AND BIOMEDICAL APPLICATIONS

L T P: 3 1 0

Unit 1
Introduction: 8051, Comparison with microprocessor, pin diagram explanation, internal diagram 8051.

Unit 2
Instruction Set: Addressing mode, data transfer instruction, logical, arithmetic instruction, bit instruction, branching instruction.

Unit 3
Timers: Mode of timers, simple programming, generation of square wave.
8051 connection to RS 232
Interrupts: Interrupt priority in 8051, generation of waveforms using interrupt, serial interface using interrupt.

Unit 4
Interfacing of memory, intelligent LCD, 8255, ADC, DAC, LED display.

Unit 5
Applications: Introduction to DSP processor, Applications of microcontrollers and computers in biomedical engineering, microcontrollers in embedded biomedical applications.

Text Books
1. Micro controllers & its applications by B.S. Chhabra, Dhanpat Rai Pub. Co., India
2. 8051mC, Scott Mackenizie, PHI, Englewood Cliffs, New Jersey.
3. Myke Predko,'Programnming & Customizing the 8051 Microcontroller,' Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
Reference Books:
1. 8051 m C Architecture Programming & Applications, K.J. Ayata: Penram International Publishers, India.
2. S.K. Venkata Ram,'Advanced Microprocessor & Microcontrollers, Luxmi Pub. Pvt. Ltd., New Delhi

EBM 603 BIOMEDICAL SIGNAL PROCESSING

L T P: 3 1 0

Unit 1.

Z transform introduction, definition, convergence. Inverse Z transforms, Analysis of discrete time systems using Z transforms. Solutions of differential equations. Transfer functions and stability.

Unit 2.

Fourier transform for continuous signals. Energy spectrum, Properties (without proof), Gibbs phenomena, Auto and cross correlation. Discrete Fourier transforms. Properties (without proof), Inverse DFT, introduction to FFT

Unit 3.

IIR & FIR Filters, Low pass, High Pass, Band Pass Filters using windows – Kaiser Windows. Sampling Theorem, aliasing Nyquist criteria, ADC's and DAC's.

Unit 4.

Digital signals and systems: Classification of systems causal, time varying, time invariant, lumped. Introduction to digital signals systems. Convolution, Auto-correlation and cross correlation , Use of Matlab signal processing toolbox on various real bio **-** medical signals**.**

Unit 5.

Introduction**,** Characteristics of Bio **-** Signals**,** Types of Signals**,** Measurement**,** Transformation. and reduction**,** computation of signal parameters that are diagnostically significant**,** stationary and non **-** stationary bio **-** signals**,** Application areas of Bio **-**Signals analysis **-** EEG, ECG, Phonocardiogram, Spiro Gram, Evoked Signals.

TEXT

1. Digital signal processing, Proakis (PHI)
2. Signal Analysis By R**.** P**.** Singh **,** Second edition Tata McGraw **–** Hill
3. Engineering Electronics By Mauro R Prentice – Hall
4. Malmivuo, J. and Plonsey, R. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.
5. D C Reddy, McGraw Hill, Biomedical Signal Processing.

References

1. Biomedical signal processing: Metin Akay (academic press)
2. Biomedical signal processing: Tompkins (academic press)
3. Theory and application of digital signal processing: Rabiner and Gold (EEE pub)

EBM 604 BIOMATERIALS

L T P: 3 0 0

Unit-1

Introduction: Definition of biomaterials, requirements & classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Biological responses (extra and intra-vascular system). Surface properties of materials, physical properties of materials, mechanical properties.

Unit-2

Metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking. Host tissue reaction with bio metal, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants, Dental implants. Soft tissue replacement implants: Percutaneous and skin implants, Vascular implants, Heart valve implants-Tailor made composite in medium.

Unit-3

Polymeric implant materials: Polyolefin's, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetyls. (Classification according to thermo sets, thermoplastics and elastomers).Viscoelastic behavior: creep-recovery, stress-relaxation, strain rate sensitivity. Importance of molecular structure, hydrophilic and hydrophobic surface properties, migration of additives (processing aids), aging and environmental stress cracking. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications.

Unit-4

Ceramic implant materials: Definition of bio ceramics. Common types of bio ceramics: Aluminum oxides, Glass ceramics, Carbons. Bio resorbable and bioactive ceramics. Importance of wear resistance and low fracture toughness. Host tissue reactions: importance of interfacial tissue reaction (e.g. ceramic/bone tissue reaction).
Composite implant materials: Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out). Polymers filled with osteogenic fillers (e.g. hydroxyapatite). Host tissue reactions.

Unit-5

Biocompatibility & Toxicological screening of biomaterials: Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situimplantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intracutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests.

TEXT

1. Biomaterials Science**:** An Introduction to Materials in Medicine**,** By Buddy D**.** Ratner**,** et**.** al**.** Academic Press**,** San Diego**,** 1996**.**
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.
3. J B Park, Biomaterials - Science and Engineering, Plenum Press, 1984.

PHYSIOLOGY CONTROL SYSTEM AND SIMULATION MODELLING (PCSM) LAB

EBM-651 **L T P: 0 0 2**

LIST OF EXPERIMENTS

1. To Study the Cardiovascular system.
2. Simulation of Cardiovascular system by using MATLAB/SIMULINK.
3. To Study the Heart Model and simulate it using MATLAB/SIMULINK.
4. To Study the Eye Movement System, its mathematical mode.
5. To study linear muscle model.
6. To study model of respiratory mechanics.
7. Implement the simulink model for Lung Mechanics.
8. Implement the glucose insulin regulation model by MATLAB tools.
9. To study the circulatory model by MATLAB.
10. Implement the simulink model for neuromuscular transient response

Important: Four Experiments should be added in above as per the requirement of the relevant subject.

MICROCONTROLLER AND ITS APPLICATION LAB

EBM-652 **L T P: 0 0 2**

LIST OF EXPERIMENTS

1. Study of 8051 Microcontroller, Architecture & command.
2. Write an ALP for the Addition & Subtraction of 8 bit no's.
3. Write an ALP for multiplication of Two 8 bit no's.
4. Write an ALP for Division of Two 8 bit no's.
5. Write an ALP to find smallest & largest no in a given array.
6. Write an ALP to generate 10 KHz frequency using interrupt.
7. Write an ALP to interface intelligent LCD display with m C.
8. Write an ALP for m C & HLL for PC (VB/C++/VC++) to demonstrate/implement serial Interfacing.
9. Write an ALP to interface LED display.
10. Write an ALP to interface one m C with other using serial/parallel communication.
11. Write an ALP to switch ON alarm when m C receive interrupt

Important: Three Experiments should be added in above as per the requirement of the relevant subject.

BIOMEDICAL SIGNAL PROCESSING LAB

EBM-653 **L T P: 0 0 2**

LIST OF EXPERIMENTS

1. Realization of signal-continuous & discrete by using MATLAB.
2. Write a MATLAB program to perform convolution of two signals.
3. Write a short program to perform
(a) DFT
(b) Inverse DFT
(c) FFT
By using MATLAB.

4. By using toolbox(MATLAB) simulate
(a) FIR Filter
(b) IIR Filter
5. Data acquisition of EEG & ECG signals by using DSP kit. 6.Noise removal from EEG & ECG signals
7. Power spectrum analysis of EEG signals.

Important: Five Experiments should be added in above as per the requirement of the relevant subject.

ELECTIVE I

EBM 011 LASER & FIBER OPTICS AND ITS MEDICAL APPLICATION

L T P: 3 1 0

Unit1.
Introduction to fiber optics: Basic fiber link, applications, principles of light: Introduction, EM spectrum, internal & external reflections, Snell' slaw, optical fiber numerical aperture, Fresnel reflection.

Unit2.
Optic fiber & its properties: Introduction, Basic fiber construction, propagation of light, modes of operation, refractive index profile, types of fibers, dispersion, data rate and bandwidth, attenuation, losses. Connectors, Splices & Couplers: Introduction, splices: mechanical, fusion, protection of splice, connectors: SMA, STC, bionic etc, coupling: passive, Stan, TEE types. Optical sources & Photo Detectors: Introduction: creation of photons, LED, ILD, photo detectors: introduction, PIN photodiode, avalanche photodiode, photodiode parameters, detector noise, speed of response, SNR.

Unit 3. Modulation scheme for fiber optics transmission: Introduction, digital modulation, analog modulation schemes, multiplexing.

Unit 4.
Laser Systems: Introduction, types of lasers: Solid state lasers, Gas lasers, Dye lasers, Lasers used in medical practice: Ruby laser, CO_2 laser, Nd-Y AG laser and related solid state laser. Laser -Tissue Interaction: Terminology : spectral band designations, energy & power, irradiant & radiant exposure, fluency, thermal diffi1sion fibers & contact tips, Types of laser-tissue interactions

Unit 5. Laser Application in Medical Therapy: Introduction, application in general surgery, dermatology, ophthalmology, cardiovascular & chest surgery, dentistry, neuro surgery, otolaryngology & head and neck surgery, tumor surgery, gynecologic laser.

TEXT

1. Therapeutic Lasers -Theory and practice by G. David Baxter, Churchill Livingstonepublications.
2. Medical Lasers and their safe use by David H Shiney, Stephen and L. Trokel, Springer-Verlag publications.
3. Elements of fiber optics by S. L. Wymer, Regents-Prentice Hall publications.
4. Biomedical Electronics & Instrumentation by S. K. Venkata Ram, Galgotia publications.

REFERENCES

1. Laser and optical fibers in medicine by Katzer and Abraham, Academic press publications
2. An Introduction to optical fibers by A. M. Cherin, McGraw Hill publications.

EBM 012 BIOELECTRICITY

UNIT-I
Bioelectricity generation at the cellular & sub cellular level. Different biopotentials and their characteristics.

UNIT-II
Nernst Equation: Derivations and its significance. Refractory Period Characteristics of Stimulus. Strength-Duration relationship. Electrical equivalent circuit of Axon. Membrane time and space constants.

UNIT-III
Hodgkin-Huxley formulation, Membrane conductance, Nerve conduction, membrane properties from current voltage relations, Models of squid axon. Propagation of impulses in unmyelinated and myelinated nerve fiber. Electrical properties of receptors. Intensity-frequency relationship. Electrical properties of synaptic junctions - EPSP and IPSP.

UNIT-IV
Characteristics of Action potentials at SA Node, Atria, A V Node, Purkinje fibers and Ventricles. ECG Complexes. 12 lead ECG. Standard leads of Einthoven. Pericardial leads and Augmented limb leads. Relationship between unipolar extremity leads and standard Bipolar leads. Electrical activity of skeletal muscles, Motor unit potentials, neuromuscular transmission, EMG wave form.

UNIT-V
Biopotential electrodes: classification & characteristics. Electrode-Electrolyte Interface, Equivalent Circuit Properties of Needle & Micro Electrodes, Electrodes for Surgery, Physiotherapy & Analytical instruments.

TEXT BOOKS
1. Robert Plonsey and Roger Barr, Bioelectricity, McGraw Hill, 1986.
2. John Webster. Medical Instrumentation.- Application and Design. John Wiley and Sons. Inc., New York. Third edition 2003.

REFERENCES:
1. L.A Geddes, Principles of Applied Biomedical Instrumentation, John Willy & Sons, 1989.
2. Plonsey Robert and Flemming David G. Bioelectrical phenomena, McGraw Hill, 1969.

EBM 013 BIOMECHANICS

L T P: 3 1 0

Unit 1. Scalar And Vector Quantities:
Different operations on vectors, forces and Moments.

Unit 2.
System of Forces in 2D and 3D; Equilibrium equation, Applications with examples on Human Body.

Unit 3
Work Energy Equation, Application to Bio-Medical System.

Unit 4.
Stress Strain Diagram, Stress in Bending ,Torsion and Compound Loading, Stress Shielding of Bone.

Unit 5.
Mechanical Properties of Human Bone and Soft Tissues, Cortical and Cancellous Bone, Viscoelasticity, Elastic Model of Bone.

TEXT
1.Ozkaya Nihat,Margrate Nordine,"Fundamental of Bio- Mechanics". Springer Publication.
2.Lucas G. L.,W.F.Cook " A priemer of Bio Mechanics". Springer Publication.
3.Gardiner M .Dena ," The Principle of Exercise Therapy". CBS Publicer.c. Orthotics

EEC 013 ADVANCED SEMICONDUCTOR DEVICES

Unit	Topic	Chapter/ Section	3 1 0 Proposed number of Lectures
I	**Review of Fundamentals of Semiconductors:**		
	Semiconductor Materials and their properties	3.1 to 3.8	
	Carrier Transport in Semiconductors	4.1 to 4.9	10
	Excess Carriers in Semiconductor	5.1 to 5.7	
II	**Junctions and Interfaces:**		
	Description of p-n junction, Action, The Abrupt Junction, Example of an Abrupt Junction, The linearly graded Junction.	6.1 to 6.4 7.1 to 7.5	
	The Ideal Diode Model, Real Diodes, Temperature Dependence of I-V Characteristics, High Level Injection Effects, Example of Diodes.	8.1,8.3,8.5,8.7	8
	Description of Breakdown Mechanism, Zener and Avalanche Breakdown in p-n Junction		
III	**Majority Carrier Diodes:**		
	The Tunnel Diode, The Backward Diode, The Schottkey Barrier Diode, Ohmic Contacts Heterojunctions.	10.1 to 10.5	6
IV	**Microwave Diodes**:		
	The Varactor Diode, The p-i-n Diode, The IMPATT Diode, TRAPATT Diode, The BARITT Diode, Transferred Electron Devices	11.1 to 11.6	8
	Optoelectronic Devices:	12.1 to 12.4	
	The Solar Cell, Photo detectors, Light Emitting Diodes, Semiconductor Lasers.		
V	**Metal Semiconductor Field Effect Transistors**:		
	Basic Types of MESFETs, Models for I-V Characteristics of Short –Channel MESFETs, High Frequency Performance, MESFETs Structures.	15.4 to 15.7	
	MOS Transistors and Charge Coupled Devices:		8
	Basic Structures and the Operating Principle, I-V Characteristics, Short-Channel Effects, MOSFET Structures, Charge Coupled Devices.	16.4 to 16.9	

Text Book: M.S. Tyagi, “Introduction To Semiconductor Materials And Devices”, John Wiley India Pvt. Ltd.

Reference Books:

1. S. M. Sze, “Physics of Semiconductor Devices”, 2nd Edition, John Willy-India Pvt. Ltd.
2. B. G. Streetman and S. Banerjee, “Solid state electronics devices”, 5th Edition, PHI.

SEMESTER – VII

EBM 701 BIOMEDICAL IMAGE PROCESSING

UNIT-I IMAGE PERCEPTION

Introduction, light, luminance, brightness and contrast, MTF of the visual system - visibility, function, monochrome vision models, color representation, color matching and reproduction, color vision model Image sampling and quantization, Image quantization, visual quantization.

UNIT-II IMAGE ENHANCEMENT & IMAGE RESTORATION

Point operations; contrast stretching, clipping and threshold, digital negative intensity level slicing, bit extraction, Histogram modeling, histogram equalization, modification, Convolution theorem and correlation, spatial operations, smoothing techniques.

UNIT-III IMAGE TRANSFORMS

Two dimensional orthogonal and unitary transforms, properties of unitary transforms — one dimensional DFT, cosine, sine Harmrd and Haar transforms.

UNIT-IV IMAGE SEGMENTATION ANLYSIS AND COMPUTER VISION

Spatial feature extraction, transforms features, Segmentation techniques, Analysis techniques.

UNIT-V

Application of MATLAB for Digital image processing.

BOOKS:

1. Jain Anil K., "Fundamentals of Digital Image Processing.", Prentice Hall.
2. Refael C. Gonzalez. Wintz Paul, "Digital Image Processing.", Addision Wesley.
3. Pratt W.K., "Digital Image Processing.", John Wiley and Sons.

EBM 702 HOSPITAL MANAGEMENT SYSTEM

UNIT I

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

UNIT II

Elements of Safety - Safety Publications and Standards Organizations - Orientation to Laboratory Safety - Types of risks in the hospitals - factors of environment - Safety showers and Eye Washes – Radiation hazards – radiation detection – safety measures – standards. Ergonomics - Flammables and Explosives – Formaldehydes - PEL Standards and Calculations - Material Safety - Organization of Safety in the hospitals. Electrical power systems in hospitals: Safety of electrical systems, Protective systems - interference of patient's protection grounding. Design of sub stations, breakers, Surge protectors, EMI filters, voltage stabilizers, generator sets and UPS. Uninterrupted power supply for ICU and computerized monitoring units. Specification & estimation for hospital wiring - small case study.

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOKS

1. P.E.Stanley, Handbook of hospital safety, CRC Press (UNIT II)
2. Arun Kumar, Hospital Management, Anmol Publications Pvt. Ltd., Jan 2000 , 1st.ed (UNITS IV & V)
3.Harold E. Smalley, "Hospital Management Engineering – A guide to the improvement of hospital management system", PHI.

REFERENCES:

1. Sharma, Essentials for Hospital Support Services and Physical Infrastructure, 1/e, Jaypee Medical Publishers 2003
2. Hospital Engineering And Facilities Management 2007 - Report, Fifth official report of the International Federation of Hospital Engineering (IFHE), January 2007
3. Gupta, Kant, Chandrashekhar, Satpathy, Modern Trends in Planning and Designing of Hospitals Principles and Practice with CD-ROM, Jaypee Medical publishers, 1/e, 2007
4. Sakharkar, Principles of Hospital Administration and Planning, Jaypee Medical publishers 1/e, Reprint 2004

EBM 703 BIOTRANSPORT PHENOMENA

UNIT 1

Introduction to fluid mechanics, heat and mass transfer. Physical, chemical and rheological properties of blood.

UNIT II

Unified approach of momentum, heat and mass transfer. Heat Transport: Heat production in humans, Loss of heat to the environment, Heat transfer within the body

UNIT III

Transport through cell membranes: Membrane structure, composition and permeability, Osmosis, Passive diffusion, Pressure diffusion, Facilitated transport, Facilitated diffusion of oxygen in haemoglobin solutions, Active transport, Pinocytosis.

UNIT IV

Compartment modeling: Pharmacokinetic models, The one-compartment and two-compartment open models. Structure and gross operational features of the respiratory system, Gas transport mechanisms in the lungs, Oxygen and carbon dioxide transfer in the blood, Modeling oxygen uptake in the pulmonary capillaries.

UNIT V

Structure and general features of operation of kidneys, Transport mechanisms in the tubules, Pore models of the glomerular tuft, Countercurrent mechanism of urine formation, Models of nephron function, Analytical model for Henle's loop. Artificial kidney devices: Hemodialysis, types of hemodialyzers.

TEXT BOOKS:

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

EBM 751 BIO MEDICAL IMAGE PROCESSING LAB

1. Study of MRI Images.
2. Study of CT Scan.
3. Study of Mammograms.
4. Reconstruction of Images.
5. Image analysis.
6. MATLAB implementation.

REFERENCE BOOKS:

1. Pathology & Micro Biology Laboratory Manual

EBM 752 MEDICAL SYSTEMS LAB

1. pH meter : Study, standardisation & calibration.
2. Calorimeter
3. Spectro Photometer
4. Flame photometer
5. Hb meter
6. Conductivity meter
7. Study & familiarization of Laser Equipments
8. Study of physiological pre-amplifiers.
9. pressure measurements using physiological transducers.
10. Servicing of ECG equipments.
11. Study of multi channel physiological recorders.
12. Study of vacuum tube and solid state cautery.
13. Study of ventiltor.
14. Study of ultrasonic equipment.
15. Study of X-ray radiography system.

ELECTIVE II

EBM 021 BIOINFORMATICS

UNIT-I INTRODUCTION TO BIOINFORMATICS

Objectives of Bioinformatics, Data integration, Data Analysis, Bioinformatics databases and tools, Molecular approach versus Bioinformatics approach, Overview of Bioinformatics application.

UNIT-II MOLECULAR BIOLOGY AND INFORMATION

Basic chemistry of nucleic acids, Structure of DNA, Genes, The functional elements in DNA, DNA sequencing and Polymeric chain reaction, Cloning methodology, Amino acids, Protein structure Protein folding, Protein function.

UNIT-III SEQUENCE ALIGNMENT

Introduction to Sequence Analysis, Models for sequence analysis and their Biological motivation, Methods of alignment, Usage of gap penalties and Scoring matrices, Tools for sequence alignment, Tools for multiple sequence alignment, Applications of Multiple alignment.

UNIT-IV GENE MAPPING AND GENE EXPRESSION

Applications of Gene mapping, DNA sequencing, DNA micro arrays, Algorithms for gene alignment, Gene prediction tools, Tools for DNA/RNA structure and function analysis.

UNIT-V PROTEOMICS

Protein structure visualization, Protein structure prediction, Methods of protein structure for known folds, Methods of protein structure for unknown folds, Methods for structure prediction, Protein analysis, Tools for protein analysis.

BOOKS

- Rastogi S.C., Namita Mendiratta, Parag Rastogi, "Bioinformatics Concepts, Skills and Applications", CBS publication.
- Baxevanis A.D, Francis Ouellette, "Bioinformatics: A practical guide to the Analysis of Genes and Proteins", Wiley Interscience, New York.
- Mount David, "Bioinformatics Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press.
- Hooman Rashidi, and Lukas K.Buehler, "Bioinformatics Basics Applications in Biological Science and Medicine", CRC Press.
- Tisdall James, "Beginning Perl for Bioinformatics", O'Reilly publications.

EBM 022 ARTIFICIAL ORGANS & REHABILITATION ENGINEERING

UNIT I

Introduction to artificial organs: Biomaterials used in artificial organs and prostheses, inflammation, rejection, correction. Rheological properties of blood, blood viscosity variation: effect of shear rate, hematocrit, temperature and protein contents. Casson equation, flow properties of blood through the blood vessels, problems associated with extracorporeal blood flow.

UNIT II

Artificial kidney: Brief of kidney filtration, basic methods of artificial waste removal, hemodialysis, equation for artificial kidney and middle molecule hypothesis. Hemodialysers: flat plate type, coil type and hollow fiber. Analysis of mass transfer in dialyers (cross current & cocurrent flow), regeneration of dialysate, membrane configuration, wearable artificial kidney machine, separation of antigens from blood in ESRD patients.

UNIT III

Artificial heart-lung machine: Brief of lungs gaseous exchange / transport, artificial heart-lung devices. Oxygenators: bubble, film oxygenators and membrane oxygenators. Gas flow rate and area for membrane oxygenators. Liver support system, artificial pancreas, blood and skin.

UNIT IV

Audiometry: air conduction, bone conduction, masking, functional diagram of an audiometer. Hearing aids: different types, receiver amplifiers. Opthalmoscope, retinoscope, I.A.B.P principle and application.

UNIT V

Rehabilitation Engineering: Impairments, disabilities and handicaps, Measurement and assessment. Characterizing engineering concepts in sensory and motor rehabilitation. Engineering concept in communication disorders. Rehabs for locomotion, visual, speech & hearing. Artificial limb and hands, prosthetic heart valves. Externally powered and controlled orthotics and prosthetics. Myoelectric hand and arm prostheses. The marcus intelligent hand prostheses, gait study, spinal rehabilitation

TEXT BOOKS:

1. Robbinson C.J., Rehabilitation Engineering. CRC press 1995
2. Gerald E. Miller, Artificial Organs, Morgan & Claypool Publishers, 2006

REFERENCE BOOKS:

1. Bronzino Joseph, Hand book of biomedical engineering. CRC; 2 Sub edition, 1999
2. R.S. Khandpur, Hand book of biomedical instrumentation. Tata Mcgraw Hill Publishers, 1/e.
3. David O. Cooney., Biomedical Engineering Principles (Volume – II). Marcel Dekker Inc.
4. Ballabio E.et al, Rehabilitation Engineering. IOS press 1993.

EBM 023 THERAPEUTIC EQUIPMENTS

UNIT I

Cardiac Pacemakers & Defibrillators: Effects of electric field on cardiac muscles and laws of stimulation. External, internal, and Programmable pacemakers. Pulse generator: sensing, output and timing circuits. Power sources, electrodes and leads system, pacing system analyzers. Defibrillators - basic principle and comparison of output wave forms of different DC defibrillator, energy requirements, synchronous operation, implantable defibrillators, defibrillator safety and analyzers, RF ablation treatment for arrhythmia.

UNIT II

Ventilators & Anaesthetic system: Basic principles of ventilators, different generators, inspiratory phase and expiratory phase, different ventillatory adjuncts, neonatal ventilators, p based ventilator, ventilator testing. Anaesthesia: Need of anaesthesia, gas used and their sources, gas blending and vaporizers, anaesthesia delivery system, breathing circuits.

UNIT III

Physical therapy: Physical therapy principles

- Electrical stimulators: Strength-duration curve, types of stimulators, an electrodiagnostic / therapeutic stimulator. Nerve-muscle stimulator: peripheral nerve stimulator, Ultrasonic stimulators, stimulators for pain and relief.
- Diathermy: IR diathermy, UV diathermy, short wave diathermy, microwave diathermy, ultrasonic diathermy.

UNIT IV

Surgical Diathermy & LASER: Principles and applications of surgical diathermy, Physics and engineering of ultrasonic lithotripter, basic principle of extracorporeal shock wave lithotripter. Principle operation of LASER, various application of CO_2, argon, He - Ne, Nd – YAG & pulsed ruby LASER, Application of LASER in surgery.

UNIT V

Electro-surgery & Neonatal care unit: Electrosurgery machine, electrosurgery circuits, solid state electrosurgery generator circuits, electrosurgery safety, testing electrosurgery units, cautery, light sources, suction apparatus, and sterilizers. Baby incubator, radiant warmer and phototherapy unit.

Text Books:

R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, Tata McGraw Hill.
Carr & Brown, “Introduction to Biomedical Equipment Technology” Pearson Education, Asia.
J.Webster, “Bioinstrumentation”, Wiley & Sons

References:

Joseph Bronzino, “ Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.
Willard Van Nostrand, “.Instrumental Methods of Analysis”
Sharms, “Instrumental Methods”, S Chand & Co.
Harry Bronzino E, “Handbook of Biomedical Engineering and Measurements”, Reston, Virginia.
Jacobson & Websler, “ Medicine & Clinical Engg”
Leslie Cromwell, “ Biomedical Instrumentation and Measurements”
Hcinz Kressc, “ Handbook of Electro medicine” , John Wiley.
Geddes & Baker , “Principles of Applied Biomedical Instrumentation” Wiley.

EBM 024 BIOMATERIALS

UNIT-I

Definition and classification of Biomaterials, surface properties of materials, Electro kinetic theory. Crystal structure of solids, Crystal Imperfection, Grain Boundaries, Non crystalline solids, Strength and strengthening mechanism.

UNIT-II

Metallic Implants, Alloys for Biomedical Application, Galvanic corrosion. Ceramic, Alumina and Carbon Implants, Glass Ceramics, Dental Ceramic, Orthopedic Implant Restorable ceramics.

UNIT-III

Polymer – Molecular weight of Polymers, Viscosity of polymer, Solution Swelling of Polymer theta solvent, co-solvent, non-solvent, Strength and strengthening mechanism of Polymer, Polymerization, Thermal properties of polymer, Structure property relationship of Polymers. Copolymers and blends, Hydrogels, polymer degradation and their application in medical field Restorable polymers, Dialysis membranes, soft tissue replacement Implants, Drug delivery systems.

UNIT-IV

Artificial organs and tissues: Implantable cardiac assist devices, Degradation of materials in biological environment, wound healing, bone healing, tendon healing, host and tissue response to biomaterials, effect of wear particles, device failure.

UNIT-V

In vivo and in vitro, assessment of tissue compatibility, blood material interaction, orthopedic biomaterials, artificial joints, intraocular lens, cochlear implants, artificial blood cells, ligament replacement.

BOOKS

1) Black Jonathan, "Biological Performance of materials", Marcel Decker, 1981.
2) Park J.B., "Biomaterial Science and Engineering", Plenum Press, 1984.
3) Hench L.L. & E.C.Ethridge, "Biomaterial: an interfacial approach", Academic Press, 1982.

SEMESTER - VIII

EBM 801 COMMUNICATION ENGINEERING

UNIT-I

Need for modulation - Amplitude modulation – Frequency spectrum of AM wave – Representation of AM – Power relation –Frequency modulation – Frequency spectrum of FM wave –AM transmitter – FM transmitter – Super heterodyne AM receiver –FM receivers.

UNIT-II

Principles of pulse modulation – sampling theorem, PAM – PWM – PPM– Conversion of PWM wave to PPM wave – Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM, PPM – An introduction to digital modulation systems – PCM, ASK, FSK and PSK.

UNIT- III

Microwave communication systems: advantage, block diagram of a microwave radio system, microwave radio stations- Terminal station and repeater station.

Satellite Communication system: Satellite Orbits, launch vehicles, look angles, satellite parameters, satellite link model, personal communication systems- GPS services.

UNIT- IV

Amount of information, Entropy, Information rate, Shannon's theorem, Channel capacity, Bandwidth and S/N trade off, Introduction to error and error correction code.

UNIT -V

Cellular concept, basic cellular concept and its operation, uniqueness of mobile radio environment- Performance metrics in cellular system-Elements of cellular mobile radio-Handoff-Frequency management and channel assignment- Introduction to various cellular standards like AMPS, GSM, GPRS, IS-95A, IS-95B, CDMA-2000 and WCDMA.

TEXT BOOK:

1. Kennedy Davis, "Electronic Communication Systems", Tata McGraw Hill Publishing Company Limited, New Delhi, 1999.
2. Wayne Tomasi, "Electronic Communication Systems", Pearson education Private Limited, Delhi, 2004.

REFERENCE BOOKS:

1. Roddy D and Coolen J, "Electronic Communications", Prentice Hall of India Private Limited, fourth edition, 2007.
2. William C.Y. Lee, "Mobile Cellular Telecommunication Systems", McGraw Hill International Edition, Second edition, 2006.
3. Gerd Keiser, "Optical fiber Communications", McGraw Hill International Edition, Fourth edition, 2006.

EBM 802 TELEMEDICINE

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

1. B.D. Gupta, “Introducing Telemedicine (Applications, challenges, needs and benefits, components and infrastructure)”

2. A.C. Norris, “Essentials of Telemedicine and Telecare”

3. Marlene Maheu, Pamela Whitten, Ace Allen, “E-health, Telehealth and Telemedicine”

4. Marilyn J. Field, Telemedicine: A Guide to Assessing Telecommunications for Health Care, National Academic Press, 1996

REFERENCE BOOKS

1. Charles J. Amlaner (Author), David W. Macdonald (Author), A Handbook on Biotelemetry and Radio Tracking, Pergamon Press; 1st edition (January 1, 1980)

EBM 803 Artificial Intelligence & its Applications in Biomedical Engineering

UNIT-I

Introduction to Artificial neuron and neural networks, Feature selection. Types of learning, supervised and unsupervised learning, Supervised learning decision surfaces, Two, category separation, linearly separable sets, Multiple category classification problems, Relationship to neural network models, Comparison of methods, Applications.

UNIT-II

Unsupervised learning, Clustering, Kohonen network and competitive learning. Hebbian learning, Adaptive resonance theory (ART), Applications.

UNIT-III

Introduction, Foundation of Fuzzy system, Fuzzy systems at work; Fuzzy system design, Crisp V/s Fuzzy sets, Fuzzy sets to fuzzy event, Fuzzy logic, Practical fuzzy measures, Fuzzy set operations, properties of fuzzy sets, Fuzzification techniques, Relational inference, Compositional inference. Linguistic variables and logic operators, Inference using fuzzy variables, Fuzzy implication.

UNIT-IV

Fuzzy systems and algorithms, Defuzzification, Adaptive fuzzy system algorithms, Expert systems v/s fuzzy inference engines, Basic fuzzy inference algorithm, Overall algorithm, Input data processing, Evaluating antecedent fuzzy variables, Left hand side computations; Right hand side computations, Output processing.

UNIT-V

Introduction to Genetic Algorithm, Application of AI in biomedical engineering.

TEXT BOOKS:

1. Donna L. Hudson and Maurice E. Cohen., "Neural Networks and Artificial Intelligence for Biomedical Engineering", Prentice Hall of India. Pvt. Ltd., New Delhi
2. Riza C. Berkan and Sheldon L. Trubatch., "Fuzzy systems Design Principles", Standard Publishers and Distributors, Delhi.
3. Abraham Kandel and Gideon Langholz, "Fuzzy Control Systems", CRC Press, Boca Raton.
4. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro, Fuzzy and soft computing", Prentice Hall of India. Pvt. Ltd., New Delhi.

ELECTIVE III

EBM 031 ADVANCED BIOMEDICAL INSTRUMENTATION

UNIT I

Analytical equipments: Colorimeter-principles of measurement and applications, Beer-Lambert's Law in spectrometry. UV, visible and infra-red spectrophotometers. Design of monochromators, detection systems. Basic applications in Biochemical analysis-Autoanalyser. Principles and applications - atomic absorption photometer, flame photometers, densitometers, gas and liquid chromatographs. Principles of scanning and transmission electron microscopy. Principles of simple, compound and phase contrast microscopes. Centrifuge-principles and applications. Different types of sterilization methods-autoclave. Blood cell counters: Different methods for cell counting, Coulter Counters, automatic recognition and differential counting of cells.

UNIT II

Blood Flow meters: Electromagnetic blood flow meter, ultrasonic blood flow meter, Doppler blood flow meter, NMR blood flow meter, cardiac output measurement – indicator dilution methods and impedance technique.

UNIT III

Pulmonary function analyzers: Pulmonary function measurement-spirometry, respiratory gas analyzers, pneumotachography – different types of pneumotachometers, respiratory rate meter, impedance plethysmograph / pneumograph.Blood gas analyzers: Blood pH measurement, pCO2 measurement, pO2 measurement, a complete blood gas analyzer. Different types of oximetry systems, pulse oximeter.

UNIT IV

Blood pressure and heart sound measurement: Measurement of blood pressure using sphygmomanometer instrument based on Korotkoff sound, indirect measurement of blood pressure, automated indirect measurement, and specific direct measurement techniques. Heart sound measurement – stethoscope, phonocardiograph.

UNIT V

Endoscopy: Introduction, various types of endoscopes, cystoscopes, laproscopes, fiber optic endoscopes and endoscopes with integral TV cameras.

Text Books:

R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, Tata McGraw Hill.
Carr & Brown, “Introduction to Biomedical Equipment Technology” Pearson Education, Asia.
J.Webster, “Bioinstrumentation”, Wiley & Sons

References:

Joseph Bronzino, “ Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.
Willard Van Nostrand, “.Instrumental Methods of Analysis”-
Sharms, “Instrumental Methods”, S Chand & Co.
Harry Bronzino E, “Handbook of Biomedical Engineering and Measurements”, Reston, Virginia.
Jacobson & Websler, “ Medicine & Clinical Engg”
Leslie Cromwell, “ Biomedical Instrumentation and Measurements”

EBM 032 TISSUE ENGINEERING

UNIT I

Introduction: Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

UNIT II

Cell culture: Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

UNIT III

Molecular biology aspects: Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

UNIT IV

Scaffold and transplant: Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology, stems cells: introduction, hepatopoiesis.

UNIT V

Case study and regulatory issues: Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

TEXT BOOK

1. Clemens van Blitterswijk, Tissue Engineering, Academic Press, 2008

REFERENCE BOOKS:

1. Principles of tissue engineering, Robert. P.Lanza, Robert Langer & William L. Chick, Academic press.
2. The Biomedical Engineering –Handbook, Joseph D. Bronzino, CRC press.
3. Introduction to Biomedical Engg. , Endarle, Blanchard & Bronzino, Academic press.
4. Tissue Engineering, B. Palsson, J.A. Hubbell, R.Plonsey & J.D. Bronzino, CRC- Taylor & Francis

EBM 033 Principles of Radio Diagnosis and Radio Therapy

UNIT - I

Production of X-rays Various components of radiographic systems Electrical circuit for X-ray unit filament circuits and mA control- IITV circuits - KV control exposure switching and control of exposure timers - types of X -ray tubes for various medical application. Rating charts of X -ray tubes.

UNIT - II

Scattered radiation & its control in radiography collimators bucky grids absorbed dose - Basics of tables & arms. Fluoroscopy systems TV chain for fluroscopy Properties of X-ray films &screens- Characteristics of imaging system - modulation transfer function.

UNIT - III

Automatic exposure controls - Photo timers - types - limitations - performance - serial film chargers types - radiographic considerations - film exposure time - photo timer applications - automatic brightness control system.

UNIT - IV

Basic of digital angiography - Image processors for digital angiography - processor architecture -Temporal integration techniques for digital angiography- digital subtraction angiography

UNIT - V

Physical principles of radio therapy. Dosage data for clinical applications. Measurement of output and use of ISODOSE charts. Collimators and beam direction devices. Telemetry sources and acceptancecalibration. Safety protocols & protection. Principles of linear accelerators for radiation therapy.Radiation therapy planning.

References:

Massey & Meredith , "Fundamental Physics of Radiology", John Wright & SonsWebb S, " The Physics of Medical Imaging", Adam Hilger, Bristol Thomas Thompson , "A Practical Approach to Modern Imaging Equipment" ,.Little Brown eloSybil M Stockley, " A Manual of Radiographic Equipments", Churchill Livingstones Chistrmis, "Physics of Diagnostic Radiology"

EBM 034 DESIGN AND MODELING OF BIOMEDICAL SYSTEMS

UNIT-I SELECTION OF HARDWARE

Sensor selection and their specifications, Power Supply Design, Filter Design, Amplifier Design, Display Devices, Data Recorders.

UNIT-II

Simulation of Design on using Simulation Softwre.

UNIT-III PCB DESIGN AND FABRICATION TECHNIQUES

PCB Design Software, types of PCB Design, Different Method of PCB Making.

UNIT-IV RELIABILITY ASPECT OF BIOMEDICAL EQUIPMENTS

Basic Reliability related Definitions, Need of reliability in Medical Device, Medical device reliability and Associated areas, Basic reliability Mathematics and Concepts for Medical Devices, Reliability Configuration.

UNIT-V SFETY ASPECT OF BIOMEDICAL EQUIPMENTS & THEIR CALIBRATION AND TESTING

Electrical shock hazards, Leakage current, proper Ground, Shielding, Safety codes for electro medical Equipments, Electrical safety Analyzer.

Calibration and Testing of Equipments.

REFERENCE BOOKS:

1. Balbir S Dhillon, "Medical Device Reliability and Associated Areas", Pub-CRC Press.
2. Khandpur R.S., "Hand book of Biomedical Instrumentation", Tata McGraw Hill, 2004.