G.B. TECHNICAL UNIVERSITY, LUCKNOW

Syllabus

3rd Year (V & VI Semester)

B.TECH. BIOMEDICAL ENGINEERING

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.Tech. Electronics Engineering, B.Tech. Electronics & Communication Engg.,
B.Tech. Electronics & Tele Communication Engg.
(Also for B.Tech. Biomedical Engineering)
[Effective from the session 2009-10]

YEAR 2nd, 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

U.P. TECHNICAL UNIVERSITY, LUCKNOW
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B.Tech. Electronics Engineering, B.Tech. Electronics & Communication Engg.,
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YEAR 2nd , SEMESTER-IV

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
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.	EEC-402	Computer Architecture & Organization	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	EEC-452	Digital Electronics Lab II	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

SYLLABUS & EVALUATION SCHEME FOR BIO-MEDICAL ENGINEERING (B. Tech Course)
[Effective from the session 2010-11]
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	Bio-Instrumentation	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	Bio-Instrumentation 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

SYLLABUS & EVALUATION SCHEME FOR BIO-MEDICAL ENGINEERING (B.Tech Course)
(Effective from the session 2010-11)
Year III, Semester VI

S. No.	Course Code	Subject	Periods			Evaluation Scheme					Credi
			L	T	P	Sessional			ESE	TOTAL	
						CT	TA	TOTAL			
THEORY											
1		Departmental 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 & Bio-Medical Applications	3	1	0	30	20	50	100	150	4
4	EBM-603	Bio- Medical 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	Bio-Material	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	Bio- Medical 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

Departmental Elective-I

EBM 011 : Laser & Fibre Optics & Its Medical Applications.
EBM 012 :Rehabilitation Engineering.
EBM 013 : Bio-Mechanics
EEC 013 : Advance Semiconductor Devices

Unit	SEMESTER – V 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* $_r$ *(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

SEMESTER – V
BIO-INSTRUMENTATION

EBM-501

L T P: 3 1 0

Unit 1.

Oximeters: Oximetry, Ear Oximeter, Pulse Oximeter, Skin Reflectance Oximeters, Intravascular Oximeter.

Blood Flow meters: Electromagnetic Blood flow meters, Types of electromagnetic Blood Flow meters, Ultrasonic Blood Flow meters, NMR Blood Flow meter and Laser

Doppler Blood Flow meter.

Unit 2.

Cardiac Output Measurement: Indicator dilution Method, Dye dilution Method, Thermal dilution Techniques, Measurement of Continuous Cardiac Output Derived from the Aortic Pressure Waveform, Impedance Technique, Ultrasound method.

Unit 3

Pulmonary function Analyzer: Pulmonary function Measurement, Spirometery, Pneumo tachometers, Measurement of volume, Pulmonary function Analyzer, Respiratory Gas Analyzers.

Blood Cell Counters: Types of Blood cells, Methods of Cell Counting, Coulter Counters, Automatic Recognition and Differential Counting of Cells.

Unit 4

Clinical Laboratory Instruments: Medical Diagnosis with chemical tests, Spectrophotometer, Spectrophotometer Type instruments, Colorimeters, Spectrophotometers, Automated Biochemical Analysis Systems, Clinical Flame photometers, Selective ion Electrodes Based Electrolytes Analyzer.

Unit 5

Audiometers and Hearing Aids: Mechanism of Hearing, Measurement of sound, Basic Audiometer, Pure Tone Audiometer, Speech Audiometer, Audiometer System Bekesy, Evoked Response Audiometery System, Calibration of Audiometers, Hearing Aids.

Unit 6

Patient Safety: Electric Shock Hazards, Leakage Currents, and Safety Codes for Electro Medical Equipments, Electrical Safety Analyzer, and Testing of Biomedical Equipment.

TEXT

1. Handbook of Biomedical Instrumentation. By: R. S. Khandpur. Pub: Tata McGraw - Hill, New Delhi.

2. Biomedical Electronics and Instrumentation. By: S. K. Venkata Ram. Pub: Galgotia Publication Pvt. Ltd., New Delhi.

3. Medical Instrumentation. Application and Design. By: John Webster. Pub: John Wiley and Sons. Inc., New York.

4. Biomedical Instrumentation and Measurements. By: Leslie Cromwell, Fred J. Weibell. Pub: Erich A. Pfeiffer.

(Revised) 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; DC 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: Basic Structure CMOS realization of Inverters, AND, OR, NAND and NOR Gates	13.2-13.3	
	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.

SEMESTER - V
MICROPROCESSOR & ITS APPLICATIONS

EBM-502

L T P: 3 0 0

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

SEMESTER – V
HUMAN ANATOMY & PHYSIOLOGY

EBM-503

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, Spiro meter (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, hemoglobin
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.
4. Human Physiology by A. Vander, J. Sherman and D. Luciano Mc Graw Hill.
5 Basic Human Theory by Charles E Tobin Mc Graw Hill.

SEMESTER – V

BIO-INSTRUMENTATION LAB

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

LIST OF EXPERIEMENTS

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.

SEMESTER – V

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.

SEMESTER – V

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.
   (b) 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

PHYSIOLOGY CONTROL SYSTEM AND SIMULATION MODELLING

EBM-601

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

SEMESTER – VI

MICROCONTROLLER AND BIO-MEDICAL APPLICATION

EBM-602

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: Control Word, mode of timers, simple programming, generation of square wave.
Serial Interface: Introduction, Control Word, mode of serial interface, simple Programming.

Unit 4.
Interrupts: Introduction, Control word Simple Programming, generation of waveforms using interrupt, serial interface using interrupt.

Unit 5.
Applications: Interfacing of memory, intelligent LCD, 8255, ADC, DAC, LED display.

Text Books
1. Micro controllers & its applications by B.S. Chhabra, Dhanpat Rai Pub. Co., India
2. 8051m C, 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

SEMESTER – VI

BIO-MEDICAL SIGNAL PROCESSING

EBM-603

L T P: 3 1 0

Unit 1.
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.

Unit 2.
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 3.
Fourier transform for continuous signals. Energy spectrum, Properties (without proof), Gibbs
phenomena, Auto and cross correlation. Discrete Fourier transforms. Properties (without proof), Inverse DFT. FFT, Decimation in time and decimation in frequency.

Unit 4.
Digital filter design, introduction, Realization of Digital system, canonical form, direct form &
Cascade Realization of IIR & FIR Filters. Design of IIR & FIR Filters, Low pass, High Pass,
Band Pass Filters using windows – Kaiser Windows.

Unit 5.
Data reduction Techniques, Power spectrum analysis, Sampling Theorem, aliasing Nyquist
criteria, ADC's and DAC's.

Unit 6.
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 Mat lab signal processing toolbox on various real bio **-** medical 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)

SEMESTER – VI
BIO-MATERIALS

EBM-604 **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.

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-2

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-3

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-4

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.

SEMESTER – VI
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.

SEMESTER – VI
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.

SEMESTER – VI

BIO-MEDICAL 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.

SEMESTER – VI
LASER & FIBER OPTICS AND ITS MEDICAL APPLICATION

EBM-011 **L T P: 3 1 0**

Elective-I

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.

REFERENCE

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.

SEMESTER – VI

REHABILITATION ENGINEERING

EBM-012 **L T P: 3 1 0**

Elective-II

Unit 1.

Introduction to Rehabilitation Engineering

Principles and Application involved in the study of Rehabilitation Engineering.

Unit 2.

Rehabilitation Engineering – Science and Technology

Concepts in Motor rehabilitation and Communication disorders.

Unit 3.
Prosthetics and Orthotics in Rehabilitation Engineering
Introduction, Fundamentals and applications of externally powered and controlled orthotics and prosthetics.

Unit 4.
Sensory Augmentation and Substitution
Visual Systems – Retinal Implants, Auditory system- Cochlear Implants, Tactual System.

Unit 5.
Future development of Rehabilitation Science – Neural Prosthesis

Text book / Reference Books
1. The Biomedical Engineering Handbook ; Joseph D Bronzino ; 3rd Ed.; CRC Press(2006)
2. Handbook of Biomedical Engineering (Handbooks in Science and Technology);Jacob Kline ; Academic Press (1988)

SEMESTER – VI
BIO-MECHANICS **L T P: 3 1 0**

EBM-013

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 ADVANCE SEMICONDUCTOR DEVICES 3 1 0

Unit	Topic	Chapter/ Section	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	8
	MOS Transistors and Charge Coupled Devices:		
	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 Willy-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.