

M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
B.TECH IN BIOMEDICAL ENGINEERING
SEMESTER-V
Modified 'F' Scheme effective from 20010-11

Course No	Subject	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam (in Hrs)
		L	T	P	Total		Theory	Practical		
BME-301-F	Biomechanics	3	1	-	4	50	100	-	150	3
BME-303-F	Biomechanics Lab.	-	-	2	2	25	-	25	50	3
BME-305-F	Basic Clinical Sciences	3	1	-	4	50	100	-	150	3
BME-307-F	Biomedical Equipments – I	3	1	-	4	50	100	-	150	3
BME-309-F	Biomedical Equipments-I Lab.	-	-	2	2	25	-	25	50	3
BME-311-F	Practical Training – I (Six weeks)	--	--	--	--	25	--	25	50	--
EE-309-E	Microprocessor & Interfacing	3	1	-	4	50	100	-	150	3
EE-329-E	Microprocessor & Interfacing Lab	-	-	2	2	25	-	25	50	3
EE-355-E	Integrated Circuit Systems	3	1	-	4	50	100	-	150	3
CSE-351-E	Digital Image Processing	3	1	-	4	50	100	-	150	3
CSE-353-E	Digital Image Processing Lab	-	-	2	2	25	-	25	50	3
	Total	18	6	8	32	425	600	125	1150	

Note

1. Students are allowed to use single memory, non-programmable scientific calculator during exam.
2. All the scheme has been given the code "F" which shows the current scheme for all the branches to avoid any confusion in various schemes.
3. The subject of Microprocessor and Interfacing (EE-309-E) and Microprocessor and Interfacing Lab (EE-329-E) respectively will have to be provided by the respective department
4. The subject of Intergarted Circuit Systems (EE-355-E) will have to be provided by the respective department
5. The subject of Digital Image Processing (CSE-351-E) and Digital Image Processing Lab (CSE-353-E) will have to be provided by the respective department
6. The grand total is 1150 .

SEMESTER - V
BIOMECHANICS

BME –301- F

L T P	Class Work	:	50 Marks
3 1 - -	Theory	:	100 Marks
	Total	:	150
	Duration of Exam	:	3 Hrs

SECTION A

BIOMECHANICS OF SPINE AND LOWER EXTREMITY

Biomechanics of Spine- Structure, Muscles of the spine, Movements, Loads on Spine, Common injuries of back and neck, Exoskeletal system for Paraplegics, Structure of Hip- Movements, Loads on Hip, Common injuries of Hip, knee and lower leg, Structure of Knee- Movements , loads on knee, Knee prosthesis , Powered wheel chair, Crutches and canes.

SECTION B

BIO FLUID MECHANICS

Introduction : Newton's laws, Stress, Strain, Non Viscous fluid, Newtonian Viscous fluid, Viscoelasticity,
The flow properties of Blood : Blood Rheology, Laminar Blood Flow, Blood Viscosity, Mechanical Interaction of Red blood cells with solid wall, Thrombus formation and dissolution, Medical applications of blood rheology.

SECTION C

GAIT ANALYSIS : Kinetics and Kinematics of GAIT, Stair and running GAIT, Abnormal GAIT, Effects of Age, Gender, Assistive Devices, and Orthoses

BONE & ITS PROPERTIES : Bone structure and Composition, Blood Circulation in Bone, Viscoelastic properties of Bone, Electrical Properties of Bone, Fracture Mechanism and Crack Propagation in bones

SECTION D

Linear of Human Movements : Newton's Laws, Mechanical Behaviour of Bodies in contact, Work, Power and Energy Relationship

Angular kinetics of Human Movements : Resistance to Angular Acceleration, Angular Momentum, Angular Analogues of Newton's Laws.

TEXT BOOKS

Y.C. Fung, Biomechanics-Circulation Springer Verlang, 2nd Edition, 1997
Basic Biomechanics, By Susan J. Hall

REFERENCE BOOKS

Fundamentals of Biomechanics, By Duane Knudson
VC Mow and W C Hayes, Basic Orthopedic Biomechanics, Lippincott - Raven Publishers

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

SEMESTER - V
Biomechanics Lab

BME – 303 F

L T P	Class Work	:	25 Marks
0 0 2	P/VV	:	25 Marks
	Total	:	50
	Duration of Exam	:	3 Hrs

LIST OF EXPERIMENTS

1. To determine the coefficient of static friction between two given material surfaces with the help of an inclined plane.
2. To study the lever action by using 'Bell Crank Lever'.
3. To study the equilibrium of a particle under the action of forces in a plane.
4. To study the equilibrium of a particle under the action of forces in space.
5. To determine the moment of Inertia of a stepped pulley or a flywheel.
6. To determine the effect of the principle of conservation of angular momentum on human body.
7. To determine the minimum initial height of a ball in order that it may succeed in 'looping the loop'.
8. To verify Bernaulli's Theorm, for fluid flow through pipes.
9. To determine the 'Center of Gravity' of a plane figure.
10. To study the projectile motion using a ball.
11. Study Gait Analysis
12. Study Skip - Vertical Jump Analysis

Note: Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the concerned

**SEMESTER - V
BASIC CLINICAL SCIENCES**

BME – 305 F

	Class Work	:	50 Marks
L T P	Theory	:	100 Marks
3 1 - -	Total	:	150
	Duration of Exam	:	3 Hrs

CONTENTS

SECTION A

Surgical Tools and Equipment : Electro-cautries, Shortwave and Microwave diathermy, **Laser in Medicine, Surgical Equipments**

SECTION B

Therapeutic endoscopy and microscopy, Radiation therapy, Microwave therapy, Thermotherapy
Automatic Drug Delivery, Patient Monitor and Alarms, Incubators, Anesthesia Equipment

SECTION C

Physiological aspect of eye : Physiology of eye, Electro-retinogram (ERG), EOG, Colour Vision testing equipment, Sneller's Chart, Keratometer, Refractometer, Retinoscope, Ophthalmoscope, Funduscope, Contact lenses and intra-ocular lenses

SECTION D

Physiological aspect of Autonomic nervous system – Structure and functional features of Sympathetic and Para-sympathetic responses, Disorders of ANS

Physiological aspect of cardiovascular system – Coronary artery Diseases, Congenital Heart Defects, Arrhythmia, Regulation of Heart Beat and Blood Pressure, Hyper/Hypotension, Diabetes,

Text

1. Sembulingam, "Medical Physiology" published by Jaypee Brothers
2. Asthana, "Ophthalmoscopy"
3. R D Miler, "Textbook of anesthesia"

REFERENCES

1. M K B ykes and M D Vickers, "measurements in anesthesia"
2. Mushin, "Automatic ventilation of lungs"
3. Duke Elder, "System of Ophthalmology Vol VII"
4. Miller Stephen J H , " Parson disease of the eye"

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

SEMESTER - V
BIOMEDICAL EQUIPMENTS – I

BME – 307 F

	Class Work	:	50 Marks
L T P	Theory	:	100 Marks
3 1 -	Total	:	150
	Duration of Exam	:	3 Hrs

CONTENTS

SECTION A

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.

Lithotrippers: The stone disease problem, Lithotripter machine, modern systems, Extra Corporeal Shock Wave Therapy.

SECTION B

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.

Pulmonary function Analyzer: Pulmonary function Measurement, Spirometry, Pneumotachometers, Measurement of volume, Pulmonary function Analyzer, Respiratory Gas Analyzers.

SECTION C

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

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

SECTION D

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

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

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.

References

1. Encyclopedia of Medical Devices and Instrumentation – John G. Webster Vol. I, II, III, IV.
2. Introduction to Biomedical Equipment Technology – Carr Brown (Pearson Education Pub)
3. Various Instruments Manuals.

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

SEMESTER - V
BIOMEDICAL EQUIPMENTS – I LAB

BME – 309-F

L T P	Class Work	:	25 Marks
-- 2	Theory	:	25 Marks
	Total	:	50
	Duration of Exam	:	3 Hrs

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
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.

Note: Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the concerned institution as per the scope of the syllabus.

BME-311-F

**SEMESTER – V
PRACTICAL TRAINING-I**

L T P	Class Work	:	25 Marks
- - -	P/VV	:	25 Marks
	Total	:	50
	Duration of exam	:	3 hrs

At the end of fourth semester each student would undergo six weeks practical training in an industry/Professional organization/research laboratory/Hospital with the prior approval of the Director-Principal/Principal of the concerned college and submit a written typed report along with a certificate from the organization. The record will be evaluated by examiner(s) to be appointed by the Director-Principal/Principal of the concerned college.

EE-309-F

Microprocessors and Interfacing

L T P

3 1 -

Theory : 100 Marks

Class work : 50 Marks

Total : 150 Marks

Duration of Exam : 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

PART A

THE 8085 PROCESSOR :

Introduction to microprocessor, 8085 microprocessor : Architecture, instruction set, interrupt structure, and Assembly language programming.

PART B

THE 8086 MICROPROCESSOR ARCHITECTURE :

Architecture, block diagram of 8086, details of sub-blocks such as EU, BIU; memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals

PART C

INSTRUCTION SET OF 8086 :

Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

PART D

INTERFACING DEVICE :

8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller.

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

Microprocessor & Interfacing Lab

EE-329-F

L T P
0 0 2

CLASS WORK	:	25
EXAM	:	25
TOTAL	:	50
DURATION OF EXAM	:	3 HRS

List of Experiment

ANY TEN EXPERIMENTS SHOULD BE PERFORMED:

1. Write a program using 8085 for Hexadecimal addition & subtraction of two numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers
3. Write a program to perform multiplication and division of two 8 bit numbers using 8085
4. Write a program using 8086 for division of a defined double word (stored in a data segment) by another double Word division and verify.
5. Write a program using 8086 for finding the square root of a given number and verify.
6. Write a program using 8086 to copy 12 bytes of data from source to destination & verify.
7. Write a program to find maximum and minimum from series using 8086.
8. Write a program to initiate 8251 and to check the transmission and reception of character.
9. Write a program to interface ADC & DAC with 8085 & demonstrate generation of square wave.
10. Write a program to control the operation of stepper motor using 8085/8086 and 8255 PPI.
11. Write a program to interface 8X8 LED Matrix Display using 8085/8086 microprocessors and 8255 PPI.
12. Write a program to control the traffic light system using 8085/8086 and 8255 PPI.
13. Write a program to control simulated elevator 8085/8086 microprocessors and 8255 PPI.

INTEGRATED CIRCUIT SYSTEMS

EE-355-E

L T P
3 1 - -

Class Work	:	50 Marks
Theory	:	100 Marks
Total	:	150
Duration of Exam	:	3 Hrs

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Section A

Operational Amplifiers: The basic OOPAMP, The differential amplifier, Emitter coupled differential amplifier. Transfer characteristic, IC OPAMP, offset error voltages and currents, Temperature drift of input offset voltage and current, Measurement of OPAMP parameters, Frequency response of OPAMP.

Section B

Linear Analog Systems: Basic OPAMP applications, differential DC amplifier, summing, scaling. Averaging and Instrumentation amplifier, stable AC coupled amplifier, Analog Integration and Differentiation, Voltage to current and current to voltage converter, Active filters, active resonant band pass filters, Delay equalizer.

Non Linear Analog Systems: Comparators, Sample and hold circuits, Precision rectifiers, Logarithmic amplifiers, Waveform generators, (Square wave, triangular, sawtooth), voltage controlled oscillator, Schmitt trigger.

Section C

Specialized IC Applications: Switched Capacitor filter. Theory of Operation, Switched Capacitor Integrator, Universal Monolithic Switched Capacitor filter. The 555 Timer, 555 as a monostable multivibrator, Monostable Multivibrator Applications. 555 as an Astable Multivibrator, Astable Multivibrator Applications, Phase locked loops; Operating Principles, Monolithic Phase-Locked Loops, 565 PLL Applications, Voltage Regulators; Fixed Voltage regulator; Adjustable voltage regulator, Switching regulators.

Section D

A/D and D/A Converter: The counter type A/D Converter, Successive Approximation A/D Converter, Parallel Comparator A/D Converter, Dual Slope or Ratio Metric A/D Converter, Ladder type D/A Converter, D/A Converter with Binary weighted resistors.

Text

1. Jacob Millimant, Christors C Halkias, "Integrated Electronics", Mcgraw Hill, 2002
2. Ramakanth A Gayakwad, "OPAMPS and Liner Integrated Circuits", Prentice Hall, Edition 4, 2000.
3. J Nagrath, "Electronics (Analog and Digital)", Prentice Hall

Reference

1. Jacob Millman, Irvin Gabel, "Microelectronics", McGraw Hill, Edition2, 1988

DIGITAL IMAGE PROCESSING

CSE– 351 E

	Class Work	:	50 Marks
L T P	Theory	:	100 Marks
3 1 - -	Total	:	150
	Duration of Exam	:	3 Hrs

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section A

Introduction and Digital Image Processing Fundamentals: Digital Image Formation, Fundamentals Steps in Image Processing, Elements of Image Processing systems, Sampling and Quantization, Image Neighbours and Distance.

Transforms used in Image Processing: Introduction to Fourier Transform, Discrete Fourier Transform and Some Properties of Fast Fourier Transform.

Section B

Image Enhancement: Background, Minimum Mean-square Error Restoration, Least square Error Restoration, Constrained Least square Error restoration, Restoration by singular Value decomposition, Homomorphic filtering.

Image Restoration: Background, Minimum mean-square Error Restoration, Least square Error Restoration, Constrained Least square Error restoration, Restoration by singular Value decomposition, Homomorphic filtering.

Section C

Image Compression: Fundamentals, Image Compression Models, Error Free compression techniques, Lossy compression techniques

Image segmentation: Detection of Discontinuities, Pixel Board approach of segmentation, Multilevel Thresholding, Local Thresholding, Region based approach of segmentation.

Section D

Colour Image Processing: Colour Fundamentals, Colour Models, Examples of colour Image Processing, Pseudo colouring and colour Displays.

Biomedical Application: Computer Tomography (Radon Transform, Back Projection Operator). MRI Images, Processing of Radiograph, Angiogram, Sonography including Doppler Technique.

Text

1. Digital Image Processing – Rafael C. Gonzalez and Richard E. Woods (Pearson Education).
2. Fundamentals of Digital Image Processing – A.K. Jain (Pearson Education)

Reference

1. Digital Image Processing and Analysis – B., Chanda and D. Dutta Najumdar (Eastern Economy Edition)
2. Fundamentals of Electronic Image Processing, Arthur R. Weeks.

Note: Examiner will set eight questions in all. Students will be required to attempt any five questions.

SEMESTER – V

CSE-353-E

DIGITAL IMAGE PROCESSING LAB

L T P	Class Work	:	25 Marks
-- 2	P/VV	:	25 Marks
	Total	:	50
	Duration of Exam	:	3 Hrs

LIST OF EXPERIEMENTS

1. Background on MATLAB & the Image processing tool box.

2. Digital Image representation.
3. Histogram Processing & Function Plotting.
4. Spatial filtering.
5. Generating Frequency domain filter
6. Sharpening frequency domain filter.
7. Weiner filtering.
8. Constrained Least square filtering.
9. Color Image Representation in MATLAB
10. Background on compression techniques.
11. Coding Redundancy.

Note: Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the concerned institution as per the scope of the syllabus.

M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
B.E IN BIOMEDICAL ENGINEERING
SEMESTER VI
Modified 'F' Scheme effective from 2010-11

Course No	Subject	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam (in Hrs)
		L	T	P	Total		Theory	Practical		
BME-310 F	Medical Informatics	3	1	-	4	50	100	-	150	3
BME-314 F	Bio Medical Equipments-II	3	1	-	4	50	100	-	150	3
BME-316 F	Introduction to Biomaterials	3	1	-	4	50	100	-	150	3
BME-320 F	Bio-Medical Equipment-II Lab.	-	-	2	2	25	-	25	50	3
BME-322 F	Principles of Medical Imaging	3	1	-	4	50	100	-	150	3
BME-324 F	Principles Medical Imaging Lab.	-	-	2	2	25	-	25	50	3
EE-206 E	Communication Systems	3	1	-	4	50	100	-	150	3
EE 226-E	Communication Systems Lab	-	-	2	2	25	-	25	50	3
EE-312-F	Microcontroller and Embedded Systems	3	1	-	4	50	100	-	150	3
EE-328-F	Microcontroller and Embedded Systems Lab	-	-	2	2	25	-	25	50	3
GPBME-302 F	General Proficiency	-	-	-	-	50	-	-	50	3
	Total	18	6	8	32	450	600	100	1150	

Note

1. Students are allowed to use single memory, non-programmable scientific calculator during exam.
2. All the scheme has been given the code "F" which shows the current scheme for all the branches to avoid any confusion in various schemes.
3. The subject of Micro controller & its Applications (EE-351-E) and Micro controller & its Applications Lab (EE-353-E) will have to be provided by the respective department
4. The subject of Communication Systems (EE-206-E) and Communication Systems Lab (EE-226-E) will have to be provided by the respective department
5. Grand Total is 1150
6. Each student has to undergo practical training of 6 weeks during summer vacation and its evaluation shall be carried out in the VII semester.

SEMESTER – VI
MEDICAL INFORMATICS

BME – 310 F

L T P	Class Work	:	50 Marks
3 1 - -	Theory	:	100 Marks
	Total	:	150
	Duration of Exam	:	3 Hrs

CONTENTS

SECTION A

Computerized Patient Data Base Management: Introduction, History-taking by computer, Dialogue with the computer, Computerized medical record –Evaluation, Artificial Intelligence in Medicine, The Structure of Medical Informatics. Uncertainty of medical data and security issues. Sources of Data for Decision –Making, Modes of Decision. Telemedicine

SECTION B

Hospital Information System: Introduction, need, Benefits, capabilities, development and functional areas. Modules forming HIS, Pre-requisites for HIS, drawbacks of HIS , advantages of HIS, The HELP System, Output to physician.

HOSPITAL MANAGEMENT : Management of Hospital organisation, Nursing section Medical Sector, Central Services, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis Human relation in Hospital, Importance to Team Work, Legal aspect in Hospital Management.

SECTION C

Computers in Clinical Laboratory: Introduction, Data base approach to Laboratory Computerization, Automated Clinical Laboratories, Automated Methods in Hematology, Chromosome Analysis by computer, Computerized Electrocardiography ECG, EMG, EEG

PATENT : Copyright protection, **PATENT** : Criteria for patent, Nomenclature, contents of a patent, drafting of a patent, Need and application of a patent.

SECTION D

Computer-Assisted Medical Decision-Making: Introduction, General Model of CMD, Algorithmic Methods, Computers in the care of Critically Ill Patients: Automated computer Assisted Fluid and Metabolic balance, Pulmonary Function Evaluation

Computer Aids for the Handicapped: Introduction, Mobility, Blind and Visually Handicapped, Computer aids for the deaf, computer speech generation and recognition.

TEXT

7. Computers in medicine : Progress in medical informatics – R.D.Lele, Tata McGraw Hill 2005
8. J. H. van Bommel and M. A. Musen (eds.), Handbook of Medical Informatics. Bohn Stafleu Van Loghum, Houten 1997
9. Enrico Coiera: Guide to Medical Informatics, the Internet and Telemedicine. Chapman & Hall Medical, London 1997.
10. Bronzino JD, The biomedical engineering handbook, IEEE Press, 2000

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

SEMESTER - VI
BIO - MEDICAL EQUIPMENT II

BME – 314 F

	Class Work	:	50 Marks
L T P	Theory	:	100 Marks
3 1 -	Total	:	150
	Duration of Exam	:	3 Hrs

CONTENTS

SECTION A

Cardiac Pacemakers : Asynchronous and Synchronous(demand) mode of operation. External and implantable Asynchronous pacemakers. Working principles, Block diagram and circuit diagram of a blocking oscillator Asynchronous pacemakers, synchronous pacemakers. Working principles. Modes of triggering.

Implantable pacemakers:

Technical and qualitative requirements of power supplies. Lead wires and electrodes transcutaneous RF powered Cardiac pacemaker systems. Susceptibility of implantable pacemakers to electrical interference and remedial measures.

SECTION B

Assist devices for the heart : Principles of external counter pulsation techniques, intra aortic balloon pump. Auxiliary ventricle and schematic for temporary bypass of left ventricle.

Heart lung machine : Governing principles qualitative requirements, functional details of bubble, thin film, membrane type of blood oxygenators.

SECTION C

Prosthetic heart valves : Qualitative requirements categories; Mechanical and tissue valves, types of medical valves, ball and cage, tilting disc, and bileaflet valves, types of tissue valves, homografts or allografts (human cadaver) and heterografts or xenografts (procine or bovine) in vivo performance testing of prosthetic heart valves using a pulse duplicator.

SECTION D

Hemodialysers : Structure and Function of Kidney, Types of Dialysers, Dialysis Machine, General scheme of operations, types of exchangers, Electronic control & Monitoring Systems.

Ventilators : Mechanism of Respiration, Artificial Ventilation, Ventilators, Types of Ventilators, Classification, Modern and High frequency Ventilators

TEXT

1. Biomedical Instrumentation volume 2 By N. Mohan Murali(O. H. Press)
2. Medical Instrumentation Haughton By John C. Webster (Mifflis Co. Boston USA)
3. Hand Book of Biomedical Instrumentation By R. S. Khandpur (Tata McGraw Hill)

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The

students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

SEMESTER - VI
INTRODUCTION TO BIOMATERIALS

BME – 316 F

L T P	Class Work	:	50 Marks
3 1 -	Theory	:	100 Marks
	Total	:	150
	Duration of Exam	:	3 Hrs

CONTENTS

SECTION A

Characterization of Materials : Mechanical Properties – Stress-strain behaviour, mechanical failure, viscoelasticity, Surface and bulk properties,

Metallic implant materials : Stainless steel, Co-based alloys, Ti and Ti-based alloys. Dental implants. Degradation of Metallic Implants in Biological Environment: Importance of stress-corrosion cracking. Soft and Hard tissue replacement

SECTION B

Polymeric implant materials : Polymerization and properties; Effect of structural modification and temperature on Polymers ; Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, rubbers, acetals. Chemical and Biochemical Degradation of Polymers.

SECTION C

Ceramic implant materials : Definition of bioceramics. Structure-property relationship of ceramics, Classification of bioceramics: Alumina, Zirconia, Calcium Phosphate, Glass ceramics, Carbons. Bioresorbable and bioactive ceramics.

Composites : Mechanics of composites, Application of composite Biomaterials,

Sterilisation techniques : Concept of Sterility, SAL, Various techniques of Sterilization

SECTION D

Host Reactions to Biomaterials : Inflammation and Wound Healing, Innate and Adaptive Immunity, Complement System, Hypersensitivity, Blood Coagulation and BMI,

Biological Properties of Biomaterials : Introduction to testing of Biomaterials, *In-vitro* and *in-vivo* assesment of tissue compatibility, Evaluation of Blood-material interaction : requirement of blood compatibility, thrombogenicity, factors affecting BMI, Evaluation of BMI

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.

Reference

1. Lawrence Stark & Gyan Agarwal , *Biomaterials*
2. L. Hench & E. C. Ethridge, *Biomaterials - An Interfacial approach*.

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

SEMESTER - VI
BIOMEDICAL EQUIPMENTS II LAB

BME – 320 F

L T P	Class Work	:	25 Marks
0 0 2	P/VV	:	25 Marks
	Total	:	50
	Duration of Exam	:	3 Hrs

List of Experiments

1. Design and realize synchronous/ asynchronous pacemaker
2. To study different types of prosthetic heart valves.
3. Study of different types of oxygenators used in hemodialysis.
4. Design Muscle Stimulator circuit and generate trapezoidal waveform and galvanic waveforms
5. To study Heart Lung Machine.
6. To study modes of triggering in artificial pacemaker.
7. To design and realize faradic and surge faradic stimulator waveforms.
8. To study stress test analysis system (TMT)
9. To study Nerve and muscle conduction using PC based Physiology system.
10. .Using PC based Physiology system study Pulmonary functions analysis.

Note: Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the concerned institution as per the scope of the syllabus.

SEMESTER - VI
PRINCIPLES OF MEDICAL IMAGING-I

BME – 322-F

L T P	Class Work	:	50 Marks
3 1 - -	Theory	:	100 Marks
	Total	:	150
	Duration of Exam	:	3 Hrs

CONTENTS

SECTION A

Introduction: Clinical and scientific needs in medical imaging.

X-ray imaging: Basis of diagnostic radiology, nature & production of x - rays, X - Ray generators, Attenuation of X – Rays, Diagnostic and therapeutic Role of X - rays.

SECTION B

X-ray Filters, Bean Restrictors: Filtration – Inherent and Added, Heavy metal filters, Collimators and diaphragms, functions of restrictors.

X-ray Grids: Terminology, Evaluation of grid performance, Lead content, Grid cut off, Moving grids, Grid selection.

SECTION C

X-ray Film Generation: Photographic Film, Film Processing.

Computerized Tomography: Applications, System components, Gantry Geometry and Patient Doses, Generations of CT, Image Reconstruction, Image Quality, Artifacts.

SECTION D

Digital Radiography : Radio graphic Contrast, Sharpness, Line spread function, Modulation transfer function

Thermography – Physics of Thermography, Infrared Detectors, Thermographic equipment and thermographic camera based on IR sensor.

Surface potential mapping and biomagnetic imaging. Near - infrared transillumination.

TEXT

1. Christensen's Physics of Diagnostic Radiology, Thomas, James, Robert C. Murry Lea & Febiger London 1990.
2. Principles of Magnetic Resonance Imaging, Zhi - Pei Liang, Paul C. Lauterbur, IEEE Press
3. Joseph P Hornak's book at <http://www.cis.rit.edu/htbooks/mri/>
4. Imaging Systems for Medical Diagnostics, Erich Krestel (Ed), Siemens Aktiengesellschaft.

1990, ISBN 3 - 8009 - 1564 - 2 [EK]. This was used as the text in past years.

5. There is an excellent selection of free material on http://www.ismrm.org/mr_sites

REFERENCES

7. The Physics of Radiology, III'rd or IV'th ed, H. E. Johns and J. R. Cunningham, Chas. C Thomas pub.
8. Principles of Magnetic Resonance Imaging, Zhi - Pei Liang, Paul C. Lauterbur, IEEE Press.
9. Radiological Imaging, Vols 1&2, Harrison H. Barret and W Swindell, Academic Press, 1981.

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

SEMESTER - VI
PRINCIPLE OF MEDICAL IMAGING I LAB

BME – 324 F

L T P	Class Work	:	25 Marks
0 0 2	P/VV	:	25 Marks
	Total	:	50
	Duration of Exam	:	3 Hrs

LIST OF EXPERIMENTS

As per Scope of Subject

Note:

- 1. The Demonstration shall be conducted in Hospitals or Diagnostic Centers**
- 2. Evaluation shall be based on the report submitted by the student and the viva vice.**

SEMESTER - VI
COMMUNICATION SYSTEMS

EE-206-F

L T P
3 1 0

Class Work	:	50
Exam	:	100
Total	:	150
Duration of Exam	:	3 Hrs

SECTION-A

INTRODUCTION TO COMMUNICATION SYSTEMS:

The essentials of a Communication system, modes and media's of Communication, Classification of signals and systems , Fourier Analysis of signals. Analog Communication & Digital Communication. Basic concepts of Modulation, Demodulators, Channels, Multiplexing & Demultiplexing.

SECTION-B

AMPLITUDE MODULATION:

Amplitude modulation, Generation of AM waves, Demodulation of AM waves, DSBSC, Generation of DSBSC waves, Coherent detection of DSBSC waves, single side band modulation, generation of SSB waves, demodulation of SSB waves, vestigial sideband modulation (VSB).

ANGLE MODULATION :

Basic definitions: Phase modulation (PM) & frequency modulation(FM), narrow band frequency modulation, wideband frequency modulation, generation of FM waves, Demodulation of FM waves.

SECTION C

PULSE ANALOG MODULATION:

Sampling theory, sampling and hold circuits. Time division (TDM) and frequency division (FDM) multiplexing, pulse amplitude modulation (PAM), pulse time modulation.

PULSE DIGITAL MODULATION :

Coding & Decoding techniques, Elements of pulse code modulation, noise in PCM systems, Measure of information, channel capacity, channel capacity of a PCM system, differential pulse code modulation (DPCM). Delta modulation (DM)

SECTION D

DIGITAL MODULATION TECHNIQUES: ASK, FSK, BPSK, QPSK, M-ary PSK.

PC-PC data Communication

INTRODUCTION TO NOISE: External noise, Internal noise, S/N ratio, noise figure.

TEXT BOOKS:

1. Communication systems (4th edn.): Simon Haykins; John wiley & sons.
2. Communication systems: Singh & Sapre; TMH.

REFERENCE BOOKS :

1. Electronic Communication systems : Kennedy; TMH.
2. Communication Electronics : Frenzel; TMH.
3. Communication system : Taub & Schilling; TMH.

Note: For setting up the question paper, Question No 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

	SEMESTER - VI		
EE-226-F	COMMUNICATION SYSTEMS LAB		
	Class Work	:	25 Marks
L T P	P/VV	:	25 Marks
0 0 2	Total	:	50
	Duration of Exam	:	3 Hrs

LIST OF EXPERIMENTS:

1. Generation of DSB-SC AM signal using balanced modulator.
2. Generation of SSB AM signal
3. To study envelop detector for demodulation of AM signal and observe diagonal peak clipping effect.
4. Frequency modulation using voltage controlled oscillator.
5. To generate a FM Signal using Varactor & reactance modulation.
6. Detection of FM Signal using PLL & foster seelay method..
7. To Study Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
8. To study the circuit of PAM/PWM/PPM modulator & Demodulator
9. Study of Frequency Division Multiplexing/Demultiplexing with sinusoidal & audio inputs.
10. Generation & study of Analog TDM at least 4 channels.
11. Study of 4 channel Time Division Multiplexing system.
12. Study of pulse code modulation and demodulation with parity & Hamming code .
13. Study pulse data coding & Decoding techniques for various formats .
14. Study of ASK, FSK modulator and demodulator.
15. Study of PSK & QPSK modulator and demodulator.

NOTE: Atleast ten experiments are to be performed , atleast seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

L T P

Theory : 100 Marks

3 1 -

Class work : 50 Marks

Total : 150 Marks

Duration of Exam : 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

INTRODUCTION OF MICROCONTROLLER: Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts, timers, peripherals.

Section-B

MICROCONTROLLER ARCHITECTURE: Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, Addressing modes, CPU registers, Instruction set, simple operations.

Section-C

Microcontrollers - Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

Section-D

Embedded Systems-Introduction, Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices, Case Study of an Embedded System for a Smart Card.

Text Book

1. B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2. Design with PIC Microcontrollers by John B. Peatman , Pearson.
3. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
4. V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.

References:

1. **Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.**
2. **A. V. Deshmukh: Microcontroller (Theory and Application), TMH.**
3. **D. V. Hall: Microprocessors and Interfacing, TMH**
4. **Programming and Customizing the 8051 Microcontroller : Predko ; TMH.**
5. **Programming Embedded Systems in C and C++ : Michael Barr; SHROFF PUB. & DISTR**

SEMESTER - VI

EE-328-F

MICROCONTROLLER&EMBEDED SYSTEM DESIGN LAB

L	T	P
-	-	2

Class Work:	25
Exam:	25
Total:	50

Duration of Exam: 2 Hrs.

List of Experiment:

8051/AT 89C51 microcontroller

01. Write an Assembly language Programme (ALP) to generate 10 kHz square wave.
02. To study implementation & interfacing of Display devices Like LCD, LED Bar graph & seven segment display with Microcontroller 8051/AT89C51
03. To study implementation & interfacing of Different motors like stepper motor, DC motor & servo Motors.
04. Write an ALP for temperature & pressure measurement.
05. Write a program to interface a graphical LCD with 89C51.
06. To study Programming and Transmission & reception of data through Serial port & study of Parallel printer port.

PIC Microcontroller

07. To interface PWM based voltage regulator using PIC Microcontroller .
08. Study and analysis of interfacing of Graphical LCD using PIC controller
09. Study and interfacing of IR (RC5 protocol) and RF Communication using PIC controller
10. Study of SD/MMC card Interface using 18F4550

SEMESTER - VI
General Proficiency

GPBME – 302 F

L T P
0 0 2

Class Work	:	50 Marks
Total	:	50
Duration of Exam	:	3 Hrs

LIST OF EXPERIMENTS

At least ten experiments should be performed including demonstration, applications and designing from the contents of the **THEORY SUBJECTS**.

The lab will consist of 4 GD's, 3 Writing Skill exercises and 3 presentations.