M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
B.TECH IN BIOMEDICAL ENGINEERING
SEMESTER VII
'F' Scheme
EFFECTIVE FROM THE SESSION 2012-13

Course No	Subject	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam (in Hrs)
		L	T	P	Total		Theory	Practical		
BME-413-F	Principles of Medical Imaging II	3	1	-	4	50	100	-	150	3
BME-417-F	Nuclear Medicine Radiation & Safety	3	1		4	50	100	-	150	3
BME-419-F	Bio-Medical Ethics & device regulation	3	1	-	4	50	100	-	150	3
BME-421-F	Computational Techniques	3	1	-	4	50	100	-	150	3
	Open Elective	3	1	-	4	50	100	-	150	3
	Dept. Elective	3	1	-	4	50	100	-	150	3
BME-415-F	Principles of Medical Imaging II Lab	-	-	2	2	50	-	50	100	3
BME-423-F	Computational Techniques Lab	-	-	2	2	25	-	25	50	3
BME-409-F	Practical Training-II (6 weeks)	-	-	--	--	-	-	-	-	3
BME-421-F	Independent Study Seminar	-	-	4	4	100	-	-	100	3
GPBME-401-F	General Fitness for the Profession	-	-	-	-	--	-	50	50	3
	Total	**18**	**6**	**8**	**32**	**475**	**600**	**125**	**1200**	

List of Open Electives

1.	HUM-451-F	Language Skills for Engineers
2.	HUM-453-F	Human Resource Management
3.	HUM-459-F	Renewable Energy Resources and Technology
4.	ME-451-F	Mechatronics Systems
5.	IC-455-F	Intelligent Instrumentation for Engineers
6.	OR-401-F	Operations Research

List of Departmental Electives

1.	BME-453-F	Fiber Optics and Lasers in Medicine
2.	BME-455-F	Principles of Bioengineering
3.	BME-452-F	Rehabilitation Engineering
4.	BME-454-F	Bio-Electromagnetism
5.	BME – 456 – F	Biological Control System
6.	BME – 458-F	Advanced Biomedical Engineering

Note

1. **Students are allowed to use single memory, non-programmable scientific calculator during exam.**
2. ***Student will be permitted to opt for any one elective run by the other department. However the departments will offer only those electives for which they have expertise. The choice of the students for any elective shall not be a binding for the department to offer, if the department does not have expertise.**
3. **A team consisting of Principal / Director HOD of concerned department and external examiner appointed by the University shall carry out the evaluation of the student for his / her General Fitness for the Profession.**
4. **Assessment of Practical Training-II, undergone at the end of IV semester, will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the industry. According to performance letter grades A, B, C, F are to be awarded. A student who is awarded 'F' grade is required to repeat Practical Training.**

M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
B.TECH IN BIOMEDICAL ENGINEERING
SEMESTER VIII
'F' Scheme
EFFECTIVE FROM THE SESSION 2012-13

Sr. No.	Course No.	Subject	Internal Marks	External Marks	Total Marks
1	BME - 402 - F	Industrial Training / Institutional Project Work	150	150	300

Note :

The students are required to undergo Industrial Training or Institutional Project Work of Duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should at least by a private limited company. The students shall submit and present the mid-term progress report at the institute. The presentation will be attended by a committee. Alternatively, the teacher may visit the industry to get the feedback of the students.

The final viva-voce of the industrial training of institutional project work will be conducted by an external examiner and one internal examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the Board of Studies in Engg. And Technology. Assessment of Industrial Training or Institutional Project Work will be based on seminar, viva-voce, report and certificate of Industrial Training or Institutional Project Work obtained by the student form the industry or Institute.

The internal marks distributions for the students who have undergone Industrial Training consist of 50 from the industry concerned and 100 marks by the committee members consisting of faculty members of concerned department of the institute

The teachers engaged for Institutional Project Work shall have a workload of 2 hours per group (at least 4 student) per week.

SEMESTER - VII
PRINCIPLES OF MEDICAL IMAGING II

BME – 413 F

	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.

CONTENTS

SECTION A

Fundamentals of Acoustic Propagation, characteristic impedance, intensity, radiation force, reflection and refraction, attenuation, absorption, scattering.
Generation and detection of ultrasound: piezoelectric effect, ultrasonic transducers (mechanical and electrical matching), transducer beam characteristics, axial and lateral resolution, focusing arrays.

SECTION B

Ultrasonic diagnostic methods: pulse-echo systems (A or amplitude mode, B or brightness mode, M or motion mode and C- mode), Doppler Effect and Doppler methods, color Doppler.
Biological effects of ultrasound: Acoustic phenomena at high intensity levels, ultrasound bioeffects.

SECTION C

Fundamentals of Nuclear magnetic Resonance: angular momentum, magnetic dipole moment, magnetization, Larmor frequency, rotating frame of reference and the RF magnetic field.
Generation and Detection of NMR Signal: The magnet (superconducting magnets, permanent magnets), magnetic field gradients, the NMR coil/probe, data acquisition.

SECTION D

Imaging Methods: Slice selection, frequency encoding, phase encoding, spin-echo imaging, gradient-echo imaging, blood flow imaging.
Biological effects of magnetic fields: Static magnetic fields, radio frequency fields, gradient magnetic fields.
Radiotherapy equipment: Introduction to dental X-ray machines, Cobalt-60 machines, Medical linear X-ray machines.

TEXT
1. K. Kirk Shung, Michael B Smith, Benjamin Tsui, Principles of Medical Imaging, academic Press, inc., London, 1992
2. Textbook of Radiology: Christensen
3. Handbook of Biomedical Instrumentation: R S Khandpur

References:
1.   Avinash C. Kak, Malcolm Slaney available in pdf format at
www.slaney.org/pct/index.html, Principles of Computerized Tomographic Imaging, IEEE Press, New York, 1988
2. B. H. Brown, R H smallwood, D C Barbere et al, medical Physics and Biomedical engineering, Institute of physics, 1999

PRINICIPLES OF MEDICAL IMAGING II LAB

BME – 415 F

	Class Work	:	50 Marks
L T P	P/ VV	:	50Marks
- - 2	Total	:	100 Marks
	Duration of Exam	:	3 Hrs

CONTENTS

1. Generation and detection of ultrasound using ultrasound equipment.
2. Understanding of various Ultrasound modes- A mode, B mode, AB mode, C mode and M mode using ultrasound equipment
3. Study of Generation and Detection of NMR Signal using MRI machine.
4. Image formation and X-ray film processing.
5. Study different types of magnets used in Imaging with their properties.
6. With help of magnets study the fundamentals of Nuclear magnetic Resonance
7. Using different ultrasound probes study US image formation.
8. Study of Radiotherapy instrument
9. Study of Biological effects of electromagnetic radiation
10. Study of different images taken by MRI

Note: Visit to a Diagnostic center /Hospital / Industry dealing with Medical Imaging Equipment is compulsory. 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 – 417- F

	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.

CONTENTS

SECTION A

Introduction: Properties and effects of radio active emissions and their applications in nuclear medicine. Kinetics of Radioactive Decay. Units of Radioactivity, Interaction of Radiation with Matter : Interaction of Charged Particles, □-Radiations, Neutrons

SECTION B

Radiation detectors: Gas Filled Detectors, Scintillation and Semiconductor Detectors types and their applications in nuclear medicine.

SECTION C

Radio Isotope Imaging Equipments : The gamma camera, Construction and working, Performance Characteristics
SPECT Construction,Working, Image Reconstruction techniques
Positron Emission Tomography – Introduction to PET Imaging, Properties of PET, Study of PET machine.

SECTION D

The computer in NM: Basics of Computer, Applications
Radiation protection and safety. Safety of non - ionizing and Ionizing radiation. Stocastic and non-Stocastic effects, ALARA, Risk Factors, Safety limits.
Principles of radiation dosimetry; Internal and External dosimetry, Units of exposure and dose.

TEXT
1. The physics of radiology By H. E. Johns and J. R. Gunningham.
2. Physics and Radiobiology in Nuclear Medicine By Saha G (Springer Verlag N. Y.)
3. Quality control of Nuclear Medicine instrumentation By R. F. Mould (IPSM. York)

BIOMEDICAL ETHICS AND DEVICE REGULATIONS

BME-419 F

L	T	P
3	1	-

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

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

Medical Ethics : History of medical ethical systems, The role and sources of codes
Principles of Medical Ethics : Moral justification, theories, principles and rules
The Health care professional : Depersonalizing trends, traditional ideas and its biases

SECTION B

Consent : concept and quality of consent, law and its limits, competence to consent and justification for not obtaining consent,
Death - definition and determination, mystery and fear, framework for life support decisions, euthanasia

SECTION C

Human Experimentation and Ethics : Justification and principles, Nuremberg code,
Reproductive technologies – Amniocentesis,, Fetal testing, Abortion – Laws, Contraception and sterilization methods, reconstructive and cosmetic surgery
Organ Transplantation – Intrinsic Morality, Supply of organs,

SECTION D

Principles for Clinical Evaluation of Drugs, Vaccines, Diagnostic Agents, Medical Devices and Surgical Procedures
Regulation of medical devices – safety of medical devices, product control, quality system requirements, standards for medical devices

TEXTS :

Medical Ethics - Robert M. Veatch, Jones & Bartlett Publishers, Inc

Health Care Ethics : A Theological Analysis - Ashley, Benedict M.; O'Rourke, Kevin D. ; Georgetown University Press

SEMESTER – VII
COMPUTATIONAL TECHNIQUES

BME – 421 – F

	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

Errors In Numerical Calculations: Introduction, Numbers and their accuracy, Absolute, relative and percentage errors and their analysis, General error formula.

Interpolation and Curve Fitting: Interpolation: Newton's forward and backward interpolation formulae, Gauss forward and backward interpolation formulae, Central difference formula, Lagrange's interpolation formula, Divided difference, Newton's divided difference formula, Least squares approximations, curve fitting.

Section B

Non linear Equations: Bisection method, Regula Falsi method, Secant method, Iteration Method, Newton's Raphson method, Muller's method.

Simultaneous Linear Equations: Gauss Elimination method, Gauss-Jordan method, UV-Factorization Method, Jacobi's method, Gauss- Seidal method, Relaxation method.

Section C

Numerical Differentiation and Integration: Derivatives from differences tables, higher order derivatives, Newton-cotes integration formula, Trapezoidal rule, Simpson's rules, Boole's rule and Weddle's rule, Romberg's Integration.

Numerical Solution of Ordinary Differential Equations: Taylor series methods, Euler and modified Euler method, Runge-Kutta methods, Milne's method, Adams-Moulton method.

Section D

Numerical Solution of Partial differential Equations: finite difference approximation of partial derivatives, solution of Laplace equation (standard 5-point formula only), one dimensional heat equation (Schmidt method, Crank-Nicolson method, Dufort and Frankel method)

TEXT BOOKS:-
1. Applied Numerical Analysis : Curtis F Gerald and Patrick, G Wheatley-Pearson Education.
2. Numerical Methods : E Balagusamy
3. Numerical Methods for Mathematics, Science and Engineering by John H Mathews PHI
4. Applied Numerical Methods : Carnahan B H; Luthar H A; Wikes J O
5. Numerical Methods in Engineering and Science by B S Grewal, Khanna Publishers

COMPUTATIONAL TECHNIQUES LAB

BME – 423 F

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

CONTENTS

WRITE DOWN AND EXECUTE THE FOLLOWING PROGRAMS USING C/C++/MATLAB

1. To find the roots of non-linear equation using Bisection method.
2. To find the roots of non-linear equation using Newton's   method.
3. Curve fitting by least - square approximations.
4. To solve the system of linear equations using Gauss-   Elimination method.
5. To solve the system of linear equations using Gauss-Seidal   iteration method.
6. To solve the system of linear equations using Gauss-Jorden   method.
7. To Integrate numerically using Trapezoidal rule.
8. To Integrate numerically using Simpson's rules.
9. To find the largest eigen value of a matrix by power-method.
10. To find numerical solution of ordinary differential   equations by Euler's method.
11. To find numerical solution of ordinary differential   equations by Runge-Kutta method.

BME – 409 F	Class Work	: A,B,C,F
L T P	P/VV	: -
- - -	Total marks	: A,B,C,F

At the end of sixth 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.

SEMESTER VII
INDEPENDENT STUDY SEMINAR

BME- 421 F
L   T   P   **Class Work   : 100 Marks**
-   -   4   **Total   : 100 Marks**

The student will select a topic in emerging areas of Biomedical Engineering and study independently. He/She must submit two hard copies and soft copy of their report and presentation to the department after getting the same approved by the concerned faculty. He/She will give a seminar talk on the same before the committee constituted by the **Head** of the dept. The committee should comprise of at least three faculty members.

GENERAL FITNESS FOR THE PROFESSION

GPBME- 401- F

L   T   P   Class Work   : -- Marks
-   -   -   P V/V   : 50 Marks
                                                            Total Marks   : 50 Marks
                                                            Duration of Exam : 3Hrs.

       At the end of the year students will be evaluated on the basis of their performance in various fields in Biomedical Engineering. The evaluation will be made by the panel of three experts/examiners/teachers to be appointed by the Principal/Director of the College. A specimen perform indicating the weightage to each component/ activity is given below :

Name : _____ College Roll No. _____

Univ.Roll No._____ _____

Branch _____ Year of Admission _____._____

I. Academic Performance (15 Marks) :
Performance in University Examinations:

Sem.	Result	%age of Marks obtained	Number of Attempt in which the Sem. exam. has been cleared
I			
II			
III			
IV			
V			
VI			
VII			

II. Extra Curricular Activities (10 Marks) :

Item	Level of Participation	Remarks (Position Obtained)
Indoor Games (Specify the Games	_____ _____ _____	_____ _____
Outdoor Games (Specify the Games)	_____ _____ _____	
Essay Competition	_____ _____ _____	
Scientific Technical	_____ _____	

Exhibitions   _____

Debate   _____
    _____
    _____

Drama   _____
    _____
    _____

Dance   _____
    _____
    _____

Music   _____
    _____
    _____

Fine Arts   _____
    _____
    _____

Painting   _____
    _____
    _____

Hobby Club   _____
    _____
    _____

N.S.S.   _____
    _____
    _____

Hostel Management _____
Activities   _____
    _____

Any other   _____
activity (Please   _____
Specify)   _____

III. Educational tours/visits/Membership of Professional Societies (5 Marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

IV. Contribution in NSS Social Welfare Floor Relief/draught relief/Adult Literacy mission/Literacy Mission/Blood Donation/Any other Social Service (5 Marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

V. Briefly evaluate your academic & other performance & achievements in the Institution (5 Marks)

_____
_____
_____
_____

VI. Performance in Viva voce before the committee (10 Marks)

_____
_____
_____
_____
_____

*Marks obtained I.(   )+II(   )+III(   )+IV(   )+V(   )+VI(   ) =

**Total Marks :

Member   Member   Member

DEPARTMENTAL ELECTIVE
SEMESTER VII
FIBER OPTICS AND LASERS IN MEDICINE

BME-453 F

L	T	P
3	1	-

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

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.
CONTENTS

SECTION A

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.

Optic fiber & its properties: Introduction, Basic fiber construction, propagation of light, modes of operation, refractive index profile, types of fibres, dispersion, data rate and bandwidth, attenuation, losses.

SECTION B

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.

SECTION C

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

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.

SECTION D

Laser -Tissue Interaction:Terminology : spectral band designations, energy & power, irradiant & radiant exposure, fluence, thermal diffi1sion fibers & contact tips, Types of laser-tissue interactions

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 livingstone publications.

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.

DEPARTMENTAL ELECTIVE
SEMESTER VII
PRINCIPLES OF BIOENGINEERING

BME-455 F

L	T	P
3	1	-

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

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.

CONTENTS

SECTION A
- Human Physiological Fluid Mechanics
- Physiology of the Human Circulatory System, Hemodynamics in the Arterial System.
- Blood Flow in the Microcirculation, and other Body Fluid Systems
- Pulse and Wave Propagation in Blood Vessels
- Mechanical Forces on Blood Vessels: Pressure, Stretch, and Shear Force
- Viscoelasticity and Mechanical Properties of the Vessel

SECTION B
- Membrane Potentials & Cable Model
- Dielectric Properties of Cells & Biopolymers
- Quantitative Physiology of Brain Blood Flow
- Visual System Psychophysical Bioengineering: Matching warning signals to the properties of the eye and the visual nervous system
- Optical Imaging

SECTION C
- Multi-Dimensional Signal Processing
- Basic Electronics for Bioengineers
- Capacitors, Inductors and Semiconductors
- Wireless Bioengineering
- Imaging as an Inverse Problem
- Human Molecular Imaging

SECTION D
- DNA Arrays
- Biostatistics: Applications of DNA arrays to schizophrenia disease genetics
- Bioreactor Arrays
- Bioheat Transfer Applications to Cryosurgery
- Stem Cell Research
- Biological Molecular Structure and Function
- Computational Modeling of Protein Structure and Function
- Molecular Structure/ Function of Neurodegeneration

TEXT

1. S. Berger, Introduction to Bioengineering

DEPARTMENTAL ELECTIVE
SEMESTER VII
REHABILITATION ENGINEERING

BME-452-F

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

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 to Rehabilitation Engineering
Principles and Application involved in the study of Rehabilitation Engineering
Rehabilitation Engineering – Science and Technology

SECTION B
Concepts in Motor rehabilitation and Communication disorders

SECTION C
Prosthetics and Orthotics in Rehabilitation Engineering
Introduction, Fundamentals and applications of externally powered and controlled orthotics and prosthetics.
Sensory Augmentation and Substitution

SECTION D
Visual Systems – Retinal Implants, Auditory system- Cochlear Implants, Tactual System
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)**

DEPARTMENTAL ELECTIVE
SEMESTER VII
BIOELECTROMAGNETISM

BME-454-F

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

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.

CONTENTS
SECTION A
The Concept of Bioelectromagnetism; Subdivisions of Bioelectromagnetism - Theoretical and Anatomical basis; Importance and History of Bioelectromagnetism.
Anatomical and Physiological basis of Bioelectromagnetism
SECTION B
Bioelectric Sources and Conductors and their Modeling
Theoretical Methods in Bioelectromagnetism

SECTION C
Electric and Magnetic Measurement of the Electric Activity of Neural Tissue
Electric and Magnetic Measurement of the Electric Activity of the Heart
Electric and Magnetic Stimulation of Neural Tissue
SECTION D
Electric and Magnetic Stimulation of the Heart
Measurement of the Intrinsic Electric Properties of Biological Tissues
Other Bioelectromagnetic Phenomena

TEXT
Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, by Malmivuo, J. Oxford University Press, New York, 1995.

Biological Control Systems

BME-456 F

L	T	P
3	1	-

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

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.**

CONTENTS

SECTION A

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.

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.

SECTION B

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

SECTION C

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.

Biological receptors: -Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity.

SECTION D

Modeling the body as compartments, behaviour in simple compartmental system, pharmacy kinetic model, urea distribution model, multi compartmental system. Dissolution of drugs in solid form, distribution and accessibility of body water & tissue compartments, basis for zero order & first order chemical kinetic behavior in the biological 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

REFERENCE

1. Modern Control Engineering: By K. Ogata

DEPARTMENTAL ELECTIVE
SEMESTER VII
ADVANCED BIOMEDICAL ENGINEERING

BME – 458- F

	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.

CONTENTS
SECTION A

Introduction: Substitutive medicine, outlook for organ replacement, design consideration, evaluation process.

Artificial Heart and Circulatory Assist Devices: Engineering design, Engg design of artificial heart and circulatory assist devices, blood interfacing implants – introduction, total artificial hearts & ventricular assist devices, vascular prostheses, Non-blood interfacing implants for soft tissues-sutures and allied augmentation devices, percutaneous and skin implants, maxillofacial implants, eye and ear implants.

Artificial blood: Artificial oxygen carriers, flurocarbons, hemoglobin for oxygen carrying plasma expanders, hemoglobin based artificial blood.

SECTION B

Cardiac Valve Prostheses: Mechanical valves, tissue valves, current types of prostheses, tissue versus mechanical, engineering concerns and hemodynamic assessment of prosthetic heart valves, implications for thrombus deposition, durability, current trends in valve design, vascular grafts-history, synthetic grafts, regional patency, thrombosis, neointimal hyperplasia, graft infections.

Artificial Kidney: Functions of the kidneys, kidney disease, renal failure, renal transplantation, artificial kidney, dialyzers, membranes for haemodialysis, haemodialysis machine, peritoneal dialysis equipment-therapy format, fluid and solute removal.

SECTION C

Artificial Lungs: Gas exchange systems, Cardiopulmonary bypass (heart-lung machine)-principle, block diagram and working, artificial lung versus natural lung. Liver functions, hepatic failure, liver support systems, general replacement of liver functions.

Artificial Pancreas: Structure and functions of pancreas, endocrine pancreas and insulin secretion, diabetes, insulin, insulin therapy, insulin administration systems.

Tracheal replacement devices, laryngeal replacement devices, Artificial esophagus

Artificial Skin: Vital functions of skin, current treatment of massive skin loss, design principles for permanent skin replacement.

SECTION D

Biodegradable Polymeric Biomaterials: Introduction, Glycolide based biodegradable homopolymers polyesters, non-glycolide linear aliphatic polyesters, aliphatic and aromatic polycarbonates, biodegradation properties of synthetic biodegradable polymers.

Tissue Engineering- Basic principles of Tissue Engineering, Gene Therapy and Tissue Engineering, Biomaterials: Protein – Surface Interactions

TEXT

1. Biomedical Engineering Handbook edited by Bronzino D Joseph, CRC Press (New York) 1995

References:

1. Biomedical Engineering Principles Volume 1 by Cooney David Marcel Decker 1976
2. Handbook of Biomedical Engineering. Kline Jacob, Academic press (New York) 1988

HUM-451-F   **LANGUAGE SKILLS FOR ENGINEERS**

L T P   Class Work Marks: 50

3 1 0   Exam Marks: 100

                                                   Total Marks: 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.

The real challenge before the students starts when they cross the threshold of the college after completing their degree. They, all of a sudden, find themselves competing for job/P.G. Degrees, through various entrance tests and interviews. Verbal ability forms a major portion of these tests. Without sound language skills and its semantic-syntactic know-how, the students with engineering background find themselves almost under- prepared for such tests. With this difficulty of students in mind, this course is proposed to

make them technically proficient in handling the language skills required in competitive exams. The course would expose students to almost all variety of items, the common run of such tests as CAT, GMAT etc. And in the context of LPG, this cutting edge competence becomes imperative, and no professional education can afford to overlook this aspect.

Section A

Remedial English : Parts of speech, Gerunds, Participles and infinitives; Clauses; Sentence-constructions (unity; avoidance of choppy and rambling sentences, logic and consistency, conciseness, sequencing of ideas); Sentence errors-agreement between verb and subject, pronoun and antecedents, sequence of tenses, problems involving modifiers (dangling and misplaced modifiers); Shifts in point of view consistency of number and person, tense, mood, voice and subject; Parallelism; Omissions and mixed constructions.

Section B

Vocabulary : Methods of building vocabulary-etmological roots, prefixes and suffixes; Commonly used foreign words and phrases; spelling; words often confused synonyms and homonyms; one word substitutes; verbal idioms.

Section C

Punctuation and Mechanics: End Punctuation; internal Punctuation; Word Punctuation. Comprehension: Abstracting; Summarizing; Observation, Findings and Conclusions; Illustration and Inductive Logic; Deduction and Analogy.

Section D

Presentation: Oral presentation- Extempore, discussion on topics of contemporary relevance, Interviews.

TEXT BOOKS:

1.Working with words by R. Gairns and S. Redman, Cambridge University Press, London.

2. Meanings into Words-Upper Intermediate Students Book, Deff/Jones, Foundation Books (Cambridge University Press), Delhi.

3. A Practical English Grammar by A.J. Thomson and A.V. Martinet, OUP, Delhi.

4. Examine your English by Margaret M. Maison, Orient Longman, New Delhi.

5. A Practical Guide to Colloquial Idom by W.J. Ball. Longman.

6. A guide to correct English by L.A. ill, Oxford.

7. Structural Essentials of english by H.whitehall, Longman.

8. Advanced English Practice by B.D. Graver, OUP, Delhi
9. Public Speaking, Sudha Publication Pvt. Ltd., New Delhi.
10. Group Discussion, Sudha Publication Pvt. Ltd., New Delhi.

HUM-453-F   **HUMAN RESOURCE MANAGEMENT**

L T P   Class Work Marks: 50

3 1 0   Exam Marks: 100

                                                                    Total Marks: 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

Understanding Organizational Behavior: Definition, Goals of Organizational behavior. Key forces affecting Organizational Behavior. Fundamental Concepts of Organizational Behavior. Motivation : Meaning, Objectives and importance of motivation. Theories of Motivation, Maslow's theory, Mc Greger's Theory Herzberg's theory. Morale : Meaning; Factors affecting morale, types of morale and productivity, Evaluation of morale, improving morale.

Section B

Communication: Definition & importance, Nature of leadership various approaches to leadership styles.

Leadership: Definition & importance, Nature of leadership various approaches to leadership styles.

Section C

Importance of human resources in industry, Definition of human resource management, mechanical approach towards personnel, Paternalism, Social system approach. Need for human resource planning, process of human resource planning, Methods of recruitment, Psychological tests and interviewing meaning and importance of placement Meaning and techniques of induction. Training and development : Concepts of training and development, importance of training and development, Management development its nature, purpose and method.

Section D

Significant factors affecting compensation, Methods of wage payment, Wage differentials, Causes of difference in Wages, Types of wage differentials, Wage incentives, Meaning, Objectives, types of incentive plans.

Text Books:

1. Human Resource and Personnel Management-K. Aswathappa-Tata McGraw Hill

Publishing Company Ltd.

2. Personnel Management : C.B. Mamoria, Himalaya Publishing House.

3. Organisational Behavior-Dr. L.M. Prasad (Sultan Chand & Sons).

Reference Books:

1. Personnel Management & Industrial Relations : Dr. T.N.Bhagoliwal Sahitya

Bhawan Agra.

2. Personnel Management : V.G. Karnik, Jaico Publishing House.

3. Personnel management & Industrial Relation : Tripathi : Sultan Chand & Sons.

4. Personnel Management-Arun Monappa & Mirza Saiyadain- Tata McGraw Hill

Publishing Co. Ltd.

5. Personnel Management and Industrial Relations-D.C. Sharma & R.C. Sharma S.J.

Publications.

6. Principles of Personnel Management-Edwin B. Flippo (McGraw Hill).

7. Organizational Behavior-K. Adwathappa.

8. Organizational Behavior-John W. Newsstorn & Keith Davis, Tata McGraw Hill

Publishing Company Limited, New Delhi.

HUM-459-F   **RENEWABLE ENERGY RESOURCES & TECHNOLOGY**

L T P   Theory : 100
3 1 -   Class Work : 50
                                                         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: Energy Sources and their availability, renewable energy sources, Prospects of renewable energy sources, application of non conventional and renewal energy sources.

Environmental Aspects of Electric Energy Generation: Introduction Thermal pollution, Atmospheric pollution, Effects of Hydroelectric projects, Nuclear power generation and environment, Green House Gas Effects, Global Environmental awareness, Energy options for Indian Economy.

Section -B

Solar Energy : Solar radiation estimation, Basic Principle of Solar Energy physical Principal of the conversion of solar radiation into heat, Collectors, Solar Energy storage system, solar thermal electric conversion, solar electric Power Plant & applications.

Wind Energy: Basic Principle of wind energy conversion, nature & Power of wind, site selection, wind energy conversion SYSTEM. Scheme for Electric Generation, Generator Control load control, Inter connected SYSTEM & applications.

Section -C

Bio Mass Energy: Biomass conversion technologies bio mass generation, classification of Bio Gas Plants material used in Bio Gas Plants., Selection of site & applications.

Geothermal Energy: Sources of Geothermal energy Estimation of Geothermal Power, Geothermal Power Plants, Geothermal energy in India and Prospects.

Ocean Energy: Ocean thermal electric conversion, site selection, Power Plant, Prospects of ocean energy in India, tidal Power tidal Power Plant, Prospects in India.

Section -D

MHD & Hydrogen Energy: Basic Principle MHD SYSTEM, advantages, Power OUTPUT of MHD Generation, future Prospects. Principle and classification of fuel cell energy, hydrogen as alternative fuel for Generation of Electrical Energy & applications.

Fuel Cell: Fuel Cell, Management of Fuel, Thermionic power generation, water Resource Electricity deviend scenario storage and handling, Pricing, Contract etc, Introduction to risk, rules

and regulation Aspects of Risk & Hazard Health & risk assessment visit to site, Mini hydro generators.

TEXT BOOKS:
1. Renewable Energy Sources and Emerging Technologies : D.P Kothari, K.C.Singla, Rakesh Ranjan - PHI Publications.
2. NON-Conventional energy Sources : G.D. Rai – Khanna Publications.
3. Renewal energy sources and their environmental aspects by Abbari: PHI
4. Electric Power :   Dr. S.L. Uppal - Khanna Publications

REFERENCE BOOKS:
1.   Power Plant Engineering : Jain & Bala Subramanyam

ME-451-F   **MECHATRONICS SYSTEMS**

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 : Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.
SIGNAL CONDITIONING : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , sped channels
Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –
Software - Digital Signal Processing – Low pass , high pass , notch filtering

Section B
PRECISION MECHANICAL SYSTEMS : Pneumatic Actuation Systems - Electro-pneumatic Actuation
Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts - Ball
Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.
ELECTRONIC INTERFACE SUBSYSTEMS : TTL, CMOS interfacing - Sensor interfacing - Actuator
interfacing – solenoids , motors Isoation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors/ mosfets

Section C
ELECTROMECHANICAL DRIVES : Relays and Solenoids - Stepper Motors - DC brushed motors - DC
brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.
MICROCONTROLLERS OVERVIEW : 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications.
Programming –Assembly , C (LED Blinking , Voltage measurement using ADC).

Section D
PROGRAMMABLE LOGIC CONTROLLERS : Basic Structure - Programming : Ladder diagram -
Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -
Analog input / output - PLC Selection - Application.
PROGRAMMABLE MOTION CONTROLLERS : Introduction - System Transfer Function -

Laplace
transform and its application in analysing differential equation of a control system - Feedback
Devices :
Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive ,
Capacitive ,
Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital
Controllers
- P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles –
Trapezoidal
- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP ,
Linear ,
Circular - Core functionalities – Home , Record position , Go to Position - Applications : SPM,
Robotics.

TEXT BOOKS :
1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W
Bolton,
Pearson Education Press, 3rd edition, 2005.
2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

REFERENCES :
1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publisers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.

IC-455-F INTELLIGENT INSTRUMENTATION FOR ENGINEERS

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:
Definition of an intelligent instrumentation system; feature of intelligent instrumentation; components of
intelligent instrumentation; Block diagram of an intelligent instrumentation.

Section -B

INTERFACING INSTRUMENTS & COMPUTERS:
Basic issue of interfacing; Address decoding; Data transfer control; A/D converter; D/A converter; Other
interface consideration.

Section -C

INSTRUMENTATION/ COMPUTER NETWORKS:
Serial & parallel interfaces; Serial communication lines; Parallel data bus; EEE 488bus; Local area networks(LANs) : Star networks, Ring &bus networks, Fiber optic distributed networks, Field bus; Communication Protocols for very large systems: communication network rationalization.

Section -D

SOFTWARE FILTERS :
Description of Spike Filter, Low pass filter, High pass filter etc.

TEXT BOOK:
1. Principles of measurement & Instrumentation: Alan S. Moris; PHI

OR-401-F   **OPERATIONS RESEARCH**

L T P   **Class Work :** 50 Marks
3 1 0   **Exam :**100
Marks

Total : 150 Marks
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

Development – Definition– Characteristics and Phases – Types of models –
operation Research models – applications.
ALLOCATION : Linear OPERATIONS-RESEARCH
Problem Formulation – Graphical solution – Simplex method – Artificial
variables techniques -Two–phase method, Big-M method – Duality Principle.

Section – B

TRANSPORTATION PROBLEM – Formulation – Optimal solution, unbalanced
transportation problem – Degeneracy. Assignment problem – Formulation – Optimal
solution - Variants of Assignment Problem-Traveling Salesman problem.
REPLACEMENT : Introduction – Replacement of items that deteriorate with time – when
money value is not counted and counted – Replacement of items that fail completely, group
replacement. staffing problem, equipment renewal problem.

Section – C

System Reliability: Introduction-Definition-Failure Rates-Bath-tub shaped failure rate(Hazard
Rate)-Reliability of systems-series arrangement and parallel arrangement-methods of assuring
reliability.

Section – D

Information Theory-Introduction, measure of Information, binary unit of information , entropy,
properties of average measure of entropy, important relations for various entropies, set of axioms for an
entropy function, uniqueness theorem, communication system, noiseless channel, channel capacity, efficiency
and redundancy, mutual information, encoding.

TEXT BOOK :
1. OPERATIONS-RESEARCH / S.D.Sharma-Kedarnath
2. Introduction to O.R/ Taha/ Pearsons
REFERENCES: 1)Operation Research/A.P.VERMA/SK KATARIA AND SONS
    2) Operations Research/P.K.GUPTA & D.S.HIRA