SCHEME OF STUDIES & EXAMINATION
B.E IN BIOMEDICAL ENGINEERING
SEMESTER - VII
Modified 'E' Scheme effective from (2009-10)

Course No.	Subject	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam (in hrs.)
		L	T	P	Total		Theory	Practical		
EE - 304 E	Control System Engineering	3	1	-	4	50	100	-	150	3
BME-409 E	Practical Training	-	-	-	-	50	-	-	50	3
BME-411E	Advance Bio-Medical Engg.	3	1	-	4	50	100	-	150	3
BME 413E	Principle of Medical Imaging-II	3	1	-	4	50	100	-	150	3
BME-415-E	Principle of Medical Imaging-II Lab.	-	-	2	2	25	-	25	50	3
BME-417-E	Nuclear Medicare Radaiation & Safety	3	1	-	4	50	100	-	150	3
	Open Elective	4	-	-	4	50	100	-	150	3
BME-421-E	Project/ Indutrial Project	-	-	4	4	100	-	-	100	3
	Total	16	4	6	26	425	500	25	950	

List of Open Electives

1	HUM-451-E	Languages Skills for Engg.	8	CSE-303-E	Computer Graphics
2	HUM-453-E	Human Resource Management	9	CSE-451-E	Artificial Intelligence & Expert System
3	HUM-455-E	Enterpreneurship	10	IC-403-E	Embedded Systems
4	HUM-457-E	Business Communication	11	IC-455-E	Intelligent Instrumentation for Engineers
5	PHY-451-E	Nano Technology	12	CH-451-E	Pollution & Control
6	PHY-453-E	Laser Technology	13	IT-204-E	Multimedia Technologies
7	ME-451-E	Mechatronics	14	IT-471-E	Management Information Systems

Note :

1. Students will be allowed to use single memory, non-programmable scientific calculator during exam.
2. All the scheme has been given the code " E" which shows the current for all the branches to avoid any confusion in various schemes.
3. There has been no previous syllabus for Bio- Medical Engineering and Bio- technology Engineering. The 1st schme for these courses start from" E"code.
4. The subject Hospital Mangement (BME-403-E) and Speech Processing(BME-405-E) have been replaced by Nuclear Medicaine Radition & Safety (BME-417-E) and Advanced Bio-medical Engineering (BME-411-E) respectively w.e.f.. 2008-09.
5. The subject Biological Control system (BME-401-E)has been replaced by Control system Engineering (EE-304-E) w.e.f. 2008-09.
6. The subject A1 and Expert Systems (CSE-451-E) has been replaced by principle of Medical Imaging Lab. II (BME-415- E) and Project/ Industrial Project (BME-419-E) w.e.f. 2008-09.

The Code of Practical Training II(BME- 409 -E) has been changed to Practical Training II (BME-421-E)

8. Elective- I has been replaced by Open elective w.e.f. 2008-09.Students will be permitted to opt. for any elective run by the other departments. However, the departments will offer only those electives for which they have expertise. The choice of the students to any elective shall not be a binding for the department to offer, if the department does not have expertise.

10. Assessement of Practical Training-II, carried out at the end of VI semester, will be based on seminar, viva-voce and project report of 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.

11. Project load will be treated as 2 hrs. per week for Project co-ordinator and 1 hr. for each participating teacher. Project will commence in VIIt semester where the students will identify the Project problem, complete the design/ procure the maternal/ start the fabrication/ complete the survey etc., depending upon the nature of the problem. Project will continue in VIII the semester.

SCHEME OF STUDIES & EXAMINATION
B.E IN BIOMEDICAL ENGINEERING
SEMESTER - VIII
Modified 'E' Scheme 2009-10

Course No.	Subject	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam (in hrs.)
		L	T	P	Total		Theory	Practical		
BME 402-E	Bio-Medical Ethics & device regulation	3	1	-	4	50	100	-	150	3
	Dept. Elective-I	4	-	-	4	50	100	-	150	3
	Dept. Elective-II	4	-	-	4	50	100	-	150	3
BME 404-E	Independent study Seminar	-	-	4	4	50	-	-	50	
BME 406-E	Biological Control Systems	3	1	-	4	50	100	-	150	3
BME 408-E	Project in Industrial/ Research Lab./ Hospital	-	-	6	6	100	-	150	250	3
GP BME-402-E	General Fitness for the Profession	-	-	-	-	50	-	100	150	3
	Total	14	2	10	26	400	400	200	1050	

Dept. Elective -I

BME-451-E	Medical Physics
BME-453-E	Fiber Optics and Lasers in medicine
BME-455-E	Principles of Bioengineering
BME-457-E	Tissue Engineering
BME-459-E	Bionanotechnology

Dept. Elective -II

BME-452-E	Rehabilitation Engineering
BME-456-E	Bio-Electromagnetism
HUM-462-E	Operation Management
CSE-451-E	AI and Expert Systems
CSE-462-E	OOPS and C ++

Note :

1. Students are allowed to use single memory, non-programmable scientific calculator during exam. Sharing of calculator wil not be permitted in the examination.
2. All the scheme has been given the code " E" which shows the current scheme for all the branches to avoid any confusion in various schemes.
3. There has been no previous syllabus for Bio- Medical Engineering and Bio- technology Engineering. The 1st scheme for these courses start from" E"code.
4. The new subject Biological control system (BME 406-E) has been introduced w.e.f. 2008-09.
5. Project Load will be treated as 2 hrs. per week for the project coordinator and 1 hour for each participating teacher. project involving design, fabrication, testing, computer simulation, case studies etc. which has been commenced by students in VII semster, will be completed in VIII semester.
6. For subject BME-404-E(Independent Study Seminar), a student will select a topic from emerging areas of Bio-Medical Engineering and study it thoroughly and independently. Later he will give a seminar talk on the topic.
7. A team consisting of Principal/ Director, HOD of concerned department and external examiner appointed by University shall carry out the evaluation of the student for his/her General Fitness for the Profession.
8. The subject GFBME-410-E (General Fitness for the Profession) code has been changed to GFBME-402-E and will be effective from 2008-09.

SEMESTER - VII

EE - 304 E CONTROL SYSTEM ENGINEERING

L	T	P
3	1	-

Class Work : 50
Exam : 100
Total : 150
Duration of Exam. : 3 hrs.

UNIT - I INTRODUCTORY CONCEPTS :

System/ Plant model, types of models, illustrative examples of plants and their inputs and outputs, controller, servomechanism, regulating system, linear time - invariant (LTI) system, time- varying system, causal system, open loop control system, closed loop control system, illustrative examples of open-loop and feedback control systems, continuous time and sampled data control systems. Effects of feedback on sensitivity (to parameter variations), stability, external disturbance (noise), ovearall gain etc. Introductory remarks about non-linear control systems.

UNIT - II MATHEMATICAL MODELLING

Concept of transfer function, relationship between transfer function and impluse response, order of a system, block diagram algebra, signal flow graphs : Mason's gain formula & its application, characteristics equation, derivation of transfer functions of electrical and electromechanical systems. Transfer functions of cascaded and non-loading cascaded elements. Introduction to state variable analysis and design.

UNIT - III TIME DOMAIN ANALYSIS

Typical test signals, time response of first order systems to various standard inputs, time response of 2nd order system to step input, relationship between location of roots of characteristics equation, w and wn, time domain

specifications of a general and an under damped 2nd order system, steady state error and error constants, dominant closed loop poles, concepts of stability, pole zero configuration and stability, necessary and suffeicient conditions for stability, Hurwitz stability criterion, Routh stability criterion and relative stability.

UNIT IV ROOT LOCUS TECHNIQUE :

Root locus concept, development of root loci for various systems, stability considerations.

UNIT V FREQUENCY DOMAIN ANALYSIS :

Relationship between frequency resonse and time- response for 2nd order system, polar, Nyquist, Bode plots, stability, Gain margin and Phase Margin, relative stability, frequency response specifications.

UNIT VI COMPENSATION :

Necessity of compensation, compensation networks, application of lag and lead compensation, basic modes of feedback control, proportional, integral and derivative controllers, illustrative examples.

UNIT VII CONTROL COMPONENTS :

Synchros, AC and DC techo- generators, servomotors, stepper motors & their applications, magnetic amplifier.

TEXT BOOK :

1. Control System Engineering : I.J. Nagrath & M. Gopal; New Age

REFERENCE BOOKS :

1. Automatic Control Systems : B.C. Kuo, PHI.
2. Modern Control Engg : K. Ogata : PHI
3. Control Systems : Principles & Design : Madan Gopal : Tata Mc Graw Hill.

4. Modern Control Engg : R.C. Dorl & Bishop : Addison - Wesley.

Note : Eight questions are to set - at least one from each unit. Students have to attempt five questions.

Prcatical Training - II (6 Weeks)

BME - 409 E

L T P		
- - -	Class Work	: 25 Marks
	P/VV	: 25 Marks
	Total	: 50 Marks

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.

ADVANCED BIOMEDICAL ENGINEERING

BME - 411 E

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

CONTENTS

1. Introduction to Artificial Organs : substitutive medicine, biomaterial outlook for organ transplant, design considerations.
2. Artificial Heart and Circulatory assist devices, Artificial Kidney : Structure and function of the Kidney, Kidney disease, renal failure, treatment of renal failure, renal transplantation.

3. Artificial Blood : Modern history of transfusion and blood substitutes, oxygen carrying artifical blood, Hb-based artificial blood.
4. Nanotechnology - Trends in Biomedical Nanotechnology; Drug Delivery Systems and Drug Synthesis; Nanotechnology in diagnostics; nano-enabled components for biodefense; implants and prosthetics, Toxicity in nanomaterials
5. Bioinformatics - Introduction to Molecular biology & biological Chemistry, Data structure and pair wise alignments, substitution pattern, Distance based and Character based methods of phylogenetics, Genomics & gene recognition, Protein & RNA structure prediction, Proteomics.
6. Tissue Engineering - Basic principles of Tissue Engineering, Gene Therapy and Tissue Engineering, Biomaterials : Protein - Surface Interactions.
7. Biomems : Introduction to BioMEMS ; Historical background - Smart Materials and structures, Microsystems and their advantages. Materials used - Technology involved in MEMS. General Application in Healthcare.

TEXT BOOK :

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

REFERENCE BOOKS :

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

3. Fundamental concepts of bioinformatics by Dane E Karne & Michael C Raymer (Pearsons Education) 2006.

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

PRINCIPLES OF MEDICAL IMAGING - II

BME - 413 E

L	T	P
3	1	-

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

CONTENTS

1. Fundamentals of Acoustic Propagation, characteristic impedance, intensity, radiation force, reflection and refraction, attenuation, absorption, scattering.
2. Generation and detection of ultrasound : piezsoelectric effect, ultrasonic transducers (mechanical and electrical matching), transducer beam characteristics, axial and lateral resolution, focusing arrays.
3. 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.
4. Biological effects of ultrasound : Acoustic phenomena at high intensity levels, ultrasound bioeffects.
5. Fundamentals of Nuclear magnetic Resonance : angular momentum, magnetic dipole moment, magnetization, Larmor frequency, rotating frame of reference and the RF magnetic field.
6. Generation and Detection of NMR Signal : The magnet

(superconducting magnets, permanent magnets), magnetic field gradients, the NMR coil/ probe, data acquistion.

7. Imaging Methods : Slice selection, frequency encoding, phase encoding, spin echo imaging, gradient- echo imaging, blood flow imaging.
8. Biological effects of magnetic fields : Static magnetic fields, radio frequency fields, gradient magnetic fields.
9. Radiotherapy equipment : High Voltage X-ray machines, Cobalt-60 machines, Medical Linear X-ray machines.

TEXT BOOK :

1. K. Kirk Shung, Michael B Smith, Bejamin Tsui, Principles of Medical Imaging, academic Press, inc., London, 1992.
2. Handbook of Biomedical Instrumentation : R.S. Khandpur.
3. Text book of radiology christensen

REFERENCE BOOKS :

1. Avinash C. Kak, Malcolm Slaneyavailble 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.

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

PRINCIPLES OF MEDICAL IMAGING - II LAB

BME - 415 E

L	T	P
-	-	2

Class Work : 25 Marks
P/w : 25 Marks
Total : 50 Marks
Duration of Exam. : 3 Hrs.

CONTENTS

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

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.

NUCLEAR MEDICINE : RADIATION AND SAFETY

BME - 417 E

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

CONTENTS

Introduction : Properties and effects of radio active emissions and their applications in nuclear medicine.

Radiation detectors : Types and applications in nuclear medicine.

Radio Isotope Imaging : The gamma camera, Construction and working, Performance Characteristics, SPECT Construction and Working, Positron Emission Tomography.

The computer in NM : applications, Image Construction, Frame Modes.

Units of exposure and dose.

Radiation protection and safety, Safety of non : ionizing and Ionizing radiation, Stocastic and non-Stocastic effects, Risk Factors, Safety limits.

Principles of radiation dosimetry : Internal and External dosimetry.

TEXT BOOK :

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)

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

PROJECT / INDUSTRIAL PROJECT

BME - 421 E

L	T	P		
-	-	4	Class Work	: 100 Marks
			Total	: 100 Marks
			Duration of Exam.	: 4 Hrs.

Project involving design/ fabrication/ testing/ computer simulation/ case studies etc. will be evaluated through a panel of examiners consisting of HOD of the concerned department, project coordinator and one external examiner to be appointed by the University.

The student will be required to submit three copies of his/ her project report to the office of the concerned depratment for record (one copy each for the department office, participating teacher and college library).

Project coordinator will be assigned the project load of 3 hrs. per week while the participating teachers will be assigned 2 hr. load for the same.

SEMESTER - VIII

BIOMEDICAL ETHICS AND DEVICE REGULATIONS

BME - 402 E

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

CONTENTS

Part 1 - Sources of Medical Law and Ethics.

- Nature and sources of medical ethics
- Sources of medical laws

Part 2 - Consent, Confidentiality and Clinical Negligence

- Consent to Treatment
- Confidentiality
- Clinical Negligence

Part 3 - Medical Health

- Mental Health
- Adults with Incapacity

Part 4 - Issues

- The law in relation to abortion
- The ethics of abortion
- Reproductive technology and surrogacy
- The law in relation to end of life issues
- The ethics of end of life issues.
- Research

Part 5 - Maintaining professional standards

- Maintaining standards and regulation
- Presenting evidence and reports
- The Coroner's court
- The General Medical Council

Part 6 - Doctor's rights

- Employment and other rights of doctors

TEXT BOOK :

1. Ronald Munson's Intervention and Reflection : Basic Issues in Medical Ethics 5th Ed.

2. Ethics of Health Care : An Introductory Textbook by Benedict M. Ashley, Kevin D. O' Rourke, Georgetown University Press, 3rd edition, 2002.

INDEPENDENT STUDY SEMINAR

BME - 404 E

L	T	P	Class Work: 50 Marks
-	-	4	Total : 50 Marks

The student will select a topic in emerging areas of Biomedical Engineering and study independently. He will give a seminar talk on the same before the committee constituted by the head of the dept. The committe should comprise of at least three faculty members.

BIOLOGICAL CONTROL SYSTEMS

SEMESTER - VIII

BME - 406 E

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

CONTENTS

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 diffrential equations, state eqaution and transfer function, characteristics equation, Eigen values & Eigen vectors.
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.

3. 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.
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.
5. Modelling 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 behaviour in the biological system
6. Biological receptors : Introduction, receptor characteristics, transfer function models of receptors, receptors and perceived intensity.
7. Respiratory model & systems, cardio vascular control system, skeletal muscle servo mechanism.

TEXT BOOK :

1. Automatic control systems : By Bejamin 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

PROJECT IN INDUSTRY / RESEARCH LAB./ HOSPITAL

BME - 408 E

L	T	P
-	-	6

Class Work	: 100 Marks
Practical	: 150 Marks
Total	: 250
Duration of Exam.	: 3 hrs.

Project involving design/ fabrication/ testing/ computer simulation/ case studies etc. will be evaluated through a panel of examiners consisting of HOD of the concerned department, project coordinator and one external examiner to be appointed by the University.

The student will be required to submit three copies of his/ her project report to the office of the concerned depratment for record (one copy each for the department office, participating teacher and college library).

Project coordinator will be assigned the project load of 3 hrs. per week while the participating teachers will be assigned 2 hr. load for the same.

GENERAL FITNESS FOR THE PROFESSION

BME - 402 E

L T P		
	Class Work	: 50
	Practical	: 100
	Total	: 150
	Duration of Exam.	: 3 hrs.

At the end of the year studnts wil 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/ examiner/ 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.

_____

Uni. Roll No., _____

Branch_____ Year of Admission

_____

I. Academic Performance (15 Marks) :

Performance in University Examination

Scale	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 _____ _____
_____ _____

Any other _____ _____
activity (Please _____ _____
Specify) _____ _____

III. Educational tours/ visits/ Membership of Professional Societies (10 Marks)

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

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

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

V. Briefly evaluate your academic & other perfromance & 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

MEDICAL PHYSICS

BME - 451 E

L	T	P
3	1	-

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

CONTENTS

1. Heat and cold in medicine : Physical basis of heat and temperature. Thermography and temperature scales, mapping of body's teperatures. Heat therapy, use of cold in medicine, Cryosurgery and safety aspects.
2. Energy, work, Power and pressure : Conservation of energy in the body. Energy changes in the body work, power heat losses of body. Measurement of pressure in the body, pressure inside skull, Eye, Digestive system, Skeleton, Urinary bladder etc. Hyperbaric oxygen therapy.
3. Physics of the lung & breathing : The airways, blood & lung interaction, measurement of lung volumes Pressure flow- volume relationship of the lungs. Physics of the alveoli Breathing mechanism, airway resistance. Work of breathing. Physics of some common lung diseases.
4. Physics of the Cardiovascular system : Major components of the Cardiovascular system. Oxygen and Carbon dioxide exchange in the capilary system. Work done- by the heat. B.P. and its measurements Transmural pressure. Bemoulli's principle applied to Cardiovascular system. Laminar and turbulent blood

flow. Heart sounds. The physics of some cardiovascular diseases.

5. Electricity within the body : nervous system and neurons. Electrical potentials of nerves. electromyogram. ECG, EEG, Electroretinogram and Electrooculogram, Mageneto cardiogram and Magneto encephalogram. Electric shock. High frequency & low frequency electricity in medicine and magnetism in medicine.
6. Sound in Medicine : General properties of sound. The body as a drum. The stethoscope, Ultrasound picture of the body. Ultrasound to measure motion, Physiological effects of Ultrasound in Therapy. The production of speech.
7. Physics of Ear & hearing : The outer ear, The middle Ear, The inner ear, Sensitivity to the ears. Testing your hearing, Deafness and Hearing Aids.
8. Light in medicine : Measurement of light & its unit., Applications of Visual light in medicine, Applications of UV & IR in medicine, LASERS in medicine, Applications of microscopes in medicine.
9. Physics of Eyes and Vision : Focusing elements of the eye. The retina, diffraction effects of the eye, optical illusion, defective vision and correction, color vision and chromatic aberration. Instrument used in ophthalmology.

TEXT BOOK :

1. Medical physics, J R Cameron & J G Skofronick, 1978.

FIBER OPTICS AND LASERS IN MEDICINE

BME - 453 E

L	T	P
3	1	-

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

CONTENTS

1. Introduction to fiber optics : Basic fiber link, applications, principles of light : Introduction, EM spectrum, internal & external reflections, Snell's law, optical fiber numerical aperture, Fresnel reflection.
2. Optic fiber & its properties : Introduction, basic fiber construction, propagation of light, modes of operation, refrective index profile, types of fibers, dispersion, data rate and bandwidth, attenuation, losses.
3. 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.
4. Modulation scheme for fiber optics transmission : Introduction, digital modulation, analog modulation schemes, multiplexing.
5. 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.

6. Laser - Tissue Interaction : terminology : spectral band designations, energy & power irradiant & radiant exposure, fluence, thermal diffiusion fibers & contact tips, Types of laser-tissue interactions.
7. Laser Applications 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 BOOK :

1. Therapeutic Lasers - Therapy 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.

REFERENCES:

1. Laser and optical fibers in medicine by Katzer and Abraham, Academic Press Publications.
2. An Introduction to optical fibers by A.M. Cherin, Mc Graw Hill Publications.

PRINCIPLES OF BIOENGINEERING

BME - 455 E

L	T	P
3	1	-

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

CONTENTS

* Optical Imaging.
* Multi- dimensional Signal Processing.
* Basic Electronics for Bioengineers
* Capacitors, Inductors and Semiconductors.
* Bio Nanotechnology
* Wireless Bioengineering
* Imaging as an Inverse Problem
* Computed Tomography
* Human Molecular Imaging
* DNA Arrays
* Biostatistics : Applications of DNA arrays to schizophrenia disease genetics
* Bioreactor Arrays
* Bioheat Transfer Applications to Cryosurgery
* Stem cell Research.
* Bioastronautics
* Biological Molecular Structure and function
* Computational Modelling of Protein Structure and Function
* Molecular Structure/ Function of Neurodegeneration

TEXT BOOK :

1. S. Berger Introduction to Bioengineering

TISSUE ENGINEERING

BME - 457 E

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

CONTENTS

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

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

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

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

Case study and regulatory issues : Mechanical properties of Biological tissues, Transport properties of biological tissues, Cell transplantation for liver, musculokeletal, cardiovascular, neural, visceral tissue engineering. Ethical FDA and regulatory issues of tissue engineering.

TEXT BOOK :

1. Principles of tissue engineering, Robert. P. Lanza,

Robert Langer & William L. Chick, Academic Press.

2. The Biomedical Engineering - Handbook, Joseph D. Bronzino, CRC Press.
3. Introduction to Biomedical Engg., Endarle, Blanchard & Bronzino, Academic Press.
4. Frontiers of Tissue Engineering - Patrick. Mikos, MacIntire, Pergamon Press.
5. Tissue Engineering, B. Palsson, J.A. Hubbell, R. Plonsey & J.D. Bronzino, CRC - Taylor & Francis.

BIONANOTECHNOLOGY

BME - 459 E

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

Introduction to MEMS : Introduction to Bio MEMS; Historical background - Smart Materials and structures Microsystems and their advantages. Materials used - Technology involved in MEMS. General Application in Healthcare.

Micromachining Technology : Soft Lithography, Etching, Ion implantation, wafer bonding, Integrated processing, Wet & Dry Bulk micro machining surface micromachining, coating technology and CVD -LIGA process

Principles of Microsystems : General principles - Microsystems - Pressure system ; Actuators, Electrostatic forces Piezoelectric Crystals.

BIOMEMS

Special features, Requirements for medical applications, MEMS for Health care, Drug delivery systems, Application in Blood pressure sensors, Biochip, Micro

needles, Microelectrodes, Prosthesis and catheter and sensors.

Biomedical Nanotechnology

Trends in Biomedical Nanotechnology ; Drug Delivery Systems and Drug Synthesis; Nanotechnology in diagnostics; nano-enabled components for biodefense; implants and prosthetics, Toxicity in nanomaterials

Text / References BOOK :

1. The MEMS Handbook, Second Edition - 3 Volume Set (Mechanical Engineering) : Mohamed Gad-el-Hak; CRC; 2 edition (2005)
2. Fundamentals of Micro fabrication : The Science of Miniaturization, Second Edition : Mare J. madou; CRC; 2 edition (2002)
3. Fundamentals of Bio MEMS and Medical Microdevices (SPIE Press Monograph Vol. PM 153); Steven S. Saliterman; SPIE-- the International Society for Optical Engineering (2006)
4. MEMS and Microsystems : Design and Manufacture ; Tai- Ram Hsu; Mc Graw Hill; 1 Edition (2001)
5. Biomedical Nanotechnology; Neelina H Malsch; CRC (2005)

REHABILITATION ENGINEERING

BME - 452 E

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

Introduction to Rehabilitation Engineering

Principles involved in the study of Rehabilitation Engineering.

Rehabilitation Engineering-Science and Technology

Concepts in Motor rehabilitation and Communication disorders

Prosthetics and Orthotics in Rehabilitation Engineering

Fundamentals. Applications and summary

Sensory Augmentation and Substitution, Visual Systems, auditory system, Tactual System Rehabilitation Engineering technologies; Principles and Application The Conceptual framework - Education and Quality assuarance, Future development

Text / References BOOK :

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)

BIOELECTROMAGNETISM

BME - 456 E

L	T	P
3	1	-

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

CONTENTS

PART I The Concept of Bioelectromagnetism; Subdivisions of Bioelectromanetism -Theoretical and Anatomical basis; Importance and History of Bioelectromagnetism.

PART II Anatomical and Physiological basis of Bioelectromagnetism

PART III Bioelectric Sources and Conductors and their Modelling

PART IV Theoretical Methods in Bioelectromagnetism

PART V Electric and Magnetic Measurement of the Electric Activity of the Neural Tissue.

PART VI Electric and Magnetic Measurements of the Electric Activity of the Heart.

PART VII Electric and Magnetic Stimulation of Neural Tissue.

PART VIII Electric and Magnetic Stimulation of the Heart

PART IX Measurement of the Intrinsic Electric Properties of Biological Tissues

PART X Other Bioelectromagnetic Phenomena

Text :

1. Malmivuo, J and Plonsey, R, Bioelectromagnetism ; Principles and Applications of Bioelelctric and Biomagnetic Fields, Oxford University Press, New York, 1995.

OPERATIONS MANAGEMENT

HUM - 462 E

L	T	P
3	1	-

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

CONTENTS

1. Operations Analysis : This initial module covers basic tools used to analyze manufacturing and service operations. We will introduce different types of processes and the strategies behind their selection.

2. Coordination and Planning - Operations management consists largely of coordination and planning tasks -

inventory, production and service provision must be managed to meet the needs of the customer. In this module, we will introduce tools and techniques employed by organizations to perform these tasks.

3. Quality Management - Quality has received considerable attention during the last two decades and is an integral component of many of the tools introduced in the preceding module. This two section mini module provides a brief overview of the most important quality concepts.

4. Project Management - Effective project management is crucial for the sucess of many companies. In this 3-class module, we introduce tools to succefully manage large projects and discuss examples from aerospace and entertainment industries.

5. Logistics and supply Chain Management. the final module introduces problems of the entire supply chain from vendor to customer and the methods used to manage these supply chains. Strategic issues, global implications and product and process development receive particular attention in this module.

TEXT BOOK :

1. Nahmias, Steven Production and Opeartions Analysis. 4th ed. Mc Graw Hill, 2001.

2. Hopp, W. J., and M. L. Spearman. Factory Physics, 2nd ed. M c Graw Hill, 2000

3. Goldraft, E.M. and J. Cox. The Goal : A Process of Onagoing Improvement. 2nd Revised ed. North River Press, 1992.

AI AND EXPERT SYSTEMS

CSE - 451 E

L	T	P
3	1	-

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

CONTENTS

1. Introduction to Artificial intelligence : Scope, history & applications. AI as representation and search the predicate calculus inference rules. Logic based financial advisor, structures and strategies for state space search graph theory strategies for space using state space to represent reasoning with the predicate caculus.

2. Heuristics Search : An algorithm for heuristic search, admissibility monotonicity and informed ness heuristics in games, complexity issues, control and implementation of state space search recursion based search, pattern directed search. Production systems, predicate calculus and planning the black board architecture for problems solving.

3. LISP and PROLOG, Knowledge representation languages issues in knowledge representations network representation language, structured representations, introduction to LISP. Search in LISP : a functional approach to the farmer, Wolf, Goat and cabbage problem, higher order functions & procedural abstraction, search strategies in LIPS.

4. Expert systems : Introduction, History basic concepts, structure of expert systems, the human element in ES, how ES works, problem areas addressed by ES,

ES sucess factors, types of expert systems, ES and the internet interacts web, knowledge engineering , scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, knowledge acquisition form multiple experts validation and verification of the knowledge base, analyzing coding, documenting & diagramming

5. Expert systems - II, societal impacts reasoning in artificial intelligence, inference with rules, with frames : model based reasoning, case based reaszoning, explanation & meta knowledge inference with uncertainty representing uncertainty probabilities and related approaches theory of certainty (certainty factors) Qualitative reasoning, the development life cycle phases I, II, III, IV, V, VI the future of expert system development process societal impacts.

TEXT BOOK :

1. Efrain Turban and Jay E Aranson : Decision support systems & intelligent systems (5th Edn.) Prentice Hall, 1988.
2. Donald A Waterman : A Guide to expert Systems, Addison - Wesley 1995.
3. G.F. Luger & WA Stubble Field Artificial intelligence structures and strategies for complex problem solving, 3rd Edn. Addision Wesley 1988.
4. E. Rich and Knight Artificial Intelligence, Second Edn, Tata Mc Graw Hill Publishing, 1981.

OOPS and C++

CSE - 462 E

L	T	P
3	1	-

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

CONTENTS

1. Introduction Object oriented programming, characteristics of object oriented languages classes, C++ and C
2. C++ programming language : Program statements - Declaration statements and variables, assignment systems, C in and C out statements, function call statement variables and constants, integer and character types, arithmatic operation, loops and decisions for while and do loops, if else, else if, Switch statements, logical AND, OR, NOT operators, break, continue and go statements.
3. Functions : defining a function, function arguments and passing by value, array and pointers, functions and strings, function and structure.
4. Classes and objections, class constructors and destructors operator overloading.
5. Class inheritance - derived class and base class virtual functions multiple inheritance
6. Input output and files, Streams buffers and the I/O stream oh file, redirection output with C out and input with C in, file input and output

TEXT BOOK :

1. The wait group object orieted programming in Turbo C++ by Robert Lafore- Galgatia.
2. The wait Groups C++ Primer Plus - Stephen Partia - Galgatia

REFERENCES :

1. C++ Programming Languages - Bjarne Strusstrup Addison Wesley 3rd Edn.

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