SEMESTER – III

Mathematics –III

**MATH-201 E**

| | | | |
|---|---|---|---|
| L T P | Class Work | : | 50 Marks |
| 3 2 0 | Theory | : | 100 Marks |
| | Total | : | 150 |
| | Duration of Exam | : | 3 Hrs |

**CONTENTS**

**Part A**

1. Fourier Series and Fourier Transforms : Euler's Fourmalae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.
2. Fourier Integrals, Fourier transforms, Shifting theorem(both on time and frequency axes) Fourier transforms of derivatives, Fourier transforms of integrals, Convulation theorem, Fourier transform of Dirac –delta function

**Part B**

1. Function of Complex variable : Definition, Exponential function, Trigonometric and Hyperbolic function, Logarithmic functions, Limit and continuity of a function, Differentiability and Analytically
2. Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of a Cauchy-Riemann equations. Harmonic functions, application to flow problems. Integration of complex functions. Cauchy-Integral theorem and formula
3. Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues, Evaluation of real integrals using residues (around unit and semi circle only)

**Part C**

1. Probability Distributions and Hypothesis testing : Conditional probability, Bayes theorem and its applications, expected value of a random variable. Properties and application of Binomial, Poisson and Normal distributions.
2. Testing of a hypothesis, tests of significance for large samples, Student's t-distribution (applications only), Chi-square test of goodness of fit.
3. Linear Programming :Linear programming problems formulation, Solving linear programming problems, using (i) Graphical methods (ii) Simplex method (iii) Dual simlex method

**Text Books:**


1. Advanced Engg. Mathematics : F Kreyszig
2. Engg. Mathematics : B. S. Grewal - Khanna Pub.


**Reference Books :**

1. Advanced Engg. Mathematics : R K Jain, S R K Iyenger
2. Advanced Engg. Mathematics : Michael D Greenberg
3. Operation Research : H A Taha
4. Probability and Statistics for Engineers : Johnson , PHI

**Note:** Examiner will set eight questions in all **:** taking two from Part **-** A three from Part **–** B and three from Part **-** C**.** Students will be required to attempt five questions**,** taking at least one from each part**.**

**SEMESTER - III**

**Biochemistry**

**BME – 201 E**

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

**CONTENTS**

Introduction to Biochemistry and Medicine : Cell, Eukaryotic cell structure, functional role of each Organelle, Sub cellular Fractionation : Differential Centrifugation, Redox potentials & Oxidative phosphorylation, Transport of substances across biological membrane function.

Enzymes (Proteins) : Chemical nature of enzymes (Proteins). General properties of enzymes, Spectrophotometric measurement of enzymes (proteins) isolation methods study of enzyme properties, Diagnostic enzymes, Enzyme biotechnology

Nucleic Acids : Composition and functions of nucleic acids (A brief account) Genes, Outlines of DNA structure, Recombinant DNA and its applications

Blood chemistry : Chemical composition of blood

Urine chemistry : Chemical composition of urine under normal and abnormal conditions.

Instrumentation : Principles and applications of photometry, Spectrophotometery fluorometry, Nephalometry and turbidimetry,Spectroscopy:Basic concepts and instrumentation-IR(including FTIR),NMR(including FTNMR),and UV. Biochemical analysis carried out in the estimation of blood constituents like glucose, urea, creatinine, protein, cholesterol, bilirubin etc., Separation of Serum Proteins by electrophoresis, Automation in biochemical analysis.

Acid base homeostasis : Acids, bases, measurement of pH and glass electrodes, Role of kidney and lungs in acid base balance, Biochemical measurement of acid base status of patients, Blood gas analyzer disorders of acid-base balances

Isotopes : Definitions, Units, radioactive isotopes, Applications of isotopes in life sciences and medicine.

**Texts:**

1.Organic spectroscopy-Principles and applications by Jagmohan,Narosa Publish House, New Delhi
2.A textbook of biochemistry –A.V.S.S.Rama Rao (UBSPD)
3.Instant notes on biochemistry-Hooper etral.
4.Enzymes-Biochemistry,Biotechnology,Clinical chemistry-Trenor Palmer(EWP)

**References :**

1.Organic Analytical chemistry-Theory and practice by Jagmohan.Narosa publishing house, New Delhi.
2.Haper's Biochemistry, 25th edition(McGraw Hill)
3.Fundamentals of biochemistry-J.L.Jain,sanjay Jain (S.Chand)

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

**SEMESTER – III**

**Introduction to Biomedical Engineering**

**BME – 205 E**

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

**CONTENTS**

1 Generalized Instrumentation Systems, general properties of input transducers

1.1 Static characteristics: Accuracy,Precision,Resolution,Reproducibility,Sensitivity,Drift,Hysterisis ,Linearity, Loading effect, Input Impedance and Output impedance

1.2 Dynamic characteristics: First and second order characteristics, Time delay, Error free instrument, Transfer functions, design criteria, generalized instrument specifications

2 Displacement and Pressure measurement

Resistive- Potentiometers, strain Guages, Bridge circuits.

Inductive-Variable Inductance and LVDT

Capacitive type, Piezoelectric transducers.

Types of diaphragms, bellows ,bourdon tubes.

3 Temperature measurement : Thermistor, thermistor characteristics and its linearization, thermocouple, resistive temperature detector, Radiation Thermometry, Fiber Optic sensor, Optical measurement, Geometrical

4 Properties of electrodes and transducer used in biomedical measurements

Bipotential electrodes: Electrode electrolyte interface, half cell potential polarization, polarizable and nonpolarizable electrodes, Calomel electrode, electrode circuit model, electrode skin interface and motion artifact. Body surface electrodes.

Internal electrodes :Needle and wire electrodes(different types)

Micro electrodes : metal, supported metal, micropipet(metal filled glass and glass micropipet electrodes)microelectronic, properties of microelectrodes, method of use.

Electrodes used for measurement of ECG,EEG,EMG.

6. Electrical properties of nerves, the exterior potential and the electro cardiogram**.** Interaction of photons and charged particles with matter**.**

6 Study of Various imaging modalities (X rays, CT, MRI, PET)

**Texts:**

1. Intermediate Physics for Medicine and Biology By Hobbie RK**,** 2nd Edition Chichester Wiley

2. Clinical Chemistry : Interpretation and techniques By- A.Kaplan, S.Laverne and K.E. Opheim, Lean and Febige, Philadelphia.
3. Transducers in BME: Richard S.Cobbold
4. Medical Instrumentation.. applications and design by John G. Webster.(Marcel Dekkar Pub)

**References:**

1.Biomedical sensors-Fundamentals and applications by Harry N.Nortan(Plennum Press)

2.Biomedical Instrumentation and measurements-by Leslie Cromwell,Fred J.Weibell

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

**SEMESTER - III**

**Human Anatomy and physiology**

**BME – 215 E**

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

**CONTENTS**

ANATOMY:

1. Structure & functions of cell. Polarization & depolarization of cell.
2. Basic tissues & functions in brief.
3. Outline of structures of the following systems:
   Cardiovascular system, Respiratory system, Alimentary system, Central Nervous system, Reproductive system, Urinary system, Muscular system, Endocrine system
   Sense organs: Eye, Ear, Integumentry system (skin study)

PHYSIOLOGY:

1. Cardiovascular system: Heart, conductive tissue of heart, cardiac cycle, heart valves, systemic & pulmonary circulation, Transmission of cardiac impulse, blood pressure
2. Respiratory system: respiration external (ventilation), Exchange in gases in the alveoli, Artificial respiration, Spiro meter (Forced expiration volumes), peak flow meter.
3. Alimentary system: all organs of the digestive system, other secretions & main functions.
4. Blood: composition of blood – blood cells & their functions. Cell counting, hemoglobin
5. Excretory system: Structure of Nephron, formation of urine & function of kidneys, urinary bladder, urethra, internal /external sphincters.
6. Nervous system: different parts, their functions. Reflex action & reflex arc. Function of sympathetic & parasympathetic nervous system. Nervous conduction & action potentials.
7. Reproductive system: (male & female)
   Different organs & their function Main action of Androgens, Estrogens & progesterone.
8. Endocrine system: all glands, their secretions. Control of secretions.
9. Muscle physiology.
10. Physiological aspects of skin resistance.

TEXT


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


**REFERENCES**

1. Charles E Tobin , “Manual of Human Dissection”, Mc Graw Hill, Edition 4, 1961
2. J Gibson, “ Modern Physiology and Anatomy of Nurses”, Black Well, 1981.
3. Physiology of human body :Guyton.(prism books)
4. Principles of anatomy and physiology :Tortora and Grabowski.(haper collin pub.)

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

**SEMESTER – III**

**ELECTRONICS-I**

**BME – 253 E**

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

**SEMICONDUCTOR MAATERIALS & DIODES**

Review of semiconductor materials & properties. The PN junction, introduction to semiconductor diode theory. Diode circuits: DC Analysis & Models, AC Equivalent circuits, other diode types – solar cell, photodiode, light – emitting diode, Schottky Barrier diode, Zener diode, temperature effects, understanding Manufacturer's specifications

**DIODE CIRCUITS**

Design of rectifier circuits' half wave Rectification, full wave rectification, filter, ripple voltage & diode current, voltage Doubler circuit, Zener Diode circuits, clipper & clamper circuits, Multiple – diode circuits, photodiode & LED circuits.

**THE BIPOLAR JUCTION TRANSISTOR**

Basic bipolar junction transistor, Transistor Structures, NPN Transistor: forward _active
Mode Operation, PNP Transistor: Forward – active mode operation, circuit symbols & conventions, current- voltage characteristics, Non ideal Transistor leakage currents & Breakdowns, DC Analysis of Transistor circuits, common – Emitter circuits, Load Line & Models of Operation, common Bipolar circuits: DC analysis, Basic Transistor Applications- Switch, Amplifier, Bipolar Transistor Biasing _single Base Resistor Biasing, voltage Divider Biasing 7 bias stability, integrated circuit Biasing, Multistage circuits.

**BASIC BJT AMPLIFFIERS**

Analog Signals & linear Amplifiers, The Bipolar Linear Amplifier, Graphical Analysis & AC Equivalent circuit, small signal Hybrid – a Equivalent Circuit of the Bipolar Transistor, Hybrid – л Equivalent Circuit Including the early Effect, Expanded Hybrid – л Equivalent Circuit, Other Small – Signal Parameters and Equivalent Circuits, Basic Transistor Amplifier Configurations, Common Emitter Amplifiers, AC Load Line Analysis, Common collector Emitter Follower Amplifier, Common base Amplifier, The three Basic Amplifier configurations, Summary comparison, Multistage Amplifiers, Power Considerations, Envoirmental Thermal considerations in Transistor Amplifiers, Manufacturer's Specifications.

**THE FIELD EFFECT TRANSISTOR**

Junction Field Effect Transistor, MOS Field Effect Transistor, MOSFET DC current Analysis, Basic MOSFET Applications: Switch Digital Logic Gate and Amplifier, Temperature Effects in MOSFETs, Input Protection in MOSFET. The Power FET (VMOS).

**BASIC FET AMPLIFIERS**

The MOSFET Amplifier, Basic Transistor Amplifier Configurations, The common source Amplifier, The Source Follower Amplifier, The common Gate configuration, The three Basic Amplifier configuration, Summary and Configuration, Single – Stage Integrated Circuit MOSFET Amplifiers, Multistage Amplifiers, Basic JFET Amplifiers.

**TEXT:**


1. Donald A. Neamen, Electronic Circuit Analysis and Design, Second Edition, McGraw Hill International edition 2001
2. Martin Roden, Hordon Carpenter, William Wieserman, Electronic Design, Fourth edition, Shroff publisher, 2002


**REFERENCES:**


1. Donald Schilling & Charles Belove, Electronic Circuits Discrete and Integrated, Third edition, McGraw Hill International edition, 1989.
2. Milliman Halkins


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

**SEMESTER – III**

Network Analysis and Design

**EE- 251 E**

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

**CONTENTS:**

1. **Network Topology:** Graph of a Network**,** Concept of a Tree and Links**,** incidence Matrix**,** Tieset and Cutset Schedulues**,** solution of Networks**,** Principals of Duality and Network Transformation**.**
2. **Review of Loops and Nodes:** Linearly independent KVL & KCL equations**,** Methods of Analysis of DC and AC Networks**.** Network reduction using Y **-** D Transformations**.**
3. **Theorms:** SuperPosition**,** Reciprocity**,** Thevenin**,** Norton's**,** Maximum Power Transfer And Miller's Theorms**,** Tellegens Theorms**.**
4. **Resonant Circuits:** Series and Parallel resonance**,** Frequency response of series and parallel circuits**,** Q **-** Factor**,** Bandwidth**.**
5. **Transient behaviour and initial conditions in networks:** Behaviour of circuit element under switching condition and their representation**.** Evaluation of initial and final conditions in RL**,** RC and RLC circuits for AC&DC excitations**.**
6. **Laplace transformation and its application:** Definition and Properties of Laplace Transforms**.** Inverslaplace transforms**,** initial and final value theorms**,** shifting theorms**,** convolution integral**.** Laplace transform of periodic and non **-** periodic signals**.**
7. One & two port network parameters**.**

**TEXTS:**

1.Network Analysis by Van Valkenburg(PHI)

2.A.Sudharkar & S.P Shyam Mohan,Circuits and networks,Tata Mc Graw Hill,thirteenth reprint,2000

**REFERENCES:**

1.William Hayt,Kennedy,Durbin,Engg. ckt analysis McGraw Hill Intemation,6$^{th}$ edition,2002

2.Raymond.De Carlo,P.Minlin,linear ckt.analysis,Oxford university press,2$^{nd}$ edition 2001

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

**SEMESTER - III**

**Biochemistry Lab**

**BME – 203 E**

| | | | |
|---|---|---|---|
| | 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. Carbohydrates: Estimation of Blood Glucose
2. Proteins : Test for Albumin and globulin, Test for Cystine
3. Estimation of Blood Urea
4. Estimation of Blood Cholesterol
5. Liver function test (SGOT)
6. Liver function test (SGPT)
7. Alkaline phosphates test
8. Study of abnormal urine content bile pigment salt
9. Estimation of total serum bilrubin
10. Estimation of gastric juices – Ph and acidity test

**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 – III**

Biomedical Engineering Lab

**BME – 207 E**

| | | | |
|---|---|---|---|
| | 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. Introduction to different type of electrodes – surface electrodes, suction electrodes, floating electrodes, disposable electrodes, needle electrodes and microelectrodes.
2. To study the placement of EEG electrodes, recording of EEG waveform and its interpretation
3. Recording of ECG waveform from 12 limb leads and the interpretation of ECG waveform.
4. To study placement of EMG electrodes, recording of EMG waveform and its interpretation
5. Demonstration of sphagmanometer and stethescope. Measurement of systolic and diastolic arterial blood pressure using sphagmanometer.
6. Study of nerve muscle stimulator
7. Study of Wheatstone bridge transducers or strain gauge
8 To study troubleshooting of ECG machine
9. Study of thermistor, its characteristics and its linearization
10. Hospital visit for various imaging modalities(X ray,CT,MRI and PET)

**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 - III**

Human Anatomy and Physiology Lab

**BME – 213 E**

| | | | |
|---|---|---|---|
| | 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. To study the
   a) T.S. of Pancreas Gland
   b) T.S. of Liver Gland
   c) T.S. of Thyroid Gland
   d) T.S. of Adrenal Gland
   e) T.S. of Spinal cord

2. a) To study the effects of various trends of solution on RBCs
   b) To study the effect of acid and alkali on RBCs
   c) Effect of chloroform on RBCs

3. To study estimation of erythrocyte sedimentation rate(ESR)

4. Estimation of hemoglobin percentage by haemometer

5. To determine the total no. of RBCs in Human blood

6. To determine the total no. of WBCs in Human blood

7. To prepare the blood film of your own blood. Stain it and study the blood picture and identify the various blood cells

8. To determine your own blood group

9 To determine the bleeding and clotting time of blood

10. To study models of sensory organs available in the lab

**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 IV**

**Biomedical Statistics**

**BME – 206E**

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

**CONTENTS**

Introduction the scope and purpose of statistics, types of data, estimation and measurement errors, Elements of Probability, Measurement, Probabilities and distribution, Conditional probabilities, Bayes theorem, ROC curves, Diagnostic use of probabilities, Methods of uncertainty reasoning

Descriptive and summary statistics, means, SD, SEM, Median, centiles, outliers, missing data, Random variables and expectations, Variance , co-variance, distributions – binomial, normal, poisson

Population samples, frequencies, estimaters, variability, confidence intervals, graphical; presentations, histograms, scatter plots, checking normality, transformations

Sources of error and biological variations, false positive, false negative, sensitivity, specificity, reliability, noice. Designing for precision – sampling, sample size, replication, paired/ matched/ balanced design. Diagnostics tests and their predictive value.

Hypothesis testing and tests of significance. Clinical trials –study design, organization and planning Randomization, size, monitoring, surveys, survival analysis

**Reference:**


1. Modern Medical Statistics : A practical Guide by By Brain S. Everitt, published by Edward Arnold 2003
2. Biostatistics by Daniel W
3. Biostatistics by S, Prasad, S Chand
4. Biostatistics by Negi, K S., Rastogi Publishers
5. Introduction to Biostatistics by P K Banerjee, S Chand
6. Basic Biostatistics: A Primer for the Biomedical Sciences by Olive Jean Dunn and Virginia A Clark., Wiley – Interscience, 3rd Edition, 2001
7. Biomedical Statistics with computing by M H Reigier et al. John Wiley and Sons, 1982
8. Statistics : A Biomedical Introduction by Byron Wm,. Brown and Myles Hollander, Wiley-Interscience, 1977
9. Statistical Methods for the Analysis of Biomedical Data, 2nd Edition by Robert F Woolson and William R Clarke, Wiley – Interscience, 2002

10. An Introduction to Medical Statistics , Third Edition, Martin Bland, Oxford Medical Publications

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

## SEMESTER IV

## Electronic Instruments

| | | | |
|---|---|---|---|
| BME- 210 E | | Class Work | :50 Marks |
| L | T P | Theory | :100 Marks |
| 3 | 1 - | Total | :150 Marks |
| | | Duration Of Exam | :3 Hrs |

**Contents**

1. **Electronic Voltmeter:**
   Principles of operation, Advantages over Conventional Type Analog Voltmeters, Factors involved in section of Voltmeters, FET Voltmeter, Multimeter, Peak Reading, Average Reading, True RMS Reading Voltmeter.
2. **Digital Voltmeters**
   Methods of Analog to Digital & Digital to Analog Conversion,
   Principle & Working of
   i) Ramp Type
   ii) Dual Slope Integrating Type
   iii) Successive approximation Type Digital Voltmeter,
   Resolution & Sensitivity of a Digital Meter.
3. **Frequency & Phase Meters:**
   Analog Electronic Frequency Meter – Operation & Limitations
   Digital Frequency Meter – Operation (with block Diagram)
   Analog Electronic Phase meter using Flip-Flop, Operation & Limitations, Digital Phase meter.
4. **Oscilloscopes:**
   Block Diagram study of C.R.O., Description of Panel Layout & Implementation of Controls, Requirements of Time base, Delayed Time base, Lissajous Patterns, Intensity modulation, Velocity modulation, use of these in phase & frequency measurements, Dual Trace, Double beam, Sampling, Storage, Digital readout oscilloscope, Use of CRO in Tracing Diode & Transistor characteristics.
5. **Signal Generators:**
   Requirements of a good laboratory type Signal Generator, A.F. Signal Generator, Function Generator.
6. **Fundamental Concepts of Measurement & Performance Characteristics of an Instrumentation System:**
   System Configuration – Block Diagram of a generalized, Measurement system, Zero Order system – Response of a system to step, Ramp, Impulse Inputs & Frequency Response. Second Order System – Response of the system to step & Ramp Inputs & Frequency Response.
   Dead Time Element, Dynamic Response of a Measurement system
7. **Transducers For Measurement:**
   Temperature, Vibration, Velocity, Flow, Level, Photoelectric, Performance Characteristics & selection for a given application
8. **Signal Conditioning:**
   Chopper Stabilized Amplifier, Instrumentation Amplifier, Active Filters.
9. **Data Acquisition System:**
   Generalized Data Acquisition System, PC based Data Acquisition System.

**Texts:**


1. Copper W. D. & Helfrick A.D. – Electronic Instrumentation & Measurement Techniques, Prentice Hall of India, 3rd Edition 1993.
2. Kalsi H.S. – Electronic instrumentation, Tata Mc Graw Hill, 3rd Edition, 1996.
3. Rangan, Sharma and Mani – Instrumentation devices and systems, Tata McGraw Hill, 1985


**References:**


1. Jones and Chin – Electronic and measurements, John Wiley and Sons, 1987
2. Jog N.K. Electronic Instrumentation & Control, Nandu Publications, 1st Edition 2001.
3. Doebelin E.O. – Measurements – Applications and design, Tata Mc Graw Hill, 4th edition, 1990.

SEMESTER – IV

Digital Electronics

**EE- 252 E**

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

**CONTENTS**

**Basic Digital Circuits:**

Digital Signals, logic gates**:** AND, OR, NOT, NAND, NOR, EX **-** OR, EX **-** NOR**.**

**Number System And Codes:**

Boolean Algebra, Binary, Octal and Hexadecimal Number systems**,** Conversion from one number system to another**.** Signed binary number, sign magnitude**,** 1's complement and 2's complement, BCD code**,** Excess **-** 3, Gray, EBDIC, ASCII, Error correction & error detection Codes**.**

**Combinational Circuits:**

Designing using gates**,** simplification by K **-** Map**,** Multiplexer**,** De **-** Mux**,** adders**,** Subtractors**,** BCD Arithmetic**,** Digital Encoder, Priority encoders**,** Decoders**,** Designing by MUX, & DEMUX

**Sequential Circuits:**

Flip **-** Flops**,** (JK, SR,T, D )Master Slave**,** Edge trigger**,** Shift Register**,** Counters**,** Asynchronous & synchronous ring & Johnson counters

**Digital Logic Families:**

Bipolar Logic Families**:** TTL, RTL, CMOS, ECL

**TEXT**

1. Digital Electronics **:** Tocii **-** PHI
2. Digital Electronics **:** R**.** P**.** Jain – TMH

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

## SEMESTER - IV

## Electronics-II

**EE-264 E**

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

### CONTENTS

**Frequency response of Amplifiers**

Amplifier frequency Response, System transfer functions, S-domain Analysis, First Order functions, Bode Plots, Short-circuit and open- circuit time constants, Frequency Response: Transistor amplifiers with Circuit Capacitors, Frequency Response: Bipolar Transistor, Frequency Response :The FET, High Frequency response of transistor circuits. Sinusoidal Oscillators: The phase shift oscillator, The wein bridge oscillator, The tuned circuit oscillator, The colpitts oscillator and Hartley oscillator.

**Output stage and power amplifier**

Power amplifiers, Power transistors-Power BJTs, Power MOSFETs, Heat sinks, design of heat sinks, classes of amplifiers-Class-A, Class-B Operation, Class-AB operation, Class-c operation, Class-A power amplifiers, Class-AB push pull complementary output stages.

**Differential and Multistage Amplifiers**

The Differential amplifier, Basic BJT differential pair, Basic FET differential pair, differential amplifier with active load, BICMOS circuits, Gain stage and simple output stage, Simplified BJT operational amplifier circuit, Differential amplifier frequency response. The Darlington amplifier and cascode amplifier.

**Feedback and Stability**

Introduction to feedback, Basic feedback concepts, Ideal close-loop gain, Gain sensitivity bandwidth extension, Noise sensitivity, Reduction of nonlinear Distortion, Ideal feedback topologies, Series-shunt, shunt-series, shunt-shunt configurations, voltage (series-shunt) amplifiers, Current (shunt-series) amplifiers, trans conductance (series-series) amplifiers, trans resistance (shunt-shunt) amplifiers, loop gain, stability of the feedback circuit, The stability problem, bode plots: one-pole, two-pole and three-pole amplifiers, Nyquist stability criterion, Phase and gain margins, Frequency compensation basic theory, closed loop frequency response, miller compensation

### Text


1. Donald A. Neamen, Electronic Circuit Analysis and Design, Second Edition, McGraw Hill International edition 2001
2. Martin Roden, Hordon Carpenter, William Wieserman, Electronic Design, Fourth edition, Shroff publisher, 2002


### References


i. Donald Schilling & Charles Belove, Electronic Circuits Discrete and Integrated, Third edition, McGraw Hill International edition, 1989.

ii. Milliman Halkins

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

*SEMESTER - IV*

## Computer Networks

**CSE-252 E**

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

**CONTENTS**

Introduction**:** uses of computer network**,** network hardware & software **,** reference model (OSI & TCP **-** IP)**.**

Physical Layer**:** Theoretical basis of Data Communication **,** Transmission media**,** wireless transmission,Telephone system**.**

Data link Layer**:** Design issues that is framing **,** error control & flow control**. ,** Error detection & correction**.**

Media Access Sublayer**:** Channel Alocation (Static & Dynamic)multiple

access protocols (ALOHA**,** CSMA**,** Collision Free protocol,WDM access protocol)**.**

Network Layer**:** Network layer design issue i**.** e**.** services provided to transport layer**,** internal organisation of N/W layer**,** Virtual circuit datagram subnet**,** Routing Algorithm**.**

**TEXT**

Computer Network by Tanenbaum **-** PHI

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

**SEMESTER - IV**

**Biomedical Signal Analysis**

**BME – 202 E**

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

**CONTENTS**

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

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

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

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

5. Data reduction techniques, Power spectrum analysis, Sampling theorem aliasing Nyquist criteria, ADC's and DAC's

6. Digital signals and systems : Classification of systems causal, time varying, time invariant, lumped. Introduction to digital signals systems. Convolution, Auto-correlation and cross –correlation, sampling, aliasing,

7.Use of Matlab signal processing toolbox on various real bio - medical signals.

**Texts**

1. Digital signal processing, Proakis(PHI)
2. Signal Analysis By R. P. Singh , Second edition Tata McGraw - Hill
3. ***Engineering Electronics By Mauro R Prentice – Hall***

4.Malmivuo, J. and Plonsey, R. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.

**References**

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

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

## SEMESTER - IV

Digital Electronics Lab

**EE- 254 E**

| | | | |
|---|---|---|---|
| | 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. Study of TTL gates - AND, OR, NOT,NAND, NOR, EXNOR
2. Design & verify expression using K - MAP
3. To verify the operation of MUX & DEMUX
4. To verify the operation of a comparator
5. To verify the Truth tables of SR,JK,T,D FF
6. To verify the operation of Shift Register
7. To verify the operation of 3 - bit synchronous counter
8. To verify the operation of Up - Down decade counter
9. To verify the working of Ring counter
10. To verify the working of Johnson counter

**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 - IV**

**Computer Networking Lab**

**CSE- 254 E**

| | | | |
|---|---|---|---|
| | 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. Study of Internet Explorer and Netscape Navigator
2. Study of Network Neighborhood utility of Windows Operating System
3. Networking using Windows 98 Operating System
4. Implement the IP datagram header
5. Find the shortest path between two routers**.**
6. Construct the TCP/IP server using Socket Interface
7. Construct the TCP/IP client using Socket Interface
8. Construct the TIME server**.**
9. Construct the ECHO server and Client
10. Construct the TCP/IP Chat server for two users**,** using Socket Interface

**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 – IV**

**Bio – Signal Analysis Lab**

**BME – 204 E**

| | | | |
|---|---|---|---|
| | 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. Design a low pass filter and plot graph of gain versus frequency
2. Design a high pass filter and plot graph of gain versus frequency
3. Design a band pass filter and plot graph of gain versus frequency
4. Generate a Huffman code for a waveform using Digiscope
5. Using digiscope study waveform generation and power spectrum analysis.
6. Demonstration of ECG recorder, illustration of its various electronic components and their functioning.
7. Study turning point compression of a noise signal using digiscope
8. Study the ECG waveform (QRS) for subjects S1 and S2**.**
9. Develop a MATLAB program to perform synchronized averaging for a noisy signal**.**
10. Write a MATLAB program to compute RMS value at each instant for the EMG signal**.**

**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 - V**

**Basic Clinical Sciences**

**BME – 305 E**

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

**CONTENTS**

PART A OPTHALMOLOGY

Physiology of Eye, Structure of Eye, Function, Generation of signal and transmission to brain, Electrophysiology, aqueous humor production, intraocular pressure fluctuation

The electrical characteristics of the eye**,** including the anatomy and physiology of the eye**,** the electrical activity in the eye and retina**,** the genesis of the electroretinogram (ERG)**,** the basis of ERG diagnosis**,** the genesis of the electrooculogram (EOG)**,** and applications of the EOG**.**

Vision testing equipments, Snellen's chart, keratometer, refractometer,
Color vision.

Slit lamp biomicroscope and camera, fundus camera, opthalmoscope, retinoscope, tonometer, perimeter, ultrasound scanner, electromagnet, organ laser, contact lenses, intraocular lenses, operating microscope, vitrectomy instrument

PART B ENT
Anatomy of ear and cental connection, mechanics of hearing and equilibrium, auditory receptors, audiometers, hearing aids, cochlear implants

Electronystography, application of laser in ENT, application of cryo in ENT, anatomy of larynx, speech rehabilitation in post laryngotomy cases, principle of scopy.

PART C Anesthesia
Application in anesthesia, intensive care, medical gas supply system and intravenous drug delivery system, principal of equipment used in pain therapy, principle of OT tables and lights , phototherapy, surgical diathermy.

**REFERENCES**


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


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

**SEMESTER - V**

**Biomechanics**

**BME – 301 E**

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

**CONTENTS**

Introduction to biomechanics, basic mechanical concepts, types of motion, movement terms

Basic kinematic concepts, vectors & trigonometry

Linear Kinematics I: Position, velocity, and acceleration

Linear Kinematics II: Projectile motion I, uniformly accelerated motion

Linear Kinematics III: Projectile motion II, uniform motion (constant velocity)

Angular Kinematics I: Angles (relative vs. absolute), angular velocity, and angular acceleration

Angular Kinematics II: Angular velocity and acceleration (linear to angular relationship)

Linear Kinetics I: Force, mass, inertia, free body diagrams.

Linear Kinetics II: Newton's laws

Linear Kinetics III: Impulse, momentum

Linear Kinetics IV: Friction

Linear Kinetics V: Spin and elasticity

Linear Kinetics VI: Work, power, energy

Angular Kinetics I: Torque, moment arm

Angular Kinetics II: Net Torque, joint torques, levers, static equilibrium

Angular Kinetics IV: Center of Gravity, balance and stability

Angular Kinetics III: Dynamic equilibrium Newton's laws for angular motion

Angular Kinetics IV: Moment of inertia, angular momentum

Fluid mechanics I: Density, buoyancy, relative flow

Fluid mechanics II: Fluid resistance, drag, lift, Magnus force

Patterns: Push/Throw Continuum

Biomechanics of push **-** like motions

Biomechanics of throw **-** like motions

**TEXT**

Basic Biomechanics, Fourth edition, by Susan J. Hall. The McGraw - Hill Companies, Inc. 2003

**REFERENCES**


1. A Primer of Biomechanics, Lucas et al., Springer - Verlag, 1999
2. An Introduction to Biomechanics: Solids and Fluids, Analysis and Design
   by Sherry L. Delange, Jay Dowell Humphrey, 2004


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

**SEMESTER - V**

**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 |

**CONTENTS**

Introduction to the area of imaging and image processing. Image generation. The generation of 2 **-D** representation of the 3 - D worlds.

Operation of camera systems, Solid-state arrays, illumination, optics. Digital image representation, sampling and quantization.

Techniques for improving image quality **-** restoration, geometric correction, enhancement. Use of degradation models. Image segmentation techniques **-** their shading, edge detection, region growing. Limitations advantages and properties. Image measurements, there use in application, recognition and object description

Compression and coding of images. binary, grey scale and color images. Practical techniques **-** performance aspects, coding efficiency, quality of results, processing speed

Image processing hardware **-** PC based, custom. Special computer architectures, Parallel processing. Color image processing – multi spectral, segmentation, recognition, coding.

Introduction to computer vision **-** interpretation of 3 **-** D Scenes. Use of CAD models.

**TEXT**

1. Image Processing By Sonka, Hlavac & Boyle (Chapman and Hall).
2. Digital Image Processing By R. C Gonzalez and P Woods. (Addison Wesley. )

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

SEMESTER - V

**Microprocessors and Embedded Systems**

**EE-351 E**

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

**CONTENTS**

Programmer's Model of a Microprocessor: Address Space, Registers Instructions, Assembly Language Programs

Assembly Language Programming: Specification, Program Description Language, Data Declarations, Code Modules

The Hardware Model of a Microprocessor: CPU Organization, External Interface Timing, Synch/ Asynch. Buses

Interfacing: I/O Organization, Address Decoding, Static and Dynamic Memory Interfacing

I/O Support Devices: Parallel Interface, PIA, Peripheral Control, Handshaking, Serial Interface, ACIA, RS232C, Interrupt - driven I/O, Interrupt Vectors, Interrupt Handlers, DMA Mechanism/Controllers

Microcomputer Busses: Standards, Examples

Embedded System Characteristics, Case Study 1: Microwave Oven

Development Process Outline: Requirement, Analysis, Specification System, Hardware, and Software Design, Integration and Testing

Case Study 2: Traffic Light Controller

**TEXT**

1. Microprocessors 8085 By Ramesh Goankar(Penram Publications).
2. 8051 Arcitecture By Kennth Aayla (Penram Publications).
3. EMBEDDED SYSTEMS : RAJ KAMAL, TMH
4. EMBEDDED REALTIME SYSTEMS PROGRAMMING : IYER, SRIRAMGUPTA, PANKAJ

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

SEMESTER - V

**Integrated Circuit Systems**

EE-355 E

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

CONTENTS

**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.

**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.

**Specialised 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.

**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.

REFERENCES


1. Jacob Milliman, Christors C Halkias, “Intergrated Electronics”, Mcgraw Hill, 2002
2. Jacob Millman, Irvin Grabel, “Microelectronics”, McGraw Hill, Edition2, 1988.
3. Ramakanth A Gayakwad, “OPAMPS and Linear Integrated Circuits”, Prentice Hall, Edition 4 , 2000.
4. J Nagrath, “Electronics (Analog and Digital)”, Prentice Hall.


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

SEMESTER - V

**Biomedical Equipments – I**

**BME – 307 E**

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

**CONTENTS**

**Blood Flow meters**

Electromagnetic Blood flow meters; Ultrasonic Blood Flow meters; NMR Blood Flow meters; Laser Doppler Blood Flow Meters.

**Blood Gas Analyzers**

Blood PO2 Measurement; Measurement of Blood PCO2; Blood Ph measurement; Complete Blood Gas Analyzer; Oximetry.

**Blood Cell Counters**

Methods of cell counting - Coulter Counters; Automatic recognition and differential counting of cells. Photoelectric Calorimeter; Spectrophotometer; Flame photometer; Autoanalyzer.

**Pulmonary Function Analyzers**

Pulmonary function measurement; Spirometry; Pulmonary function analyzers. Respiratory gas analyzers.

**Audiometer**

Basic Audiometer; Pure tone audiometer; Audiometer system Bekesy; Evoked response audiometer system.

**Foetal Monitoring Instruments**

Cardiotocograph, Foetal heart rate measurements; Foetal scalp pH monitoring; Monitoring Labour activity.

**Ventilators**

Mechanism of respiration, types of ventilators, Humidifier, Nebulizers & 8. Humidifiers

**Lithotriptors**

**Anaesthesia machine**

**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.

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

**SEMESTER - V**

Biomechanics Lab

**BME – 303 E**

| | | | |
|---|---|---|---|
| | 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. 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 Bernoulli's Theorem**,** 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. Gait Analysis
12. 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 institution as per the scope of the syllabus.**

**SEMESTER - V**

**Digital Image Processing Lab**

**CSE-353 E**

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

**LIST OF EXPERIMENTS000**

1. Creating an image
2. Computing the histogram of an image
3. Computing the statistical measures of the histogram of a region of an image.
4. Implementation of a Ideal Low Pass filter.
5. Implementation of a Ideal High Pass filters
6. Implementation of a Butter Worth Low Pass filter.
7. Implementation of a Butter Worth High Pass filter.
8. Implementation of a Gaussion Low Pass filter.
9. Implementation of a Gaussion High Pass filter.
10. Implementation of Point Detection Segmentation Method.
11. Implementation of Line Detection Segmentation Method.
12. Implementation of Edge Detection (Prewitt, Sobel) Segmentation Method.
13. Implementation of LoG + Zero Crossing Segmentation Method.

**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 - V**

**Microprocessor & Embedded Systems lab**

**EE-353 E**

| | | | |
|---|---|---|---|
| | 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. Introduction to the architecture of Microprocessor 8085**.**
2. Assembly **-** Language Program for BCD to Binary Conversion**.**
3. Assembly **-** Language Program for Binary Conversion to BCD**.**
4. Assembly **-** Language Program for addition of two 8 bit numbers.
5. Assembly **-** Language Program for BCD to Floating Point Conversion.
6. To find the largest number in a given array**.**
7. To multiply two 8 **-** bit numbers.
8. Assembly **-** Language Program for addition of 16 bit integers**.**
9. To study the Architecture of 8255**.**
10. To study the Architecture of 8051**.**
11. Memory Interfacing and Bus Wave forms
12. To study Serial Communication interfaces**.**
13. To study Parallel Communication interfaces**.**

**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 - V**

**Practical Training - I**

**BME – 309 E**

| | | |
|---|---|---|
| Class Work | **:** | 25 Marks |
| P/VV | **:** | 25 Marks |
| Total | **:** | 50 |

At the end of fourth semester each student would undergo six weeks practical training in an 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 - VI

## Medical Informatics

**BME – 310 E**

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

**CONTENTS**

**Introduction to Medical Informatics**
Introduction, What is medical informatics?

**Medical Data, Information and Knowledge**
Medical data, Medical information, Knowledge and Models, Information and Communication, Uncertainty of medical data, Systems, Medical Computer Systems **-** Systematisation of Computer Applications

**Databases**
Database management

**Classification of medical data and information**
Classification, Examples of classification systems

**Health Care Information Systems**
Introduction, Electronic Patient Record, Electronic referral **-** consulting system, Primary Care Systems, Clinical Departmental Information Systems, Clinical Support Systems, Nursing Information Systems

**Information Safety and Security in Health Care Information Systems**

**Evaluation of health information systems and technology**

**Medical decision - support systems**
Rationales for computer **-** aided decision making, Decision models **-** quantitative models, qualitative models, Knowledge Based systems **-** characteristic features of KBS, knowledge representaion in KBS, Artificial intelligence methods

**TEXT**


1. J. H. van Bemmel and M. A. Musen (eds. ), Handbook of Medical Informatics. Bohn Stafleu Van Loghum, Houten 1997
2. Enrico Coiera: Guide to Medical Informatics, the Internet and Telemedicine. Chapman & Hall Medical, London 1997.
3. Bronzino JD, The biomedical engineering handbook, IEEE Press, 2000


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

**SEMESTER - VI**

**Sensors And Sensing Systems**

**BME – 302 E**

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

**CONTENTS**

**SENSORS**

- Primary sensing principles and measurement variables
- Sensor performance characteristics and terminology
- Fibre - optic Sensors, Solid - state Sensors, and Ultra - sonic Sensors
- Limitation of Sensors

**INSTRUMENTATION**

- Transducer measurement circuits
- Signal conditioning circuits
- Data conversion: DAC, ADC
- Principles and basic architecture of typical sensing systems and analytical instruments

**PATTERN ANALYSIS**

- Introduction to Statistical Pattern Recognition
- Dimensionality reduction
- Classification
- Validation
- Data analysis

**INTELLIGENT SENSOR SYSTEMS**

- Structure, definitions and concepts
- Advanced processing and control techniques
- Smart sensors
- Case studies - sensing of a range of variables, illustrations of principles of sensor selection and integration of sensors into instrumentational systems.
- The future of intelligent sensor systems

**TEXT**


1. Introduction to instrumental methods of Analysis By Willard HH 7th edition(Wadsworth Inc. )
2. Fibre Optic Fluorescence thermometry By Grattan K T V and Zhang Z (Chapman and Hall).
3. J. Brignell and N. White, Intelligent Sensor Systems, Revised Ed. , IOP, 1996
4. R. Frank, Understanding Smart Sensors, 2nd Ed. , Artech, 2000
5. R. Pallás - Areny and J. G. Webster, Sensors and Signal Conditioning, Wiley, 1991
6. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2001
7. Optical Fibre sensor technology By Grattan K T V and Meggitt B T (Chapman and Hall)
8. R. H. Bishop, Learning with LabVIEW, Addison Wesley, 1999
9. D. Hanselman and B. Littlefield, Mastering MATLAB 5, Prentice Hall, 1998


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

**SEMESTER - VI**

**Principles of Medical Imaging**

**BME – 306 E**

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

**CONTENTS**

Introduction: clinical and scientific needs in medical imaging.

X - ray imaging, basis of diagnostic radiology, nature & production of x - rays, X - Ray Machine, Visualization of X - Rays, Digital Radiography, Diagnostic and therapeutic Role of X - rays.

Computerized Tomography and applications, System components, Gantry Geometry and Patient Doses.

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

Radio - isotope imaging.

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

**TEXT**

1. Principles of Magnetic Resonance Imaging, Zhi - Pei Liang, Paul C. Lauterbur, IEEE Press
2. Joseph P Hornak's book at http: //www. cis. rit. edu/htbooks/mri/
3. 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.
4. There is an excellent selection of free material on http: //www. ismrm. org/mr_sites

**REFERENCES**


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


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

**SEMESTER - VI**

**Nuclear Medicine: Radiation and Safety**

**BME – 312 E**

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

**CONTENTS**

Properties and effects of radio active emissions and their applications in nuclear medicine**.** Radiation detectors and their applications in nuclear medicine**.** The gamma camera **-** planner and SPET**.** The computer in NM**.** Units of exposure and dose**.** Radiation protection and safety**.** Safety of non **-** ionizing radiation**.** Stocastic effects – Risk Factors**,** Finnish radiation law and safety limits**.** Principles of radiation dosimetry**.**

**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)

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

**SEMESTER - VI**

**Bio - Medical Equipment II**

**BME – 314 E**

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

**CONTENTS**

1. 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**.**
2. 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**.**
3. 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**.**
4. Prosthetic heart values**:**
   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 hetetrografts or xenografts (procine or bovine) invero performance testing of prosthetic heart valves using a pulse duplicator**.**
5. heart lung machine**:**
   Governing principles qualitative requirements**,** functional details of bubble**,** thin film**,** membrane type of blood oxygenators**.**
6. hemodialysers**:**
7. qualitative requirements general scheme of operations**,** types of exchangers**,** block diagram **,** electronic control & Monitoring Systems**.**

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

**SEMESTER - VI**

**Introduction to Biomaterials**

**BME – 316 E**

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

**CONTENTS**

Basic bulk and surface properties of materials
Metals, polymers, hydrogels, and natural materials for biomedical applications
Protein structure, properties, and surface interactions
Cell and tissue interactions with surfaces
Host reactions to biomaterials
Biomaterials assessment
Material degradation in implants
Applications of biomaterials
Artificial organs
Material and device sterilization
FDA biomaterial standards
Methods for biomaterial selection and design
Joint kinematics and orthopedic biomechanics

**TEXT**

1. Biomaterials Science: An Introduction to Materials in Medicine, By Buddy D. Ratner, et. al. Academic Press, San Diego, 1996.

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

SEMESTER - VI

## Sensors & Sensing Systems Lab

**BME – 304 E**

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

**LIST OF EXPERIMENTS**

**I Sensor interfacing**

1. Temperature sensor calibration
2. Gas sensor isothermal excitation

**II Data acquisition**

3. Virtual instrument and GUI design
4. Analog and digital I/O
5. File I/O

**III System integration**

6. Control of electromechanical actuators
7. Flow injection assembly
8. Integration of control, DAQ and GUI modules

**IV Pattern analysis**

9. Signal preprocessing
10. Dimensionality reduction
11. Classification

**V Advanced sensor excitation**

12. Pulse Width Modulation
13. Temperature cycling
14. Analysis of performance

**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*

**Medical Imaging Lab**

**BME – 308 E**

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

**LIST OF EXPERIMENTS**

***Detectors***

1. To study/ use Detectors**,** Nuclear Electronics and BMD (1 **-** dim**.** "imaging")**.**

***Transmission Imaging***

2. To study/ use X **-** ray Imaging with Wire Chamber (2 **-** dim**.** Transmission Imaging)**.**
3. An exercise on Computer Tomography (2 **-** dim**.** Transmission Imaging)**.**

***Emission Imaging***

4. An exercise on Time **-** of **-** flight PET Detector System (2 **-** dim**.** Emission Imaging)**.**
5. An exercise on Gamma Camera (2 **-** dim**.** Emission Imaging)**.**

***MRI of Human Joints (hand/ knee)***

To study methods for**:**

6. improving the spatial resolution
7. characterising the architecture of trabecular bone
8. measuring cartilage quality

9. A demonstration on ***MRI Measurement of Flow in Kidney Dialysis***
10. A demonstration on ***MRI of Filters***

**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*

**Communication Proficiency**

**BME – 318 E**

| | | | |
|---|---|---|---|
| | Class Work | : | 25 Marks |
| L T P | P/VV | : | 25 Marks |
| 0 0 2 | 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**.**

**SEMESTER VII**

**Biological Control Systems**

**BME-401 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**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 differential equations, state equation 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. 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.
6. Biological receptors: -Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity.
7. Respiratory model & systems, cardiovascular control system, skeletal muscle servomechanism.

**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

**SEMESTER VII**

**Hospital Management**

**BME-403 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

1. Manpower planning: Applying management by objectives to hospitals, Nature, Functions, Classification and indices of a hospital.
2. Aspects of Hospital Services: Line services, supportive services and auxiliary services, Hospitals of different kinds and systems, Teaching cum research hospitals, General hospital, Specialist hospital, P.H.C system.
3. Hospital Planning & Administration Technical Considerations: Size & kind of hospitals, Principles of planning, Selection, Site and orientation, budgeting, Hospital elements, general considerations, Equipment plans, Communication & information systems, Power supply, Air conditioning and water supply requirements, Elevators, Ambulance, Fire fighting and safety, disposables, hospital infection and control.
4. Computers and Information Management in Hospitals: Computer aided hospital management, Applications, Admission/discharge records, Patient billing, In-patient medical records, Investigative labs, Pharmacy management, Operation theatre & ICU, OPD registration, Purchase & inventory control, Planning: general layout of the systems & its components, installation requirements, training & execution, Integration of all sections of hospital through communication and information system.
5. Financial Management: Financial management and cost containment, Records management in a hospital, Nursing services in hospitals.
6. Biomedical Equipment Maintenance Management: BME services in hospitals, Role & responsibilities, Bio-medical equipment procurement procedure, Proper selection, Standardisation, Compatibility, Safety requirements, Spares requirements, Evaluation, Testing & installation. Purchase & contract procedures, Training to medical staff on technical capabilities & proper use of bio-medical equipment, Operating instructions, Preventive maintenance & periodic servicing procedure.

## *TEXT*


1. Hospital administration and management, volume: 1,2,3 by S.B.Goel & Kurnar Deep & Deep, New Delhi.
2. Principles of hospital administration and planning by B.M.Sakharkar, 1998.


## *REFERENCE*


1. Hospital administration by C.M.Francis.
2. Clinical Engineering -principles and practices by John.G.Webster & Albert M.Cook,Prentice Hall, 1979.
3. Handbook of BME - Jacob Kline, Academic press,inc Lm,1988.
4. The BME Handbook - Joseph D.Bronzino, CRC press, 1995.

**SEMESTER VII**

**Speech Processing**

**BME-405 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

1. Historical Background: Speech Recognition overview
2. Mathematical Background: Pattern classification, statistical pattern Classification, Wave Basics, acoustic tube Modeling of Speech Production, Music Production, Room acoustics
3. Auditory Perception: Ear Physiology, psychoacoustics, Models of Pitch perception, Speech perception, Human Speech recognition.
4. Speech features: The Auditory System as a Filter Bank, The Cepstrum as a spectral analyzer. Linear Prediction.
5. Automatic Speech Recognition: Feature Extraction for ASR, linguistic Categories for speech Regonistion, Deterministic Sequence Recognition for ASR, Statistical Model Training, Determinant Acoustic Probabily Estimation, Speech Recognition and Understanding.
6. Synthesis and coding: Speech synthesis, Pitch detection, Vocoders, Low –Rate Vocoders, Medium-Rate,Vocoders, and High Rate Vocoders

**TEXT**

1. Speech and Audio Signal Processing- B.Gold and N.Morgan Jhon Wiley.

**REFERENCE**

1. Digital Speech - A.M. Kondoz -John Wiley

**SEMESTER VII**

**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 | : 3Hrs. |

**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 search, using state space to represent reasoning with the predicate calculus.
2. Heuristic 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 representation, 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 success 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 rezoning, 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**


1. Efrain Turban and Jay E Aranson: Decision support systems & intelligent systems (5th Edn.) Prentice hall, 1998.
2. Donald A Waterman: A Guide to expert Systems, Addison -Wesley 1995
3. G.F. Luger & W.A Stubble Field -Artificial Intelligence structures and Strategies for complex problem solving, 3 rd Edn. Addision Wesley 1998.
4. E.Rich and Knight, Artificial Intelligence, Second Edn, Tata Mc. Graw Hill Publishing, 1981.

**SEMESTER VII**

## Introduction to Medical Imaging

**BME-407 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

1. Introduction
2. Fundamentals of X-ray: electromagnetic radiation, interactions between X-rays and matter, intensity of an X-ray beam, attenuation.
3. Generation and detection of X-rays: X-ray generators, filters, beam restrictors and grids, intensifying screens, fluorescent screens, X-ray films.
4. X-ray diagnostic methods: conventional X-ray radiography, fluoroscopy, angiography, mammography, image subtraction, conventional tomography.
5. Computed tomography: projection function, Radon integral, parallel projection, backprojection, filtered backprojection, Fourier slice theorem, convolution backprojection.
6. X-ray image characteristics: spatial resolution (point spread function, line spread function, edge spread function), image noise, image contrast.
7. Biological effects of ionizing radiation: threshold, exposure time, exposure area.
8. Fundamentals of Acoustic Propagation: stress and strain relationship, equation of motion, characteristic impedance, intensity, radiation force, reflection and refraction, attenuation, absorbtion, scattering, Doppler effect and Doppler methods.
9. Generation and detection of ultrasound: piezoelectric effect, ultrasonic transducers (mechanical and electrical matching), transducer beam characteristics, axial and lateral resolution, focusing, arrays.
10. Ultrasonic Diagnostic methods: pulse-echo systems (A or amplitude mode, B or brightness mode, M or motion mode and C-mode),
11. Ultrasonic transmission methods and transmission tomography.
12. Biological effects of ultrasound: acoustic phenomena at high intensity levels, ultrasound bioeffects.
13. Fundamentals of nuclear medicine: Nuclear particles, nuclear activity and Half-life, units for measuring nuclear activity, interaction of nuclear particles and matter (alpha particles, beta particles,gamma Rays), attenuation of gamma radiation, radionuclides, counting statistics.
14. Generation and detection of nuclear emission: nuclear sources, radionuclide generators, nuclear radiation detectors, collimators.
15. Radionuclide Imaging Systems: rectilinear scanner, scintillation scanner, single photon emission tomography, positron emission tomography.
16. Internal radiation dosimetry and biological effects.
17. Fundamentals of Nuclear magnetic resonance: angular momentum, magnetic dipole moment, magnetization, larmor frequency, rotating frame of reference and the RF magnetic field.
18. Generation and detection of NMR signal: the magnet (superconducting magnets, permanent magnets), magnetic field gradients, the NMR coil/probe, data acquisition.

19. Imaging methods: slice selection, frequency encoding, phase encoding,spin-echo imaging, gradient-echo imaging, blood flow imaging.
20. Biological effects of magnetic fields : static magnetic fields, radio frequency fields, gradient magnetic fields.

**TEXT**


1. K. Kirk Shung, Michael B. Smith, Benjamin Tsui, Principles of Medical Imaging, Academic Press, Inc., London, 1992


**REFERENCE**


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. Z.H. Cho, J.P. Jones and M. Singh, Foundations of Medical Imaging, Wiley, New York, 1993

3. Zhi-Pei Liang and Paul Lauterbur, Principles of Magnetic Resonance Imaging (MRI): A signal processing perspective, IEEE Press, New York, 1999

4. Albert Macowski, Medical Imaging Systems, Prentice-Hall, New Jersey, 1983

5. Gabor T. Herman, Image Reconstruction from Projections; The Fundementals of Computerized Tomography, Academic Press, New York, 1980

6. S. Webb (Ed.), The Physics of Medical Imaging, Adam Hilger, Bristol, 1990

7. B.H. Brown, R.H. Smallwood, D.C.Barber et al, Medical Physics and Biomedical engineering, Institute of Physics, 1999

**SEMESTER VII**

**Practical Training – II (6 Weeks)**

**BME – 409 E**

| | |
|---|---|
| Class Work | **:** 25 Marks |
| P/VV | **:** 25 Marks |
| Total | **:** 50 |

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**

**Medical Physics**

**BME-451 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

1. Heat and cold in medicine: Physical basis of heat and temperature, Thermography and temperature scales, mapping of body's temperatures. 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 capillary system. Work done - by the heat. B. P. and its measurements Transmural pressure. Bemou1li's principle applied to Cardiovascular system. Laminar and turbulent blood flow. Heart sounds. The physics of some cardiovascular diseases.
5. Electricity within the body: The nervous system and neurons. Electrical potentials of nerves. Electromyogram. ECG, EEG, Electroretinogram and Electrooculogram, Magneto 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 units, 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.

**REFERENCE**

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

**SEMESTER VII**

**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 | : 3Hrs. |

**CONTENTS**

1. Introduction to fiber optics: Basic fiber link, applications, principles of light: Introduction, EM spectrum, light as wave, light as a particle, speed of light, internal & external reflections, Snell' slaw, optical fiber numerical aperture, Fresnel reflection.
2. 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.
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: Introduction, the eye, skin & other tissue. Terminology : spectral band designations, energy & power, irradiant & radiant exposure, fluence, thermal diffi1sion fibers & contact tips, Types of laser-tissue interaction : photocoagulation, photo-thermal ablation, photochemical ablation, photo-disruption, photochemical interaction.
7. 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.

**SEMESTER VII**

**Principles of Bioengineering**

**BME-455 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

- 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
- Vascular Remodeling and Tissue-Engineered Vascular Graft: Mechanical Factors
- Biomaterials Associated with Coronary Stentsv
- Membrane Potentials & Cable Model
- Hodgkin Huxley Model
- Dielectric Properties of Cells & Biopolymers
- Quantitative Physiology of Brain Blood Flow
- Imaging Brain Blood Flow with Magnetic Resonance Imaging
- Visual System Physiology - The interpretation of noisy nerve messages: a signal analysis problem
- Visual System Psychophysical Bioengineering: Matching warning signals to the properties of the eye and the visual nervous system
- Visual Science Clinical Aspects
- Geometrical Optics
- Physical Optics and Microscopes
- Optical Imaging
- Multi-Dimensional Signal Processing
- Basic Electronics for Bioengineers
- Capacitors, Inductors and Semiconductors
- BioNanotechnology
- 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 Modeling of Protein Structure and Function
- Molecular Structure/ Function of Neurodegeneration

**TEXT**

1. S. Berger, Introduction to Bioengineering

## SEMESTER VIII

## Biomedical Ethics

**BME-402 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

Part 1 – Sources of Medical Law and Ethics

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

Part 2 – Consent, Confidentiality and Clinical Negligence

- Consent to Treatment
- Confidentiality
- Clinical Negligence

Part 3 – Mental 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 – Doctors' rights

- Employment and other rights of doctors

**TEXT**

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

## SEMESTER VIII

## INDEPENDENT STUDY SEMINAR

**BME-404 E**

| L | T | P | | |
|---|---|---|---|---|
| - | - | 4 | Sessional | : 50 Marks |
| | | | 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 committee should comprise of at least three faculty members.

**SEMESTER VIII**

**GENERAL FITNESS FOR THE PROFESSION**

**GPBME- 402 E**

| L | T | P |
|---|---|---|
| - | - | - |

Class Work : 50 Marks
Practical : 100 Marks
Total Marks : 150 Marks

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 | _____<br>_____<br>_____ | _____<br>_____ |
| Outdoor Games (Specify the Games) | _____<br>_____<br>_____ | |
| Essay Competition | _____<br>_____<br>_____ | |
| Scientific Technical Exhibitions | _____<br>_____<br>_____ | |

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

**Semester VIII**

**Project in Industry/ Research Lab/ Hospital**

**BME-408 E**

| L | T | P |
|---|---|---|
| - | - | 6 |

Class Work : 100 Marks
Practical : 200 Marks
Total : 300 Marks
Duration of Exam : 3Hrs.

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 department 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**

**Artificial Organs**

**BME-452 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

1. Introduction to artificial organs: substitutive medicine, biomaterial outlook for organ transplant, design considerations, evaluation process.

2. Artificial heart and circulatory assist devices: Engg. Design of artificial heart and circulatory assist devices, detailed design to execute the plan.

3. Artificial Kidney: Structure and function of the Kidney, Kidney disease, renal failure, treatment of renal failure, renal transplantation.

4. Artificial blood: Modern history of transfusion and blood substitutes, blood, component and characteristics blood substitutes and hemodialation oxygen carrying artificial blood, hemoglobin based artificial blood.

5. Introduction to biomaterial Science: Characteristics of biomaterial science subjects integral to biomaterial science.

6. Classes of materials used in medicine: polymers metals, protein structures absorption to surfaces, cells and their surfaces and interaction with materials, tissues.

**TEXT**


1. Biomedical Engineering Hand Book edited by Bronzino D Joseph, CRC Press (Newyork) 1995
2. Biomaterial Science edited by Ratne & HoffMan -Academic press 1996.


**REFERENCE**


1. Biomedical Engineering Principles Volume 1 by Cooney David Marcel Dekker 1976
2. Handbook of Biomedical Engineering, Kline Jacob, Adademic press (Newyork) 1988
3. Bio-materials science & Engineering by Joon BU Park (Plenum press).

**SEMESTER VIII**

**OOPS and C++**

**CSE-462 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**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 statements, C in and C out statements, function call statement, variables and constants, integer and character types, arithmetic 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 destructor 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**

1. The wait group object oriented programming in Turbo C++ by Robert Lafore -Galgatia 2. The wait Group's C++ Primer Plus -Stephen Partia- Galgatia

**REFERENCE**

1. C++ programming Languages -Bjarne Struosstrup Addison Wesley 3rd Edn.

**SEMESTER VIII**

**Artificial Neural Networks in Medicine**

**BME-454 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

1. The classic neuron, Membrane potential, Action potential, Synaptic Integration
2. Models of neuron, Feedback, Network Architecture
3. Memory based learning, Hebbian learning, Competitive learning
4. Introduction to adaptive filtering, Optimization, Steepest decent method, Single layer & multi layer perception
5. Information representation in biological systems, Distributed, map, layered structures, visual system, Auditory system

**TEXT**


1. James A. Anderson, An Introduction to Neural Networks, Printice Hall of India, 2nd Reprint,1995
2. Simon Haykin, Neural Networks; Addison Wesley Longrnan, Indian Reprint,2001


**REFERENCE**


1. Mohamrnad Hasan, Fundamentals of Artificial Neural Networks, Prentice Hall of India, 1999

**SEMESTER VIII**

**Fuzzy Logic and Its Applications**

**CSE-464 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

1. Crisp sets and fuzzy sets: Introduction crisp sets, The notion of fuzzy sets, Basic concepts of fuzzy sets, classical logic, fuzzy logic.
2. Operations on fuzzy sets: General discussion, fuzzy complement, fuzzy union fuzzy intersection, combinations of operations.
3. Fuzzy Relations: Crisp and fuzzy relations, Binary relation, Binary relations on a single set, equivalence and similarity relations, compatibility or tolerance relations, ordering morphisms, fuzzy relation equations.
4. Fuzzy measures: General discussion, Belief and plausibility measures, probability measures, possibility and necessity measures, relationship among classes of fuzzy measures.
5. Applications: General discussion, natural life and social Sciences, engineering, medicine, management and decision making, computer science and systems science.

**TEXT**

PART I Fuzzy sets, Uncertainty and information by George J. Klin and Tine A.Folger

## SEMESTER VIII

## Bioelectromagnetism

**BME-456 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**CONTENTS**

PART I The Concept of Bioelectromagnetism; Subdivisions of Bioelectromagnetism - 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 Modeling

PART IV Theoretical Methods in Bioelectromagnetism

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

PART VI Electric and Magnetic Measurement 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, Jaakko and Plonsey, Robert Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.

**SEMESTER VIII**

**Operations Management**

**HUM-462 E**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

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

**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 success of many companies. In this 3-class module, we introduce tools to successfully 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**


1. Nahmias, Steven. *Production and Operations Analysis.* 4th ed. McGraw-Hill, 2001.
2. Hopp, W. J., and M. L. Spearman. *Factory Physics,* 2nd ed. McGraw-Hill, 2000.
3. Goldratt, E. M., and J. Cox. *The Goal: A Process of Ongoing Improvement*. 2nd Revised ed. North River Press, 1992.