**PROGRAMME:** B.E. Biomedical Engineering- VIII-Semester  
**Course:** BM-1181, Digital Image Processing

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<th>CATEGORY OF COURSE</th>
<th>COURSE TITLE</th>
<th>COURSE CODE</th>
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<tr>
<td>Departmental Core</td>
<td>Digital Image Processing</td>
<td>BM 1181</td>
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<td>Max.Marks-70 Min.Marks-22 Duration-3hrs.</td>
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**Unit I** Digital Image Processing Elements of a Digital Image Processing system, Structure of the Human eye, Image formation and contrast sensitivity, Sampling and Quantization, Neighbours of a Pixel, Distance measures, Perspective projection, Video camera, Color image, Color model and conversion to gray, Image processing applications.

**Unit II** Image Transforms Introduction to Fourier transform-DFT, Properties of two dimensional FT, Separability, Translation, Periodicity, Rotation, Average value, FFT algorithm, Walsh transforms, Hadamard transform, Discrete Cosine transform, Introduction to wavelet transform

**Unit III** Image Enhancement Definition, Spatial domain methods, Frequency domain methods, Histogram modification technique, Neighborhood averaging, Media filtering, Low pass filtering, Averaging of multiple images, Image sharpening by differentiation and high pass filtering.

**Unit IV** Image Restoration Definition, Degradation model, Discrete formulation, Circulant matrices, Block circulant matrices, Effect of diagonalization of circulant and block circulant matrices, Unconstrained and constrained restorations, Inverse filtering, Wiener filter, Restoration in spatial domain.

**Unit V** Morphological Image Processing: Basics, Erosion, Dilation, opening, closing, Image segmentation: Boundary detection based techniques, point, line, edge detection, edge linking, local processing, regional processing, Hough transform, thresholding, multivariable thresholding, Ostu’s method, region based segmentation, watershed algorithm.

**Reference books:**

**List of Experiments:** (Using Simulation software like MATLAB/ImageTool/Scilab)
1. To perform spatial transformation including image resizing, cropping, rotation and addition etc.
2. To perform intensity adjustment and obtain negative of an image.
3. To obtain histogram of an image and perform histogram equalization.
4. To compute global threshold of an image.
5. To perform 2-D DCT, 2-D filtering and filter design.
6. To perform color based segmentation.
7. To perform dilation and erosion of an image.
8. To perform deblurring of an image.
9. To perform edge detection of an image.
10. To reconstruct an image from projection of data.
PROGRAMME: B.E. Biomedical Engineering- VIII-Semester
Course: BM-1182, Therapeutic Instruments

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Unit I Cardiovascular system assisting equipments
Cardiac Pacemaker: Need for Cardiac Pacemaker, Types of Pacemaker; External Pacemaker, Implantable Pacemaker, Recent Development in Implantable Pacemaker, Pacing System Analyzer. Cardiac Defibrillators: Need for a Defibrillator, DC Defibrillator, Implantable Defibrillator, Pacer cardioverter- Defibrillator and Defibrillator Analyzer.

Unit II Respiration assisting equipments

Unit III Operation Theatre and Physiotherapy Equipments
Principles of Surgical Diathermy, Surgical Diathermy machine, Safety aspect in Electro-Surgical Units, Surgical Diathermy Analyzers, Physiotherapy Equipments, High frequency Heat Therapy, Short wave Diathermy, Microwave Diathermy, Ultrasonic Therapy unit, Electro diagnostic Therapeutic Apparatus, Pain relief through electrical simulation (TENS).

Unit IV Radiotherapy equipments and Automated Drug Delivery System

Unit V Renal system assisting equipments

Reference Books:
1. RS Khandpur, “Hand Book of Biomedical Instrumentation”. TMH
2. Carr JJ, Brown JM, “Introduction to Biomedical Equipment Technology” Asea Parson
3. Chromwell, Weibell & Pfeiffer, “Biomedical Instrumentation and Measurements” PHI
6. Massey & Meredith, "Fundamental Physics of Radiology", Write, Bristo

List of Experiments:
1. Study of cardiac pacemakers.
2. Study of cardiac defibrillators.
4. Study of hemodialysis machine
5. Study of anesthesia machine.
7. Study of ventilators.
8. Study of physiotherapy.
10. Study of radiotherapy equipments.
PROGRAMME: B.E. Biomedical Engineering- VIII-Semester
Course: BM-1183, Laser and fiber optics in Medicine

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Unit I  OPTICAL FIBER AND COMPONENTS

Unit II  LASER THEORY AND TYPES

UNIT III - MEDICAL APPLICATIONS OF LASER IN SURGICAL FIELD
Photo-Chemical Interaction, Thermal interaction, Photo ablation, Plasma Induced Ablation Photo-Disruption, Applications: Neurosurgery, Dermatology, Orthopedics, Angioplasty, Cardiology, and Surgery, Diffused Optical Tomography. Surgical Applications of LASER in Medical Fields.

UNIT IV - MEDICAL APPLICATIONS OF LASER IN DIAGNOSTIC FIELD
Endoscopy, Ophthalmology, Dentistry, Urology Angiography, Flow Meters, Diagnostic Applications of LASER in Medical Fields.

UNIT V - MEDICAL APPLICATIONS OF LASER IN THERAPEUTIC FIELD
Cataract, Bloodless Surgery (Coagulation), Retinal stitching, Kidney lithotripters, Therapeutic applications of LASER in medical fields.

REFERENCES
5. Laser and optical fibers in medicine by Katzer and Abraham, Academic press publications
6. An Introduction to optical fibers by A. M. Cherin, McGraw Hill publication
Unit I Fuzzy system introduction, Fuzzy relation, Membership function, Fuzzy matrices and entropy, Fuzzy operation and composition.

Unit II Fuzzy Variables, Linguistic variables, measures of fuzziness, concepts of Defuzzification, Fuzzy control applications.


Unit IV Counter propagation networks, Kohonen layer, Training the kohonen layer, Preprocessing the inputted vectors, Initialising the wright vectors, Statistical properties, Training the grossberg layer. Full counter propagation networks, Applications. Statistical methods, Boltzman training, Cauchy training, Artificial specific heat methods, Applications to general non-linear optimization problems. Back propagation and cauchy training.


Reference books:
UNIT I Introduction to Biostatistics
Statistics in Biomedical data analysis common statistical terms and notations, Sources and presentation of data.

UNIT II Sampling
Representative sample, Precision, sample bias Sampling techniques, Simple random sampling, Systematic, Stratified, Multistage, Cluster, Multiphase.

UNIT III Measures of locations and variability
Measures of central tendency: averages, mean, median, mode, Measures of locations percentiles Graphic method, arithmetical method, Applications and uses of Percentiles. Variability: Types, Biological, Real, Experimental, Measures of Variability,Range, Semi-interquartile range (Q), Mean Deviation, Standard deviation (SD), Coefficient of variation (CV)

UNIT IV Probability, Sampling variability and significance
Addition law of Probability, Multiplication law, Binomial Probability distribution Probability chance from shape of normal distribution or normal curve, Sampling distribution significance estimation of population parameter, Testing Statistical hypothesis Type I and Type II errors, Tests of significance, Z-Test, One tailed and two tailed tests

UNIT V Tests and Regressions
Significance of Chi-square test and Calculation of $\chi^2$ value, Restriction in application of $\chi^2$ test, Yates correction. Calculation of correlation coefficient, Regression, Calculations of regression coefficient, Regression line, Standard deviation of the Y measurements for the regression line

Reference Books:
2. Research Methodology” Methods and by C.P. Kothari
PROGRAMME: B.E. Biomedical Engineering- VIII-Semester  
Course: BM 1184 Elective II (C), Hospital Management & Information System

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Unit I: Principles of Hospital Management  
Concept of Health Care Industry & its ever-changing character, Management of Indian Hospitals- challenges & strategies Managerial activities for effective hospital functioning, Duties and responsibilities of Hospital Managers; Planning, organizing, staffing, directing, coordinating and controlling. Effective inter and intra departmental co-ordination. Hospitals of different kinds & systems -Teaching cum research hospitals, general hospitals, specialty hospital, PHC system overview.

Unit II: Planning and designing of Hospital  
Stages in planning, Finance, Location, Need assessment survey of community, factors determining site, legal requirements, design consideration, General considerations, Equipment plans, Communication & Information systems.

Unit III: Patient Care Services  
Outpatient services emergency services clinical laboratories radiological services diagnostic radiology radiation therapy department nuclear medicine department surgical department physical therapy occupational therapy.

Unit IV: Hospital Supportive Services  
Admitting department medical records department (Medicolegal cases) Central sterilization and supply department pharmacy materials management food service department laundry and linen service House Keeping volunteer department. Public areas of Hospital Staff facilities maintenance management clinical engineering electrical system air conditioning system water supply and sanitary system centralized medical gas system communications systems environmental control solid waste management safety and security in the Hospital.

Unit V: Hospital Equipment Maintenance  

Text Books:
3. Health Information Management: Principles & Organization for health record services
By: Skurka M.F., San Francisco, Jossey-Bass
PROGRAMME: B.E. Biomedical Engineering- VIII-Semester  
Course: BM 1184 Elective II (D), AI and Expert Systeming Medicine

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**Unit-I** Basic Problem solving methods: Production systems-state space search, control strategies, Heuristic search, forward and backward reasoning, Hill climbing techniques, Breadth first search, Depth first search, Best search, staged search.

**Unit-II** Knowledge Representation: Predicate logic, Resolution question Answering, Nonmonotonic Reasoning, statistical and probabilistic reasoning, Semantic Nets, Conceptual Dependency, frames and scripts.

**Unit-III** AI languages: Important characteristics of AI languages - PROLOG, LISP.

**Unit-IV** Introduction to Expert Systems: Structure of an Expert system interaction with an expert, Design of an Expert system.

**Unit-V** Fundamentals of Artificial Neural Network (ANN), perceptrons, Back propagation, Cohenon self organizing network, Hop field networks

**References:**
4. Waterman D.A., A guide to Expert system, Adision - Wesley, Reading
6. Kos Ko B, Neural Networks and Fuzzy system – PHI.