

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, VIII-Semester

BM-8001MEDICAL IMAGE PROCESSING

UNIT-I

Fundamentals of image processing and image perception Two-dimensional systems - linear systems and shift invariance. Fourier transform - Z - transform - Block matrices, Toeplitz and Kronecker product. luminance, brightness and contrast. Color representation, color matching and reproduction, color vision model. Image sampling and quantization: Two dimensional sampling theory reconstructions of images from its samples. Image acquisition.

UNIT-II

Image enhancement spatial domain techniques Image negative, contrast stretching, gray level and bit plane slicing, power law transformation, histogram equalization and histogram specification, local enhancement techniques, image subtraction, averaging and logical operations. Spatial filtering: low pass, high pass and derivative filters, median filtering. Frequency domain filters: low pass high pass and butterworth filters.

UNIT-III

Image restoration Noise degradation model. Estimation of degradation model. restoration in presence of noisespatial filtering, frequency domain filtering, inverse filter and least mean square error(wiener) filtering.

UNIT- IV

Image Transforms 2-D FFT , Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform

UNIT-V

Image analysis Feature extraction: spatial features: amplitude and histogram features, transform features, edge detection: gradient, Compass Laplace, Sobel, Prewitt operators, stochastic gradients. Line and spot detection. Boundary extraction: connectivity and contour following.

TEXT BOOKS:

1. Fundamentals of Digital Image Processing by Jain Anil K, Prentice Hall
2. Digital Image Processing and Analysis by B. Chanda, D. Dutta Majumder.,PHI

REFERENCES:

1. Digital Image Processing by Gonzalez Rafael C, WintzPaul , Addison Wesley
2. Digital Image Processing by Pratt William K, John Wiley and Sons

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BM-8002 NEURAL NETWORKS

UNIT-I

Structure and Function of a single neuron Biological neuron, artificial neuron, definition of ANN, single layer network, Learning and adaptation, Neural network learning Rules-Perceptron training algorithm, Linear separability, Widrow & Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN.

UNIT-II

Multilayer feed forward networks Linearly non separable pattern classification. Generalized Delta learning rule. Delta learning rule for multi perceptron layer. learning factors, The back Propagation Algorithm

UNIT-III

Single layer feed back networks Basic concept of dynamic networks, the Hopfield Network both discrete and gradient forms.

UNIT-IV

Associative memory Linear associator, recurrent associative memory., bidirectional associative memory

UNIT-V

Matching and self associating networks: Hamming net and Maxnet, unsupervised learning of clusters, counter propagation network, feature mapping, self organizing feature maps, ART 1.

TEXT BOOK:

1. Introduction to Artificial Neural Networks by Jacek M. Zurada. West Publishing Company (October 1992)

REFERENCES:

1. Neural Computing, by Philip D. Wasserman , Van Nostrand Reinhold Pub.
2. Neural Networks A Classroom Approach By Satish Kumar, Mc Graw Hill.
3. Neural Network Architecture, by Judith E. Dayhoff, Van Nostrand Reinhold Pub.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, VIII-Semester

Elective-V BM-8003 (1) HOSPITAL MIS

UNIT-I

Introduction to Data structures Elements, arrays, records, sets, tables etc. Singly and doubly linked data, stacks, queues, trees etc.

UNIT-II

Introduction to database models Relational databases, data indexing and structuring - data independence- data definition language and data manipulation language E-R diagram with examples Relational model structures of relational databases.

UNIT-III

Relational database design- Normalization 1NF, 2NF and 3NF Indexing and Hashing. Security of database Design example on a popular RDBMS package. Miniaturized data storage and retrieval system like CD-ROM, Magneto optical discs, optical juke boxes, write many read many devices and miniature magnetic tape devices. Interfacing and retrieval details.

UNIT-IV

Hospital Information system Role of database in HIS. Need of networking in HIS Overview of networking, topologies and its configuration. Detailed study of pictures archival and communication systems (PACS).

UNIT-V

Introduction to Ai and Experts system Knowledge components, knowledge representation schemes- production system. Expert's system tools- language.

TEXT BOOKS:

1. Computer in practice of medicines by H. Dominic Covey et al, Addison Wesley.
2. Computer based medical consultation by Edward Shortliffe, Elsevier Scientific
3. An introduction to database systems by Date C. J.

REFERENCES:

1. Hospital computer system by M.F. Collen., PetrocelliPubl
2. Fundamentals of Database Systems, RamezElmasri, Shamkant B. Navathe, Addison Wesley;

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, VIII-Semester

Elective-V BM-8003 (2) REHABILITATION ENGINEERING

UNIT-I

Introduction: Types of physical impairment, Principles of Rehabilitation, Motory, Sensory and Communication disorders. Orthotics and Orthoprosthetics Rehabilitation: Intelligent Prosthetic knee & Arm. Advanced automatic Prosthetics and Orthotics.

UNIT-II

Mobility: Electronic travel appliances, Path sounder, Laser Cane, Ultrasound Torch and Guide, Light probes, Obstacle Sensors, Electro Cortical Prosthesis.

UNIT-III

Sensory Augmentation and Substitution: Classification, Prevention and cure of Visual Impairment.

UNIT-IV

Measurement Tools and Process in Rehabilitation: Subjective and Objective Measurement Methods. Characterizing human systems, sub-systems and assertive devices.

UNIT-V

Computer Application in rehabilitation engineering: Interfaces in compensation for visual perception and improvement of orientation and mobility. Rehabilitation Aids for Mentally Impaired

References:

1. Rehabilitation technology by: Ballabio E. IOS Press
2. Biomedical Engg. Handbook Edited, by: Bronzino D. Joseph Publishers: CRC press (new York), 1995.
3. Rehabilitation Engineering, by: Robinson C.J. . CRC Press

Biomedical Engineering, VIII-Semester

Elective-V BM-8003 (3) LASER APPLICATION IN MEDICINE

UNIT-I

Optical Fiber Waveguides: - Ray theory transmission, electromagnetic mode theory for optical propagation .Types of fiber, Transmission and polarization, optical fiber connection joints and couplers.

UNIT-II

Optical Sources, Detector, Laser:- lasing action semiconductor injection laser, types and characteristics of co2 laser , Nd-Yag laser, Eximer laser, He-NE laser.LED: - Power and efficiency, led characteristics , optical detectors –pn diode pin , Semiconductor photo diode with internal gain.

UNIT-III

Laser tissue interaction: - Laser propagation in tissue , Monte Carlo simulation of Laser tissue interaction, Photocoagulation, Photo-thermal Ablation Photochemical ,Ablation, Photo disruption, photochemical interaction

UNIT-IV

Application of laser in general surgery-I:-Dermatology, Ophthalmology, Cardiology, Gynecologic laser.

UNIT-V

Application of laser in general surgery-II:- Neuro surgery, Tumor Surgery, Urology, Otolaryngology and Neck and Head Surgery.

References:

1. Optical Fiber Communication, by Senior, PHI
2. Therapeutic Laser, Theory & Practice, by G.David Baxter, Churchill-Livingstone.
3. Optoelectronics- An Introduction, by K.N. Tripathiet.al., B.S. Publications.
4. Semiconductor Optoelectronic Devices, byBhattacharya P, PHI.
5. Medical Application of lasers by Dr. Vij& K. Mahesh, Deep & deep Pub.
6. IEEE Journals on Applied Optics.
7. Medical Lasers & their safe use, by David. H Shiney, Stephen &L.Trokel, SpringerVerlag.
8. Lasers in Medicine By: Leon Goldman Springerverler

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, VIII-Semester

Elective-VI BM-8004 (1) HOSPITAL TECHNOLOGY

Unit. 1 Classification of hospital & architecture

General hospital, specialized hospital, primary health care – their role and 8L functions. Aspects of hospital services – inpatient, outpatient and emergency. Location and environment of hospital, Hierarchy of medical and paramedical staff & their functions and responsibilities. Modern Hospital Architecture- space in a hospital building, design of ward, intensive care units, air conditioning, plumbing & sanitation, gas supply, waste disposal, cleaning, dietary, sterilizing, laundry, storage and operation theatre systems, Radiology, Central labs, Blood banks, OPD, Casualty, etc

Unit. 2 Electrical power systems in hospitals

Safety of electrical systems, Protective systems - interference of patient's protection grounding. Design of sub stations, breakers, Surge protectors, EMI filters, voltage stabilizers, generator sets and UPS. 8L Uninterrupted power supply for ICU and computerized monitoring units. Specification & estimation for hospital wiring.

Unit. 3 Hospital engineering & Management

Definition of biomedical Engineering, clinical engineering & hospital engineering. Importance of BME department – servicing and maintenance, testing, acceptance & maintenance protocols, Computerized preventive maintenance planning, MROs. Training of men for medical equipments preventive and periodical maintenance 10L procedures. Preparation of estimates, specifications, tender details etc. Importance of ISO 9000 Certificates - Obtaining ISO certificates in hospitals. Proposed protocols.

Unit. 4 Hospital Information system

Role of database in HIS. Need of Networking in HIS. Overview of Networking, topologies and its configuration. Structuring medical records to carry out functions like admissions, discharges, treatment history etc. Computerization in pharmacy & billing. Automated clinical laboratory systems & radiology information system

Unit. 5 Hospital Information system

Role of database in HIS. Need of Networking in HIS. Overview of Networking, topologies and its configuration. Structuring medical records to carry out functions like admissions, discharges, treatment history etc. Computerization in pharmacy & billing. Automated clinical laboratory systems & radiology information system.

TEXT BOOK

1. Harold E. Smalley, "Hospital Management Engineering – A guide to the improvement of hospital management system
2. L. C. Redstone, "Hospital and Health Care Facilities
3. PHI. C. A. Caceras, "Clinical Engineering"
4. Ward, "Anesthetics Equipments".
5. BIS, "ISO Certification details"

REFERENCES

1. Bhaumick and Bhattachary, "EHV Substation equipments"
2. Alexander Kusko, "Emergency and Standby Power Systems"
3. BalaguneSwamy, "Reliability Engineering"
4. AnanthaNarayanan, "Basic Refrigeration and Air Conditioning"

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, VIII-Semester

Elective-VI BM-8004 (2) TELEMEDICINE

Unit. 1 History, definitions and current applications

General Introduction to the Telemedicine Applications, Advantages /disadvantages & scope. Network technologies, Topologies, LAN, WAN, MAN, OSI model, Physical layer, Data link layer, Network layer, Transport layer, TCP/IP model, Comparison of OSI & TCP/IP model.

Unit. 2 ATM technology

IDN, ISDN, telephone telemedicine(PSTN), Switching techniques, telemetry, data compression, Wireless transmission, Wireless technologies, 802.11, 802.16, Satellite communication.

Unit. 3 Clinical Applications

Clinical parameters, cardiology, dermatology, Tele-radiology, ENT, Emergency medicine(CDMA, GSM), Gastroenterology, Homecare, Neurology, Oncology, Ophthalmology, tele-rehabilitation, tele-pathology & tele-surgery.

Unit. 4 Telemedicine equipments

IP Video and audio – video conferencing hardware/software. Video hardware (Cameras, Monitors, recorders etc.), Video production, editing, broadcasting, Voice over IP/ Audio systems. Network equipments – Tele-medical workstations, DSL, ADSL, SDSL, cable modems, VOip modem, Fast switched Ethernet, Routers, switches, hubs, multipoint conferencing units. Monitoring devices – Electronic stethoscope, Vital sign monitoring devices, Respiratory monitoring devices, Neurological monitoring devices, Videoscopes, robotics and virtual reality devices

Unit. 5 Legal and ethical issues

Licensure and accreditation, Security and confidentiality, Government regulations, International and National protocols-HL7, HIPAA, DICOM Indian IT act. **TEXT BOOKS**

1. Computer Networks, By: Tenenbaum, PHI
2. Essential of Telemedicine and Telecare, By: Norris A.C.

REFERENCES

1. E-Health, Telehealth, and Telemedicine: A Guide to Startup & Success, By: Marlene Maheu, Pamela Whitten, Ace Allen
2. Essential of Telemedicine and Telecare, By: Norris A.C.

- Unit. 1** The history and development of medical jurisprudence. Legal terms and definitions, case law. The ethical standards and legal requirements governing medical practice. The medical practitioner as a legal witness. Preparation of statements and medico-legal reports.
- Unit. 2** Medical aspects of the law Acts dealing with offences against the person; infanticide and child destruction; poisons and drugs; medical practice; National Health Service; the General Medical Council; mental health; road traffic; factories; coroners; registration of births and deaths; cremation procedure; health and safety at work; protection of children and young persons; sexual offences; removal and transplantation of human tissues; crimes of violence; fatal accidents and homicide.
- Unit. 3** General medico-legal investigation (pathological and clinical). Methods to establish the post-mortem interval. Duties at the scene of crime, preservation of evidence and medico-legal and scientific reports. Relation with and function of, the Coroner and Police in crimes against the person. Methods of identification. Medico-legal aspects of pregnancy and sexually oriented crimes and death. Interpretation of wounds and injuries. Recognition of poisoning and intoxication. The sources of common poisons and the general principles of their pathological action.
- Unit. 4** Examination & Specimen handling. Examination of persons with particular reference to: consent; the unconscious patient; the intoxicated patient; injured person, negligence; professional secrecy; documentation. The general principles of collection, packaging, transmission and evidential value of medico-legal specimens.
- Unit. 5** Liaising : Practical considerations in liaising with court officials, advocates, solicitors, police officers, prison officers, forensic scientists, social workers, forensic pathologists, forensic odontologists, forensic psychologists and other medical colleagues.

References:

1. Law Ethics & Medicine: Studies in medical law. Oxford- Clarendon Publication.
2. Medical Jurisprudence & Toxicology, By Glaister, John, Rentoun, Edgar : Edenberg, E & S Livingstone.