RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

BM801- Medical Image Processing

Theory

Unit. 1
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. 2
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. 3
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. 4
Image Transforms 2D FFT and its properties. Walsh transform, Hadamard transform, discrete cosine transform, Haar transform, Slant transform, K L transform.

Unit. 5
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. Jain Anil K, Fundamentals of Digital Image Processing, Prentice Hall, 1996.
2. B. Chanda, D. Majumder, Digital Image Processing and Analysis, PHI, 2011.

REFERENCES
1. Gonzalez Rafel C, Wintz Paul, Digital Image Processing, Addison Wesley, 1987.
2. Pratt William K, Digital Image Processing, John Wiley and Sons, 2006.

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New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

Departmental Elective BM 802(A) 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

Air Conditioning & Gas Supply Systems Air conditioning and refrigeration systems for small and large areas. Air changes, filtering and sterility. Deodorization, disinfection, dehumidification and cryogenic systems. Centralized supply of air, 6L oxygen, nitrous oxide & vacuum, principle of production of liquid oxygen. Management of lifts, firefighting equipment's.

Unit. 4

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 staff 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. 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 BOOKS

1. Harold E. Smalley, Hospital Management Engineering – A guide to the improvement of hospital management system, Prentice Hall, 1982.
2. L. G. Redstone, Hospital and Health Care Facilities, McGraw Hill, 2002.
3. C. A. Caceras, Clinical Engineering, Academic Press, 1977.
4. J Davey and D Ali, Ward's Anaesthetics Equipment's, 6 th ed., Elsevier Health-UK, 2011.

REFERENCES

1. BIS, ISO Certification details. 2. Alexander Kusko, Emergency and Standby Power Systems, McGraw Hill, 1989.

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New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

Departmental Elective BM 802(B) 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, and 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, telerehabilition, 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 – Telemedicine 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, video scopes, 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, and Indian IT act.

TEXT BOOKS
1. Tenenbaum, Computer Networks, PHI, 2003
2. Norris A.C., Essential of Telemedicine and Telecare, John Wiley & Sons, 2001.

REFERENCES
1. M Marlene, W Pamela, A Allen, E-Health, Telehealth, and Telemedicine: A Guide to Start-up & Success, Wiley, 2001.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

Departmental Elective BM 802(C) Rehabilitation Engineering

Unit. 1

Engineering Concepts in Rehabilitation Engineering Anthropometry: methods for static and dynamic measurements. Area measurementsmeasurement of characteristics and movement, measurement of muscular strength and capabilities. Measurement tools and processes in rehabilitation engineering: fundamental principles, structure, function. Measurement systems for performance and behaviour.

Unit. 2

Engineering Concepts in Sensory Rehabilitation Engineering Sensory augmentation and substitution, visual system, visual augmentation, tactual vision substitution, and auditory vision substitution. Auditory system: auditory augmentation, audiometer, hearing aids, cochlear implantation, visual auditory substitution, tactual auditory substitution. Tactual system: tactual augmentation, tactual substitution.

Unit. 3

Artificial Larynx (pneumatic & electronic) Analysing artificial electronic larynx, augmentative communication, control and computer access (AAC): user interface, outputs, acceleration techniques, intervention and other issues.

Unit. 4

Orthopedic Prosthetics and Orthotics in Rehabilitation Engineering concepts in motor rehabilitation. Computer aided engineering in customized component design. Intelligent prosthetic knee. Hierarchically controlled prosthetic hand, Selfaligning orthotic knee joint. Externally powered and controlled orthotics and prosthetics. FES systems-restoration of hand function, restoration of standing and walking, HAS.

Unit. 5

Active Prostheses Active above knee prostheses. Myoelectric hand and arm prostheses-different types, block diagram, signal flow diagram and functions. The MARCUS intelligent hand prostheses.

TEXT BOOKS

1. Bronzino, Joseph, Handbook of Biomedical Engineering, 2nd ed., CRC Press, 2000.
2. Robinson C.J, Rehabilitation Engineering, CRC press, 1995.

REFERENCES

1. H N Teodorecu, L.C.Jain, Intelligent Systems and Technologies in Rehabilitation Engineering, CRC, 2000.
2. Etienne Grandjean, H. Oldroyd, Fitting the task to the man, Taylor & Francis, 1988.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

Open Elective BM 803(A) Laser Applications in Medicine

Theory

Unit. 1 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. 2 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. 3 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. 4 Application of laser in general surgery-I:-Dermatology, Ophthalmology, Cardiology, Gynecologic laser.

Unit. 5 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. Tripathi et.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, Springler Verlag.
8. Lasers in Medicine By: Leon Goldman Springerverler

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New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

Open Elective BM 803(B) HOSPITAL MIS

Theory

Unit. 1
Introduction to Data Structures Elements, arrays, records, sets, tables etc. Singly and doubly linked data, stacks, queues, trees etc.

Unit. 2
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. 3
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. 4
Hospital Information System Role of database in HIS. Need of networking in HIS, overview of networking, topologies and its configuration. Detailed study of picture archiving and communication systems (PACS).

Unit. 5
Introduction to AI and Experts System Knowledge components, knowledge representation schemes- production system. Expert's system tools- language.

TEXT BOOKS

1. H. Dominic Covvey, Computer in practice of medicines, Addison Wesley, 1980.
2. Edward Shortlife, Computer based medical consultation, Elsevier Scientific, 1976.
3. Date C. J, An introduction to database systems, 8th ed., Pearson, 2003.

REFERENCES

1. Remez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th ed., Pearson, 2017.

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New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

Open Elective BM 803(C) Medical Jurisprudence

Theory

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 Liasing : 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- Clarendan Publication.
2. Medical Jurisprudence & Toxicology, By Glaister, John, Rentoun, Edgar : Edenberg, E & S Livingstone.

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New Scheme Based On AICTE Flexible Curricula

Biomedical Engineering, VIII-Semester

BM804- MEDICAL IMAGING SYSTEMS

Theory

Unit. 1
Ultrasound in Medicine Introduction, production of ultrasonics - properties - principles of image formation, capture and display, principles of A-mode , B-mode and M-mode display, principles of scan conversion, doppler ultra sound and colour flow mapping, application of diagnostic ultrasound.

Unit. 2
X-Ray Computed Tomography Principles of sectional imaging, scanner configuration, data acquisition system, image formation principles, conversion of X-ray data into scan image, 2D image reconstruction techniques - iteration and Fourier transform methods.

Unit. 3
Magnetic Resonance Imaging(MRI) Principles of MRI, pulse sequence, image acquisition and reconstruction techniques, MRI instrumentation: magnets, gradient system, RF coils, receiver system, functional MRI, applications of MRI.

Unit. 4
Radio Isotope Imaging Rectilinear and scanners, SPECT, PET, gamma camera, radionuclide for imaging, emission computed tomography.

Unit. 5
Infra-Red Imaging Physics of thermography, imaging systems, pyro electric vidicon camera, clinical thermograph, liquid crystal thermography.

TEXT BOOKS
1. P. Allisy-Roberts, J. Williams and R. Farr, Farr's physics for medical imaging. Edinburgh: Saunders Elsevier, 2008.
2. W. Hendee and E. Ritenour, Medical Imaging Physics. Hoboken: Wiley, 2003.

REFERENCES
1. S. Webb, The Physics of Medical Imaging, 2nd ed. CRC Press, 1999.
2. A. C. Kak, Principle of Computed Tomographic Imaging, IEEE Press New York, 1988.
3. G. A. Hay, Medical Image Formation Perception and Measurement, John Wiley & Sons, 1977.