Rajiv Gandhi Technological University, Bhopal (MP)
B.E. (BM) Biomedical Engineering
Scheme of Examination

EIGHTH SEMESTER

S. No	Course Category	Course Code (New)	Subject	Periods Per Week				Distribution of Marks				
								Theory	Practical	Internal Assessment		Total
				L	T	P	C			MST	TW	
1	DC-23	BM801	Fuzzy Logic and Neural Networks	3	1	0	4	100	-	20	-	120
2	DC-24	BM802	Digital Image Processing.	3	1	2	6	100	50	20	30	200
3	DC-25	BM803	Therapeutic Instruments	3	1	2	6	100	50	20	30	200
4	DCO(E)-II	BM804	Elective - II	3	1	0	4	100	-	20	-	120
5	DC-26	BM805	Major Project -II	0	0	8	8	-	200	-	100	300
6	NECC-10	BM806	Industrial / Hospital Visit	0	0	2	2	-	-	-	30	30
7	NECC-11	BM807	Seminar/Group Discussion	0	0	2	2	-	-	-	30	30
Total				12	4	16	32	400	300	80	220	1000

COURSE CONTENTS

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core - 23	**Fuzzy Logic & Neural Networks**	BM 801	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35 Duration-3hrs.

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 III Fundamentals of Artificial Neural networks- Biological prototype – Artificial neuron, Activation functions, Single layer and multiplayer networks. Training Artificial neural networks, Preceptrons, Exclusive Or Problem – Linear seperability, Storage efficiency, Preceptron learning, perceptron training algorithms. Back propagation, Training algorithm, network configurations, Network paralysis, Local minima, temporal instability.

Unit IV *Counter propagation networks, Kohonen layer, Training the kohonen layer, Pre processing the inputted vectors, Initialising the wright vectors, Statistical properties, Training the grosberg 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.*

Unit V *Hopfield nets, Recurrent networks, Stability, Associative memory, Thermodynamic systems, Statistical Hopfiled networks, Applications. Bi-directional associative memories, Retrieving on stored association, Encoding the associations.*

Reference books :

1. Laurence Fausett, “Fundamentals of Neural Networks”, Prentice Hall.
2. Zmmermann H.J., “Fuzzy Set Theory and its Applications”, Allied Publishers Ltd.
3. Klir G.J., and Folger T., “Fuzzy Sets, Uncertainty and Information”, Prentice Hall.
4. Limin Fu., “Neural Networks in Computer Intelligence”, McGraw Hill.
5. Zuroda J.M., “Introduction to Artificial Neural Systems”, Jaico Publishing.
6. Haykin S., "Artificial Neural Network: A Comprehensive Foundation: Asia Pearson Pub.

COURSE CONTENTS

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-6C			THEORY PAPER
Departmental Core - 24	**Digital Image Processing**	BM 802	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35 Duration-3hrs.

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, Photographic file structure and exposure, Filem characteristics, Linear scanner, Video camera, 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 transform, Hadamard transform, Discrete Cosine transform.

Unit III Image Enhancement Definition, Spatial domain methods, Frequency domain methods, Histogram modification technique, Neighborhood averaging, Media filtering, Lowpass 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 diagnolization of circulant and block circulant matrices, Unconstrained and constrained restorations , Inverse filtering, Wiener filter, Restoration in spatial domain.

Unit V Image Encoding Objective and subjective fidelity criteria, Basic encoding process, The mapping, The quantizer, The coder, Differential encoding, Contour encoding, Run length encoding, Image encoding relative to fidelity criterion, Differential pulse code modulation.

Unit VI Image Analysis and Computer Vision Typical computer vision system, Image analysis techniques, Spatial feature extraction, Amplitude and Histogram features, Transform features, Edge detection, Gradient operators, Boundary extraction, Edge linking, Boundary representation, Boundary matching, Shape representation.

Reference books:

1. Rafael, C. Gonzlez., and Paul, Wintz, “Digital Image Processing”, Addison-Wesley Publishing Company.
2. Jain Anil K., “Fundamentals of Digital Image Processing”, Prentice Hall.
3. Sosenfeld, and Kak, A.C., “Digital Image Processing”, Academic Press.
4. William K. Pratt., “Digital Image Processing”, John Wiley and Sons.
5. Sonka, Hlabac & Boyle-Image Processing Analysis & machine Vision- Vikas publication.

List of Experiments: (Using Simulink software like MATLAB/ImageTool/Scilab)

1. To perform spatial transformation including image resizing, cropping, rotation 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

Scilab URL: http://www.scilab.org/
ImageTool URL: http://ddsdx.uthesa.edu.dig/download.html

COURSE CONTENTS

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-6C			THEORY PAPER
Departmental Core - 25	**Therapeutic Instruments**	BM 803	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35 Duration-3hrs.

Unit I Cardiovascular system assisting equipments: Need of cardiac Pacemaker, External pacemaker, Implantable Pacemaker, Recent Development in Implantable Pacemaker, pacing System Analyzer.
Cardiac Defibrillators: Need for a Defibrillator, DFC Defibrillator, Implantable Defibrillator, pacer-cardioverter-defibrillator, Defibrillator Analyzer.

Unit II Therapeutic equipments: Use of High Voltage X-ray Machines, Development of Betatron, Cobalt-60 Machine, Medical Linear Accelerator Machine. High frequency Heat Therapy, Short wave Diathermy, Microwave Diathermy, Ultrasonic Therapy unit, Electrodiagnostic/ Therapeutic Apparatus, Pain Relief Through Electrical Simulation. Diaphragm pacing by Radio – frequency for Treatment of chronic Ventilatory Insufficiency.

Unit III Renal system assisting equipments: :Function of the Kidneys, Artificial Kidney, Dialyzers, Membrane for H Haemodyialysis, Haemodyialysis Machine, Portable Kidney Machines.
Lithotriptors: The Stone Disease Problem, First Lithotriptors machine, Morden Lithotriptor System, Extra Corporeal Shock – wave Therapy.

Unit IV Respiration assisting equipments:: Need for anesthesia, anesthesia Machine, Electronics in anesthesia Machine.
Ventilators: Mechanics of respiration, Artificial ventilation, Ventilators, type of ventilators, Pressure-volume- flow Diagrams, modern Ventilators, High frequency ventilators, Humidifiers nebulizers, and aspirators.

Unit V Operation Theatre Equipments: Principles of Surgical Diathermy, Surgical Diathermy machine, Safety aspect in Electro- Surgical Units, Surgical Diathermy Analyzers,
Laser Applications in Biomedical field. The laser- pulsed Ruby laser, Nd- YAG Laser, Helium- Neon Laser, Argon Laser, Co_2 Laser, Excimer Lasers, Semiconductor Lasers, Laser Safety.
Automated Drug Delivery System: Infusion Pumps, Components of Drug infusion System, Implantable infusion System, Closed –loop Control in infusion System.

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
4. Togawa, Tamura & Oberg – Biomedical Transducers & Instruments – CRC Press Boca Raton, New York
5. Mushin, " Automation Ventilation of Lungs", Black Well
6. Goldman, "Biomedical Laser", Springer Verlag,
7. Massey & Meredith, " Fundamental Physics of Radiology", Write, Bristol.

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List of Experiments:

1. Study of cardiac pacemakers.
2. Study of cardiac defibrillators.

3. Study of instruments for surgery.
4. Study of heamodialysis machine.
5. Study of anesthesia machine.
6. Study of lithotripters.
7. Study of ventilators.
8. Study of physiotherapy.
9. Study of automated drug delivery system.
10. Study of radiotherapy equipments.

COURSE CONTENTS

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Electives DCO(E)-II	**Biostatistics**	BM 804 Elective-II (i)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35 Duration-3hrs.

Unit I The Scope of statistics in biomedical data analysis. Measures of central tendency; Mean, mode etc. Dispersion: Standard deviation, variability, RMS etc.

Unit II Statistical design of experiments for clinical laboratory data; random allocation, method of allocation without random numbers. Volunteered bias. Cross over design selection and distribution of experimental units.

Unit III Case control analysis; probability: Normal, Binomial chi^2 Rican, exponential, Gaussian and Poisson distribution. Analysis of variance (ANOVA) factor analysis. Correlation and Regressaion.

Unit IV Sampling from normal distribution, T test. Principles of experimental dersign: Introduction, objective of an experimental, different types of error, error control etc.

Unit V Stastical method orientation and problem oriented illustration for computer aided interfacing.

Reference books:

1. Martin Bland, An introduction to medical statistics, Oxford university Press
2. G. Eason, C.W. Coles, G.gittinby, Mathematics & Statistics for the Bioscience, Ellis Harwood, 1980
3. Chap T. Le. Introductory Biostatistics, Wiley-Interscience.
4. Ralph D'Agostino, Tutorials in Biostatistics Vol. I & II, Wiley.
5. Belle. Fisher. Biostatistics: A Methodology for the Health Science, Wiley-Interscience.

COURSE CONTENTS

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Electives DCO(E)-II	**Hospital Management Information System**	BM 804 Elective-II (ii)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35 Duration-3hrs.

Unit-I Hospital planning and management**:** Role of hospitals in health care: Health services, Hospital as a system , Intramural and extramural function of hospital, Hospital and community ,Hospital community relationship, Primary health care and hospitals, Hospital planning & designing: Guiding principles in planning, Regionalisation of hospital service, Classification of hospital, Hospital planning team, Assessment of the extent of need for the hospital services, choosing a site, Master plan in its totality, Circulation routes, Distances, Compactness, parking, Landscaping, Landscaping and Visual impact, Zonal distribution and interrelationships of departments, Gross space requirements, Climatic consideration in design, Preparation of function brief, Equipping a hospital, Construction and commissioning, Effective hospital management: Principles of management, Skills of effective management, Characteristics of effective management, Planning, Organizing, Directing & leading, Controlling, Financial management.

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Unit-II Hospital services**:** Outpatient services, Planning considerations, Siting accommodation and physical facilities, Consulting and examination rooms, Ancillary services, Policies and procedures, Common problems in outpatient services.

Nursing unit: progressive patient care, classification of ward accommodation, nursing station, Special nursing unit, ward ventilation & lighting.

Nursing services: function of the nursing services, role of nursing services, determining the nursing staff requirement, factor which influence the number of nursing, nursing time utilizations studies & non nursing duties, organization.

Unit-III Clinical supportiv services**:** Radiological services: introduction, classification, work load & machine utilization, siting & layout, staffing, radiation protection, ultrasonography. Laboratory services: introduction, work load, functional division & planning, siting & space, description of accommodation, policies & procedures. Operation theatre suite: introduction, no. of operating room, Zoning, functional interrelationship of rooms, lighting, electrical & air-conditioning, flooring, ceiling & finishes, policies & procedure. Pharmacy: introduction, function of pharmacy, drug & therapeutic committee, need for hospital formulary, inventory management, quality, charges of drugs, physical facility, Central sterile supply department (CSSD).

Unit-IV Administrative services**:** Medical records , Hospital Infection , Hospital Utilization Statistics , Materials Management , Evaluation of Hospital Services , Factors which influence hospital services, Individual clinical and supportive services, Tools of evaluation, Biomedical equipment services, their purchase, servicing and maintenance of equipment, training of men for medical equipments, Preventive and periodical maintenance procedure.

Unit-V Hospital organization**:** Disposal of hospital waste: introduction, types, Characteristics, classification Public relations in hospitals, Ethical and legal aspects of hospital administration, Quality assurance through record review and medical audit. Role of computers in hospital administration and management.

Reference books:

1. Technology, Health care & Management in the Hospital of future. By: Geisler, E.K. Karbbendam, et al. Published By: Westport, CT, Praeger.
2. Managing a Modem hospital By: Srinivasan, Sage Publications Inc.
3. Health Information Management: Principles & Organization for health record services By: Skurka M.F., San Francisco, Jossey-Bass
4. Principles of hospital administration and planning By: BM Sakharkar
5. Hospitals by G.D. Kunders.
6. Hospital Administration and Management by S.I. Gole and R. Kumar. Deep and Deep Publ.
7. SHA Sourcebook of Modern technology for Hospitals and Health care by Sahni

COURSE CONTENTS

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Electives DCO(E)-II	**Rehabilitation Engineering**	BM 804 Elective-II (iii)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35 Duration-3hrs.

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

Unit III Measurement Tools and Process in Rehabilitation: Subjective and Objective Measurement Methods. Characterizing human systems, sub-systems and assertive devices. Substitutive Medicine: Biomaterials outlook for organ transplant, design considerations evaluation process.

Unit IV Artificial Heart & Circulatory Assist Devices: Engineering design of Artificial Heart & Circulatory Assist Devices. Implementation & implantation aspects.

Unit V Artificial Kidney: Structure & flinction of the kidney. Kidney disease renal failure. Treatment of Renal failure. Renal transplantation, artificial kidneys artificial tissue culture. Computer Application in rehabilitation engineering: Interfaces in compensation for visual perception and improvement of orientation and mobility. Rehabilitation Aids for Mentally Impaired

Reference Books:

1. Rehabilitation technology, By: Ballabio E. 105 Press
2. Biomedical Engg. Hanbook Edited, by: Bronzino D. Joseph Publishers: CRC press (new York) 1995
3. Rehabilitation Engineering, By: Robinson C.J. . CRC Press

COURSE CONTENTS

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Electives DCO(E)-II	**Telemedicine**	BM 804 Elective-II (iv)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35 Duration-3hrs.

Unit I History, definition and Current application: General Introduction to the Telemedicine, Applications, advantages/ disadvantages & scope. Telecommunication technologies in healthcare: Network, technologies, ATM technology, Broadband transmission technology, telephone telemedicine, telemetry, data multiplexing, data compression, wireless technologies, Wi- Fi and WLAN, Satellite communication , Digital equipment.

Unit II Clinical Applications: Clinical network, clinical parameters, cardiology, dermatology, Teleradiology, ENT, Emergency medicine, Gastroenterology, homecare, Neurology, Oncology, Ophthalmology, Mental health, tele-rehabitation, tele-pathology & tele-surgery.

Unit III Computerization of medical records: Data information, Knowledge & wisdom, learning and decision theory, Computing- legency system, HER, Decision Support. Historic medical data, medicine decision making , data standards. Convergence- future trends, training and opportunities in medical informatics. Critical – security, Confidentiality, privacy, accuracy, access, data integrity.

Unit IV Telemedicine equipments: IP Video and audio- video conferencing hardware/ software. Video hardware (cameras, Monitor, recorders etc.), video production, editing, broadcasting, voice over IP/ Audio systems. Network equipments- Tele- medicine workstations, DSL equipments, cable modems, POTS line, fast switched Ethernet, Fiber optic equipments, Routers, switches, hubs, multipoint conferencing units. Monitoring devices- Electronic stethoscope, vital sign monitoring devices, R respiratory monitoring devices, Neurological monitoring devices, Video scope, robotics and virtual reality devices

Unit V Legal and Ethical Issues- Duty of care, Malpractice and Liability, Licensure and accreditiality, Ethical standadards, Intellectual property rights. Malpractice and risk management: Government regulations, International and National protocols, Indian IT act.

Reference books:

1. Computer Networks, By: Tenenbaum
2. E- Health, Teleheith, and Telemedicine: A guide to Start & Success, By: Marlene Meheu, Pamela Whitten, Ace Allen.
3. Essential of Telemedicine and Telecare, By Norris A.C
4. Introduction telemedicine (Application, challenges, needs and benefits, Component and infrastructure), By : B.D.Gupta