RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2020 – 2021

MEDICAL ELECTRONICS

VII & VIII SEMESTER B.E

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 13 UG programs and 15 PG programs. All these programs are approved by AICTE. All the UG programs & 09 PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A' grade by NAAC in 2014. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs till the year 2029. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility to all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology & Schneider Centre of Excellence. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.**

The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), an initiative of Ministry of Human Resource Development (MHRD), Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. It has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework, MHRD, Government of India, M S Ramaiah Institute of Technology has achieved 59th rank among 1071 top Engineering institutions of India for the year 2020 and 1st rank amongst Engineering colleges (VTU) in Karnataka.

About the Department

The Medical Electronics department at Ramaiah Institute of Technology (MSRIT), Bangalore was started in the year 1996. The department is offering 4-year full time B. E. degree course in Medical Electronics, affiliated to VTU, Belgaum, recognized by Government of Karnataka, approved by AICTE, New Delhi and accredited by NBA. The department is located at Lecture Hall Complex of RIT Campus. The department consists of a highly motivated & qualified faculty and dedicated supporting staff headed by Dr. N. Sriraam, Academy-industry experienced Professor with specialization in biomedical signal processing.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio economic needs

MISSION OF THE INSTITUTE

RIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

Provide quality education, motivational academic environment and foster a conducive Institute-industrial relationship to empower the students to face the real-time challenges in the field of engineering and medicine

MISSION OF THE DEPARTMENT

The department shall transform the entrant of the program into professionally competent engineers through innovative curricula, research, practical training and effective collaboration with industry, hospital and academia

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO 1 : Solve the real-life engineering problems by employing the knowledge and skills of Medical Electronics

PEO 2: Provide a multi-disciplinary environment to link engineering and medical domains

PEO 3: Inculcate professional and ethical values in lifelong learning process

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Acquire and comprehend the basic skill sets of mathematical approaches along with analog and digital electronics essential in the development of biomedical systems

PSO2: Provide hardware and software oriented real-time solutions in healthcare using the knowledge of Biomedical electronics and instrumentation

PSO3: Utilize the concepts of advanced clinical engineering to cater to the requirements of healthcare oriented applications

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Curriculum Course Credits Distribution

Batch 2017-2021

Semester	Humanities & Social Sciences (HSS)	Basic Sciences / Lab (BS)	Engineering Sciences/ Lab (ES)	Professional Courses- Core (Hard core, soft core, Lab) (PC-C)	Professional Courses - Electives (PC-E)	Other Electives (OE)	Project Work (PW)	Internship/ other activities (IS/ECA)	Total semester load
First	02	09	14	-	-	-	-	-	**25**
Second	06	09	10	-	-	-	-	-	**25**
Third	--	04	-	21	-	-	-	-	**25**
Fourth	-	04	-	21	-	-	-	-	**25**
Fifth	03	-	-	19	03	-	-	-	**25**
Sixth	-	-	-	15	04	-	06	-	**25**
Seventh	-	-	-	14	12	-	-	-	**26**
Eighth	-	-	-	-	-	04	14	06	**24**
Total	**11**	**26**	**24**	**90**	**19**	**04**	**20**	**06**	**200**

SCHEME OF TEACHING VII SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	ML71	Diagnostic & Therapeutic Equipment & Applications	PC-C	4	0	0	0	4	4
2.	ML72	Medical Imaging Systems	PC-C	4	0	0	0	4	4
3.	ML73	Neural Networks and its Applications	PC-C	3	1	0	0	4	5
4.	MLE3X	ELECTIVE GROUP III	PC-E	3	0	0	1	4	3
5.	MLE4X	ELECTIVE GROUP IV	PC-E	3	0	0	1	4	3
6.	MLE5X	ELECTIVE GROUP V	PC-E	4	0	0	0	4	4
7.	MLL74	Diagnostic & Therapeutic Equipment Lab	PC-C	0	0	1	0	1	2
8.	MLL75	Application Lab	PW/IN	0	0	1	0	1	2
			Total	21	1	2	2	26	**27**

ELECTIVE GROUP-III

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLE31	Physiological System Modeling	PC-E	3	0	0	1	4	3
2	MLE32	Fundamentals of Health Interoperability	PC-E	3	0	0	1	4	3
3	MLE33	Human Assist Devices	PC-E	3	0	0	1	4	3
4	MLE34	Pharmacology & Drug Delivery System	PC-E	3	0	0	1	4	3
5	MLE35	Medical Devices Regulations	PC-E	3	0	0	1	4	3
6	MLE36	Ergonomics & Rehabilitation Engineering	PC-E	3	0	0	1	4	3

ELECTIVE GROUP-IV

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLE41	Computer Communication Networks	PC-E	3	0	0	1	4	3
2	MLE42	Speech Signal Processing	PC-E	3	0	0	1	4	3
3	MLE43	Advanced Medical Instrumentation Technology	PC-E	3	0	0	1	4	3
4	MLE44	Analytical Instrumentation	PC-E	3	0	0	1	4	3
5	MLE45	Smart Wearable Systems	PC-E	3	0	0	1	4	3
6	MLE46	Pattern Recognition	PC-E	3	0	0	1	4	3

ELECTIVE GROUP-V

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLE51	Digital Video Processing	PC-E	4	0	0	0	4	4
2	MLE52	Multimedia Applications	PC-E	4	0	0	0	4	4
3	MLE53	Biometrics	PC-E	4	0	0	0	4	4
4	MLE54	Bio-MEMS	PC-E	4	0	0	0	4	4
5	MLE55	Infrared Imaging & Applications	PC-E	4	0	0	0	4	4
6	MLE56	Point of Care Testing	PC-E	4	0	0	0	4	4

SCHEME OF TEACHING VIII SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	MLIN81	Internship/Departmental Elective (Industry collaborated course)	PW/IN	0	0	4	0	4	8
2.	MLP82	Project Work	PW/IN	0	0	14	0	14	28
3.	XXOExx	**OPEN ELECTIVE**	OE	3	0	0	1	4	4
4.	ECA	**Extra-Curricular/Co-curricular Activities**	ECA	0	0	2	0	2	-
		Total		3	0	20	1	24	--

OPEN ELECTIVE

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLOE01	Introduction to Medical Instrumentation	OE	3	0	0	1	4	3
2	MLOE02	Biomechanics	OE	3	0	0	1	4	3
3	MLOE03	Hospital Management	OE	3	0	0	1	4	3

VII Semester

DIAGNOSTIC & THERAPEUTIC EQUIPMENT & APPLICATIONS

CourseCode:ML71 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. Sanjay H S, Mrs. Prabhu Ravikala Vittal,

Course contents:

UNIT 1

Introduction to Diagnostic & Therapeutic Equipment: Basic concepts of diagnosis and therapy and related applications
Blood pressure measuring devices: Blood pressure & Sound: Direct measurements, Harmonic analysis, dynamic properties, System response, bandwidth requirements, pressure waveforms, venous pressure measurement, heart sounds, phonocardiography, cardiac catheterization, indirect measurements, tonometry.

Unit II

Flow measuring devices: Indicator dilution method with continuous infusion and rapid injection, electromagnetic flowmeters, ultrasonic flowmeters, thermal convection velocity sensors, chamber plethysmography, electric impedance plethysmography, photo-plethysmography

UNIT III

Pulmonary equipment: Pulmonary function measurement, spirometry, pneumotachometers, measurement of volume, pulmonary function analyser, respiratory gas analyser
Neurological equipment: Electroencephalography, electrodes and 10-20 system, EEG bands and diagnostics, Multichannel EEG systems, Block diagram of EEG system, evoked potentials, EEG telemetry, system artifacts and troubleshooting, EMG and its relation with EEG

UNIT IV

Therapeutics & prosthesis: Cardiac pacemakers, electric stimulators, defibrillators, cardioverters, mechanical cardiovascular orthotic and prosthetic devices, haemodialysis, lithotripter, ventilator, incubators, drug delivery devices, surgical instruments, laser applications in therapy

UNIT V

Auditory diagnostics: Hearing mechanism, sound measurement, basic audiometer, pure tone audiometers, speech audiometer, Bekesy approach, evoked response audiometry

Clinical Laboratory Equipment: Spectrophotometry, Automated chemical analyzers, Chromatology, Electrophoresis, Hematology

Text Books

1. R.S. Khandpur "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw Hill Publications.
2. John G Webster, "Medical Instrumentation-Application and design", 3rd edition, John Wiley Publications**.**

Reference Books

1. Joseph D. Bronzino, "Medical Devices and Systems - The Biomedical Engineering Handbook", Third Edition – CRC Press, 2006.
2. Carr& Brown, "Introduction to Biomedical equipment technology", 4th edition, Pearson publications

Course Outcomes (COs):

At the end of the course, students will be able to

1. Accent the design and working of cardiac equipment (PO-1,2,4,12 & PSO-1,3)
2. Comprehend and relate the construction, working and applications of pressure measuring devices. (PO-2,3 & PSO-1)
3. Interpret the importance of pulmonary equipment in healthcare (PO-1,3,12 & PSO-1,3)
4. Recognize the need for neurological equipment in the patient monitoring applications (PO-2,3 & PSO-1)
5. Analyze the working of instruments used in medical laboratories (PO-1,4,5,12 & PSO-1,2,3)

MEDICAL IMAGING SYSTEMS

Course Code: ML72 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. Prabha Ravi, Dr. Sanjay H S

Course contents:

UNIT I

Radiography

Fundamentals of x-rays, Generation and Detection of x-rays, X-ray Diagnostic method, Recent developments, x-ray image characteristics, biological effects of ionizing radiation

X-ray Computed Tomography

Introduction, x-ray detectors in CT, imaging, cardiac CT, dual energy CT, Image quality, equipment, clinical use, biological effects and safety, latest advances

UNIT II

Ultrasound Imaging

Fundamentals of acoustic propagation, Generation & detection of Ultrasound, Ultrasonic Diagnostic Methods, Recent Developments, Image characteristics, Biological effects of ultrasound

UNIT III

Nuclear Medicine Imaging:

Fundamentals of radio activity, Generation and Detection of Nuclear Emission, Diagnostic methods using radiation Detector probes, radionuclide Imaging systems, Recent developments, Internal radiation dosimetry and biological effects

UNIT 1V

Magnetic Resonance imaging

Fundamentals of Nuclear magnetic resonance, Generation and Detection of NMR signal, Imaging Methods, Invivo NMR Spectroscopy, Characteristics of magnetic resonance images, Biological effects of magnetic fields

UNIT V

Other Imaging Methods: Principle of working of DEXA, fMRI, Optical Coherence Tomography, Microscopic Imaging, Multimodal Imaging.

Text Book/s:

1. Shung K. Kirk, Tsui Benjamin, Smith. B. Michael, "Principles of Medical Imaging
2. Suetens Paul, "Fundamentals of Medical Imaging" Cambridge University Press, 2nd edition, 2008.

Reference Books:

1. Introduction to Medical Imaging: Physics, Engineering and Clinical Applications (Cambridge Texts in Biomedical Engineering) 1st Edition by Nadine Barrie Smith (Author), Andrew Webb (Author)
2. Dowsett, Kenny & Johnson, "The physics of Diagnostic Imaging", Chapman & Hall Medical, Madras/London.
3. Advanced Imaging Techniques in Clinical Pathology edited by Francesco M. Sacerdoti, Antonio Giordano, Carlo Cavaliere

Course Outcomes (COs):

At the end of the course, students will be able to

1. Apply image processing techniques to digital images, quantitatively assess image quality and compare the capabilities of different imaging systems. (PO-1,2,3,5 & PSO-1,2)
2. Exhibit an understanding of the physical and technological basis of various radiological equipment, and associated imaging techniques of x-ray radiography, fluoroscopy and x-ray computed tomography (CT) (PO-1,2,3,6 &PSO-1,2)
3. Illustrate the application of physics principles such as ultrasound and Nuclear Magnetic Resonance to MR Imaging and ultrasound imaging (PO-1,2,3,7 &PSO-2,3)
4. Discuss the concepts of nuclear medicine such as radionuclide production and selection, radiopharmaceuticals, tracer studies, in-vitro assay, detection systems and the operation of the gamma camera and describing Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT) processes. (PO-1,2,3,8 &PSO-2,3)
5. Apply the imaging concepts to assess the contemporary implementation of advanced modes of imaging by X rays, MRI, PET, and SPECT techniques and hybrid imaging systems. (PO-1,2,3,4 & PSO-1,3)

NEURAL NETWORKS AND ITS APPLICATIONS

Course Code:ML73 **Credit: 3:1:0:0**
Prerequisite: Nil **Contact Hours: 42+28**
Course Coordinator(s): Dr.N.Sriraam, Dr.Prabha Ravi

Course contents:

UNIT I

Overview of Neural Networks: Elementary neurophysiology and biological neural network- typical applications- models of a neuron- typical architecture- activation functions -Mcculloch Pitts neuron model.- Learning rules: Hebbian, Perceptron, Delta, Competitive, Oustar, Boltzmann

Simple neural nets for pattern classification: Biases and Thresholds, Linear Separability- Hebb net-perceptron, Adaline and Madaline.

UNIT II

Pattern Association: Training Algorithms for Pattern Association Hetero associative Memory Neural Network, Autoassociative Net, Iterative Auto-associative Net, Bidirectional Associative Memory (BAM)

UNIT III

Back Propagation Neural Net: Back propagation Architecture and Algorithm-Weight Update Procedures, Learning Rules

UNIT IV

Neural Networks Based on Competition: Fixed-Weight Competitive Nets, Kohonen Self-Organizing Maps, Learning Vector Quantization, Counter propagation

UNIT V

Adaptive Resonance Theory: Basic Architecture and Operations- ART1: architecture-algorithm-applications-ART2: architecture-algorithm-applications

All networks will be demonstrated using MATLAB/SCILAB

Text book/s:

1. Laurene Fausett, “Fundamentals Of Neural Networks” , Pearson, 2013

2. J.A. Freeman & David.M. Skapura, Neural networks, Algorithms applications and programming techniques, Addison Wesley, 1991. ISE Reprint 1999.

Reference Books:

1. David M. Skapura, “Building Neural Networks”, Addison Wesley, 1996.
2. Bose, “Neural Network Fundamentals with graphs, algorithms and applications”, Tata McGraw-Hill, 1995
3. Simon Haykins, “Neural Networks”, Pearson Education Asia, Third Edition, 2009
4. S.N.Sivanandam, Sumathi, Deepa “An Introduction to Neural Networks using MATLAB”. Tata McGraw Hill 2006

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the basic foundations on biological and artificial neural network and the importance of neuron models for pattern classification (PO1, PO5, PSO2)
2. Demonstrate the process of forming association between related patterns through associative networks (PO-2 & PSO-1)
3. Apply the principles of back propagation supervised learning for error minimization (PO-1, &PSO-1)
4. Understand and analyze the various competitionbased learning algorithms (PO-5 &PSO-2)
5. Analyze the importance of resonancebased network learning algorithms (PO-4 &PSO-1)

PHYSIOLOGICAL SYSTEM MODELLING

Course Code: MLE31 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.N.Sriraam, Dr.C.K.Narayanappa

Course contents:

UNIT I

Properties of Systems and Electrical Analog: System concept, system properties – Resistance, storage, resistance – compliance, piece-wise linear approximation, electrical analog for compliance, thermal storage, step response of first order systems – resistance- compliance systems, and pulse response of first order systems

UNIT II

Transfer Functions: Transfer functions and its use, Study of transfer function of first order and second order systems, engineering concept in coupled system, example of Transformed signals.

UNIT III

Impedance Concept: Transfer functions with impedance concept, prediction of performance, identification of the system from impedance function, periodic signals, relationship between transfer function and sinusoidal response, evaluation of transfer function from frequency response.

UNIT IV

Feedback Systems: Characteristics of physiological feedback systems, stability analysis of systems.

UNIT V

Simulation of Biological Systems: Simulation of thermal regulation, pressure and flow control in circulation, occulo motor system, endocrinal system, functioning of receptors.

Text Book/s:

1. William B.Blesser, " System approach to Bio-medicine", McGraw-Hill, New York, 1969.
2. Manfred Clynes and John H.Milsum, "Bio-medical engineering system", McGraw-Hill ,NewYork, 1970.
3. Michael C.K. Khoo," Physiological Control Systems -Analysis, Simulation and Estimation" Prentice Hall of India Pvt. Ltd., New Delhi, 2001

Reference Books:

1. Douglas S. Rigg, "Control theory and physiological feedback mechanism", The William & Williams co., Baltimore, 1970.

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the principles behind the physiological system modeling (PO-1 & PSO-1)
2. Analyze the various resistive and storage properties of the physiological system (PO-2 &PSO2)
3. Demonstrate the importance of impedance (PO-4 &PSO-1)
4. Illustrate the mechanisms of stability and feedback (PO-5 & PSO-2)
5. Apply the concepts for various clinical applications (PO-2&PSO-2)

FUNDAMENTALS OF HEALTH INTEROPERABILITY

Course Code: MLE32 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours:42**
Course Coordinator(s): Dr Prabha Ravi, Mr. S J Mahendra

Course contents:

UNIT I

Principles of Health Interoperability: The Health Information Revolution. Why Interoperability Is Hard, Models, UML, BPMN, XML and JSON, Information Governance, Standards Development Organizations

UNIT II

Terminologies and SNOMED CT: Coding and Classification Schemes, SNOMED CT, SNOMED CT Concept Model, Implementing Terminologies

UNIT III

HL7 and Interchange Formats: HL7 Version 2, The HL7 v3 RIM, Constrained Information Models.

UNIT IV

HL7 and Interchange Formats: Constrained Information Models, CDA – Clinical Document Architecture, HL7 Dynamic Model , IHE XDS.

UNIT V

Fast Healthcare Interoperability Resources (FHIR): Principles of FHIR, The FHIR Restful API, FHIR Resources, Conformance and Terminology, Implementing FHIR.

Text Book/s:

1. Principles of Health Interoperability: SNOMED CT, HL7 and FHIR (Health Information Technology Standards) 3rd ed. 2016 Edition by Tim Benson (Author), Grahame Grieve (Author) ,Springer Publications

Reference Book:

1. Healthcare Interoperability Standards Compliance Handbook: Conformance and Testing of Healthcare Data Exchange Standards Authors: **Oemig**, Frank, **Snelick**, Robert, Springer Publications

Course outcomes (COs):

At the end of the course, students will be able to

1. Knowledge of the framework for why interoperability is important and what is needed to accomplish that interoperability (PO-1,2 & PSO-1)
2. Identify the need and significance of the full spectrum of interoperability applications.(PO-2,6,12 & PSO-2)
3. Infer and apply the International Healthcare Technology Standards (PO-5,7,8 &PSO-3)
4. Classify and apply Health Level Seven standards Health Level Seven (PO-1,2 & PSO-1)
5. Have knowledge and ability to apply HL7 and SNOMED CT information on other standards. (PO-1,2 & PSO-1)

HUMAN ASSIST DEVICES

Course Code:MLE33 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr. Sanjay H S, Dr.Vani Damodaran

Course contents:

UNIT I

Heart Lung Machine and Artificial Heart: Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for Cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Mock test setup for assessing its functions.

UNIT II

Cardiac Assist Devices: Synchronous Counter pulsation, Assisted through Respiration Right Ventricular Bypass Pump, Left Ventricular Bypass Pump, Open Chest and closed Chest type, IntraAortic Balloon Pumping,Veno Arterial Pumping, Prosthetic Cardio Valves, Principle and problem, Biomaterials for implantable purposes, its characteristics and testing.

UNIT III

Artificial Kidney: Indication and Principle of Haemodialysis, Membrane, Dialysate, Different types of heamodialysers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.

UNIT IV

Prosthetic and Orthodic Devices: Hand and Arm Replacement - Different Types of Models Externally Powered Limb Prosthesis Feedback in Orthodic System, Functional Electrical Stimulation, Sensory Assist Devices, Materials for Prosthetic and orthodic devices, Haptic Devices.

UNIT V

Respiratory and Hearing Aids: Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratoryparameters. Types of Deafness, Hearing Aids, Construction and Functional Characteristics.

Text Book/s:

1. Kolff W.J., Artificial Organs, John Wiley and Sons, New York, 1979.
2. Andreas.F.Vonracum, Hand book of bio material evalution, Mc-Millan publishers, 1980.
3. Albert M.Cook and Webster J.G., Therapeutic Medical Devices,Prentice Hall Inc., New Jersey, 1982
4. Gray E Wnek, Gray L Browlin – Encyclopedia of Biomaterials and BiomedicalEngineering – MarcelDekkerInc New York 2004.
5. John. G. Webster – Bioinstrumentation - John Wiley & Sons (Asia) Pvt Ltd.

Course outcomes (COs):

At the end of the course, students will be able to

1. Demonstrate an understanding of the basic concepts of cardiac assist devices and its importance (PO-1 &PSO-1)
2. Demonstrate an understanding of the basic concepts of kidney assist devices and its importance (PO-2 &PSO-2)
3. Demonstrate an understanding of the basic concepts of hearing aids as assistive devices and its role (PO-1 &PSO-1)
4. Demonstrate an understanding of the basic concepts of assistive devices as prosthetic implants in ortho related applications (PO-2 &PSO-2)
5. Have a wide knowledge on the recent trends applicable in assistive devices (PO-7,8 &PSO-3)

PHARMACOLOGY & DRUG DELIVERY SYSTEM

Course Code: MLE34 **Credit:3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.N.Sriraam, Dr. Sanjay H S

Course contents:

UNIT I

Pharmacodynamics And Pharmacokinetics: Drug metabolism, pharmacokinetic action of drugs in human bodies, Dynamics of Drug Absorption, Distribution, Action, and Elimination, toxic, adverse effects.

UNIT II

Diseases and Drugs: Study of the pharmacology of the diseases and drugs used with mode of action especially of diabetes, vasoactive peptides, chemotherapy, hypertension, myocardial ischemia and inflammation.

UNIT III

Drug disperse systems: drug emulsions; drug suspensions; applications of disperse systems in delivery of pharmaceuticals; pharmaceutical gels, Diffusional system, Fick's law of diffusion, transdermal delivery, ocular delivery and intra-uterine system.

UNIT VI

Formulation methods: principles, technology and manufacture of sustained drug delivery systems and applications to therapeutic delivery systems designed to release a specific quantity of drug at controlled rates; modified-release by coating: enteric and other coated tablets, particles and other systems.

UNIT V

Polymers & Release pattern: types of polymer, pharmaceutical polymers, NDDS models, osmotic pumps, Controlled release, delayed release, Sustained release etc., order of release. Oral controlled DDS, factors affecting controlled release.

Text Book/s:

1. Bertram.G.Katzung, Susan.B.Masters, Anthony.J.Trevor (2018). Basic and Clinical Pharmacology, 14th edition, Mc.Graw Hill.
2. H. C. Ansel, N. G. Popovich and L. V. Allen, (2013) Pharmaceutical Dosages Forms and Drug Delivery Systems, 10th ed, Williams & Wilkins.

Reference Books:

1. Brunton LL, Lazo JS, Parker KL, Buxton ILO, Blumenthal D: Goodman & Gilman's The Pharmacological Basis of Therapeutics. McGraw HillMedical.13th ed. 2018.
2. Vasant. V. Ranade, Mannfred. A. Hollinger. Drug Delivery Systems. CRC Press, London. 3rd edition, 2011.

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the basic foundations of pharmacology and drug delivery systems in human beings (PO-1,2,3,12 &PSO-1)
2. Ascertain the salient aspects of the drugs and diseases from a healthcare perspective (PO-1,2,4,12 &PSO-2)
3. Analyse the features of the process of drug dispersal in human body (PO-2,3,4,5 &PSO-2)
4. Assess the different formulation approaches in pharmacology(PO-1,2,5 &PSO-1,2)
5. Enumerate the concepts related to polymers and release patterns of the same (PO-1,2,12 &PSO-2)

MEDICAL DEVICES REGULATIONS

Course Code: MLE35 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s):Dr.Prabha Ravi, Mrs. Tejaswini. S

Course contents:

UNIT I

Medical Device Safety and Related ISO Standards:
Biomedical Devices: Overview, Labeling, Label, and Language: A Truly Global Matter, Clinical Trials: Legal and EthicalConsiderations of Increasing Globalization, Regulatory Affairs for Medical Device Clinical Trials in Asia Pacific.

UNIT II

Medical Device Classification and Standards:
Medical Device Classification Guide, ISO 13485:2003 Medical Devices — Quality Management Systems — Requirements or Regulatory Purposes, ISO 14971: Application of Risk Management to Medical Devices.

UNIT III

Harmonization of Medical Devices in Asia:
Medical Devices in the World Health Organization, Asian Harmonization Working Party, Asia-Pacific Economic Cooperation, Harmonization of Medical Device in ASEAN.

UNIT IV

Medical Device Regulatory System in the United States: United States Medical Device Regulatory Framework, Regulation of Combination Products in the United States Medical Device Regulatory System in Asia-Pacific Region: Medical Device Regulations in Australia & China

UNIT V

Medical Device Regulatory System in European Union: European Union: Medical Device Regulatory System, Regulation of Combination Products in the European Union. Medical Device Regulatory System in Asia-Pacific Region: Medical Device Regulations in India & Singapore

Text Books:

1. Handbook of Medical Device Regulatory Affairs in Asia: Jack Wong, Raymond Tong Kaiyu CRC Press , Taylor & Francis group
2. Medical Device Regulations Globaloverview and guiding principles (WHO)Geneva Latin American Medical Device Regulations: Patricia M. Flood

Reference books:

1. Reliable Design of Medical Devices, Second Edition, Richard Fries,© 2006 by Taylor & Francis Group, LLCCRC Press is an imprint of Taylor & Francis Group
2. Medical Devices (1st Edition): Regulations, Standards and Practices, Seeram Ramakrishna Lingling Tian Charlene Wang Susan Liao Wee EongTeo eBook ISBN: 9780081002919 Hardcover ISBN: 9780081002896 Imprint: Wood head Publishing, 2015

Course outcomes (COs):

At the end of the course, students will be able to

1. Classify and explain the importance of essential requirements. and Explain the process of conformity assessment and the use of harmonized standards. (PO-3,8,9 & PSO-1)
2. Comprehend the legislative framework for medical device regulation in the world. (PO-3,12 &PSO-2)
3. Resolve if a device or product qualifies as a “medical device”, “active implantable medical device”, “in vitro diagnostic medical device” or “drug-device” combination under the definitions contained within the Directives. (PO-3, 8 &PSO-2)
4. Illustrate the importance and process of medical device classification and outline the criteria used in the classification process. (PO-3,4,11 &PSO-3)
5. Outline the role of competent authorities and notified bodies in various nations and their regulation of medical devices (PO-6,7,11 &PSO-3)

ERGONOMICS & REHABILITATION ENGINEERING

Course Code: MLE36 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.N.Sriraam, Mrs. Purnima B R

Course contents:

UNIT I

Introduction: Focus of ergonomics & its applications, Body mechanics: Basics, Anatomy of Spine & pelvis related to posture, postural stability & adaptation, Low back pain, risk factors formusculo skeletal disorders in workplaces, Anthropometric principles in workspace: Designing for a population of users, Human variability sources, applied anthropometry in ergonomics & design, anthropometry & personal space

UNIT II

Design of Repetitive Tasks: Work related musculoskeletal disorders, injuries to upper body at work, neck disorders, carpal tunnel syndrome, tennis elbow, shoulder disorder, ergonomic interventions. Design of physical environment: human thermoregulation, thermal environment, working in hot & cold climates, skin temperature, protection against extreme climates, comfort & indoor climate, ISO standards

UNIT III

Engineering Concepts in Rehabilitation Engineering: Anthropometry: Methods for Static and dynamic Measurements: Area Measurements, Measurement of characteristic sand movement, Ergonomic aspects in designating devices: Introduction to Models in Process Control, Design of Information Devices, Design of Controls 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

UNIT IV

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 V

Orthopedic Prosthetics and Orthotics in rehabilitation: Engineering concepts in motor rehabilitation, applications.

Computer Aided Engineering in Customized Component Design. Intelligent prosthetic knee, A hierarchically controlled prosthetic and A self-aligning orthotic knee joint. Externally powered and controlled Orthotics and Prosthetics. FES systems- Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

Text Book/s:

1. Introduction to Ergonomics by R S Bridger, Rout ledge Taylor & Francis group, London,2008
2. Bronzino, Joseph; Handbook of biomedical engineering.2nd edition, CRC Press, 2000.
3. Robinson C.J Rehabilitation engineering. CRC press 1995

Reference books:

1. Fitting the task to human, A textbook of occupational ergonomics, 5th edition, Taylor & Francis, ACGIH publications, 2008
2. Work study & Ergonomics by Dhanpat Rai & sons, 1992 in rehabilitation engineering; CRC; December 2000.
3. Etienne Grandjean, Harold Oldroyd, Fitting the task to the man, Taylor & Francis,1988.

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the principles behind the ergonomics and rehabilitation engineering (PO-1,5 &PSO-1)
2. Analyze the task oriented principles of ergonomics (PO-3& PSO-2)
3. Understand the visual, augmented principles of rehabilitation engineering (PO-1 &PSO-1)
4. To demonstrate the sensory principles for various applications (PO-5 &PSO-2)
5. Demonstrate an understanding of the basic concepts of assistive devices as prosthetic implants in ortho related applications (PO-11,12 &PSO-3)

COMPUTER COMMUNICATION NETWORKS

Course Code: MLE41 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr. Sanjay H S, Mrs. Chandana S

Course contents:

UNIT I

Introduction to Computer Networks: Introduction, advantages & applications of CCN, Computer network: structure, hardware, Topology, software & architecture, services, reference models: ISO & TCPIP

UNIT II

Physical Layer: Design issues, Digital Transmission, & Media types, multiplexing & types, Modems, switching techniques, ISDN

Data Link Layer: design issues, Error detection & correction techniques, elementary data link layer protocols, pipelining, performance issues

UNIT III

Medium Access Layer: Network types, LAN, MAN & WAN, LAN protocols, IEEE 801, 802 & 803 standards

UNIT IV

Network Layer: Design issues, Connected & connectionless services, virtual circuits, datagram subnets, Routing algorithms, adaptive & non-adaptive algorithms, congestion control, internetworking, Internet layer, IP addressing

UNIT V

Transport layer: design & Performance issues, transport protocol mechanisms, TCP

Application layer: DNS, Electronic Mail, World Wide Web, Multimedia

Text Book/s:

1. Andrew S Tanenbaum, *"Computer Networks*", PHI, 5th Edition,2013

Reference Book:

1. Leon Garcia &Widjaja, “Communication Networks”, Tata McGraw Hill, 2nd Edition, 2003

Course outcomes (COs):

At the end of the course, students will be able to

1. Discriminate the functionality between the layers in OSI model and TCP/IP suite. (PO-1,7 &PSO-1)
2. Understand the concept of physical and data link layer. (PO-1,2,7,9,12 &PSO-1)
3. Distinguish the IEEE standards designed to understand the interconnectivity between different LANs. (PO-7,9,12 &PSO-1)
4. Employ different algorithms to route a packet to the destination in different networks needed for process to process delivery. (PO-1,2,3,5 &PSO-1)
5. Study the concepts of transport and application layer. (PO-1,2,7,9,12 &PSO-1)

SPEECH SIGNAL PROCESSING

Course Code: MLE42 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.C.K. Narayanappa, Mrs. Chandana. S

Course contents:

UNIT I

Digital Models for Speech Signals: Process of speech production, Lossless tube models, digital models for speech signals

UNIT II

Time Domain Models for Speech Processing: Time dependent speech processing, short time energy & average magnitude, short time averaging zero crossing rate, speech v/s silence discrimination using energy & zero crossing, Pitch period estimation, short time autocorrelation function

UNIT III

Short Time Fourier Analysis: Linear filtering interpretation, Filter bank summation method, design of digital filter banks, implementation using FFT, Spectrographic display

UNIT IV

Digital Representation of Speech Waveform: Sampling speech signals, statistical speech model, instantaneous quantization, adaptive quantization, differential quantization, delta modulation

Linear Predictive Coding of Speech: Basic principles of linear predictive analysis, solution of LPC equations & predictive error signal, frequency domain interpretation, relation between the various speech parameters, applications of LPC parameters.

UNIT V

Speech Synthesis: Principles of Speech synthesis, Synthesis based on waveform coding, Synthesis based on analysis synthesis method, Synthesis based on speech production mechanism, Synthesis by rule, Text to speech conversion.

Speech Recognition: Principles of Speech recognition, Speech period detection, Spectral distance measures, Structure of word recognition systems, Dynamic time warping (DTW), Word recognition using phoneme units.

Text Book/s:

1. Digital Processing of speech signals, L R Rabiner & R W Schafer, Pearson Education 2004
2. Digital Speech Processing-Synthesis & Recognition, Sadoaki Furui, 2nd edition, Mercel Dekker 2002

Reference Book:

1. Introduction to data compression, Khalid Sayood, 3rd edition, Elsevier Publications Digital Speech, A M Kondoz, 2nd edition, Wiley Publications

Course Outcomes (COs):

At the end of the course, students will be able to

1. Understand the production of speech and the different models of speech signal (PO-1,2 & PSO-1)
2. Demonstrate the speech representation and its Fourier analysis (PO-1,2,3 &PSO-2)
3. Analyze the homomorphic speech processing (PO-1,2 &PSO-2)
4. Illustrate the methods of speech enhancement and speech synthesis techniques (PO11,2&PSO-2)
5. Explain the working of automatic speech recognition (PO-1,2& PSO-2)

ADVANCED MEDICAL INSTRUMENTATION TECHNOLOGY

Course Code: MLE43 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr N Sriraam, Mrs. Uma Arun

Course contents:

UNIT I

Patient Monitoring Systems: System concepts, bedside patient monitoring systems, central monitors, measurement of physiological parameters, catheterization laboratory instrument

Foetal Monitoring equipment: Cardiotochograph, monitoring foetal heart rate, monitoring labor activity, recording systems

UNIT II

Ambulatory monitoring system: Cardiac Arrhythmias, arrhythmia monitors, QRS detection techniques, Exercise stress testing, Ambulatory monitoring equipment

Biomedical telemetry and telemedicine: wireless telemetry, single channel telemetry system, multi-channel telemetry system, implantable telemetry system, telemedicine

UNIT III

Instruments for surgery: surgical diathermy, diathermy equipment, safety aspects in ESUs, surgical diathermy analyzers

Physiotherapy equipment: High frequency heat therapy, short wave diathermy, microwave diathermy, ultrasonic diathermy, electro diagnostic apparatus, pain relief, stimulators

UNIT IV

Lithotriptors: Stone-disease problem, modern lithotripters, extra-corporeal shock-wave therapy,

Anesthesia machines: Need for anesthesia, anesthesia machines, electronics involved

UNIT V

Radiotherapy instruments: Use of high voltage x-ray machines, betatron development, cobalt 60 machine, medical linear accelerator machine

Automated drug delivery systems: infusion pumps, components of drug infusion systems, implantable infusion systems, closed loop control in infusion systems, typical infusion pumps

Text Book/s:

1. R S Khandpur, “Handbook of biomedical Instrumentation”, Tata McGraw Hill publications, 2014

Reference Books:

1. Joseph D. Bronzino, “Medical Devices and Systems - The Biomedical Engineering Handbook”, Third Edition – CRC Press, 2006.
2. John G Webster, “Medical Instrumentation-Application and design”, 3rd edition, John Wiley Publications

Course outcomes (COs):

At the end of the course, students will be able to

1. Reminisce the basics of medical instrumentation and extend the same to advanced monitoring systems (PO-1,2,4,12, PSO-1)
3. Explore the techniques and instrumentation based approaches involved in the ambulatory monitoring as well as biotelemetry based transmission systems (PO-2,3,,6, PSO-1,2)
4. Accent the construction, working and uses of different types equipment used for surgical as well as physiotherapy based applications (PO-1,3,5,12, PSO-1,2)
5. Quote the fundamentals of instrumentation and comprehend the features of lithotripters and anaesthesia machines (PO-2,3,5, PSO-1,2)
6. Emphasize on the recent trends in patient safety with respect to radiotherapy and automated drug delivery systems in healthcare (PO-1,4,5,6,12, PSO-1,2)

ANALYTICAL INSTRUMENTATION

Course Code: MLE44 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.Sanjay H S, Mrs. Purnima B R

Course contents:

UNIT I

Visible ultraviolet spectrophotometers: Electromagnetic radiation, Beer Lambert law, absorption instruments, colorimeters, spectrophotometers.
Infrared spectrophotometers infrared spectroscopy theory, Basic components of infrared spectrophotometers, Types of infrared spectrophotometers, Sample handling techniques.

UNIT II

Flame photometers: Principle of flame photometers constructional details of flame photometers, accessories of flame photometers, interference in flame photometry and determinations.

UNIT III

Fluorimeters & phosphorimeters: Principle of fluorescence, measurement of fluotrscence, spectrofluorescence, microprocessor based spectrofluorescence, Measurement of Phosphorescence.

UNIT IV

Mass spectrometer & NMR spectrometer: Basic concept, types of mass spectrometer, components of mass spectrometer, resolution and applications. Principle of NMR, constructional details, sensitivity enhancement for analytical NMR spectroscopy. Use of computers with NMR spectrometers.

UNIT V

Chromatography: Gas chromatograph- basic concepts, parts of gas chromatograph. Method of peak areas, liquid chromatography- basic concepts, types if liquid chromatography, the liquid chromatograph

Text Book/s:

1. Hand book of analytical Instruments by R. S. Khandpur, TMH Publications 1st Ed 1989, New Delhi

Reference Books:

1. Instrumental methods of analysis by H. H. Willard, L. L. Merritt & J. A. Dean, CBS Publications 7th Ed 1988
2. Principles of Instrumental analysis by S. J. Holler & T. A. Nilman Saunders college Publications 5st Ed 1998

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the basic components and principles of working of Flame photometers (PO-1 & PSO-1)
2. Understand the concepts of spectrophotometer and discuss the types of spectrophotometer.(PO-1&PSO-1)
3. Discuss the principle working, types of Mass and NMR spectrometer (PO-1& PSO-2)
4. Describe the principle of working of chromatography &Thermo analytical instruments (PO-12& PSO-1)
5. Interpret and analyze the various applications of Biosensors (PO-1 &PSO-2)

SMART WEARABLE SYSTEMS

Course Code: MLE45 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.N.Sriraam, Mrs. Chandana S

Course contents:

UNIT -I

Introduction: What is Wearable Systems, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Recent developments – Global and Indian Scenario, Types of Wearable Systems, Components of wearable Systems, Physiological Parameters commonly monitored in wearable applications, Smart textiles, & textiles sensors, Wearable Systems for Disaster management, Home Health care, Astronauts, Soldiers in battle field, athletes, SIDS, Sleep Apnea Monitoring.

Smart Sensors & Vital Parameters: Vital parameters monitored and their significances, Bio-potential signal recordings (ECG, EEG, EMG), Dry Electrodes design and fabrication methods, Smart Sensors – textile electrodes, polymer electrodes, non-contact electrodes, MEMS and Nano Electrode Arrays, Cuff-less Blood Pressure Measurement, PPG, Galvanic Skin Response (GSR), Body Temperature Measurements, Activity Monitoring for Energy Expenditure, Respiratory parameters. Sensors for Wearable Systems, Biomechanical Sensors, Physiological Sign Sensors.

UNIT -II

Future Direction &E-Textiles: Fibres and Textiles for Bioelectrodes, Fibres and Textiles for Sensing, Active Fibre Electronics and Woven Logics, Fibres and Textiles for Energy Harvesting and Storage, Smart Textiles for Actuation, Textile-Based Communication Devices, Smart Fabrics and Interactive Textiles Platforms. The Commercialization of Smart Fabrics: Intelligent Textiles, Analysis of the Markets: Today and Tomorrow, Common Backbone of Applications, Present Situation and Competitors in Terms of R&D and Commercialization, Market Segmentation, Market Volumes

UNIT -III

Energy Harvesting for Self-Powered Wearable Devices: Principles of Energy Harvesting by Using Human Body Heat, Calculated Characteristics of Wearable TEGs, Human Body as a heat source for a wearable thermoelectric power supply, TEG's in wearable devices, Hybrid Thermoelectric-Photovoltaic Wearable Energy Harvesters, TEGs in Clothing, Development of New Technologies for Wearable Thermopiles.

UNIT -IV

Wireless Communication Technologies for Wearable Systems: System-Level Considerations, Lower-Level Tradeoffs, Recent Applications of Wireless Technology in Wearable Health Monitoring Systems. Design of Wireless Health

Platforms, System Architecture Requirements for Wireless Health Platforms, System Design, Micro LEAP: A Wireless Health Platform with Integrated Energy Accounting, Micro LEAP Application: Smart Cane, Micro LEAP Application: Episodic Sampling, Conclusion and Next Generation Platforms.

UNIT -V

Wearable Electronic Systems: Applications to Medical Diagnostics/Monitoring, Historical Perspective, Present and Possible Clinical Applications, Sensing Constraints and Possibilities, Discussion and Conclusion. Scenarios for the Interaction Between Personal Health Systems and Chronic Patients, The New Paradigm of Personalized Health: p-Health, The AmI Vision, Challenges of User Interaction Within the Patient-Centered Care Paradigm, Scenarios for the Application of AmI to p-Health.

Text Book/s:

1. Annalisa Bonfiglo, Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011
2. Edward Sazonov, Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elseiver, 2014

Reference Books:

1. Kate Hartman, Make: Wearable Electronics: Design, Prototype and wear your own interactive garments, Maker Media
2. Elijah Hunter, Wearable Technology, Kindle Edition
3. GuangZhong Yang, Body Sensor Networks, Springer

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the basic foundations on biological and artificial neural network and the importance of neuron models for pattern classification (PO-1,5&PSO-2)
2. Demonstrate the process of forming association between related patterns through associative networks (PO-2 &PSO-1)
3. Apply the principles of back propagation supervised learning for error minimization (PO-1 &PSO-1)
4. Understand and analyze the various competition based learning algorithms (PO-5 &PSO-2)
5. Analyze the importance of resonance based network learning algorithms (PO-4 &PSO1)

PATTERN RECOGNITION

Course Code:MLE46 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr. Basavaraj Hiremath, Dr.N.Sriraam

Course contents:

UNIT I

Introduction: Machine perception, pattern Recognition systems, Design cycles, learning and adaptation
Probability: Random variable, joint distribution and densities, moments of random variable.

UNIT II

Statistical Decision Making: Introduction, Baye's theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, problems.

UNIT III

NonParametric Decision Making: Introduction, Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions. Minimum Squared Error Discriminant Functions

UNIT IV

Clustering: Introduction, Hierarchical clustering, Single-Linkage Algorithm, Complete-Linkage Algorithm, Average –Linkage Algorithm, Ward's Method Algorithm problems.
Partitional clustering: Forgy's Algorithm, K-means Algorithm, Isodata Algorithm, problems.

UNIT V

Processing of Waveforms and Images: Introduction, gray level scaling transformations, equalization, geometric image scaling and interpolation, edge detection, Laplacian and sharpening operators, line detection and template matching, logarithmic gray level scaling.

Text Book/s:

1. Pattern Recognition and Iamge Analysis, Earl Gose, Richard Johnson Baugh and Steve jost, PHI (2015)

Reference Books:

1. Richard O.Duda, Peter E.Herd and David & Stork, pattern and classification, john Wiley and sons, Inc 2 Ed.2001.
2. Robert Schlkoff, Pattern Recognition: S tatistical Structural and Neural Approaches, John Wiley and sons, Inc, 2007

Course outcomes (COs):

At the end of the course, students will be able to

1. To recognize the importance of pattern recognition and its mathematical background (PO-1,2,3 &PSO-1)
2. To have knowledge of statistical decision matching (PO-1,2 &PSO-1).
3. Apply the fundamental concepts of non-parametric decision matching. (PO-2,3,4 &PSO-1)
4. Apply the methods of nonparametric decision matching on practical application and implementation (PO-2,3 4 &PSO-1)
5. To recognize and implement the tools of the pattern recognition on image processing (PO-1,3 &PSO-1)

DIGITAL VIDEO PROCESSING

Course Code: MLE51 **Credit:4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr.C.K. Narayanappa, Dr. Basavaraj V Hiremath

Course contents:

UNIT I

Introduction: Analog video, Digital Video, Digital Video processing

UNIT II

Time Varying Image Formation Models: 3D motion models, geometric image formation, photometric image formation, observation noise

UNIT III

Spatio – Temporal Sampling: sampling for analog & digital video, 2D rectangular sampling, 2D periodic sampling, 3D sampling, reconstruction

UNIT IV

Sampling Structure Conversion: Sampling rate change for 1D signals, sampling lattice conversion

UNIT V

Optical Flow Methods: 2D motion v/s apparent motion, 2D motion estimation, methods using the optical flow equation

Text Book/s:

1. Digital Video Processing, A Murat Tekalp, Prentice Hall Signal Processing Series ISBN;0-13-190075-7, 1995

Reference Book:

1. Handbook of Image & Video Processing, AL Bovik, 2nd Edition, Academic Press, ISBN:0-12-119790-5, 2000

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the basics of analog and digital video standards (PO-1,5 &PSO-1)
2. Understand the different time Varying Image Formation Models the sampling structures for suitable video applications (PO-1,2,4&PSO-1)
3. Understand and apply Spatio – Temporal Sampling for video signals Select the suitable technique to evaluate motion estimation in different video applications (PO-2,5 &PSO-1)
4. Understand and analyze Sampling Structure Conversion (PO-1,2,5 &PSO-1)
5. Understand and analyze the Optical flow methods (PO-1,2,3 &PSO-1)

MULTIMEDIA APPLICATIONS

Course Code: MLE52 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr.C.K. Narayanappa, Dr. Basavaraj V Hiremath

Course contents:

UNIT I

Introduction: Definitions, Where to Use Multimedia, Multimedia in Business, Multimedia in Schools, Multimedia at Home, Multimedia in Public Places, Virtual Reality, Delivering

UNIT II

Images: Before You Start to Create, Plan Your Approach, Organize Your Tools ,Configure Your Computer Workspace Making Still Images, Bitmap, Vector Drawing, Vector-Drawn Objects vs. Bitmaps,3-D Drawing and Rendering, Color: Understanding Natural Light and Color, Computerized Color, Color Palettes, Image File Formats

Sound:The Power of Sound, Digital Audio, Making Digital Audio File, MIDI Audio, MIDI vs. Digital Audio, Multimedia System Sounds, Audio File Formats, Vaughan's Law of Multimedia Minimums, Adding Sound to Your Multimedia Project, Space Considerations, Audio Recording, Keeping Track of Your Sounds, Audio CDs, Sound for Your Mobile, Sound for the Internet, Testing and Evaluation.

UNIT III

Video: Using Video, How Video Works and Is Displayed, Analog Video, Digital Video, Displays, Digital Video Containers, Codecs, Video Format Converters, Obtaining Video Clips, Shooting and Editing Video, The Shooting Platform, Storyboarding, Lighting, Chroma Keys. Composition, Titles and Text Nonlinear Editing (NLE)

UNIT IV

Making Multimedia: The Stages of a Multimedia Project, What You Need: The Intangibles, Creativity, Organization, and Communication What You Need: Hardware Windows vs. Macintosh Connections, Memory and Storage Devices, Input Devices, Output Devices.

What You Need: Software: Text Editing and Word Processing Tools, OCR Software, Painting and Drawing Tools, 3-D Modeling and Animation Tools, Image-Editing Tools, Sound-Editing Tools, Animation, Video, and Digital Movie Tools, Helpful Accessories, What You Need: Authoring Systems, Helpful Ways to Get Started, Making Instant Multimedia, Types of Authoring Tools, Objects, Choosing an Authoring Tool.

UNIT V

The Internet and Multimedia: Internet History, Internetworking, Internet Addresses, Connections the Bandwidth Bottleneck, Internet Services, MIME-Types, The World Wide Web and HTML, Multimedia on the Web, Tools for the World Wide Web, Web Servers, Web Browsers, Search Engines, Web Page Makers and Site Builders, Plug-ins and Delivery Vehicles, Beyond HTML.

Text Book/s:

1. Tay Vaughan -"Multimedia: Making It Work" Eighth Edition, McGraw hill Publications,2011

Reference Books:

1. PrabhatK. Andleigh, Kiran Thakrar, Multimedia Systems Design, PHI 2002.
2. Jeffery Jefcoat, Multimedia Systems and Application, TMH.
3. FredHalsall, Multimedia Communication Application Networks, Protocols

Course Outcomes (COs):

At the end of the course, students will be able to

1. Understand the usage of Multimedia in various in various context. (PO-1,2,12 &PSO-1,2)
2. Describe the tools and approaches used for Image and sound used for Multimedia Applications (PO-3,12 & PSO-,1,2)
3. Discuss the various standards and quality aspects of digital video formats used for multimedia application. (PO-1,2,12 &PSO-1,2)
4. Describe the various stages of creating multimedia application. (PO-1,2 &PSO-1,2)
5. Understand the Internet and Web services connectivity links for creating multimedia applications. (PO-1,12 &PSO-1,2)

BIOMETRICS

Course Code:MLE53 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Mrs. Purnima. B.R, Mrs. Chandana S

Course contents:

UNIT I

Biometric Fundamentals: Introduction - Benefits of biometric security - Verification and identification - Basic working of biometric matching - Accuracy - False match rate - False non-match rate - Failure to enroll rate - Derived metrics - Layered biometric solutions.

UNIT II

Fingerprint Identification Technology: Finger scan - Features - Components - Operation (Steps) - Competing finger Scan technologies - Strength and weakness. Types of algorithms used for interpretation.

UNIT III

Face & Iris Recognition: Facial Scan - Features - Components - Operation (Steps) - Competing facial Scan technologies - Strength and weakness.
Iris Scan - Features - Components - Operation (Steps) - Competing iris Scan technologies - Strength and weakness.

UNIT IV

Voice Scan: Voice Scan - Features - Components - Operation (Steps) - Competing voice Scan (facial) technologies - Strength and weakness.
Other physiological biometrics - Hand scan - Retina scan - AFIS (Automatic Finger Print Identification Systems) - Behavioral Biometrics - Signature scan-keystroke scan.

UNIT V

Applications: Biometrics Application - Biometric Solution Matrix - Bio privacy - Comparison of privacy factor in different biometrics technologies - Designing privacy sympathetic biometric systems. Biometric Vertical Markets, Biometric standards - (BioAPI , BAPI) - Biometric middleware

Biometrics for Network Security. Statistical measures of Biometrics. Biometric Transactions.

Text Book/s:

1. Samir Nanavati, Michael Thieme, Raj Nanavati, "Biometrics - Identity Verification in a Networked World", WILEY- Dream Tech, 2009
2. Paul Reid "Biometrics for Network Security", Pearson Education, 2004

Reference Books:

1. John D. Woodward, Jr. "Biometrics- The Ultimate Reference"-Wiley Dreamtech.1edition, 2003
2. For more details, visit Http://www.jntu.ac.in

Course outcomes (COs):

At the end of the course, students will be able to

1. Describe biometric identification system and its accuracy metrics (PO-1&PSO-1)
2. Illustrate biometric finger print technology and various interpretation algorithms (PO-5,6&PSO-1)
3. Illustrate Face recognition, Iris scan technology and various interpretation algorithms (PO-1,5,6 & PSO1)
4. Interpret and compare retina scan, hand scan and behavioral biometrics (PO-1,4,5 &PSO- 1)
5. Usage of biometric identification or verification system in different security systems (PO1,3,6 &PSO-1)

BIO-MEMS

Course Code: MLE54 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course coordinator(s): Dr. N. Sriraam, Mrs. Tejaswini. S

Course contents:

UNIT- I

MEMS and Microsystem: History of MEMS, Materials in MEMS, Silicon Piezo resistors, Ga As, quartz, polymer. Micromachining- Lithography, thin film deposition, ION Implantation, Diffusion, Oxidation, Chemical and Physical vapour Deposition, Sputtering, Deposition by epitaxial, etching

UNIT- II

Microsensors and Actuators: Mechanics for MEMS design - Static bending of then plates, mechanical vibration, thermomechanics, fracture and thin film mechanics. Mechanical sensors and actuators -beam and cantilever, microplates. Thermal sensors and actuators micromachined thermocouple probe, peltier effect heat pumps, thermal flow sensors.

UNIT- III

Physical Micro Sensors: Design of Acoustic Wave sensor, resonator sensor, Capacitive and Piezo resistive pressure sensor.

UNIT- IV

Microactuators: Design of Actuators: Actuation based on thermal forces, Actuation using Shape Memory alloys, Actuations using piezoelectric crystals, Actuation using electrostatic forces (Parallel plate, torsion bar, comb drive actuators). Micromechanical motors and pumps.

UNIT -V

Micro Fluidics Systems: Fluid Dynamics, laminar flow in circular conduits. fluid flow in micro and nano conduits. Microscale fluid flow - expression for liquid flow in channel, fluid actuation methods, dielectrophoresis, micro fluid dispenser, microneedle, micropumps - continuous flow systems.

Text Book/s:

1. Tai-Ran Hsu. MEMS and Microsystems, Design Manufacturing and Nanoscale engineering.

Reference Book:

1. G.K. Anantasure, K.J.Vinoy, S.Gopala Krishnan, K.N. Bhat, V.K. Aatre. Micro and Smart

Course outcomes (COs):

At the end of the course, students will be able to

1. Discuss the basic material s used in MEMs and Microsystems (PO-1 & PSO-1)
2. Explain the various sensors and actuators used in MEMS.(PO-1&PSO-1)
3. Implementation of physical Micro Sensors.(PO-1 &PSO-1)
4. Explain the design of actuators based on different techniques .(PO-1 & PSO-1)
5. Discuss the properties & types of Micro fluidic systems .(PO-&PSO-1)

INFRARED IMAGING & APPLICATIONS

Course Code:MLE55 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course coordinator(s): Dr.Sharath.D , Dr. N. Sriraam

Course contents:

UNIT -I

Introduction to thermography: History and evolution of thermography, Electromagnetic Spectrum, Principles of black body radiation laws: Blackbody, Plank's law, Wien's displacement law, Stefan Boltzmann Law, Emissivity, Kirchoff's law, IR absorption characteristics, Radiometric measurements.

UNIT– II

Heat Transfer Mechanisms and measurements: Heat and Temperature, Heat Transfer Mechanism, Principle of Conduction, Convection and Radiation, Temperature measurements: Contact and Noncontact.

UNIT – III

Principle of Infrared Camera: Optics, Detectors, Scanning and Imaging, Detector performance parameters: Responsivity, Noise Equivalent Power, Specific detectivity, System performance parameters: Temperature range, Accuracy, Thermal sensitivity, 4 Bar Target, MRTD, MDTD, Calibration of IR camera.

UNIT - IV

Advanced Methods and Approaches: Spectrally Resolve IR Imaging, Super framing, IR Imaging Software, Processing of IR Images, IR Camera Operation, Passive Thermography, Active Thermography.

UNIT– V

Applications: Standards and Procedures, Diagnosis and Monitoring of Pain-Acupuncture-Breast Thermography and Detection of Breast Cancer-Other Medical Applications-Raynaud's Phenomenon- Pressure Ulcers

Text Book/s:

1. Michael Vollmer, Klaus-Peter Mollmann ,Infrared Thermal Imaging: Fundamentals, Research and Applications, John Wiley, 2010.
2. Holst, Gerald C. Common sense approach to thermal imaging. Washington, DC, USA: SPIE Optical Engineering Press, 2000.

Reference Books:

1. F Ring, A Jung and J Żuber, Infrared Imaging. IOP,USA, 2015.
2. Nicholas A. Diakides, Joseph D. Bronzino, Medical Infrared Imaging, CRC Press,2007
3. Xavier P.V. Maldague, Nondestructive Evaluation of Materials by Infrared Thermography, Springer Science & Business Media, 2012

Course outcomes (COs):

At the end of the course, students will be able to

1. Understand the fundamentals of infrared imaging (PO-1,2 &PSO-1)
2. Apply the temperature measurements for various applications. (PO-1,2 &PSO-1)
3. Demonstrate the working operation of IR Camera (PO-1,2,3 &PSO-1,2)
4. Analyze the various thermography technique procedure (PO-2,4,5&PSO-2)
5. Demonstrate the thermography imaging procedure for various clinical Applications (PO-2,3,5&PSO-3)

POINT-OF-CARE TESTING

Course Code: MLE56 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr.Prabha Ravi, Dr.Vani Damodaran

Course contents:

UNIT I

INTRODUCTION: Definitions and areas of application-The relevance of POCT in healthcare-Device classes-Pre- and post-analytical phases-Analytical methods, biosensor technology

UNIT II

LAB BASED TESTS: Laboratory coagulation tests- Analysis of cellular blood components-Clinical chemistry parameters-Immunological methods-Molecular biological tests

UNIT III

NON INVASIVEANALYSIS: Non-invasive analysis-Diabetes diagnostics including analytical methods for glucose monitoring- Continuous monitoring of metabolic parameters-Blood gas analysis and disorders of acid-base balance – including analytical methods

UNIT IV

Other APPLICATIONS: Emergency medicine-Neonatology-High-performance and elite sports- POCT in obstetrics and gynecology

UNIT V

Device Legislation and POCT Liability: Medical device legislation and POCT-Liability issues relating to POCT-POCT and data management-Patient safety and POCT

Text Book:

1. Point-of-care testing: Principles and Clinical Applications,Editors: **Luppa**, Peter, **Junker**, Ralf (Eds.),Springer, 2018

Reference Book:

1. A Practical Guide to Global Point-of-Care Testing1st Edition,byMark Shephard (Editor) , CSIRO Publishing,2017

Course Outcomes (COs):

At the end of the course, students will be able to

1. Realize the importance of POCT in healthcare and salient liability, device legislation-oriented issues and device classes in POCT (PO-1,6,7 & PSO-1)
2. Emphasize the various analytical methods, biosensors and laboratory tests useful in diagnosis (PO-1,2,4 & PSO-1,2)
3. Elaborate the various clinical parameters and testing (PO-2,4 & PSO-1,2)
4. Emphasize on the non-invasive approaches for diagnosis of various conditions (PO-1,2,4 & PSO-2)
5. Elaborate on the important practical applications of POCT (PO-3,5,12 & PSO-3)

D &T EQUIPMENT & APPLICATIONS LAB

Course Code : MLL74 **Credit: 0:0:1:0**
Prerequisites: NIL **Contact Hours: 28**
Course Coordinator(s): Dr. Sanjay H S, Mrs. Prabhu Ravikala Vittal

Course contents:

1. Simulation of ECG waveform and the analysis of the characteristic features
2. Acquisition of ECG signals using a 12-lead ECG acquisition system setup and to assess the different physiological conditions of the same
3. Assessment of ECG and pulse and the detection of the regularity of the pulse signals
4. Simulation of EEG waveform and the assessment of their characteristic features
5. Acquisition of EEG signals using a standard 10-20 position system and the assessment of the different bands of EEG
6. Simulation of EMG waveforms and the assessment of their characteristic features
7. Assessment of motor nerve conduction velocity based on the EMG signals
8. Assessment of the hearing threshold using audiometer and the physiological aspects associated
9. Usage of spirometer to ascertain different parameters related to breathing
10. Assessment of the functional as well as the therapeutic aspects of a defibrillator
11. Assessment of different functional as well as therapeutic aspects of haemodialysis machine
12. Development of a Hodgkin Huxley neuronal model and the design of the equivalent electrical circuit for analysis

Text Books

1 R.S. Khandpur "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw Hill Publications.

2. John G Webster, "Medical Instrumentation-Application and design", 3rd edition, John Wiley Publications**.**

Reference Books

3. Joseph D. Bronzino, "Medical Devices and Systems - The Biomedical Engineering Handbook", Third Edition – CRC Press, 2006.

4. Carr & Brown, "Introduction to Biomedical equipment technology, 4th edition, Pearson publications

Course Outcomes

On completion of this course, the students shall

1. Illustrate the applications of various biomedical signals from a diagnostic perspective (PO 1,2,4,12)
2. Diagnose various physiological aspects of human body with the aid of biomedical equipment (PO 2,3)
3. Calculate the necessary therapeutic parameters using biomedical equipment in order to help in various therapeutic approaches (PO 1,4,5,12)

OPEN ELECTIVES

INTRODUCTION TO MEDICAL INSTRUMENTATION

Course Code:MLOE01 **Credit: 3:0:0:1**
Pre-requisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.Sanjay H S, Mrs. Purnima B R

Course contents:

UNIT I

Measurement Systems: Introduction to biomedical engineering, the need for bioinstrumentation, instrumentation system, system characteristics, Errors in measurements, statistics.
Basic concepts of Electronics: Electronic components and circuit analysis, Amplifiers, Filters,ADC& DAC, Digital signal processing, microcomputers, software and programming languages, display devices, recording devices.

UNIT II

Clinical Lab Instruments: Spectrophotometry, oxygen saturation, bilirubin, lactate, creatinine, urea, Amperometric Biosensors for oxygen and glucose, Flame Photometry, Mass Spectrometry, Carbon dioxide concentration measurement by infrared transmission spectroscopy, Nitrogen by emission Spectrometry, Drugs by Flurometry and Chromatography, Electrophoresis, DNA sequencing.

UNIT III

Diagnostic Instruments: Cell potential, Brain, EEG & evoked potentials, Brain imaging: X-ray, CT, MRI. Nuclear imaging: SPECT, PET, Bio-magnetism. Eye-ERG, EOG & visual field, Ears & Audiometry, Muscles.

UNIT IV

Heart & Circulation: Cardiac anatomy & physiology, Cardiac bio-potentials, Cardiac pressures, cardiac output, Radionuclide angiography, Cardiac sounds, myocardial viability, circulation, blood flow, blood pressure, vessel distension, vessel volume flow.

UNIT V

Electrical safety: Physiological effects of electricity, important susceptibility parameters, distribution of electric power, macroshock hazards, microshock hazards, electrical safety codes & standards, basic approaches to protection against shock, equipment design, electrical safety analyzers, tests of electric appliances.

Text Book/s:

1. Bioinstrumentation by John G. Webster, John & Wiley publications- 2009.
2. Medical Instrumentation – applications & Design by John G. Webster, John & Wiley publications- 2009

Reference Book:

1. Biomedical Instrumentation & Measurements, 2e, PHI/Pearson Education by Cromwell et. al.(2011)

Course outcomes (COs):

At the end of the course, students will be able to

1. Reminisce the basics of instrumentation and relate the same to medical equipments used in healthcare (PO-1,2,4,6,12, &PSO-1,2,3)
2. Explore the features involved with the generation and applications of bioelectric potentials (PO-2,3 &PSO-1)
3. Accent the working and uses of biotelemetry in hospitals (PO-1,3,5,12 &PSO-1,2,3)
4. Quote the fundamentals of instrumentation and comprehend the features of electrical safety in medical equipments (PO-2,3,5 &PSO-1,2)
5. Emphasize on the recent trends in computers and their applications in healthcare (PO-1,4,5,6,12 & PSO1,2,3)

BIOMECHANICS

Course Code: MLOE02 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.Sanjay H.S, Mrs. Tejaswini. S

Course contents:

UNIT I

Introduction to Biomechanics: A brief history of biomedical fluid mechanics, Fluid characteristics & viscosity, Fundamental methods to measure viscosity, Pipe flow, Bernoulli Equation, Mass conservation, Fluid statistics

UNIT II

Exercise Biomechanics: Introduction, Physics of movement, Energy cost of movement, Walking & running, Carrying loads, Sustained work

UNITIII

Application of Aerodynamics in Sports: Introduction, Lateral force on the spinning ball of a soccer kick, Analysis of soccer kick, Analysis of basketball foul throw

UNIT IV

Application of hydrodynamics in swimming: Buoyancy & flotation, Resistance & propulsion, Resistive & Propulsive forces in swimming, Swimming efficiency & speed

UNIT V

Fundamental concepts of Gait: gait cycle, Gait phases, Gait variables, Gait analysis: Observational techniques, Instrumental analysis, Video based analysis, electromagnetic & Electromyographic analysis

Textbook/s:

1. Duane Knudson, “Fundamentals of Biomechanics”, 2nd edition, Springer publications, 2007

Reference Book:

1. Lee Waite, Jerry Fine, “Applied Biofluid Mechanics”, McGraw Hill publications, 2007 edition
2. Arthur T Johnson, “Biomechanics & exercise physiology”, John Wiley & Sons publications
3. Dhanjoo N Ghista, “Applied Biomedical Engineering Mechanics”, CRC Press, 2008 edition
4. Anthony Blazevich, “Sports Biomechanics – Optimizing human performance”, A & C Black Publications, 2007 edition
5. Donald R Peterson, Joseph D Bronzino, “Biomechanics-Principles & Applications”, CRC press, 2008 edition

Course outcomes (COs):

At the end of the course, students will be able to

1. Recall the basic mechanical concepts and relate the same to human physiology (PO-,12 &PSO-1)
2. Interpret the biomechanical concepts involved with exercise physiology and its importance in healthcare (PO2,PO5,PO12,PSO2)
3. Understand and apply the basics of biomechanics to illustrate the aerodynamics in sports (PO-1,3,4 & PSO-2)
4. Correlate the biomechanical aspects of human body to evaluate the hydrodynamics in swimming (PO-1,2,5,12 &PSO-2)
5. Comprehend the basics of biomechanics and apply the same to basics of gait (PO-1,2,4,12 &PSO-1)

HOSPITAL MANAGEMENT

Course Code:MLOE03 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator(s): Dr.Prabha Ravi, Mr. S J Mahendra

Course contents:

UNIT I

Introduction to Hospital Management & Administration: Introduction, definition, classification, nature and scope of a hospital, difference between a hospital and an industry, functions of a hospital, hospital ethics, leadership, challenges in hospital administration, administrative conditions in hospitals, branding emotions, succession planning, feedback in planning, branded benefits

UNIT II

Human Resource Management in Hospitals: Introduction, nature/characteristics & assumptions, fundamental principles, utilization factors, outsourcing, retention of top performers, characteristics of HR management, development & personal management, functions and importance of HR management, machines v/s human resources in hospitals, causes for poor HR management, good HR practices,

UNIT III

Man Power Planning: introduction, nature & scope of man power planning, need for man power planning, Benefits of manpower planning, objectives of manpower planning, manpower planning steps, work load ratio
Recruitment: introduction, recruitment, selection, induction, confirmation, probation & termination

UNIT IV

Organizational Development & Management by Objectives (MBO): nature & scope, goals and characteristics, phases and limitations, definition & need for MBO, establishment of objectives, appraisal interview, practice, limitations and advantages of MBO
Communication in Hospitals: Introduction, nature and scope, purpose, barriers, planning communication, effective communication, directions, styles and modes of communication

UNIT V

Counseling in Hospitals: Introduction, nature and scope, role of listening, counseling service, effective listening, types, techniques and functions of counseling

Biomedical Waste Management in Hospitals: Introduction, environmental act 1986, hazardous waste rules 1989, the municipal solid waste rules 2000, the Bio-medical waste rules 2000

Text Book/s:

1. D K Sharma & R C Goyal, Hospital Administration & Human Resource Management, PHI 5th edition (2013)
2. A V Srinivasan, Managing A Modern Hospital, SAGE publications, 2nd edition (2008)

Reference Books:

1. Robert Carroll, Risk Management for Healthcare Organizations, Wiley Publications, 2009 edition
2. Kenneth G Simone, Hospitalist recruitment & Retention, Wiley Publications, 2010 edition

Course outcomes (COs):

At the end of the course, students will be able to

1. Explain and compare the organizational elements, structure, performance, terminology, and delivery modalities for Indian. and global healthcare systems. (PO-1,6,7 &PSO-2)
2. Understand and apply resource management concepts (personnel, finance, and material resources) and the processes and strategies needed in specific hospital sectors. (PO-7,11 &PSO-2)
3. Develop innovative solutions to strategic, tactical and operational issues in managing healthcare systems and associated information technology through the combined use of information, organizational knowledge, talent management and critical thinking. (PO-5,7& PSO-2)
4. Apply modern change management and innovation management concepts to optimise structures as well as communicate effectively and develop their leadership and teambuilding abilities. (PO-9,12 &PSO-3)
5. Evaluate the ethical, legal, and regulatory requirements of the healthcare industry towards counselling in hospitals and the biomedical waste management. (PO-6,8&PSO-3)