CURRICULUM

for the Academic year 2019 – 2020

MEDICAL ELECTRONICS

VII & VIII SEMESTER B.E

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

Ramaiah Institute of Technology (RIT) (formerly known as M. S. Ramaiah Institute of Technology) is a self-financing institution established in Bangalore in the year 1962 by the industrialist and philanthropist, Late Dr. M S Ramaiah. The institute is accredited with “A” grade by NAAC in 2014 and all engineering departments offering bachelor degree programs have been accredited by NBA. RIT is one of the few institutes with prescribed faculty student ratio and achieves excellent academic results. The institute was a participant of the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. All the departments have competent faculty, with 100% of them being postgraduates or doctorates. Some of the distinguished features of RIT are: State of the art laboratories, individual computing facility to all faculty members. All research departments are active with sponsored projects and more than 304 scholars are pursuing PhD. The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus. RIT 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 over 1,35,427 books with subscription to more than 300 International and National Journals. The Digital Library subscribes to several online e-journals like IEEE, JET etc. RIT is a member of DELNET, and AICTE INDEST Consortium. RIT has a modern auditorium, several hi-tech conference halls and all are air-conditioned with video conferencing facilities. It has excellent hostel facilities for boys and girls. RIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association. RIT obtained Academic Autonomy for all its UG and PG programs in the year 2007. As per the National Institutional Ranking Framework, MHRD, Government of India, Ramaiah Institute of Technology has achieved 64th rank in 2019 among the top 100 engineering colleges across India.
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
MSRIT 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
# Curriculum Course Credits Distribution

## Batch 2016-2020

<table>
<thead>
<tr>
<th>Semester</th>
<th>Humanities &amp; Social Sciences (HSS)</th>
<th>Basic Sciences / Lab (BS)</th>
<th>Engineering Sciences/ Lab (ES)</th>
<th>Professional Courses- Core (Hard core, soft core, Lab) (PC-C)</th>
<th>Professional Courses - Electives (PC-E)</th>
<th>Other Electives (OE)</th>
<th>Project Work (PW)</th>
<th>Internship/ other activities (IS/ECA)</th>
<th>Total semester load</th>
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# SCHEME OF TEACHING VII SEMESTER

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<th>Contact Hours</th>
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<tr>
<td>1.</td>
<td>ML71</td>
<td>Diagnostic &amp; Therapeutic Equipment &amp; Applications</td>
<td>PC-C</td>
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<td>ML72</td>
<td>Medical Imaging Systems</td>
<td>PC-C</td>
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<td>ML73</td>
<td>Neural Networks and its Applications</td>
<td>PC-C</td>
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<td>MLE3X</td>
<td>ELECTIVE GROUP III</td>
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| Total  |             |                                                 |          | 21      | 27            |

L: Lecture, T: Tutorial, P: Practical, S: Seminar
### ELECTIVE GROUP-III

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<td>Fundamentals of Health Interoperability</td>
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<td>Human Assist Devices</td>
<td>PC-E</td>
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<td>Pharmacology &amp; Drug Delivery System</td>
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<td>Computer Communication Networks</td>
<td>PC-E</td>
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<td>Speech Signal Processing</td>
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<td>Advanced Medical Instrumentation Technology</td>
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<td>Analytical Instrumentation</td>
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<td>Smart Wearable Systems</td>
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<td>Pattern Recognition</td>
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## ELECTIVE GROUP-V

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<td>Digital Video Processing</td>
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<td>Multimedia Applications</td>
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<td>Point of Care</td>
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### SCHEME OF TEACHING VIII SEMESTER

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### Additional Courses

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<th>Sl. No.</th>
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<td>1</td>
<td>MLOE01</td>
<td>Introduction to Medical Instrumentation</td>
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<td>MLOE03</td>
<td>Hospital Management</td>
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VII Semester

DIAGNOSTIC & THERAPEUTIC EQUIPMENT & APPLICATIONS

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

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
Respiratory Equipment: Respiratory system modelling, pressure measurements, gas-flow rate detection, lung volume, respiratory plethysmography, respiratory mechanics related tests, gas concentration measurements, gas transport tests.
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

Medical Laboratory Equipment: Non-invasive blood gas monitoring, blood glucose sensors, spectrophotometry, automated chemical analyzers, chromatology, electrophoresis, haematology

Text Books

Reference Books

Course Outcomes (COs):
At the end of the course, students will be able to
1. Accent the design and working of cardiac equipments (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 respiratory equipments in healthcare (PO-1,3,12 & PSO-1,3)
4. Recognize the need for neurological equipments 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
Prerequisite: Nil
Credit: 4:0:0:0
Contact Hours: 56
Course Coordinator(s): Mrs. 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 IV

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: DEXA, fMRI, Optical Coherence Tomography, Advanced Imaging Techniques in Clinical Pathology, Multimodal Imaging.
Text Book/s:
4. Introduction to Medical Imaging: Physics, Engineering and Clinical Applications (Cambridge Texts in Biomedical Engineering) 1st Edition by Nadine Barrie Smith (Author), Andrew Webb (Author)

Reference Books:
2. 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)
Course contents:

UNIT I


UNIT II

Pattern association: Training Algorithms for Pattern Association Heteroassociative Memory Neural Network, Autoassociative Net, Iterative Autoassociative Net, Bidirectional Associative Memory (BAM)

UNIT III


UNIT IV

Neural networks based on competition: Fixed-Weight Competitive Nets, Kohonen Self-Organizing Maps, Learning Vector Quantization, Counter propagation

UNIT V

All networks will be demonstrated using MATLAB/SCILAB

Text book/s:
1. Laurene Fausett, ”Fundamentals Of Neural Networks”, Pearson, 2013
Reference Books:


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 competition based learning algorithms (PO-5 &PSO-2)
5. Analyze the importance of resonance based network learning algorithms (PO-4 &PSO-1)
PHYSIOLOGICAL SYSTEM MODELLING

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

Course contents:

UNIT I


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:

Reference Books:

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)
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:


Reference Book:

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. Need and significance of the full spectrum of viii Foreword applications. (PO-2,6,12 & PSO-2)
3. The International Healthcare Technology Standards (PO-5,,7,8 &PSO-3)
4. Understanding of Health Level Seven standards (PO-1,2 & PSO-1)
5. Focusing on HL7 and SNOMED CT, he includes much useful information on other standards and other organizations. (PO-1,2 & PSO-1)
HUMAN ASSIST DEVICES

Course Code: MLE33
Prerequisite: Nil
Course Coordinator(s): Prof.P.G.Kumaravelu, Dr. Sanjay H S

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


UNIT IV


UNIT V

Text Book/s:

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 assistivedevices 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.Srikaam, 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:

Reference Books:

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)
UNIT I

Medical device safety and related ISO Standards:

UNIT II

Medical Device Classification and standards:

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 Global overview and guiding principles (WHO)Geneva Latin American Medical Device Regulations: Patricia M. Flood

Reference books:

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
Prerequisite: Nil
Course Coordinator(s): Dr.N.Sriraam, Mrs.Purnima B R

Course contents:

UNIT I


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


UNIT IV

UNIT V

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


Text Book/s:

1. Introduction to Ergonomics by R S Bridger, Rout ledge Taylor & Francis group, London,2008

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

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)
Course contents:

UNIT I


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:

Reference Book:
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)
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.

Text Book/s:
1. Digital Processing of speech signals, L R Rabiner & R W Schafer, Pearson Education 2004

Reference Book:
1. Introduction to data compression, Khalid Sayood, 3rd edition, Elsevier 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

**Intensive care and coronary** units: Special care units, ICU equipments, Bedside monitors, monitor circuits, central monitoring consoles, telemetry

**Operating rooms:** surgery, types of surgeries, Operating room personnel, sterilization, Operating room equipment

UNIT II

**Electro surgery generators:** electro surgery machines, electro surgery circuitry, safety and testing of electro surgery units

**Battery operated devices:** nickel cadmium batteries, battery capacity, charging protocols, battery memory, battery maintenance, multiple cell batteries, other batteries

UNIT III

**Waveform display devices:** permanent magnet moving coil instruments, PMMC writing systems, servo recorders and recording potentiometers, X-Y recorders, problems in recorder design, maintenance of PMMC writing styluses and pens, dot matrix analog recorders, oscilloscopes, medical oscilloscopes, multibeam oscilloscopes

UNIT IV

**Computers in Biomedical equipments:** computer hardware and software, programming languages, interfaces, analog to digital connect, modern communication, signal processors, microcomputers vs mainframes, interactive databases, limitations of computers, viruses, supercomputers, neural networks and computing, internet and its uses, expert systems, workstations, computers in laboratory instrumentation

UNIT V

**Electromagnetic interference to medical equipment:** Introduction, types and sources of EMI, fields, EMI effects, standards, regulations and laws, EMI mitigation, intermodulation, TVI and signal overload issues, ECG equipment and EMI, EMI to biomedical sensors
Text Book/s:

Reference Books:

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 instrumentation aspects in ICUs and OTs. (PO-1,2,4,12 & PSO-1)
2. Explore the techniques and instrumentation based approaches involved in Electrosurgery units and battery operated devices(PO-2,3,6 & PSO-1,2)
3. Accent the construction, working and uses of different types of waveform display devices(PO-1,3,5,12 & PSO-1,2)
4. Quote the fundamentals of instrumentation and comprehend the features of computers in the field of biomedical instrumentation(PO-2,3,5 & PSO-1,2)
5. Emphasize on the approach to resolve the issues related to electromagnetic interference to medical equipment(PO-1,4,5,6 12 & PSO-1,2)
ANALYTICAL INSTRUMENTATION

Course Code: MLE44
Prerequisite: Nil
Course Coordinator(s): Prof.P.G.Kumaravelu, 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 fluorescence, 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:

Reference Books:


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)
Course contents:

UNIT -I


UNIT -II


UNIT -III

UNIT -IV


UNIT -V


Text Book/s:


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
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.Sriaram

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


UNIT III


UNIT IV

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:

Reference Books:

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)
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:


Reference Book:

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


UNIT III


UNIT IV

What You Need: Software: Text Editing and Word Processing Tools, OCR Software, Painting and Drawing Tools, 3-D Modeling and Animation Tools,

UNIT V


Text Book/s:

Reference Books:
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

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
Text Book/s:

Reference Books:
2. For more details, visit [Http://www.jntu.ac.in](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)
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 thin 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

**MicroFluidics 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:

Course outcomes (COs):
At the end of the course, students will be able to
1. Discuss the basic materials 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-1 & PSO-1)
Course contents:

UNIT - I


UNIT – II


UNIT – III


UNIT - IV


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:

Reference Books:

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): Mrs. 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 INVASIVE ANALYSIS: 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:

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

Course contents:
1. Acquisition of ECG using modules and Equipment
2. Acquisition of EEG using EEG system
3. Assessment of nerve conduction velocity using EMG
4. Acquisition and analysis of heart sounds with the aid of biopac module
5. Usage of spirometer to access the breathing parameters
6. Usage of audiometry in healthcare
7. Usage of spectrophotometers in laboratory applications
8. Demonstration of Defibrillators, ventilators

Text Books

Reference Books

Course Outcomes (COs):
At the end of the course, students will be able to
1. Accent the basics of diagnostic and therapeutic equipments used in healthcare (PO-1,2,4 &PSO-1)
2. Comprehend the importance of various biological parameters acquired using biomedical equipments in diagnostic applications (PO-3,12 & PSO-1,3)
3. Work in multi disciplinary teams (PO-9&PSO-1,3)
OPEN ELECTIVE

INTRODUCTION TO MEDICAL INSTRUMENTATION

Course Code: MLOE01
Credit: 3:0:0:1
Pre-requisite: Nil
Contact Hours: 42
Course Coordinator(s): Prof. P.G. Kumaravelu, 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 Fluorometry and Chromatography, Electrophoresis, DNA sequencing.

UNIT III


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

Body Temperature, Heat, Fat & Movement Measurements: Regulation of body temperature, clinical temperature measurement, Measurement of body heat-calorimetry, Measurement of body fat, Measurement of body movement. 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:

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)
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

UNIT III

**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:


Reference Book:

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)
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 Biomedical waste rules 2000

Text Book/s:

Reference Books:

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)