RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2020 – 2021

MEDICAL ELECTRONICS

V & VI 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

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 2018-2022

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	-	9	11	-	-	-	-	-	**20**
Second	2	8	10	-	-	-	-	-	**20**
Third	-	4	3	18	-	-	-	-	**25**
Fourth	-	7	-	18	-	-	-	-	**25**
Fifth	3	-	-	15	3	3	-	--	**24**
Sixth	-	-	-	11	6	3	4	-	**24**
Seventh	3	-	-	10	6	-	-	1	**20**
Eighth	-	-	-	-	-	-	14	3	**17**
Total	**8**	**28**	**24**	**72**	**15**	**6**	**18**	**4**	**175**

SCHEME OF TEACHING

V SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1	ML51	Medical Physics	Medical Electronics	3	1	0	4	5
2	ML52	Biomedical Instrumentation II	Medical Electronics	4	0	0	4	4
3	ML53	Biomedical Image Processing	Medical Electronics	3	1	0	4	5
4	ML54	IPR and Medical Ethics	Medical Electronics	3	0	0	3	3
5	MLE55x	Professional Elective-I	Medical Electronics	0	2	1	3	3
6	MLOExx	Open Elective - I	Medical Electronics	3	0	0	3	3
7	MLL56	Medical Physics Lab	Medical Electronics	0	0	1	1	2
8	MLL57	Biomedical Instrumentation I Lab	Medical Electronics	0	0	1	1	2
9	MLL58	Biomedical Signal Processing Lab	Medical Electronics	0	0	1	1	2
Total				**19**	**02**	**03**	**24**	**29**

PROFESSIONAL ELECTIVE -I

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLE551	Introduction to PCB fabrication	PC-E	0	2	1	0	3	3
2	MLE552	Virtual Instrumentation	PC-E	0	2	1	0	3	3
3	MLE553	IOT for healthcare applications	PC-E	0	2	1	0	3	3
4	MLE554	Introduction to 3D Printing	PC-E	0	2	1	0	3	3
5	MLE555	Introduction to Cloud Computing in Health Care	PC-E	0	2	1	0	3	3

OPEN ELECTIVE - I

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

VI SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1	ML61	Biostatistics	Medical Electronics	3	1	0	4	5
2	ML62	Real-time Processors and Applications	Medical Electronics	3	1	0	4	5
3	MLE63x	Professional Elective - II	Medical Electronics	3	0	0	3	3
4	MLE64x	Professional Elective - III	Medical Electronics	3	0	0	3	3
5	ML65	Mini Project/Elective/ NPTEL Course	Medical Electronics	0	0	4	4	8
6	MLOExx	Open Elective - II	Medical Electronics	3	0	0	3	3
7	MLL66	Bio-Medical Instrumentation II Lab	Medical Electronics	0	0	1	1	2
8	MLL67	Biomedical Image Processing Lab	Medical Electronics	0	0	1	1	2
9	MLL68	Real-time Processors Lab	Medical Electronics	0	0	1	1	2
Total				**15**	**02**	**07**	**24**	**32**

PROFESSIONAL ELECTIVE - II

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLE631	Medical Optics	PC-E	3	0	0	0	3	3
2	MLE632	Biometrics	PC-E	3	0	0	0	3	3
3	MLE633	Biosensors	PC-E	3	0	0	0	3	3

4	MLE634	Core Java	PC-E	3	0	0	0	3	3
5	MLE635	Grid Computing	PC-E	3	0	0	0	3	3

PROFESSIONAL ELECTIVE - III

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLE641	Telemedicine	PC-E	3	0	0	0	3	3
2	MLE642	Speech processing and its applications	PC-E	3	0	0	0	3	3
3	MLE643	Wearable Electronics and Computing	PC-E	3	0	0	0	3	3
4	MLE644	Hospital Management	PC-E	3	0	0	0	3	3
5	MLE645	Data Mining for Medical Applications	PC-E	3	0	0	0	3	3

OPEN ELECTIVE - II

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MLOE04	Biosafety & Healthcare	PC-E	3	0	0	0	3	3
2	MLOE05	Introduction to Thermal Imaging	PC-E	3	0	0	0	3	3
3	MLOE06	Health Informatics	PC-E	3	0	0	0	3	3

V semester

MEDICAL PHYSICS

Course code: ML51
Credits: 3:1:0 **Contact hours: 42+14**
Course Coordinators: Dr Prabha Ravi, Dr Sanjay H S

Course contents

UNIT I

Introduction to Medical Physics: Metabolism in human body: Conservation of energy and heat flow, Energy content of body fuel: Metabolizable energy, energy storage, Energy storage molecules: Production of ATP, usage of ATP, Metabolic rates, loss of body heat, Body temperature

UNIT II

Physics of fluid flow in human body: Characteristic pressures in the body, basic physics of pressure and flow of fluids, diffusion, pressure and flow in the body, motion of humans in fluid

UNIT III

Physics of speech and hearing: Physics of sound waves, speech production and the physics involved, physics of human hearing, other vibrations in the body

UNIT IV

Physics of light and vision: structure and focusing elements of the human eye, imaging and detection by the eye, vision impairment, visual perception, vision in other animals

UNIT V

Electrical and magnetic properties in human body: electrical properties of body tissues, nerve conduction, Ion Channels, Hair Cells, Balance, Taste, and Smell, Electrical Properties of the Heart, Electrical Signals in the Brain, Effects of Electric Shock, Magnetic Properties, Electromagnetic Waves

Text Books

1. Irving P Herman, “Physics of the human body”, Springer publications, 2016

Reference Books

1. Paul Davidovits, "Physics in biology and medicine", 5th edition, Academic press, New York, 2018

Course Outcomes (COs):

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

1. Identify and relate the different organs and their functions in a human system. (PO 1,2,3,6 ; PSO1,2)
2. Demonstrate their knowledge on the concepts and of physiological activities: metabolism of the human body, hemodynamic systems, sound and hearing, vision and electromagnetic properties. (PO1,2,3,7;PSO1,2)
3. Apply the behaviour of the importance of the specific physiological activities. (PO1,2,5,8;PSO1,2)
4. Analyse the methods and standards by which measurements and evaluation of the physical characteristics of physiological activities of the human system and evaluation of the physical characteristics of physiological activities of the human system. (PO1,2,3,9;PSO1,2,3)
5. Apply their physics experience and knowledge to analyze new physical situations and to solve physics problems using the appropriate methods in mathematical, theoretical and computational physics. (PO2,6,7,8;PSO2.3)

BIOMEDICAL INSTRUMENTATION II

Course code: ML52
Credits: 4:0:0 **Contact hours: 56**
Course Coordinators: Dr Sanjay H S, Mrs Chandana S

Course contents

UNIT I

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 analyzer

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. John G Webster, "Medical Instrumentation-Application and design", 4th edition, John Wiley Publications, 2009
2. R S Khandpur, "Handbook of biomedical instrumentation", 3rd edition, McGraw Hill publications, 2014

Reference Books

1. Joseph D. Bronzino, "Medical Devices and Systems – The Biomedical Engineering Handbook", 3rd Edition – CRC Press, 2006.
2. Carr & Brown, "Introduction to Biomedical equipment technology, 4th edition, Pearson's publications, 2001

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 respiratory 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)

BIOMEDICAL IMAGE PROCESSING

Course code: ML53
Credits: 3:1:0 **Contact hours: 42+14**
Course Coordinators: Dr C K Narayanappa, Dr Basavaraj V Hiremath

Course contents

UNIT I

Introduction: Objectives of Biomedical Image analysis, Computer aided diagnosis, and importance of biomedical image analysis. Image quality – difficulties in image acquisition, analysis, characterization of image quality, digitization of images, Optical density, dynamic range, contrast, histogram, resolution, signal-to-noise ratio, Error bases measures and measure of Acutance. Characterization of artifacts and its removal, synchronized or multiframe averaging, spatial domain and frequency domain filters, Wiener filtering, Application: Nuclear medicine.

UNIT II

Image enhancement: Temporal subtraction, gray-scale transforms, histogram transforms, convolution mask operators, high frequency emphasis, homomorphic filtering for enhancement, adaptive contrast enhancement. Applications: Contrast enhancement of Mammograms.

UNIT III

Image segmentation: Fundamentals, detection of isolated points, lines and edge detection, thresholding: Global and Optimal, segmentation: region growing, splitting, merging, detection of objects of known geometry: Hough transform used in detection of straight lines. Application: Detection of the breast boundary in mammograms using traditional active deformable contour model

UNIT IV

Image Matching and Image fusion techniques: Image Geometry, Registration, Geometric Transformation and Match measurement. Image fusion – Types: multi-view fusion, multi-modal fusion, multi-temporal fusion, multi-focus fusion, Classifications: pixel level, feature level and decision level fusion. Application : Digital subtraction angiography

UNIT V

Representation, Description and Recognition: Representation Schemes, Conversion between Representation, Geometric property measurement, Properties and Models

related to Description. Pattern recognition: Patterns and pattern classes, recognition based on decision theoretic methods, structural methods.

Text Books

1. R C Gonzalez & R E Woods, Digital Image Processing, Pearson Education, 4th edition, 2018
2. Rangaraj M. Rangayyan, Biomedical Image Analysis, CRC Press, 2004

Reference Books

1. Wolfgang Birkfellner, Applied Medical Image Processing: A Basic Course, 2010
2. Taylor & Francis, Richard A. Robb "Biomedical Imaging, Visualization, and Analysis", John Wiley & Sons, 1999.
3. Azriel Rosenfeld & Avinash G Kak, "Digital Picture Processing", Academic press, Volume 1 & 2

Course Outcomes (COs):

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

1. Acquire a basic understanding of the important concepts related to medical image processing. (PO-1,2, PSO-1)
2. Identify and formulate the various artifacts associated with medical images and eliminate the same. (PO-1,2,3, PSO-1,2)
3. Recognize and apply various segmentation techniques for medical images (PO-1,2,3, PSO 1,2)
4. Understand the steps of image registration and fusion and their applications. (PO-12,3, PSO1,2)
5. Assess the various types of descriptors used in feature extraction of images. (PO-1,2,3. PSO-1,2)

IPR AND MEDICAL ETHICS

Course code: ML54
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr Prabha Ravi, Dr Vani Damodaran

Course contents

UNIT I

Basic principles of IPR laws: Introduction , History of IPR-GATT,WTO,WIPO & TRIPs ,Role of IPR in Research & Development & Knowledge era ,Concept of property, Marx's theory of property, Constitutional Aspects of Intellectual property ,Different forms of IPR – Overview, copyright, trademarks, Industrial Designs, Layout designs of Integrated circuits, Patents, Geographical Indications, Traditional Knowledge, Plant varieties, Trade secrets

UNIT II

Understanding Copyright & Trademarks Law: Evolution of copy right law in India, Subject matter of copyright, Terms of protections, Concepts-originality/Novelty idea expression, Fixation & fair Use, Copyrights in software protection, Justifications, Infringement of copyright and acquisition in Indian contexts, Case studies ,TRADE MARK- Introduction, Justification, Concepts of subject matter acquisition, Implication and benefits of registration terms of protection of Geographical indication of goods ,Infringements of trademarks, Case studies

UNIT III

Patent: Basic principles of patent laws, Historical background, Basis for IP protection ,Criteria for patentability, Novelty, Utility and Inventive step, Non obviousness, Non Patentable inventions, Searching: Prior art, tangible Vs intangible prior art, search strategy, Pre-grant and post-grant oppositions, grant or refusal of patents, Request for reexamination and revocation, terms of patents and patent renewal, Infringement and prosecution in India, US and other countries , Cost of getting and maintaining patens in India, US and other countries., Importance of patent search in research., Case Studies

UNIT IV

Patent Drafting: Format, Provisional & Complete specifications, Scopes of inventions, description of invention, drawings, claims, Filing requirements: Forms to be sent, Comparison of Patentability in different countries, Filing mechanism-through individual patent office, PCT route & claiming priority from either route, Examples

Industrial Designs: Introduction, Justification, Subject matter of design law definition, Infringement of design rights

Semiconductor & IC Layout Designs: Introduction and history, Semiconductor topography design rights. Infringement, Case studies

UNIT V

Biomedical Ethics: Theory, principles, rules and moral decisions, Belmont report, the principles of biomedical ethics, respect for autonomy, voluntariness, information & informed consent, competency, nonmaleficence, the rule of double effect, beneficence, paternalism, justice, examples.

Text Books

1. Dr. T Ramakrishna -Basic principles and acquisition of Intellectual Property Rights, CIPRA, NSLIU -2005.
2. Dr.B.L. Wadhera -Intellectual Property Law Handbook, Universal Law Publishing Co. Ltd.. 2002.

Reference Books

1. Dr. T Ramakrishna -Ownership and Enforcement of Intellectual Property Rights, CIPRA, NSLIU -2005.
2. Intellectual Property Law (Bare Act with short comments) - Universal Law Publishing Co. Ltd.. 2007.
3. The Trade marks Act 1999 (Bare Act with short comments) - Universal Law Publishing Co. Ltd.. 2005.
4. The Patents Act, 1970 (Bare Act with short comments) - as amended by Patents (Amendment) Rules 2006 w.e.f. 5-5-2006. Commercial law publishers (India) Pvt. Ltd., 2006.
5. Thomas T Gordon and Arthur S Cookfair -Patent Fundamentals for Scientist and Engineers, CRC Press 1995.
6. Prabuddha Ganguli -Intellectual Property Rights, TMH Publishing Co. Ltd..2001
7. D.H.Lawerance, chapter 2,Principles of biomedical ethics : Jones & Bartlett publishers

Course Outcomes (COs):

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

1. Provide a holistic approach to the understanding of the national and

international IPR and ethics for biomedical engineers in hospitals. (PO-6,8 & PSO-2)

2. Emphasize on the impact of IP laws and ethics in a sustainable economic and social environment. (PO- 7, & PSO3)
3. Illustrate the various legal rules and infringements of different types of IPs. (PO- 10 & PSO-3)
4. Highlight the importance of generating and protecting the IP. (PO-6,11 & PSO-2)
5. Appraise the IP related issues in academic and professional environment. (PO-9,12 & PSO-3)

MEDICAL PHYSICS LABORATORY

Course code: MLL56
Credits: 0:0:1 **Contact hours: 28**
Course Coordinators: Dr Prabha Ravi, Dr Sanjay H S

Course contents

1. Temperature based – Thermistor and thermometer for monitoring of body temperature at different locations on the body
2. Heat based - Usage of Infrared light for heat therapy based applications
3. Water based - Total body water assessment with the aid of GSR acquisition
4. Strength based - Hand grip strength measurement using electronic dynamometer
5. Fluid based: Demonstration of the basic physics of pressure and flow of fluids and relating the same to human physiology (research experiment)
6. Blood flow – Assessment of turbulence and laminar flow of blood using blood pressure measurement approaches
7. Electromyogram – Assessment of the muscular action & Nerve conduction velocity measurement
8. Electrocardiogram – Acquisition of ECG signal (simulation & subject) and Analysis of the signal based on cardiovascular functioning.
9. Electroencephalogram - Acquisition of EEG signal (simulation & subject – ONE CHANNEL; FP1&FP2) and Analysis of the signal based on brain functions.
10. Electrooculogram – Assessment of eye movement with illustration of eye blinks & Pressure based – Electrooculography – measurement of pressure in the eye.
11. Sound in medicine – usage of stethoscope to assess the sound inside the body
12. Sensitivity of the ears – usage of audiometry to assess the functionality of the ears and demonstration of the usage of BERA to assess the functionality of the ears

Text Books

1. Irving P Herman, “Physics of the human body”, Springer publications, 2016

Reference Books

1. Paul Davidovits, “Physics in biology and medicine”, 5th edition, Academic press, New York, 2018

Course Outcomes (COs):

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

1. Apply the basics concepts of physics to realize different aspects of human physiology. (PO-1,2,4,12& PSO-1)
2. Understand the physiology of sensation and response in human body with the perspective of medical physics (PO-1,2, & PSO-1,2)
3. Implement and demonstrate various laws of physics, as applied to human physiology (PO-1, 2,4, & PSO-1, 2)

BIOMEDICAL INSTRUMENTATION-I LABORATORY

Course code: MLL57

Credits: 0:0:1 **Contact hours: 28**

Course Coordinators: Dr Sanjay H S, Mrs Chandana S

Course contents

1. Development of 2nd order filters for biomedical applications
2. Measurement of change in temperature using thermocouple, thermistor and RTDs
3. Measurement of weight with the aid of resistive transducer in strain gauge
4. Measurement of change in displacement with the aid of LVDT
5. Measurement of change in force with the aid of flex sensor
6. Measurement of the presence of ethanol using alcohol sensor
7. Measurement of optical variables with the aid of photo diodes and photo transistors
8. Measurement of pH of a given solution using pH meter
9. Determination of the concentration of a solute in a solution using colorimeter
10. Assessment of various safety aspects for a given equipment using Electrical Safety Analyzer
11. Measurement of Transmittance and concentration of a given solution using Digital Spectrophotometer
12. Display and analysis of various biomedical signal characteristics with the aid of suitable simulators

Text Books

1. John G Webster, "Medical Instrumentation-Application and design", 4th edition, John Wiley Publications, 2009
2. R S Khandpur, "Handbook of biomedical instrumentation", 3rd edition, McGraw Hill publications, 2014

Reference Books

1. Joseph D. Bronzino, "Medical Devices and Systems – The Biomedical Engineering Handbook", 3rd Edition – CRC Press, 2006.
2. Carr & Brown, "Introduction to Biomedical equipment technology, 4th edition, Pearsons publications, 2001

Course Outcomes (COs):

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

1. Reminisce the basics of measurements and the generic sensors used for biomedical applications (PO-1,2,4,12& PSO-1)
2. Understand the functional aspects of generic sensors to acquire various information (PO-1,2, & PSO-1,2)
3. Comprehend the usage of hardware and simulation based approaches in biomedical instrumentation (PO-1, 2,4, 12 & PSO-1, 2)

BIOMEDICAL SIGNAL PROCESSING LABORATORY

Course code: MLL58
Credits: 0:0:1 **Contact hours: 28**
Course Coordinators: Mrs. Purnima B R, Dr Sanjay H S

Course contents

1. Operations on Signals: Time Scaling, Amplitude Scaling, Shifting, Circular folding, Circular Shifting, Linear Convolution, Circular Convolution.
2. To verify properties of DFT: linearity property, Circular convolution, Multiplication in time domain Complex conjugate property of DFT, Parseval's theorem, Circular folding, Time shifting and frequency shifting.
3. Verification of Sampling Theorem
4. Design of digital IIR Butterworth filters using Bilinear transformation and impulse invariant methods
5. To design FIR filters using windowing Technique
6. Design and Implementation of Moving Average filters
7. Design and Implementation of Derivative Based Filters
8. Design and Implementation of Notch Filters and Comb Filters
9. To perform QRS detection using PAN-TOMPKINS algorithm
10. To perform derivative based QRS detection
11. Detection of EEG rhythms
12. To perform Spectral Analysis of Biomedical Signals

Text Books

1. Rangaraj M Rangayyan, "Biomedical Signal Analysis" –, Wiley India Publications, 2015

Reference Books

1. Robert J. Schilling, Sandra L Harris, "Fundamentals of Digital Signal Processing using MATLAB, 2011
2. Bio-signal& Biomedical Image Processing – John L Semmlow, Dekker Media Publishing, 3rd edition, 2014
3. Udayashankar "Modern Digital Signal Processing" PHI, 2nd Edition, 2012

Course Outcomes (COs):

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

1. Reminisce the basics of biomedical signal processing using MATLAB. (PO-1,2,4 &PSO-1)
2. Accent the design and implementation of various signal processing techniques and apply the same to biomedical signals. (PO-3,12 & PSO-1,3)
3. Relate the results obtained to the concepts of biomedical signal processing so as to obtain a better understanding of the same (PO-9,12 & PSO-1)

PROFESSIONAL ELECTIVE – I

INTRODUCTION TO PCB FABRICATION

Course code: MLE551

Credits: 0:2:1 **Contact hours: 56+28**

Course Coordinators: Mrs. Prabhu Ravikala Vittal, Mrs Uma Arun

Course contents

UNIT I

Introduction & Brief History: What is PCB, Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials.

Component introduction and their categories: Types of Components: Active Components: Diode, Transistor, MOSFET, LED, SCR, Integrated Circuits (ICs), Passive Components: Resistor, Capacitor, Inductor, Transformer, Speaker/Buzzer

UNIT II

Introduction to Electronic design Automation (EDA): Brief History of EDA, Latest Trends in Market, how it helps and Why it is required, Different EDA tools. Introduction to Development Tools Component library creation using EDA tools (Eagle or ORCAD any one)

UNIT III

Practical of PCB designing: PCB Designing Flow Chart: Schematic Entry, Net listing

Component Package Types: Through Hole Packages :Axial lead ,Radial Lead , Single Inline, Package(SIP), Dual Inline Package(DIP) ,Transistor Outline(TO) ,Pin Grid Array(PGA) , Surface mount devices(SMD): Metal Electrode Face(MELF),Leadless Chip Carrier(LCC) ,Small Outline Integrated Circuit(SOIC) , Quad Flat Pack(QPF) and Thin QFP (TQFP) , Ball Grid Array(BGA), Plastic Leaded Chip Carrier(PLCC).

UNIT IV

PCB Layout Designing: Prototype Designing, Design Rule Check (DRC), Design For Manufacturing (DFM) , PCB Making, Printing, Etching , Drilling , Assembly of components

Description of PCB Layers: Electrical Layers, Top Layer Mid Layer, Bottom Layer, Mechanical Layers, Board Outlines and Cutouts, Drill Details, Documentation Layers: Components Outlines, Reference Designation, Text.

UNIT V

PCB Materials: Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR-4, NelcoN400-6, GETEK, BT Epoxy Glass, Cyanate Aster, Plyimide Glass, Teflon, Rules for Track: Track Length, Track Angle, Rack Joints, Track Size.

Post Designing & PCB Fabrication Process: Printing the Design, Etching, Drilling, Interconnecting and Packaging electronic Circuits (IPC) Standards, Gerber Generation, Soldering and De-soldering, Component Mounting, PCB and Hardware Testing.

Text Books

1. R S Khandpur "Printed circuit boards Design, fabrication and assembly" McGraw hill publication, 2005

Reference Books

1. EAGLE Easily Applicable Graphical layout editor Manual, version 5, 2010
2. Matthew Scarpino "Designing circuit boards with EAGLE", Prentice hall publications, 2014

Course Outcomes (COs):

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

1. Appreciate the necessity and evolution of PCB, types and classes of PCB and components used in PCB design. (PO1, PO3, PS01)
2. Demonstrate the usage of EDA tools for developing the PCB. (PO1, PO3, PO5, PSO1)
3. Understand the steps involved in schematic, layout, fabrication and assembly process of PCB design. (PO1, P03, P05, PO12, PS01)
4. Demonstrate the schematic and layout PCB for analog circuits, digital circuits and mixed circuits. (PO1, PO3, PO5, PO12, PSO1)
5. Demonstrate the process of and fabrication of PCB for simple circuits. (PO1, PO3, PO5, PO12, PSO1)

VIRTUAL INSTRUMENTATION

Course code: MLE552
Credits: 0:2:1 **Contact hours: 56+28**
Course Coordinators: Mrs Purnima B R, Mrs Tejaswini S

Course contents

UNIT I

Graphical System Design: Graphical system design (GSD) model, design flow with GSD, virtual instrumentation, virtual instrument and traditional instrument, hardware and software in virtual instrumentation, virtual instrumentation for test, control and design, virtual instrumentation in the engineering process, virtual instruments beyond personal computer, graphical system design using lab VIEW.

UNIT II

Introduction to LabView: Software environment, block diagram. Data types, data flow program, lab VIEW documentation resources, modular programming.
Repetition and Loops: For loops, while loops, structure tunnels, terminals inside or outside loops, shift registers, feed-back nodes, control timing, communicating among multiple-loops, local variables, Global variables, case structure, formula node.

UNIT III

Arrays: Introduction, arrays in LABVIEW, creating one - dimensional array controls, indicators and constants. creating two dimensional arrays, creating multidimensional arrays, initializing array, deleting, inserting, and replacing elements, rows, columns, and pages with in arrays, arrays functions, auto indexing, creating 2-dimensional array using loops, identification of data structure (scalar and arrays) using wire, using auto-indexing to set the FOR-loop count matrix operation with arrays, polymorphism.

UNIT IV

Clusters: Creating Cluster Controls and Indicators, Creating Cluster Constant, Order Of Cluster Elements, Cluster Operations, Assembling Clusters, Disassembling Clusters, Conversion Between Arrays And Clusters, Error Handling, Error Cluster
File Input/ Output: File formats, fill I/O functions, path function sample VI's to demonstrate file write & read, generating filenames automatically, String handling: string functions, LABVIEW string formats, examples, parsing of strings.

UNIT V

Plotting Data: Types of waveforms, waveform graphs, waveform charts, XY graphs, Intensity graphs &charts, Digital waveform graphs, 3D graphs, customizing graphs & charts, configuring a graph or chart, Displaying special planners on the XY graph.

Data Acquisition: Introduction, transducers, signals, signal conditioning. DAQ hardware configuration, DAQ hardware, analog inputs analog outputs

Laboratory experiments

1. To implement the desired formulas in LabVIEW using formula mode
2. To perform arithmetic and logical operations using Case Structures for various controls
3. To perform operations using flat and stacked sequence structure
4. Usage of FOR loop for different applications
5. Usage of WHILE loops for different applications
6. Building a color box for RGB components
7. To convert a decimal number to binary equivalent number using LabVIEW
8. To perform arithmetic operation on one dimensional array in LabVIEW
9. To create even numbers using for & while loop in an array
10. To find the maximum and minimum variable from an array.
11. Generate sine and cosine waveform and find the time at which the waveform is maximum and minimum
12. Plot a circle in XY graph using FOR loop

Text Books

1. Jovitha Jerome, 'Virtual Instrumentation using LabVIEW', PHI learning, 2010

Reference Books

1. Jeffrey Travis, Jim Kring, 'Graphical Programming Made Easy and Fun',3rd Edition, Prentice Hall, 2015

Course Outcomes (COs):

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

1. Ascent the basics of digital instruments used for various applications (PO-1,3 & PSO-1)
2. Relate the basics of instrumentation to Virtual instrumentation-based Approaches (PO-1,3 & PSO-1)
3. Interpret the functional aspects of the instruments present in VI system (PO-3,5,6 & PSO-1)
4. Comprehend the graphical aspects of VI systems for the design of various instruments (PO-5,6,12 & PSO-1,2)
5. Analyze the various tools existing in VI and to build simple applications in VI (PO-5,12 & PSO-2)

IOT FOR HEALTHCARE APPLICATIONS

Course code: MLE553
Credits: 0:2:1 **Contact hours: 56+28**
Course Coordinators: Mrs Prabhu Ravikala Vittal, Mrs Uma Arun

Course contents

UNIT I

Introduction to IoT: Introduction to Embedded Systems-an overview, features. Networked Embedded System- types and overview, wireless communication standards-zigbee, Bluetooth & Wi-Fi. OSI & TCP/IP model in a nutshell. Introduction to the Internet and understand how internet works. Introduction to Smart Objects or Things. IOT- understand what IOT is and discuss its application in health-care systems- Patient Monitoring & diagnostics, Home healthcare & Personal care & Fitness.

UNIT II

IOT Hardware Platform Sensor Interface: Introduction to CC3100 Wi-Fi Booster Pack: overview & features. Introduction to CC3100 SDK: understand the important APIs. Getting Started with Energia Wi-Fi libraries. Sensor interface: Temperature sensor, pressure sensor, Light sensor, IR sensor.

UNIT III

Client-Server Communication Paradigm: Basic Client-Server communication model, Network Sockets, Ports, and Examples of client server communication, Energia client & server class APIs.

UNIT IV

Embedded Web-Server & IOT Cloud Services: Embedded web server: Basic introduction, its importance and role in IOT. Design of a simple embedded web server: understand the HTTP & HTML basics, Overview of different IOT Cloud Services.

UNIT V

Application Design & Case Studies: Case Study1: Wireless Patient Monitor system, Case Study2: Wearable Fitness & Activity Monitor, Application Design: Design of IOT based pulse oximeter, block diagram, concepts of analog front end, signal process and Wi-Fi integration.

Laboratory experiments

1. Introduction to CC3100 Wi-Fi Booster Pack
2. Overview & features. Introduction to CC3100 SDK
3. Getting Started with Energia Wi-Fi libraries.
4. Displaying the Access point created by the IOT Bundle (Launchpad & Booster pack) on the serial window of energia.
5. Displaying the IP address obtained by the IOT Bundle (Launchpad & Booster pack) on the serial window of energia.
6. Displaying the Subnet mask obtained by the IOT Bundle (Launchpad & Booster pack) on the serial window of energia
7. Displaying the Gateway address obtained by the IOT Bundle (Launchpad & Booster pack) on the serial window of energia
8. Implementing of TCP protocol between to IOT bundles
9. A simple web server that lets you blink an LED via the web.
10. Implement a simple web server that shows the value of the analog input pins using a Wi-Fi shield.
11. Case Study1: Wireless Patient Monitor system
12. Case Study2: Wearable Fitness & Activity Monitor

Text Books

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis, Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014
2. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
4. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

Course Outcomes (COs):

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

1. Recognize various devices, sensors and applications. (PO1,3,12, PSO1)
2. Apply design concept to IoT solutions. (PO1,3,4,5 PSO1, PO12, PSO2)
3. Analyze various M2M and IoT architectures. (PO1,3,5,12, PSO1, PSO2)
4. Evaluate design issues in IoT applications (PO1,3,5,9,12, PSO1, PSO2)
5. Create IoT solutions using sensors, actuators and Devices (PO1,3,5,9,12, PSO1, PSO2).

INTRODUCTION TO 3D PRINTING

Course code: MLE554
Credits: 0:2:1 **Contact hours: 56+28**
Course Coordinators: Dr N Sriraam, Dr Sharath D

Course contents

UNIT I

Introduction: What Is 3D Printing? - Types of 3D Printers -Robotic 3D Printers - Enabling Technologies -The Desktop 3D Printer -Types of Filament-Based Consumer Printers -Kits vs. Assembled Printers

UNIT II

3D Printer Design Considerations: Filament -Frame -Build Platform -Extruder Design-Moving Parts -Control Electronics -Machine Tool or Computer Peripheral-Safety and Ventilation -Open Source Infrastructure

UNIT III

The 3D Printing Process: Making a 3D Model -Scanning a Model -Downloading and Modifying Existing Models -Creating a New Model -Design Considerations

UNIT IV

Slicing 3D model: What Is "Slicing?" -3D Printing as Cooking-Tools and Techniques -Getting Started: How to Slice an Object -Slicing Programs: Slic3r -Alternative Hosting and Slicing Programs Material Considerations:
Filament Quality Control -Filament Materials -Multiple Extruders

UNIT V

Driving Your Printer: G-code Controlling Your 3D Printer -Understanding G-code - Using Host Programs -Getting a Part off the Build Platform -Picking Off Support and Cleaning Up The Print -Manually Controlling Your Printer. Few Case studies

Text Books

1. Mastering 3D Printing by Joan Horvath, 2014, Publisher(s): Apress, ISBN: 9781484200254

Reference Books

1. 3D Printing Technology, Applications, and Selection, By Rafiq Noorani, 2017 by CRC Press,1st edn
2. An Introduction to 3D Printing by Victoria Zukas, Jonas A Zukas Publisher, First Edition Design Pub., 2015

Course Outcomes (COs):

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

1. Exhibit knowledge of key factors that have evolved the manufacturing over the centuries and explain current and emerging 3D printing applications in a variety of industries. (PO-1, PO2,3,9 &PSO1,2)
2. Illustrate the advantages and limitations of each 3D printing technology. (PO-1, PO2,4,10 & PSO1,2)
3. Evaluate real-life situations and recommend the suitable use of 3D printing technology. (PO-2,3,4,8 & PSO1,2)
4. Identify opportunities to apply 3D printing technology optimally. (PO-1,4,5,10,11 & PSO1,3)
5. Design and print objects containing moving parts without assembly. (PO-2,4,6,8 & PSO2,3)

INTRODUCTION TO CLOUD COMPUTING IN HEALTHCARE

Course code: MLE555
Credits: 0:2:1 **Contact hours: 56+28**
Course Coordinators: Dr N Sriraam, Dr Prabha Ravi

Course contents

UNIT I

Cloud computing – An insight: Introduction to cloud computing, cloud essentials, business & IT perspective, benefits & challenges, applications, business models and cloud adoption

Cloud models: Introduction, from collaboration to cloud, cloud models and architecture, value of cloud computing and infrastructure models, scaling a cloud infrastructure

UNIT II

Standards and security: Introduction, legal and regulatory issues, security challenges, cloud data security, network security, host security, database management, risk tolerance

Cloud licensing and major players: Introduction, cloud data centre, moving into cloud, issues in cloud computing, major players in cloud computing, eucalyptus, nimbus, open nebula, cloud-sim

UNIT III

Cloud services: Introduction to services, storage, database, information, process, application, management, platform, security, testing, integration, infrastructure

Software plus services: Introduction, mobile device integration, Microsoft online, intuit quick base, cast iron cloud, bungee connect, map reduce, google file system, Hadoop framework, HDFS

UNIT IV

Cloud management: Introduction and cloud ecosystem, business process management, stack, sourcing, analytics, asset management, resiliency, provisioning, governing, charging models, metering, billing

Virtualization for cloud: Introduction, pros and cons, architecture, virtual machine and types, virtualization in cluster / grid, network, types, machine monitor, desktop infrastructure

UNIT V

Cloud storage and disaster recovery: Introduction, storage providers, disaster recovery planning, disaster management

Applications of cloud computing: cloud comparing approaches, ANEKA - private and public cloud, resource provisioning, COMET CLOUD - architecture, autonomic behavior, applications, implementation

Text Books

1. M N Rao, "Cloud Computing", PHI learning private limited (2015 edition)

Reference Books

1. Dan Marinescu, "Cloud Computing: Theory and Practice", 1st edition, MK Publishers (2013 edition)
2. Anthony T. Velte, Toby J. Velete, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw Hill, (2010 edition)

Course Outcomes (COs):

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

1. Reminisce the basics of cloud and cloud models (PO-1,2 & PSO-1)
2. Accent the standards and security issues in cloud and cloud licensing approaches (PO-3 & PSO-1)
3. Quote the fundamentals of cloud and relate the same to the software plus services (PO-1,12 &PSO-1)
4. Explore the techniques and approaches involved with management and virtualization of cloud (PO-2,12 & PSO-1)
5. Conjoin the principles of cloud computing and cloud storage and expand the same to study the applications of cloud computing. (PO1-1,2,12 & PSO-3)

OPEN ELECTIVE - I

INTRODUCTION TO MEDICAL ELECTRONICS

Course code: MLOE01
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Mrs Prabhu Ravikala Vittal, Mrs Uma Arun

Course contents

UNIT I

Electro-Physiology and Bio-Potential Recording: The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT II

Bio-Chemical and Non Electrical Parameter Measurement: pH, PO2, PCO2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood Cell Counters.

UNIT III

Assist Devices: Cardiac pacemakers, DC Defibrillator, Dialyser, Heart lung machine.

UNIT IV

Physical Medicine and Biotelemetry: Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, electrical safety.

UNIT V

Recent Trends In Medical Instrumentation: Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to telemedicine.

Text Books

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, “Medical Instrumentation Application and Design”, 3rd Edition, Wiley India Edition, 2007

Reference Books

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 2014
2. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2004.

Course Outcomes (COs):

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

1. Understand the electro-physiology and bio-potential recording. (PO-1,2 & PSO-1)
2. Describe the bio-chemical and non electrical parameter measurement (PO-1,2&PSO-1)
3. Outline the different types of assist Devices. (PO-1 &PSO-1)
4. Describe the concepts of physical medicine and biotelemetry. (PO-1,2&PSO-1)
5. Discuss the various recent trends in medical instrumentation (PO-1&PSO-1)

BIO MEMS

Course code: MLOE02
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Mrs Chandana S, Dr Vani Damodaran

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, thermos mechanics, 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 Books

1. Tai-Ran Hsu. MEMS and Microsystems, Design Manufacturing and Nanoscale engineering, John wiley & Sons, 2014

Reference Books

1. G.K. Anantasure, K.J.Vinoy, S.Gopala Krishnan, K.N. Bhat, V.K. Aatre. Micro and Smart systems, Springer ed, 2014

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)

HOSPITAL MANAGEMENT

Course code: MLOE03
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr Prabha Ravi, Mr.S J Mahendra

Course contents

UNIT I

Overview of Hospital Administration: Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management.

UNIT II

Human Resource Management in Hospital: Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III

Marketing Research Process: Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV

Hospital Information Systems & Supportive Services: Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services.

UNIT V

Quality and Safety Aspects in Hospital: Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems.

NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

Text Books

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006.
2. G.D.Kunders, ―Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

Reference Books

1. Cesar A. Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger, ―Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3. Arnold D. Kalcizony& StephenM. Shortell, ―Health Care Management‖, 6th Edition Cengage Learning, 2011.

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)

VI Semester

BIOSTATISTICS

Course code: ML61
Credits: 3:1:0 **Contact hours: 42+14**
Course Coordinators: Dr N Sriraam, Mrs.Tejaswini S

Course contents

UNIT I

Introduction of Biostatistics: Statistics, Biostatistics, statistical terms, Statistical Data, Organization and Classification of data, Frequency distribution, Representation of data

UNIT II

Descriptive measures: Measures of Central Tendency, Measures of Location or Averages of Partition value, Measures of variability or dispersion

UNIT III

Basic Probability theory: probability, set theory and Venn diagram, probability distribution: Normal, binomial and Poisson Distribution

UNIT IV

Inferential statistics: Inferential statistics, hypothesis testing and test of significance, nonparametric statistical tests.

UNIT V

Inferential statistics: Correlation, Regression, students t-Test, Analysis of Variance, Chi- Square Test

Text Books

1. Veer Bala Rastogi, Medtech Scientific International Pvt. Ltd. “Biostatistics”, Third revised edition 2017.

Reference Books

1. Wayne W Daniel, Chad L Cross, “Biostatistics- Basic Concepts and Methodology for Health Sciences”, tenth edition 2015

Course Outcomes (COs):

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

1. Assess the importance of statistics in healthcare (PO-1,6,7 &PSO-2,3)
2. Extend the basic concepts of statistics to statistical descriptive oriented applications (PO-1,2 & PSO-1)
3. Interpret the aspects of probability and sampling to solve problems in statistics (PO-1,2,4 &PSO-2)
4. Interpret the aspects of statistics for obtaining the inference on the sample data (PO-2,4,12 &PSO-1)
5. Present the acquired inference and to prove the hypothesis (PO-2,4,12 & PSO-1)

REAL-TIME PROCESSORS & APPLICATIONS

Course code: ML62
Credits: 3:1:0 **Contact hours: 42+14**
Course Coordinators: Mrs.Prabhu Ravikala Vittal, Dr Basavaraj V Hiremath

Course contents

UNIT I

Introduction to ARM Cortex M4F Architecture: ARM Cortex M4F processor feature, block diagram, Programming model: processor mode & privilege levels, Register set & Register map, datatype& memory model, ARM Cortex M4F Interrupts & Exception: Exception Model: Exception States, Types, Handlers, vector table, priority, priority grouping, entry & return, NVIC

UNIT II

Introduction to Device peripherals: Clock System: clock tree block diagram, clock sources, Main oscillator, PLL operation, System Clock configuration, GPIO: Functional block diagram, initialization & configuration, Timers: Block Diagram, operating modes, functional description, Timer modes, Timer Interrupts, initialization & configuration, Analog to Digital Converters: Block diagram & functional description, sample sequencer, initialization & configuration

UNIT III

RTOs Kernel: What is RTOs, RTOs necessity, Real Time Scheduling, components of RTOs, RTOs start-up sequence, Overview of Threading modules: Hardware interrupts (Hwi), Software interrupts (Swi), Task, Background Thread (idle), comparison of thread characteristics, thread priorities & premption, introduction to hook function

UNIT IV

RTOs Synchronization modules: Semaphores: overview, where does semaphore fit? Create & delete, semaphore_pend & semaphore_post, semaphore modes, Context Switching, Deadlocks, RTOs Timing Services: overview of timing services, clock module, configuration of clock module, Timer module, Hardware Abstraction Layer (HAL) for Timer, MailBox: data exchange between threads, creation and using a mailbox, mailbox post & pend, Event Module: Semaphore Vs Event, Event Id, Event_post & Event_pend, pending on multiple semaphores, creation & usage of event, posting event using semaphores

UNIT V

RTOs Debugging: Introduction to RTOs instrumentation, RTOs analyzer and UIA, Execution Graph, Load Analysis, Log info(), Benchmarking with Time Stamp

Text Books

1. TI-RTOS Kernel User's Guide, Texas Instruments, 2018
2. Real Time Operating System for ARM Cortex M Microcontrollers by Jonathan Valvano, 2017

Reference Books

1. Naim Dahnoun, Multicore DSP: From Algorithms to Real-time Implementation on the TMS320C66x SoC, Wiley publications, 2018

Course Outcomes (COs):

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

1. Understand the architecture of ARM Cortex M4F processor and its utilization in Embedded System Applications. (PO1, PO2, PO12, PSO1)
2. Understand the peripherals and its working used with ARM cortex MF4 processor. (PO1, PO2, PO12, PSO1, PSO2)
3. Understand and design Real Time Operating System for Embedded Applications. (PO1, PO2, PO12, PSO1, PSO2)
4. Analyze the RTO's synchronization modules used for developing an algorithm. (PO1, PO2, PO12, PSO1, PSO2)
5. Understand the RTO's Debugger to analyze the user interface facility. (PO1, PO2, PO12, PSO1, PSO2)

Mini Project

Course code:ML65
Credits: 0:0:4 **Contact hours: 112**
Course Coordinators: Dr N Sriraam, Mrs. Chandana S

Course contents

The Mini-project course provides an integrated assessment of the progress of the students toward the desired healthcare technology. It is therefore important to design fair and broad guidelines for better assessment of this course. Mini-project having a course code as ML65 in the department of Medical Electronics (ML) is a one semester course in which students form teams usually of at most five members, select a design project and are supervised by a faculty member.

The students are expected to discuss their progress with their supervisors in regular weekly meetings. The students submit a written report, present and defend their work at the end of the semester. The main purpose of the project is to improve the students' technical skills, communication skills by integrating writing, presentation and teamwork opportunities. The design project is comprehensive and focuses on professional practice and includes a variety of non-technical issues such as economic factors, safety, reliability, environment and social impacts.

The projects are proposed by the department faculty members. The student(s) will select a project from the same. The students are required to demonstrate their ability to: conduct a literature survey; perform the relevant design, propose a solution to the problem, and implement their design.

Course Outcomes (COs):

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

CO1: Understand and demonstrate the process of implementing the engineering concepts in real time application (PO: 1,2,4,9, PSO: 1,2)

CO2: Clearly identify and justify the problem statement with purpose (PO: 2,3,4,5,8,9, PSO: 2,3)

CO3: Works with a group thereby able to practice professional values (PO: 2,3,4,5, PSO: 2,3)

BIOMEDICAL INSTRUMENTATION-II LABORATORY

Course code: MLL66
Credits: 0:0:1 **Contact hours: 28**
Course Coordinators: Dr Sanjay H S, Mrs Chandana S

Course contents

1. Acquisition of Electrocardiogram and Pulse using the BIPOAC acquisition system and find the physiological parameters associated with the same.
2. Acquisition of Electrocardiogram using the ECG acquisition system (RMS) and find the physiological parameters associated with the same.
3. Acquisition of Electroencephalogram using the EEG acquisition system (RMS) and obtain the parameters for deep thinking with sound effect.
4. Acquisition of Electroencephalogram using the EEG acquisition system (RMS) and obtain the parameters for eye blinking.
5. Acquisition of Electromyogram using the EMG acquisition system (RMS) and calculation of the nerve conduction velocity of the right hand of the subject.
6. Acquisition and analysis of heart sounds with the aid of biopac module.
7. Acquisition of Breath Assessment using Spirometer and find the physiological parameters associated with the same.
8. Acquisition of anthropometric parameters with the aid of suitable skin fold and girth measurement devices.
9. Acquisition of Audiogram using the PC Based audiometer acquisition system (RMS) and find the air conduction of both Left and Right Ear.
10. Demonstration of the application of telemetry in healthcare – Biotelemetric applications using REMEDI
11. Demonstration of the functional aspects and usage of the ventilator and their applications in healthcare
12. Demonstration of the functional aspects and usage of the defibrillator and their applications in healthcare

Text Books

1. John G Webster, “Medical Instrumentation-Application and design”, 4th edition, John Wiley Publications, 2009
2. R S Khandpur, “Handbook of biomedical instrumentation”, 3rd edition, McGraw Hill publications, 2014

Reference Books

1. Joseph D. Bronzino, "Medical Devices and Systems – The Biomedical Engineering Handbook", 3rd Edition – CRC Press, 2006.
2. Carr & Brown, "Introduction to Biomedical equipment technology, 4th edition, Pearsons publications, 2001

Course Outcomes (COs):

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

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)

BIOMEDICAL IMAGE PROCESSING LABORATORY

Course code: MLL67
Credits: 0:0:1 **Contact hours: 28**
Course Coordinators: Dr C K Narayanappa, Dr Basavaraj V Hiremath

Course contents

1. Simulation and display of an image, negative of an image (Binary & Gray Scale)
2. Implementation of relationships between pixels
3. Contrast stretching, Intensity slicing, power law transformations
4. Basic morphological operation and its applications
5. Histogram processing and spectra in understanding the information content of medical images
6. 2-D Convolution
7. Medical Image smoothing (Low pass and Median filters) and Medical Image sharpening (High pass and derivative filters)
8. Implementation of homomorphic filtering technique for image enhancement
9. Error measures using MSE and NMSE
10. Implementation of image restoring techniques
11. Geometric transformation and the assessment of the applications of fusion Algorithm.
12. Boundary descriptor

Text Books

1. R C Gonzalez & R E Woods, Digital Image Processing, Pearson Education, 4th edition, 2018
2. Rangaraj M. Rangayyan, Biomedical Image Analysis, CRC Press, 2004

Reference Books

1. Wolfgang Birkfellner, Applied Medical Image Processing: A Basic Course, 2010
2. Richard A. Robb “Biomedical Imaging, Visualization, and Analysis”, John Wiley & Sons, 1999.
3. Azriel Rosenfeld & Avinash G Kak, “Digital Picture Processing”, Academic press, Volume 1 & 2

Course Outcomes (COs):

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

1. Implement the basic relationship between the pixels. (PO1,2,4, PSO1)
2. Apply the various image enhancement and morphological techniques on a medical image (PO1,2,3,4, PSO1)
3. Apply various segmentation and restoration techniques on a medical image (PO1,2,3, PSO1)
4. Demonstrate the image registration and description schemes (PO-1,2,3.4, PSO-1).

REAL-TIME PROCESSORS LABORATORY

Course code: MLL68
Credits: 0:0:1 **Contact hours: 28**
Course Coordinators: Mrs. Prabhu Ravikala Vittal, Dr Basavaraj V Hiremath

Course contents

1. Introduction to Hardware & Software Platform:
    a. Overview of Code Composer Studiov9
    b. Installing TI-RTOs
    c. Configuration of GPIO module to blink an LED and read an input pin
2. Configuration of Timer module with interrupt to generate a 1 s delay
3. Configuration of 12-bit ADC module to read a temperature sensor
4. Using RTOs thread: configuring and using Hwi thread
5. Using RTOs thread: configuring and using Swi thread
6. Using RTOs thread: configuring and using Idle thread
7. Using RTOs thread: configuring and using Task thread
8. Semaphores: Creation of semaphore to synchronize between multiple Tasks
9. Clock Function: Use of clock module APIs to determine the sleeptime of tasks
10. MailBox: Passing data between threads by creating and using a mailbox
11. Events: Write a program to create event to handle three Interrupt Service Routines.
12. RTOs Debugging: using UIA and RTOs Analyzer to debug RTOS application

Text Books

1. TI-RTOS Kernel User's Guide, Texas Instruments, 2018
2. Real Time Operating System for ARM Cortex M Microcontrollers by Jonathan Valvano, 2017

Reference Books

1. Naim Dahnoun, Multicore DSP: From Algorithms to Real-time Implementation on the TMS320C66x SoC, Wiley publications, 2018

Course Outcomes (COs):

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

1. Use the CCS software and use it to operate the GPIO using basic I/O operation. (PO1, PO3, PO4 & PSO-1,2)
2. Implement effectively use concepts of C programming for development of optimized embedded software. (PO1, PO3, PO4 PO5&PSO1, PSO2)
3. Obtain a conceptual and practical foundation for advanced embedded applications. (PO1, PO3, PO4PO5&PSO1, PSO2)

PROFESSIONAL ELECTIVE -II

MEDICAL OPTICS

Course code: MLE631
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Mrs Uma Arun, Mrs Chandana S

Course contents

UNIT I

Optical Fiber and light: Optical Fiber and light- a brilliant combination: Light guiding, communication, Refraction, Units, Snell's Law, Critical Angle, Total internal reflection, Propagation of light along the fiber: Transmission of light through straight transparent slab and bend slab, Cone of acceptance, numerical aperture, the use of decibels in fiber optic circuits.

UNIT II

Losses and dispersion in fiber optics: Absorption, Rayleigh scatter, Fresnel Reflection, Bending losses, dispersion, Graded Index fiber, Single mode fiber, cables for fiber optics

Medical Laser: Introduction, Laser physics, medical lasers, Laser safety fundamentals.

UNIT III

Application of Lasers in therapy and diagnosis: Introduction, laser assisted diagnosis and therapy fundamentals, Interaction of Laser beams and materials, principles, Laser interaction with tissue, application of Lasers in Diagnosis and Imaging, Laser surgery and therapy, thermal interaction between laser and Tissue.

UNIT IV

Endoscopy: Endoscopic imaging system fundamentals, Angioscope, Videoscopy, Fluorescence endoscopy, Endoscopic therapy.

Fiber Optic Medical Diagnosis: Introduction, fundamentals, fiber optic biomedical sensor-principles, Direct-indirect Sensor principles.

UNIT V

Clinical applications of fiber optic Laser systems: Introduction, fundamentals, Fiber optic Laser system in cardiovascular disease, Gastroenterology, general and thoracic surgery, Fiber optic Laser system in Neurosurgery, Oncology, Ophthalmology.

Text Books

1. Abraham Katzir, Lasers and Optical Fibers in Medicine, Academic press Inc, 1st edition, 2012

Reference Books

1. John Crisp, Introduction to fiber optics, Newnes, 3rd edition, 2005

Course Outcomes (COs):

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

1. Discuss the optical fiber and principle of light (PO1, PO2, PSO1)
2. Describe the losses and dispersion in fiber optics: (PO1, PO2, PSO1)
3. Discuss the application of lasers in therapy and diagnosis. (PO1, PSO1)
4. Describe the concepts of fiber optics in medical diagnosis. (PO1, PO2, PSO1)
5. Discuss the various clinical applications of fiber optic Laser systems (PO1, PSO1)

BIOMETRICS

Course code: MLE632
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Mrs. Chandana S, Dr C K Narayanappa

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 Books

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

Course Outcomes (COs):

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

1. Describe biometric identification system and its accuracy metrics (PO1, PO9, PO10, PSO1, PSO2)
2. Analyze biometric finger print technology and various interpretation algorithms. (PO1, PO6, PO9, PO10, PSO1, PSO2)
3. Demonstrate Face recognition, Iris scan technology and various interpretation algorithms. (PO1, PO6, PO9, PO10, PSO1, PSO2)
4. Compare retina scan, hand scan and behavioral biometrics. (PO1, PO6, PO9, PO10, PSO1, PSO2)
5. Apply the knowledge of biometric identification or verification system in different security systems. (PO1, PO3, PO6, PO9, PO10, PSO1, PSO2, PSO3)

BIOSENSORS

Course code: MLE633
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr Vani Damodaran, Mrs Chandana S

Course contents

UNIT I

Introduction: Historical Breakthroughs in Medical Sensing Science, Plethysmography, Blood Pressure Measurements, Electrophysiology and Einthoven's Galvanometer, Electrocardiogram, Electroencephalogram, Electromyogram, Microelectrodes and Intracellular Measurements, Pulse Oximetry, Body Temperature Measurement, MEMS and BioMEMS Sensors, Cell-Based Biosensors, Optical Biopsies

UNIT II

Biosensors for Monitoring Glucose: Introduction, Diabetes and the Need for Glucose Monitoring, Monitoring principles: Transducers, Monitoring principles: Enzymes, First Generation Amperometric Glucose Biosensors, Currently-Available Home Blood Glucose Monitors, Currently-Available Laboratory Analyzers for Monitoring Glucose, Direct Electron Transfer Systems, Implantable Glucose Sensors, Minimally-Invasive Systems, Non-Invasive Systems

UNIT III

Sensors for Respiratory Monitoring: Physiological and Clinical Relevance, Sensors Based on Respiratory Airflow Detection, Pressure and Acoustic Sensing Devices, Thermal Flow Sensors, Humidity Sensors, Carbon Dioxide Sensing, Capnometry, Indirect Sensors of Respiration, Torso Devices, Strain Gauges, Respiratory Inductance Plethysmography, Magnetometry, Transthoracic Impedance, Plethysmography, Photoplethysmographic Sensors, Mattress Systems and Non-contact Devices, Invasive Sensors, Electrocardiographic Sensors, Electromyographic sensors, Pressure Sensors, Blood Gas Monitors, Transcutaneous pO2/pCO2 Electrodes, Pulse Oximeters, Limitations and Artifact Rejection

UNIT IV

Sensors for Catheter Applications: Medical background, circulatory system and problems, vascular catheterization, urology, measurement catheters, navigation systems - fluoroscopy, ultrasound - medical tool locatization/navigation, guidance, catheter position monitoring, intravascular ultrasound, sonomicrometry, MRI, electric

and magnetic fields. Sensors overview - mechanical domain, pressure sensors, blood-flow sensors, tactile sensors, movement sensors, chemical - pH, pO2/pCO2, thermal, radiation, multi sensing, packaging issues, size, patient safety and packaging.

UNIT V

Body Motion Analysis: Introduction, Direct Measurement, Goniometry, Accelerometry, Gyroscope, Magnetic Tracking Methods, Clinometer, Velocity Measurement by Ultrasound, Footswitches, Non-contact (Optical) Measurements, Force Measurements, Force Plate, Stabilometers, Instrumented Shoe, Pressure-Distribution Monitor.

Text Books

1. Raymond Tong, "Wearable technology in medicine", Elsevier, 2018
2. Bansi Dhar & Chandra Mouli "Biosensors: Fundamentals & Applications", Smithers Group publications, 2017

Reference Books

1. Handbook of Biosensors and Biochips (2 Volume set) By Robert S. Marks, Christopher R. Lowe, David C. Cullen, Howard H. Weetall, Wiley (2007)
2. Sensor Applications, volume 3, "Sensors in Medicine and Healthcare", Oberg, T Tgawa, F A Spelman, © 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany

Course Outcomes (COs):

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

1. Understand the concept of sensors, constructional details and know the glucose monitoring of biosensors. (PO-1,12 & PSO-1)
2. Describe the concepts of optical sensors for medical care. (PO-1,12 & PSO-1)
3. Discuss the principles of sensors for respiratory monitoring (PO-1,12 & PSO-1)
4. Describe the principle of working of body motion analysis. (PO-1,12 & PSO-1)
5. Interpret and analyze the various applications of Home healthcare (PO-1,12 & PSO-2)

CORE JAVA

Course code: MLE634
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Mr Mahendra S J, Dr Prabha Ravi

Course contents

UNIT I

Java Fundamentals, Introducing Classes & Methods: Object-Oriented Programming, The Three OOP Principles, Data Types, Variables, and Arrays: The Primitive Types, Type Conversion and Casting, Arrays: One-Dimensional Arrays, Multidimensional Arrays. Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Control Statements, Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Introducing Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.

UNIT II

Inheritance, Packages &Interfaces: Inheritance Basics, using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Packages, Access Protection, Importing Packages, Interfaces.

UNIT III

Exception handling, Multithreaded Programming: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive( ) and join( ), Thread Priorities, Suspending, Resuming, and Stopping Threads, Synchronization

UNIT IV

String Handling, Event Handling: String Handling :The String Constructors, Special String Operations, Character Extraction, String Comparison, Searching and Modifying a String, String Buffer Event Handling: Two event handling mechanisms;

The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model

UNIT V

The Collections Framework: Collections Overview, The Collection Interfaces, The Collection Classes: The Array List Class, Linked List Class, Vector class, Stack class, HashSet Class. Accessing a Collection via Iterator, Storing User-Defined Classes in Collections, Working with Maps, Arrays, Why Generic Collections?

Text Books

1. Herbert Schildt: Java The Complete Reference, 10th Edition, Tata McGraw Hill, 2017.

Reference Books

1. Y. Daniel Liang: Introduction to JAVA Programming, th Edition, Pearson Education, 2012.
2. Stephanie Bodoff, Dale Green, Kim Haasel: The J2EE Tutorial, 2nd Edition, Pearson Education, 2008.

Course Outcomes (COs):

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

1. Recognize the basic object-oriented concepts & apply them to create java applications. (PO-2,3,5 & PSO-2)
2. Demonstrate java applications with inheritance and interface concepts. (PO-2,3 &PSO-2)
3. Java applications with multithreading concepts and demonstrate the error handling concepts. (PO-3,5 & PS-O1)
4. Develop java programs using Strings and event handling concepts (PO-2,3,5 &PSO-2)
5. Develop java programs using collection frame works. (PO-1,2,3 &PSO-2)

GRID COMPUTING

Course code: MLE635
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Mr Mahendra S J, Dr N Sriraam

Course contents

UNIT I

Concepts and Architecture: Introduction-Parallel and Distributed Computing-Cluster Computing-Grid Computing Anatomy and Physiology of Grid- Web and Grid Services-Grid Standards - OGSA-WSRF - Trends, Challenges and applications.

UNIT II

Grid Monitoring: Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- R-GMA - GridICE – MDS- Service Level Agreements (SLAs) - Other Monitoring Systems- Ganglia, GridMon, Hawkeye and Network Weather Service.

UNIT III

Grid Security and Resource Management: Grid Security-A Brief Security Primer-PKI-X509 Certificates-Grid Security-Grid Scheduling and Resource Management, Gridway and Gridbus Broker-principles of Local Schedulers, Overview of Condor, SGE, PBS, LSF-Grid Scheduling with QoS.

UNIT IV

Data Management and Grid Portals: Data Management-Categories and Origins of Structured Data-Data Management Challenges, Architectural Approaches-Collective Data Management Services-Federation Services-Grid Portals-Generations of Grid Portals.

UNIT V

Grid Middleware: List of globally available Middlewares - Case Studies-Recent version of Globus Toolkit and gLite - Architecture, Components and Features. Features of Next generation grid.

Text Books

1. Ian Foster, Carl Kesselman, The Grid 2: Blueprint for a New Computing Infrastructure, Elsevier Series, 2004.
2. Vladimir Silva, Grid Computing for Developers, Charles River Media, January 2006

Reference Books

1. Parvin Asadzadeh, Rajkumar Buyya, Chun Ling Kei, Deepa Nayar, and Srikumar Venugopal, Global Grids and Software Toolkits: A Study of Four Grid Middleware Technologies, High Performance Computing: Paradigm and Infrastructure, Laurence Yang and Minyi Guo (editors), Wiley Press, New Jersey, USA, June 2005.
2. JarekNabrzyski, Jennifer M. Schopf, Jan Weglarz, Grid Resource Management: State of the Art and Future Trends, (International Series in Operations Research & Management Science), Springer; First edition, 2003
3. Srikumar Venugopal, Krishna Nadiminti, Hussein Gibbins and Rajkumar Buyya,
4. Designing a Resource Broker for Heterogeneous Grids, Software: Practice and Experience, Wiley Press, New York, USA, 2008

Course Outcomes (COs):

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

1. Understand the fundamentals of grid computing. (PO-1,3& PSO-2)
2. Discuss the basics of grid monitoring. (PO-1,2,3& PSO-2)
3. Learn the concepts of grid security and resource management. (PO-1,2,5,6& PSO-2)
4. Understand the concepts of grid portals. (PO-1,2,3 & PSO-2)
5. Understand the advanced grid middleware. (PO-1,2,3& PSO-2)

PROFESSIONAL ELECTIVE - III

TELEMEDICINE

Course code: MLE641 **Credits: 3:0:0**
Course Coordinators: Mrs Chandana S, Mrs Uma Arun **Contact hours: 42**

Course contents

UNIT I

Introduction to Telemedicine: Historical perspective and Evolution of telemedicine, Tele health, Tele care, Components of telemedicine system, Global and Indian scenario, Ethical and legal aspects of Telemedicine – Confidentiality, Social and legal issues, Safety and regulatory issues, Law governing telemedicine, Healthcare Informatics Developments , The Growth of the Internet: Information Flooding in E-Health

UNIT II

Wireless Technology in Patient Monitoring: Body Area Networks, Network Backbone , At the Hospital , Remote Recovery , At Sea ,Forests and Mountains ,Buildings on Fire , Electromagnetic Interference on Medical Instrument ,General Health Assessments Technologies in Medical Information Processing Collecting Data from Patients , Bio-signal Transmission and Processing ,Patient Records and Data Mining Applications , Electronic Drug Store.

UNIT III

Telemedical Standards: Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Video conferencing, Real-time telemedicine integrating doctors / hospitals, clinical laboratory data, radiological data, and other clinically significant biomedical data, Cyber laws related to telemedicine.

UNIT IV

Tele-radiology: Definition, Components of tele-radiology system: Image Acquisition system Display system, Tele pathology, Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information system – Doctors, paramedics facilities available.

UNIT V

Telemedical Applications: Telemedicine access to health care services – health education and selfcare. Introduction to robotics surgery, tele-surgery. Tele-cardiology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability, Telemedicine access to health care services – health education and selfcare, Usage of telemedicine.

Text Books

1. Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley (ISBN 0-471-53151-0), First edition, 2002.
2. Bernard Fong, A.C.M. Fong, C.K. Li, Telemedicine Technologies: Information Technologies in Medicine and Telehealth, John Wiley & Sons, 2011
3. O'Carroll, P.W, Yasnoff W.A., Ward E.Ripp, L.H., Martin, E.L., "Public Health Informatics and Information Systems", Springer (ISBN 0-387-95474-0), 1st Edition, 2003.
4. Ferrer-Roca, O., Sosa-Iudicissa, M, "Handbook of Telemedicine", IOS Press (Studies in Health Technology and Informatics, Volume 54). (ISBN 90-5199-413-3), 3rd Edition, 2002.

Reference Books

1. Simpson, W. "Video over IP- A practical guide to technology and applications", Focal Press (Elsevier). ISBN-10: 0-240-80557-7, 2006.
2. Wootton R. Craig, J., Patterson V. "Introduction to Telemedicine", Royal Society of Medicine Press Ltd (ISBN 1853156779), 2nd Edition, 2006.

Course Outcomes (COs):

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

1. Understand the basics of telemedicine and the law governing it. (PO:1, 2, 6, 8, 12; PSO: 2, 3)
2. Illustrate various wireless communication and processing technologies used to transmit and receive telemedical signals. (PO:1, 2, 7, 10, 12; PSO: 2, 3)
3. Describe various security and communication protocols required to transmit telemedical signals. (PO:1, 2, 7, 8, 10; PSO: 2, 3)
4. Apply the standard communication technologies which allows the radiologists provide service for improved patient. (PO:1, 2, 7, 8, 9, 10, 12; PSO: 2, 3)
5. Demonstrate the use the telemedical technology for advanced applications like robotic surgery and interoperability issues. (PO:1, 2, 7, 8, 9, 10, 12; PSO: 2, 3)

SPEECH PROCESSING & ITS APPLICATIONS

Course code: MLE642
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr C K Narayanappa, Mrs Chandana S

Course contents

UNIT I

Production and Classification of Speech Sounds: Introduction, mechanism of speech production. Acoustic phonetics: vowels, diphthongs, semivowels, nasals, fricatives, stops and affricates.

Time Domain Methods for Speech Processing: time dependent processing of speech, short, time energy and average magnitude, short, time average zero crossing rate.

UNIT II

Detection and Processing of Speech: Speech vs. silence detection, pitch period estimation using parallel processing approach, short, time autocorrelation function. Brief Applications of temporal processing of speech signals in synthesis, enhancement, hearing applications and clear speech.

UNIT III

Frequency Domain Methods for Speech Processing: introduction, definitions and properties: Fourier transforms interpretation and linear filter interpretation, sampling rates in time and frequency. Filter bank summation and overlap add methods for short, time synthesis of speech, sinusoidal and harmonic plus noise method of analysis/synthesis.

UNIT IV

Homomorphic Speech Processing: Introduction, homomorphic system for convolution, the complex cepstrum of speech, homomorphic vocoder.

UNIT V

Applications Of Speech Processing: Brief applications of speech processing in voice response systems hearing aid design and recognition systems.

Text Books

1. L. R. Rabiner and R. W.Schafer, Digital processing of speech signals, Pearson Education Asia, 2004.

Reference Books

1. T. F. Quatieri, Discrete time speech signal processing, Pearson Education Asia, 2004.
2. B. Gold and N. Morgan, Speech and audio signal processing: processing and perception of speech and music, John Wiley, 2011

Course Outcomes (COs):

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

1. Discuss the production of speech and the different models of speech signal. (PO: 1, 2, 4; PSO: 1, 2)
2. Demonstrate the speech representation and its Fourier analysis. (PO: 1, 2, 3, 9,10; PSO: 1, 2)
3. Analyze the homomorphic speech processing. (PO: 1, 2, 3, 9,10; PSO: 2, 3)
4. Illustrate various methods of speech enhancement and synthesis techniques. (PO: 2, 3, 9,10; PSO: 2, 3)
5. Explain the working of automatic speech recognition. (PO: 1, 2, 3, 12; PSO:2, 3)

WEARABLE ELECTRONICS & COMPUTING

Course code: MLE643
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Mrs Chandana S, Mrs Purnima B R

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.

UNIT II

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

UNIT III

Wearable Computers: Flexible Electronics, Wearable Computers, Signal Processors, Signal Conditioning circuits design, Power Requirements, Wearable Systems Packaging, Batteries and charging, Wireless Communication Technologies and Protocols, Receiver Systems, Mobile Applications based devices.

UNIT IV

Wireless Body Area Networks: Wireless Body Area Networks – Introduction, Personal Area Networks (PAN), Application in Vital Physiological Parameter monitoring, Design of Sensor & Sink Nodes, Architecture, Communication & Routing Protocols, Security, Power and Energy Harvesting.

UNIT V

Data Processing And Validation: Classification Algorithms, Data Mining and Data Fusion, Signal Processing Algorithms in wearable Applications, Issues of wearable

physiological monitoring systems, Statistical Validation of Parameters, Certifications of Medical Devices and Patenting.

Text Books

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

Reference Books

1. Kate Hartman, Make 'Wearable Electronics: Design, Prototype and wear your own interactive garments' Maker Media, 2014
2. Elijah Hunter, Wearable Technology, Create space independent publications, 2015
3. Guang Zhong Yang, Body Sensor Networks, Springer edition, 2014

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)

HOSPITAL MANAGEMENT

Course code: MLE644
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr Prabha Ravi, Mr Mahendra S J

Course contents

UNIT I

Overview of Hospital Administration: Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management.

UNIT II

Human Resource Management in Hospital: Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III

Marketing Research Process: Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV

Hospital Information Systems & Supportive Services: Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services.

UNIT V

Quality and Safety Aspects in Hospital: Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems.

NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

Text Books

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006.
2. G.D.Kunders, ―Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

Reference Books

1. Cesar A. Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger, ―Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3. Arnold D. Kalcizony & StephenM. Shortell, ―Health Care Management‖, 6th Edition Cengage Learning, 2011.

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)

DATA MINING FOR MEDICAL APPLICATIONS

Course code: MLE645
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr N Sriraam, Dr Sharath D

Course contents

UNIT I

DATA MINING CONCEPTS: Fundamentals of data mining – patterns and data-functionalities –classification of data mining systems- task primitives- integration with data warehouse- machine learning and statistics-input: concepts, instances, attributes and output: knowledge representation

UNIT II

Data Preprocessing and Data Warehouse: Need for pre-processing- descriptive data summarization-data cleaning- data integration, transformation and reduction, Data discretization and concept hierarchy generation-Importance of data warehouse-multidimensional data model –data ware house architecture-implementation-Data Warehousing to Data Mining.

UNIT III

Data Cube Computation, Generalization And Mining Patterns: Efficient Methods for Data Cube Computation - Development of Data Cube and OLAP Technology-Attribute-Oriented Induction—Method for Data Generalization and Concept Description- importance of mining patterns- Efficient and Scalable Frequent Item set Mining Methods - Mining Various Kinds of Association Rules -Association Mining to Correlation Analysis Constraint-Based Association Mining

UNIT IV

Classification, Prediction And Cluster Analysis: Importance of classification and prediction – issues-classification by Decision Tree Induction - Bayesian Classification- Rule-Based Classification- Classification by Backpropagation - support Vector Machines - Associative Classification: Classification by Association Rule Analysis- Prediction - Accuracy and Error Measures- Evaluating the Accuracy of a Classifier or Predictor -Cluster Analysis-Types of Data in Cluster Analysis -Clustering Methods - Model-Based Clustering Methods

UNIT V

Applications: Mining Data Streams - Mining biosignal time-series data -mining sequence patterns in transactional databases-mining sequence patterns in biological data- Applications: cancer detection, kidney failure and survival prediction

Text Books

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 2000 (ISBN: 1-55860-489-8).
2. Ian H. Witten and Eibe Frank, Data Mining: practical machine learning tools and techniques with Java implementations, Morgan Kaufmann Publishers, San Fransisco, CA, (2000).

Reference Books

1. Alex A. Freitas, Data mining and knowledge discovery with evolutionary algorithms, Sprtiner,2010
2. Dorian Pyle, Data Preparation for Data Mining, Morgan Kaufmann, 1999

Course Outcomes (COs):

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

1. Understand the foundation level of data mining. (PO-1,2,3 & PSO1)
2. Interpret various clustering and data warehouse principles. (PO-1,2,3 & PSO-1,2)
3. Analyze the data mining algorithms. (PO-2,3,4 & PSO-2)
4. Apply the principles for classification, prediction and clustering. (PO-3,4,5&PSO-2, 3)
5. Apply the application of data mining for clinical environment. (PO-5,6,7 & PSO-2,3)

OPEN ELECTIVE - II

BIOSAFETY & HEALTHCARE

Course code: MLOE04
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr Sanjay H S, Mrs Purnima B R

Course contents

UNIT I

Introduction to biosafety: General principles, Biosafety guidelines: Microbiological risk assessment, biosafety levels 1 and 2 in basic laboratories, biosafety level 3 in containment laboratories, biosafety level 4 in maximum containment laboratory, animal facilities and biosafety, guidelines for facility commissioning and certification, biosecurity

UNIT II

Medical laboratory safety: Biological safety cabinets, safety equipment, Microbiological techniques: laboratory techniques, contingency plans and emergency procedures, disinfection and sterilization, transport of infectious substances

UNIT III

Safety in hospitals: Chemical, fire and electrical safety: Hazardous chemicals, additional laboratory hazards, Safety organization and training: biosafety personal and committee, safety for support staff, training programs, safety checklist

UNIT IV

Other safety aspects: First aid, immunization of the staff, WHO biosafety collaborating centers, equipment safety, chemicals used and their hazards and precautions to be followed

UNIT V

Case studies: Biosafety in hospitals: Primary hospitals, Multispecialty hospitals, Biosafety in hospital waste disposals, rules and regulations to be followed, examples of hospitals with regard to biosafety in radiology and exposure

Text Books

1. Laboratory biosafety manual, 3rd edition, World health organization, 2015
2. Fay A Razovsky, “Handbook of patient safety compliance”, Jossey Bass publications, 2014

Reference Books

1. Gordon R Higson, “Medical device safety”, IOP publications, 2012

Course Outcomes (COs):

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

1. Assess the importance of essential biosafety related rules and regulations to be followed in healthcare (PO-3,8,9 & PSO-1)
2. Comprehend the different types of safety issues in hospitals and laboratories (PO-3,12 & PSO-2)
3. Ascertain the important safety-based issues in terms of equipment and patients in hospitals PO-3, 8 & PSO-2)
4. Illustrate the importance of supportive safety aspects to be considered in healthcare. (PO-3,4,11 & PSO-3)
5. Outline the role of biosafety and their relevance in real-time with the aid of different examples (PO-6,7,11 & PSO-3)

INTRODUCTION TO THERMAL IMAGING

Course code: MLOE05
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr Sharath D, Dr Prabha Ravi

Course contents

UNIT I

IR Thermography – Theory and Physics: History and evolution of thermography, blackbody radiation laws, IR absorption characteristics, radiometric measurements, heat and temperature, heat transfer mechanism, temperature measurement

UNIT II

IR Thermography System - Components: Optics,IR detector, detector performance parameters, image formation, filters, calibration, detector selection, choice of spectral band

UNIT III

IR Thermography System – Design and Advanced Methods: Camera performance characterization: temperature accuracy, temperature resolution, spatial resolution, time resolution, image quality. Advanced Methods: Spectrally Resolve IR Imaging, Superframing, Image processing and IR Imaging Software, Recent Advances

UNIT IV

IR Thermography Applications - Passive: Introduction, condition monitoring, building inspection, process monitoring and control, night vision and surveillance, medical applications, aircraft monitoring, automobile industry

UNIT V

IR Thermography Applications - Active: Active thermography techniques, inspection of composites, thermal property measurement, defect detection, characterization of coatings, corrosion detection, thermomechanics

Text Books

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. Xavier P.V. Maldague, Nondestructive Evaluation of Materials by Infrared Thermography, Springer Science & Business Media, 2012
2. Kaplan, Herbert. Practical applications of infrared thermal sensing and imaging equipment. Vol. 75. SPIE press, 2007

Course Outcomes (COs):

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

1. Understand the theoretical background of Infrared Thermography and temperature. (PO-1,2 & PSO-1)
2. Understand the complete IR thermography system and its working principle. (PO-1,2 & PSO-1,2)
3. Analyze and use the advanced concepts of IR thermography system. (PO-2,3& PSO-1,2)
4. Understand the concepts of IR camera operation and choose proper IR imaging system for a given problem. (PO-3& PSO-2)
5. Apply IR thermography techniques for various engineering related problems. (PO-4,5,12& PSO-2)

HEALTH INFORMATICS

Course code: MLOE06
Credits: 3:0:0 **Contact hours: 42**
Course Coordinators: Dr Prabha Ravi, Dr N Sriraam

Course contents

UNIT I

General Overview: Health information technology, Health informatics, Clinical Informatics, Cybermedicine, eHealth, Health 2.0, Public health informatics.

Applications in Healthcare Management: Health Administration Informatics, Medical integration environment, Health information exchange, Hospital information system, Healthcare workflow, Computer physician order entry, ICU quality and management tools, Laboratory information management system, Laboratory information system, mHealth, Practice management software, Clinical Quality Management System

UNIT II

Health Electronic Records: Electronic health record, Electronic medical record**,** Personal health record, Computer STored Ambulatory Record, ProRec, Health record trust, Canadian EMR, Clear Health, Laika, openEHR, OpenEMR, OpenMRS, VistA, VistA imaging, VistA Web, WorldVistA, ZEPRS,

Decision Support Applications: Clinical decision support system, Computer-aided diagnosis, Medical algorithm, Medical logic module, Physicians' Information and Education Resource.

Languages and Development Platforms: MUMPS

UNIT III

Medical Imaging Applications: Digital radiography, Imaging informatics, Patient registration, Radiology information system, Picture archiving and communication system, Analysis of Functional NeuroImages,3DSlicer, Analyze, CARET, CAVEman, FreeSurfer, ImageJ, In Vesalius, ITK-SNAP, Mango, OsiriX.

Medical and biological signal applications: Medical monitor, Holter monitor, Automated ECG interpretation, Open ECG project, MECIF Protocol, SCP-ECG, European Data Format, Open XDF

UNIT IV

Databases, Digital Libraries and Literature Retrieval: Biological database, Medical literature retrieval, MEDLINE, Entrez, ETBLAST, PMID, PubMed,

GoPubMed, Pubget, PubMed Central, UK PubMed Central, TRIP Database, Twease, SciELO.

Telehealth and Telemedicine: Connected Health, Telehealth, Telemedicine, Telecare, Telephone triage, Remote guidance, Tele-epidemiology, Telenursing, Teledermatology, Telemental Health, Telepsychiatry, Teleradiology, Telerehabilitation, Virtual reality in telerehabilitation, Campus medicus, Wireless Medical Telemetry Service.

Virtual Systems: Virtual Physiological Human, Visible Human Project**.**

UNIT V

Legislation and Regulation: Health Insurance Portability and Accountability Act, Certification Commission for Healthcare Information Technology, Software Systems, Medical software, Dental software, List of freeware health software, List of open source healthcare software, List of neuroimaging software, Mirth, Mpro , Open Dental, Personal Health Application .

Clinical Research Informatics: Translational research informatics, Clinical trial management, Clinical data management system, Case report form, Clinical coder, Clinical data acquisition, Data clarification form, Patient-reported outcome.

Standards, Coding and Nomenclature: Diagnosis codes, Procedure codes.

Text Books

1. Wikipedia Handbook of Biomedical Informatics, http://code.pediapress.com

Course Outcomes (COs):

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

1. Understand Health Systems and Policy. (PO-1,2,3 & PSO-1,2)
2. Develop skills in the management of health data, the electronic health record (EHR), health informatics projects and organizational resources. (PO-2,3,4 & PSO-1,2)
3. Know how computers store, access, and process data. (PO- 5,6,7 & PSO-2)
4. Use software applications to solve simple but meaningful real-world problems. (PO-7,8,9& PSO-3)
5. Design and Implement Information Systems Determining the required and available healthcare data and identify an appropriate database design. (PO-9,10,11 & PSO-3)