SEMESTER VII

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	MD19701	Medical Image Processing	3	0	0	3
2	PC	MD19702	Medical Imaging Techniques and Radio Therapy	3	0	0	3
3	PC	MD19703	Medical Informatics	3	0	0	3
4	PE	MD1935*	Professional Elective III	3	0	0	3
5	PE	MD1945*	Professional Elective IV	3	0	0	3
6	OE	MD1990*	Open Elective II	3	0	0	3
Practical							
7	PC	MD19704	Medical Image Processing Laboratory	0	0	4	2
8	EE	MD19705	Hospital Internship	0	0	2	1
9	EE	MD19706	Project Work (Phase I)	0	0	6	3
			Total	**18**	**0**	**12**	**24**

SEMESTER VIII

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PE	MD1955*	Professional Elective V	3	0	0	3
2	PE	MD1965*	Professional Elective VI	3	0	0	3
Practical							
3	EE	MD19801	Project Work (Phase II)	0	0	12	6
			Total	**6**	**0**	**12**	**12**
							Total Credits : 163

PROFESSIONAL ELECTIVE I

S. No	Category	Course Code	Course Title	L	T	P	C
1	PE	MD19151	Robotics and Automation	3	0	0	3
2	PE	MD19152	Neural Networks and its applications	3	0	0	3
3	PE	MD19153	BioMEMS	3	0	0	3
4	PE	MD19154	Medical Expert Systems	3	0	0	3

PROFESSIONAL ELECTIVE II

S. No	Category	Course Code	Course Title	L	T	P	C
1	PE	MD19251	VLSI Design	3	0	0	3
2	PE	MD19252	Pattern Recognition	3	0	0	3
3	PE	MD19253	Advanced Medical Instrumentation Technology	3	0	0	3
4	PE	MD19254	Telehealth Technology	3	0	0	3

PROFESSIONAL ELECTIVEIII

S. No	Category	Course Code	Course Title	L	T	P	C
1	PE	MD19351	Fundamentals of Biomedical Nanotechnology	3	0	0	3
2	PE	MD19352	Smart Wearable Systems	3	0	0	3
3	PE	MD19353	Rehabilitation Engineering	3	0	0	3
4	PE	MD19354	Cloud Computing for Healthcare	3	0	0	3

PROFESSIONAL ELECTIVE IV

S. No	Category	Course Code	Course Title	L	T	P	C
1	PE	MD19451	Nanotechnology and its applications	3	0	0	3
2	PE	MD19452	Physiological Modeling	3	0	0	3
3	PE	MD19453	Medical Devices Regulations	3	0	0	3
4	PE	MD19454	Artificial Intelligence for Healthcare	3	0	0	3

PROFESSIONAL ELECTIVE V

S. No	Category	Course Code	Course Title	L	T	P	C
1	PE	MD19551	Artificial Organs and Implants	3	0	0	3
2	PE	MD19552	Body Area Networks	3	0	0	3
3	PE	MD19553	Medical Ethics and Safety	3	0	0	3
4	PE	MD19554	Embedded Systems and Internet of Things in Healthcare	3	0	0	3

PROFESSIONAL ELECTIVE VI

S. No	Category	Course Code	Course Title	L	T	P	C
1	PE	MD19651	Virtual Bioinstrumentation	3	0	0	3
2	PE	MD19652	Digital Video Processing	3	0	0	3
3	PE	MD19653	Quality control in Biomedical Engineering	3	0	0	3
4	PE	MD19654	Brain Computer Interface and its Applications	3	0	0	3

OPEN ELECTIVE I

S. No	Category	Course Code	Course Title	L	T	P	C
1	OE	MD19901	Biomedical Equipments	3	0	0	3
2	OE	MD19902	Basics of Bioinformatics	3	0	0	3

OPEN ELECTIVE II

S. No	Category	Course Code	Course Title	L	T	P	C
1	OE	MD19903	Product design and development	3	0	0	3
2	OE	MD19904	Electrical safety and Quality Assurance in Healthcare	3	0	0	3

ONE CREDIT COURSES

S. No	Category	Course Code	Course Title	L	T	P	C
1	OCC	MD19951	Embedded Programming using ARDUINO	0	0	2	1
2	OCC	MD19952	PC Hardware Assembling and troubleshooting	0	0	2	1
3	OCC	MD19953	Basic Electronic Circuit Design using Multisim	0	0	2	1
4	OCC	MD19954	MATLAB Programming	0	0	2	1
5	OCC	MD19955	Labview Programming	0	0	2	1
6	OCC	MD19556	Open source programming using Linux	0	0	2	1
7	OCC	MD19957	PCB Design using KICAD EDA Tool	0	0	2	1
8	OCC	MD19958	VHDL Programming	0	0	2	1
9	OCC	MD1995*	NPTEL / Swayam Online Courses (4 Weeks)	0	0	2	1

MD19701 **MEDICAL IMAGE PROCESSING** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn the basic concept of image fundamentals.
- identify the designing concept of post processing
- familiarize medical image representation.
- acquire knowledge on medical image analysis.
- infer knowledge on image compression, recognition.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing; Components in DIP; Elements of Visual Perception; Image Sensing and Acquisition; Image Sampling and Quantization; Relationships between pixels - Color image fundamentals - RGB, HSI models; Two-dimensional mathematical preliminaries; 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain- Gray level transformations, Histogram processing; Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering; Frequency Domain- Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters, Ideal, Butterworth and Gaussian filters, Homomorphic filtering; Color image enhancement.

UNIT III IMAGE RESTORATION, THRESHOLDING AND SEGMENTATION 9

Image Restoration - degradation model, Properties; Noise models – Mean Filters, Order Statistics; Adaptive filters – Band reject Filters, Band pass Filters, Notch Filters, Optimum Notch Filtering, Inverse Filtering, Wiener filtering. Thresholding and Segmentation: Detection methods, Optimal thresholding, multi-spectral thresholding; Edge based segmentation, Edge detection, Edge linking via Hough transform, Region based segmentation, Matching, Region growing, Region splitting and merging.

UNIT IV IMAGE COMPRESSION AND RECOGNITION 9

Morphological processing- erosion and dilation; Segmentation by morphological watersheds – Basic concepts – Dam construction, Watershed segmentation algorithm; Need for data compression; Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG; Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors; Topological feature – Texture, Patterns and Pattern classes, Recognition based on matching.

UNIT V BIOMEDICAL IMAGING 9

Biomedical Images- Nature of Biomedical images, Objectives of biomedical image analysis,

Difficulties in biomedical image acquisition and analysis; Applications - Contrast enhancement of mammograms, Detection of calcifications by region growing, Shape and texture analysis of tumors.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- analyze different domain of digital images
- develop post processing techniques..
- apply image processing concepts for medical images.
- design and implement image processing applications in medical images.
- explore the possibility of applying Image processing concepts in modern hospitals.

TEXT BOOKS

1. Gonzalez R C, Woods R E, "Digital Image Processing", Third Edition, Prentice Hall, 2007
2. Sinha G. R, Patel, B. C., "Medical Image Processing: Concepts and Applications", Prentice Hall, 2014.

REFERENCES

1. Atam P.Dhawan,-Medical Image Analysis, Wiley Inter science Publication, NJ, USA 2003.
2. John L.Semmlow, Biosignal and Biomedical Image Processing Matlab Based applications Marcel Dekker Inc.,NewYork,2004
3. Kavyan Nagarian and RobertSplerstor,-Biomedical signals and Image processing,CRC–Taylor and Francis, NewYork,2006.
4. Digital Image Processing- S Jayaraman, S. Essakkirajan, T. Veerakumar-TMH,2020

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	3	3		3	2								3	2	2
CO 2	2	3		3	3					2			3	3	3
CO 3	3	3			3		3						3	3	3
CO 4	2	3		2	3								3	3	3
CO 5	3	3		3	3					1			3	3	3

MD19702 MEDICAL IMAGING TECHNIQUES AND RADIO THERAPY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn the production of x-rays and its application in medical imaging.
- apply the different types of Radio diagnostic techniques.
- infer the special imaging techniques used for visualizing the cross sections of the body.
- learn the ultrasound imaging and scanning.
- understand the Radiation therapy techniques and also Radiation safety.

UNIT I X – RAYS AND COMPUTED TOMOGRAPHY 9

Principle and production of X–Rays- Selection of anodes, heel pattern, Scattered Radiation, Porter-Bucky systems, Digital Radiography; Principles of Angiography and Fluoroscopic Techniques- Image Intensifiers, digital subtraction angiography, mammography; Dental X- ray units, Computerised Axial Tomography- Principle, Detectors, image reconstruction, Spiral CT, 3D Imaging

UNIT II EMISSION IMAGING 9

Alpha, Beta, Gamma Emission, different types of Radiation Detectors, G.M. and Proportional Counters, Pulse Height Analyzers, Isotopic; Scanners- Principle of PET and SPECT, PET/CT.

UNIT III MAGNETIC RESONANCE IMAGING 9

Principle of MRI- Relaxation processes and their measurements, Pulse sequencing and MR image acquisition, MRI instrumentation, Magnets, gradient coils, Imaging Different Sections of the Body; Tissue Characterization, MR Spectroscopy, Functional MRI.

UNIT IV ULTRASOUND IMAGING AND THERMOGRAPHY 9

Wave propagation and interaction in Biological tissues, Acoustic radiation fields, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Imaging Modes-A, B and M; Principles and theory of image generation; Thermography- Principle, detectors and applications.

UNIT V THERAPY USING X – RAYS AND ISOTOPES 9

Direct and Indirect effects of high energy radiation, Units for radiation, Exposure, Depth Dose curves, Linear Accelerator Betatron, Cobalt and Cesium Therapy, Computation of Absorbed Dose Level, Automatic Treatment Planning, ICRP regulation, Hazardous Effects of Radiation, Radiation measuring units, Allowed Levels, Protection Methods.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- discuss the principle and working of various radiography and tomography concept and image reconstruction techniques..
- explain the concept of nuclear imaging techniques and radiation detectors
- describe the basic principle and working of Magnetic resonance imaging technique.
- describe the basic principle involved in Ultrasound Imaging technique and Thermography.
- discuss the effects of radiation, radiation safety and the principle of Radio therapy techniques.

REFERENCES

1. Jerrold T. Bushberg, J.Anthony Seibert, Edwin M. Leidholdt, John M. Boone, The Essential Physics of Medical Imaging, Lippincott Williams and Wilkins; Third Edition, 2012.
2. D.N. Chesney and M.O. Chesney, Radio graphic imaging, CBS Publications, New Delhi, 1987.
3. Alexander, Kalender and Linke, Computed Tomography: Assessment Criteria, Ct System Technology, Clinical Applications, John Wiley, Chichster, 1986.
4. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelpia,1988.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	3	3		3	2								3	2	2
CO 2	2	3		3	3					2			3	3	3
CO 3	3	3			3		3						3	3	3
CO 4	2	3		2	3								3	3	3
CO 5	3	3		3	3					1			3	3	3

MD19703 **MEDICAL INFORMATICS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- gain fundamental knowledge of Hospital Information system.
- understand the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats and recent trends in Hospital Information Systems.
- explain how to manage medical databases.
- gain knowledge in ICT applications in medicine with an introduction to health informatics.
- study the concepts of telemedicine, its issues and reliability.

UNIT I MEDICAL INFORMATICS **9**

Introduction- Medical Informatics, Bio informatics, Health Informatics, Structure of Medical Informatics; Functional capabilities of Hospital Information System;On-line services and off–line services; History taken by computer, Dialogue with the computer.

UNIT II MEDICAL STANDARDS **9**

Evolution of Medical Standards – IEEE11073, HL7, DICOM, IRMA, LOINC, HIPPA, Electronics Patient Records; Healthcare Standard Organizations – JCAHO (Join Commission on Accreditation of Healthcare Organization), JCIA (Joint Commission International Accreditation).

UNIT III MEDICAL DATA ACQUISITION AND STORAGE **9**

Plug-in Data Acquisition and Control Boards–Data Acquisition using Serial Interface; Medical Data formats –Signal, Image and Video Formats, Medical Databases; Automation in clinical laboratories-Intelligent Laboratory Information System; PACS, Data mining.

UNIT IV HEALTH INFORMATICS **9**

Bioinformatics Data bases, Bio-information technologies, Semantic web and Bioinformatics, Genome projects; Clinical informatics, Nursing informatics; Public health informatics; Education and Training

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS **9**

Medical Expert Systems, Virtual reality applications in medicine, Surgical simulation, Radiation therapy and planning–Telemedicine; Virtual Hospitals– Personalized e-health services, Biometrics.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- discuss about health informatics and different ICT applications in medicine
- explain the function of Hospital Information Systems.

- appreciate and adopt medical standards.
- understand the virtual reality tools.
- summarize the concept and need of different information systems.

TEXT BOOKS

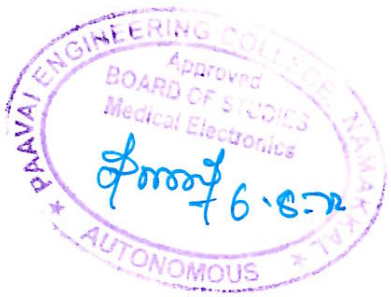
1. Radulae, "Computers in Medicine: Progress in Medical Informatics'', Tata McGraw Hill Publishing computers Ltd, New Delhi, 2005.
2. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Computers Ltd, New Delhi, 2003.

REFERENCES

1. N.Mathivanan, "PC-Based Instrumentation'', Prentice Hall of India Pvt Ltd –New Delhi,2007.
2. YiPing Phoebe Chen, "Bioinformatics Technologies'', Springer International Edition, New Delhi, 2014.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P O9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2		3									3	2	2
CO 2	2	3		1	3				3				3	3	3
CO 3	3	3	2	3	3	3						3	3	3	3
CO 4	2	3		2							1		3	3	3
CO 5	3	3		3	3		1						3	3	3



MD19704 MEDICAL IMAGE PROCESSING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To provide practice to

- analyze the basic image processing techniques.
- compute magnitude and phase representation of images.
- understand the concepts of image restoration and segmentation.
- study the various characteristics of analysis of bio-signals.

LIST OF EXPERIMENTS

1. Color Image processing.
2. Histogram Equalization.
3. Spatial filtering and non-linear filtering.
4. Edge detection using operators.
5. 2D DFT and DCT.
6. Filtering in frequency domain.
7. DWT of images.
8. Feature extraction of medical images.
9. Medical Image Compression techniques.
10. Medical Image fusion.
11. Wavelet decomposition and Reconstruction.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- use transforms and analyze the characteristics of the image.
- perform enhancing operations and segmentation operations on the image using spatial filters and frequency domain filters.
- estimate the efficiency of the compression technique on the images develop image processing algorithms for different image processing.
- apply image processing technique to solve real health care problems.

CO/PO MAPPING:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3			3	2					1			3	2	2
CO 2	2	3			3								3	3	3
CO 3	3	3		3	3	2							3	3	3
CO 4	2	3	2	2	3								3	3	3

MD19705 **HOSPITAL INTERNSHIP** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- improve the skills by visiting the hospitals.
- understand the working principle of various biomedical equipments.
- able to work on the equipments through internship.
- able to design the equipment prototype model.

GUIDELINE FOR HOSPITAL INTERNSHIP AND TRAINING

The students may be grouped upto 4 members by internship coordinator. The students will be allowed for hospital internship training for 2 weeks. After the completion of Internship, they will have to submit the report to the Coordinator and Head of the Department. At the end of the semester examination the Hospital Training report is evaluated based on oral presentation and is examined jointly by the committee constituted by the Head of the Department.

TOTAL PERIODS 30

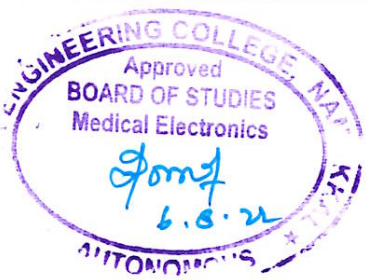
COURSE OUTCOMES

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

- advocate a patient-centered approach in healthcare.
- communicate with other health professionals under various departments ina respectful and responsible manner.
- propose a patient-centered inter-professional health improvement record plan based upon the patient perceived needs.
- design the equipment prototype model.

CO/PO MAPPING:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1		3		3	2								3	2	2
CO 2	2		2		3								3	3	3
CO 3	3	3		3			2				2		3	3	3
CO 4	2	3		2	3								3	3	3



MD19706 **PROJECT WORK (PHASE I)** **0 0 6 3**

COURSE OBJECTIVES

To enable the students to

- improve the skills to formulate a technical project.
- explain the various tasks of the project and standard procedures.
- teach the use of new tools, algorithms and techniques required to carry out the projects.
- analyze the various procedures for validation of the product and analyze the cost effectiveness.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped up to 4 members and work under a project supervisor. The prototype/simulation may be decided in consultation with the supervisor. A Project Phase I Report to be submitted by the group and the prototype model, which will be reviewed and evaluated for internal assessment by a Committee Constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the Project Phase I report is examined jointly by external and internal examiners constituted by the Controller of Examinations. It is highly desirable to publish their Project idea in State/ National level Conferences or Symposiums.

TOTAL PERIODS 90

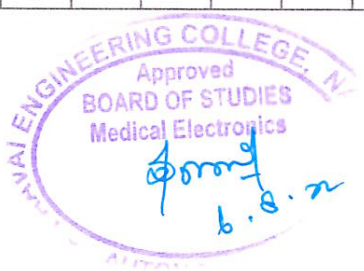
COURSE OUTCOMES

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

- formulate the real-world problem, identify the requirement and develop the design solutions.
- identify the technical ideas, strategies and methodologies.
- use the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- analyze and validate through conformance of the developed prototype and analysis the cost effectiveness.

CO/PO MAPPING:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1		3		3	2								3	2	2
CO 2	2		2		3								3	3	3
CO 3	3	3		3			2				2		3	3	3
CO 4	2	3		2	3								3	3	3



MD19801 **PROJECT WORK (PHASE II)** **0 0 12 6**

COURSE OBJECTIVES

To enable the students to

- improve the skills to formulate a technical project.
- explain the various tasks of the project and standard procedures.
- teach the use of new tools, algorithms and techniques required
- analyze the various procedures for validation of the product and analyze the cost effectiveness.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped up to 4 and work under a project supervisor. The device/system/component to be prototype may be decided in consultation with the supervisor. A project report to be submitted by the group and the prototype model, which will be reviewed and Evaluated for internal assessment by a committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the Project report jointly by external and internal examiners constituted by the COE. It is highly desirable to publish their project in state/ national level conferences or Symposiums.

TOTAL PERIODS: 180

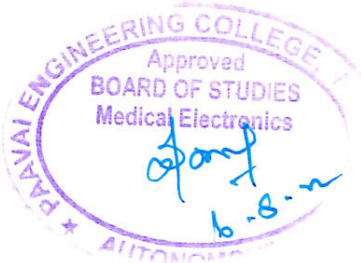
COURSE OUTCOMES

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

- formulate the real world problem, identify the requirement and develop the design solutions.
- identify the technical ideas, strategies and methodologies.
- use the new tools, algorithms, techniques that contribute to obtain the solution of the project
- analyze and validate through conformance of the developed prototype and analysis the cost

CO/PO MAPPING:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1		3		3	2								3	2	2
CO 2	2		2		3								3	3	3
CO 3	3	3		3			2				2		3	3	3
CO 4	2	3		2	3								3	3	3



MD19351 FUNDAMENTALS OF BIOMEDICAL NANOTECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- explain the basic principles of Nanotechnology.
- learn the aspects based on bimolecular synthesis of nano materials.
- learn about the advantages of nano materials in medicine.
- familiarize about biosensors and its application in nanotechnology.
- acquire knowledge on applications of future technological advancements and increasing role of nanotechnology in biomedical industries.

UNIT I INTRODUCTION TO NANOTECHNOLOGY 9

Nano scale phenomena, Opportunities, Natural nanocomposite system, Types of nanostructured materials- Zero-dimensional, one-dimensional, two-dimensional and cluster of nanomaterial; Biomaterials- 1st, 2nd and 3rd generations of biomaterials; Nanoscale effects in properties - physical, mechanical, thermal, electrical and biological properties towards nano size.

UNIT II SYNTHESIS OF NANOPARTICLES 9

Top town and bottom-up nanoparticles synthesis: Physical methods - Ball milling, PVD/Sputtering, CVD, Spray pyrolysis; Chemical methods - Sol gel, Hydrothermal, Electrochemical, Sonochemical; Lithography- Electron beam and Dip pin; Biological methods - green synthesis and microbial synthesis (Bacteria, Yeast, Fungi).

UNIT III CARBON MATERIALS AND CHARACTERISATION TECHNIQUES 9

Nanoforms of carbon materials- Bucky balls, fullerene, graphene, carbon nanotubes (SWCNT and MWCNT); Characterization techniques of nano materials –UV- visible, X-ray diffraction (XRD), FTIR, Scanning and Transmission Electron Microscopy (SEM and TEM)- Energy Dispersive X-ray (EDX), Atomic Force Microscopy (AFM) and Nanoindentation.

UNIT IV NANOMATERIAL IN BIOSENSORS 9

Principles and applications nano materials- DNA and protein based nanobiosensors; Future direction in biosensor research; MEMS and NEMS; Quantum dots– Synthesis, Properties, applications and drawbacks. Biochips and In-vivo imaging - Integrated nano sensor networks.

UNIT V APPLICATIONS OF NANOTECHNOLOGY IN BIOMEDICAL 9

Biodegradable Nanomaterials in bone substitutes– Implants and Prosthesis; MCNT and other Nano materials in cancer diagnosis and targeted drug delivery; Antibacterial agents; Tissue Engineering – Nanoartificial cells; Nanorobotics– Photodynamic Therapy; Potential risks (toxicity) and remedies towards environmental impact and human health.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- relate any architecture and assembly language for a processor.
- comprehend the architectural and pipelining concepts for microprocessors.
- design and deploy the interfacing peripherals in real time scenario.
- design, develop and trouble shoot microcontroller-based system.
- implement microcontroller-based systems in biomedical domain.

TEXT BOOKS

1. Neelina H. Malsch, "Biomedical Nanotechnology", Taylor & Francis Group, 19 Sep 2019.
2. Mauro Ferrari, Sangeeta N. Bhatia, Tejal Desai, "BioMEMS and Biomedical Nanotechnology Volume III: Therapeutic Micro/Nanotechnology · Volume 3", Springer US,1st illustrated reprint edition, 23 November 2010.

REFERENCES

1. Emily S. Day, Sarah Hurst Petrosko, "Biomedical Nanotechnology Methods and Protocols", Springer New York, 9 June 2018 .
2. Chris Binns, "Introduction to Nanoscience and Nanotechnology", Wiley,16 June 2010.
3. Amretashis Sengupta, "Introduction to Nano-Basics to Nanoscience and Nanotechnology" Springer, 2012.
4. Subbiah Balaji, "Nano biotechnology", Chennai :MJP Publishers, 2010, 228pp.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)		
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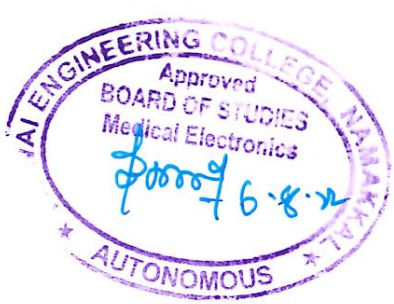
CO 4	2	3		2	3				3				3	3	3
CO 5	3	3		3	3								3	3	3



MD19352 **SMART WEARABLE SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- learn the fundamentals of sensors.
- understand signal processing association in wearable systems.
- evaluate various energy needs in wearable.
- learn the analysis of wearable systems.
- analyze the applications of wearable.

UNIT I SENSORS **9**

Need for wearable systems; Sensors for wearable systems - Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, Pneumography; Wearable ground reaction force sensor- GSR, Radiant thermal sensor, Wearable motion sensors; CMOS Based Biosensors- E-Textiles, Bio compatibility.

UNIT II SIGNAL PROCESSING **9**

Wearability issues- Physical shape and placement of sensor; Technical challenges - Sensor design, Signal acquisition, Constraint on sampling frequency for reduced energy consumption- Light weight signal processing, Rejection of irrelevant information, Data mining.

UNIT III ENERGY HARVESTING FOR WEARABLE DEVICES **9**

Solar cell, Vibration based heat source, Thermal based heat source for power generation; Hybrid thermoelectric photovoltaic energy harvests; Thermopiles.

UNIT IV PROTOCOLS IN HEALTH YSYTEMS **9**

Need for wireless monitoring; Definition of Body area network - BAN and Healthcare, Technical Challenges, System security and reliability; BAN Architecture – Introduction, Wireless communication techniques.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS **9**

Medical Diagnostics; Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients; Multi parameter monitoring- Neural recording, Gait analysis, Sports Medicine, Smart Fabrics..

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- familiarize with the principles of various types of sensors.
- choose appropriate sensors and signal processing techniques for wearable systems.

- assess the energy requirement for a wearable system.
- evaluate the security issues related to wearable systems.
- identify the application of wearable systems.

TEXT BOOKS

1. Annalisa Bonfiglio, Danilo De Rossi ,"Wearable Monitoring Systems", Springer, 2011.
2. Sandeep. K.S. Gupta, Tridib Mukherjee, Krishna Kumar Venkata Subramanian, "Body Area Networks Safety, Security, and Sustainability," Cambridge University Press, 2013.

REFERENCES

1. Hang,Yuan-Ting, "wearable medical sensors and systems",Springer-2013.
2. Mehmet R. Yuce, Jamil Y.Khan, "Wireless Body Area Networks Technology, Implementation and Applications", Pan Stanford Publishing Pvt. Ltd, Singapore, 2012.
3. Guang-Zhong Yang(Ed.), "Body Sensor Networks, "Springer, 2006.
4. Andreas Lymberis, Danilo de Rossi ,'Wearable Health systems for Personalized Health Management – State of the art and future challenges ' IOS press, The Netherlands, 2004.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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MD19353 REHABILITATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

- explain the need for medical aids.
- understand the sensory rehabilitation systems.
- learn the use of the orthopedic prosthetics and orthotics in rehabilitation.
- handle the virtual reality in rehabilitation.
- have an understanding of rehabilitation medicine and advocacy.

UNIT I INTRODUCTION 9

Definition - Impairments, disabilities and handicaps, Primary and secondary disabilities; Activities of daily living; Appropriate Technology- Residual function, Rehabilitation; Rehabilitation team – members and their functions; Rehabilitation care –Need for proper delivery of rehabilitation care, Community based rehabilitation and its aspects.

UNIT II CONCEPTS IN SENSORY REHABILITATION ENGINEERING 9

Sensory augmentation and substitution- Visual system, Visual augmentation, Tactual vision substitution, Auditory vision substitution; Auditory system- Auditory augmentation, Hearing aids, cochlear implants, visual auditory substitution, tactual auditory substitution; Tactual system-Tactual augmentation, Tactual substitution, Computerized wheel chairs – ergonomics of wheel chair propulsion.

UNIT III PROSTHETICS AND ORTHOTICS 9

Engineering concepts in motor rehabilitation, Artificial limbs- body powered, externally powered and controlled orthotics and prosthetics, Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS), MARCUS intelligent hand prosthesis

UNIT IV VIRTUAL REALITY IN REHABILITATION 9

Introduction to virtual reality, Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.

UNIT V REHABILITATION MEDICINE AND ADVOCACY 9

Physiological aspects of Function recovery, Psychological aspects of Rehabilitation therapy, Trends in the rehabilitation of the long-term ill and severely disabled, Legal aspect of Rehabilitation Amputation.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- understand the key terminologies used by the rehabilitation team.

- devise new concepts for future development and applications.
- design and develop different sensory assist devices, orthotics and prosthetics for rehabilitation applications.
- understand the need of virtual reality tools for different aids.
- appreciate the legal aspects for building rehabilitation aids for the needed people.

TEXT BOOKS

1. Joseph D Bronzino, "The Biomedical Engineering Handbook". 2nd edition, CRC Press, 2000.
2. Robinson C.J, "Rehabilitation Engineering", CRC Press, 2006.

REFERENCES

1. Sashi S Kommu, "Rehabilitation Robotics", 1st edition, CRC Press, 2007.
2. Sunder, "Textbooks of Rehabilitation", Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi, 2nd Edition, Reprint 2007.
3. Horia- Nocholai Teodorecu, L.C.Jain, "Intelligent systems and technologies in rehabilitation Engineering", CRC; December 2000.
4. Etienne Grandjean, Harold Oldroyd, "Fitting the task to the man", Taylor & Francis,1988.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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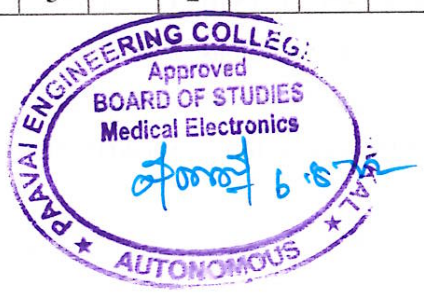

MD19354 **CLOUD COMPUTING FOR HEALTHCARE** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn the basics of cloud computing insight and models.
- understand the standards and security involved in cloud computing acquire
- the knowledge on different types of cloud services understand the concept of cloud.
- the concept of cloud management in the eco system demonstrate the applications in cloud computing.
- describe the cloud storage and its uses.

UNIT I INTRODUCTION 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish- Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- learn the key and enabling technologies that help in the development of cloud
- develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- explain the core issues of cloud computing such as resource management and security..
- be able to install and use current cloud technologies.

TEXT BOOKS

1. M.N. Rao, "Cloud Computing", PHI learning private Limited 2015 edition.
2. "Cloud Computing: Concepts, Technology & Architecture"- The Pearson Service Technology Series from Thomas Erl, 1st Edition 2020.

REFERENCES

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)
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computingl, Tata Mcgraw Hill, 2013.
4. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

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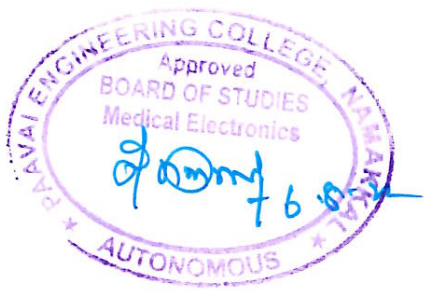

MD19451 NANOTECHNOLOGY AND ITS APPLICATIONS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- provide a broad view of the nascent field of nanoscience and technology to undergraduates
- explore the basics of nanomaterial synthesis and characterization.
- introduce the applications of nanotechnology
- provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- explore the basics of nanomaterial synthesis and characterization.

UNIT I INTRODUCTION TO NANOTECHNOLOGY 9

Basic Structure of Nanoparticles; Kinetics in Nanostructured Materials; size and shape of nanoparticles-Zero-dimensional, one-dimensional, two-dimensional nanostructures; clusters of metals and semiconductors; bionano-particles; Natural nanocomposite systems - spider silk, bones, shells; Emergence and challenges of nanoscience and nanotechnology.

UNIT II PREPARATION AND FABRICATION TECHNIQUES 9

Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning; Bio-synthesis of nanomaterials.

UNIT III PROPERTIES AND MEASUREMENT OF NANOMATERIALS 9

Principle of MRI- Relaxation processes and their measurements, Pulse sequencing and MR image acquisition, MRI instrumentation, Magnets, gradient coils, Imaging Different Sections of the Body; Tissue Characterization, MR Spectroscopy, Functional MRI.

UNIT IV ADVANCED NANO STRUCTURES 9

Properties of nanoparticles - Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; XRD, FTIR, SEM, TEM, AFM, Confocal and TIRF imaging.

UNIT V GENERAL APPLICATIONS OF NANOTECHNOLOGY 9

Nano electronics; Nanosensors, Nanotechnology in Diagnostics and treatment - MEMS and NEMS; Environmental and Agricultural Applications of nanotechnology; Nano technology for energy systems; Nanolithography; Biochips.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- describe the basic science behind the properties of materials.
- interpret the creation, characterization, and manipulation of nanoscale materials.
- comprehend the exciting applications of nano at the leading edge of scientific research
- apply their knowledge of nano to identify how they can be exploited for new applications
- describe the basic science behind the properties of materials.

TEXT BOOKS

1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004.
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004.

REFERENCES

1. Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.
2. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y. Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.
3. Handbook of Nanoceramics and their Based Nanodevices (Vol. 2) Edited by Tseung-Yuen Tseng and Hari Singh Nalwa, American Scientific Publishers.
4. S. Shanmugam "Nanotechnology" MJP Publishers, 2011, ISBN 978-81-8094-0644.

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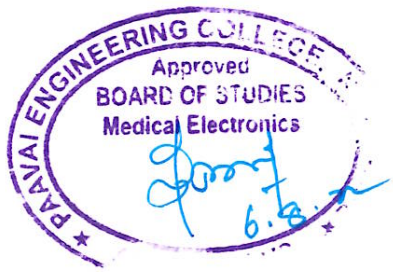

MD19452 **PHYSIOLOGICAL MODELING** **3 0 0 3**

COURSE OBJECTIVES

To enable students to .

- understand the application of Physiological models and Vital organs.
- understand methods and techniques for analysis and synthesis of dynamic models
- model dynamically varying physiological system
- develop differential equations to describe the dynamic models
- simulate and visualize, dynamic responses of physiological models using software

UNIT I SYSTEM CONCEPT **9**

Introduction to Physiological control systems- Purpose of physiological modeling and signal analysis, Illustration- example of a physiological control system, Difference between engineering and physiological control systems; System variables and properties- Resistance both static and dynamic, Compliance and combination of resistance and compliance; Resistance and compliance models - Respiratory system, Aortic segments, Lumped model of physiological thermal system, step response of resistance, compliance system, dye dilution study of circulation.

UNIT II SYSTEM ANALYSIS **9**

Review of transfer function- transfer function of coupled system, Impedance based transfer function; Flexible tube feeding- a single port compliant model, development of a lung model; Periodic signals- sinusoidal analysis of second order system, analysis of respiratory system based on sinusoidal excitation, pendelluft.

UNIT III TRANSIENT AND FEEDBACK **9**

Review of transient and stability analysis- Homeostasis, representation, finger tracking; Characterization of Physiological Feedback systems- Hypophysis adrenal systems; Nonlinear systems and linearization - Transfer function analysis of pupillary control system as a closed loop, method of opening the closed loop, pupillary hippus.

UNIT IV MODELING OF CARDIOPULMONARY SYSTEM **9**

Model of cardiac output regulation - Starling's law, Physical Significance of under damped responses of post systolic operations in aortic arch, model of circadian rhythms, chemical regulation of ventilation, Cheyne-Stoke breathing, biot breathing.

UNIT V PHYSIOLOGICAL MODELS AND SIMULATION **9**

Steady state analysis of regulation of glucose; Hodgkin-Huxley model; Thermal system – Model and simulation; Modeling of eye movement- Types of eye movement, Saccade model, Model of occulomotor control.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- explain application of Physiological models.
- model dynamically varying physiological system.
- analyze and synthesize dynamic models of physiological system
- develop differential equations to describe the dynamic models, simulate and visualize.
- implement physiological models using software to get dynamic responses.

TEXT BOOKS

1. William B.Blesser, "A System Approach to Biomedicine", McGraw Hill Book Co., New York, 1969.
2. Micheal C.K.Khoo ,"Physiological Control System Analysis, Simulation and Estimation", Prentice Hall of India , New Delhi ,2001.

REFERENCES

1. ManfreoClynes and John H.Milsum, "Biomedical Engineering System", McGraw Hilland Co., New York ,1970
2. Richard Skalak and ShuChien, "Hand Book of Biomedical Engineering" , McGraw Hilland Co., New York, 1987
3. Douglas S.Rigg, "Control Theory and Physiological Feedback Mechanism", The Wilkliam and Wilkins Co. Baltimore, 1970.
4. Joseph D,Bronzino, "'The Biomedical Engineering Handbook'', CRC Press,3 rd Edition, 2006.

CO/PO MAPPING :

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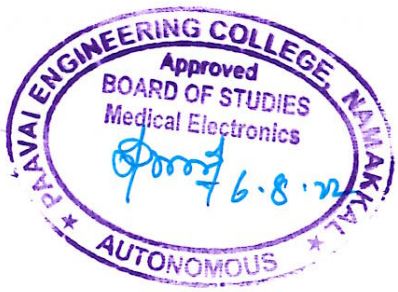

MD19453 MEDICAL DEVICES REGULATIONS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- define the basic concepts of medical device regulations
- discuss the global policies on medical device regulations
- analyze implications of the regulations
- analyze the way design concepts are imbibed in practical scenarios.
- teach the concept about medical device quality assurance

UNIT I INTRODUCTION 9

The medical device- Defining the device, the product definition process, overview of quality function deployment; The business proposal reliability- Definition, Quality vs Reliability, Reliability vs unreliability, types of reliability, optimizing reliability, reliability's effects on medical devices; Concept of failure- causes of failure, practical aspects of failure, failure rates, hardware failure, software failure, failure due to the human errors, failure from the customer point of view; Safety and risk management- effectiveness and performance of medical devices, phases in the life span of a medical device, the risk management processes, tool for risk estimation, shared responsibility for medical device safety and performance.

UNIT II GLOBAL HARMONIZATION TASK FORCE 9

Global Harmonization Task Force (GHTF)- Objectives, Scope of the four GHTF, Benefits of the GHTF, Global Medical Device Nomenclature (GMDN); The Food and Drug Administration- history of device regulation, device classification, registration and listing, the 510 (k) Process, declaration of conformance to a recognized standard; The PMA application; Investigational Device Exemptions (IDEs); Good Laboratory Practices (GLPs); Good Manufacturing Practices(GMPs); Human Factors-design Control, FDA and Software, Software classification, The FDA Inspection.

UNIT III GLOBAL POLICIES ON MEDICAL DEVICE REGULATIONS 9

The European Union- European Directives, European Standardization Bodies, European Standards Development Process, European Standards Considerations, conformity assessment and testing, European Organization for Testing and Certification, the NVCASE Program; Medical Devices Directives- Definition of a medical device, Medical Devices Directives process, choosing the appropriate directive, identifying the applicable essential requirements; Identification of corresponding harmonized standards, Essential requirements, Classification of the medical devices, identification and choice of a notified body.

UNIT IV STANDARDS AND REGULATIONS BACKGROUND 9

Standards and Regulations background- Voluntary and mandatory standards, standards development process, conformity assessment with standards, national and international of standards systems, identification of standards, current trends in the use of standards in medical device regulations; The ISO 9000 series of standards.

UNIT V SOFTWARE AND QUALITY SYSTEM REGULATION 9

Software and Quality system regulation- Software as a Technology, Domestic Software Regulations, Domestic Software Standards, International Software Regulations, International Software Standards, Software Standard

History of the quality system regulations- scope, general provisions, Quality system, Design controls, Document controls, Purchasing controls, Identification and traceability, Production and process controls, Acceptance activities, Non-conforming product, Corrective and preventive action.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- define and explain the basic concepts of medical device regulations
- illustrate the global policies on medical device regulations
- understand the design of concepts are imbibed in practical scenarios
- explain the regulations of medical devices
- construe the software and quality system regulation

TEXT BOOKS

1. Reliable Design of Medical Devices, Second Edition by Richard Fries, CRC Press, 2006
2. Medical Device Quality Assurance and Regulatory Compliance by Richard C Fries, CRC Press, 1998.

REFERENCES

1. Medical device regulations: global overview and guiding principles By Michael Cheng, World Health Organization
2. "Medical Devices: Regulations, Standards and Practices" by Seeram Ramakrishna, Lingling Tian, Charlene Wang, Susan Liao, Wee Eong Teo Woodhead Publishing.
3. Medical Device Regulations: A complete Guidebook by Aakash Deep published by Elsevier Science, 2022.
4. "The Future of Medical Device Regulation: Innovation and Protection" by Carmel Shachar, Timo Minssen, I. Glenn Cohen, W.Nicholson Price II, Christopher T. Roberson published in 2022.

CO/PO MAPPING :

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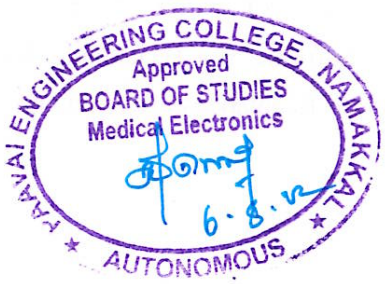

MD19454 ARTIFICIAL INTELLIGENCE FOR HEALTHCARE 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basic knowledge on Neural networks
- learn the fuzzy logic control
- study the concept of Genetic algorithm
- learn the analysis of PSO and DE optimization techniques
- study the concept of AI in medicine.

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Basics of ANN – Perceptron, Delta learning rule, Back propagation algorithm, Multilayer Feed forward network-Memory models- Bi-directional associative memory- Hopfield network, Kohonen self-organizing, ART network.

UNIT II FUZZY LOGIC CONTROL 9

Classical set Vs Fuzzy set; Operation and Properties; Fuzzy Relations – Fuzzy Logic control, Fuzzification, Membership functions, Defuzzification; Rule Based System, Applications- Decision making control through fuzzy set theory.

UNIT III GENETIC ALGORITHM 9

Genetic algorithm and search space- general genetic algorithm, operators in GA - genetic programming– multilevel optimization– advances in GA.

UNIT IV PSO AND DE OPTIMIZATION TECHNIQUE 9

Introduction- Review on PSO and DE – Restoration using particle, Swarm optimization and differential evolution techniques; Formulation; Application.

UNIT V APPLICATIONS IN MEDICINE 9

Diagnosis of disease using AI; Biometrics- Face recognition and Gene matching; Automated drug delivery systems; Computer aided diagnosis; Mining of electronic health record; Computer vision.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- represent the neural network in various forms.
- elucidate the fuzzy logic operations and application of AI in decision making.
- examine the application of Genetic algorithm.
- analyze the PSO and DE techniques.
- implement the AI in medicine.

TEXT BOOKS

1. James.A.Freeman and B.M.Skapura – "Neural Networks, Algorithms Applications and Programming techniques"- Addison Wesley, 2000.
2. Zimmerman, H.J.–"Fuzzy Set Theory and its Applications", Kluwer Academic Publishers,2004.

REFERENCES

1. George Klir and Tina Folger,.A., - "Fuzzy sets, Uncertainty and Information", Prentice Hall of India Pvt.Ltd., 2002 .
2. S.Rajasekaran and G A VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall, India, 2003.
3. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
4. Carlo Combi, Yuval Shahar; "Artificial Intelligence in Medicine" – 12 th Conference – Springer

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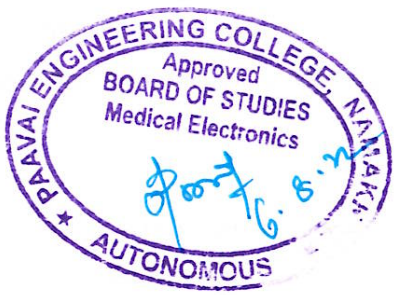

MD19551 ARTIFICIAL ORGANS AND IMPLANTS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- have an overview of artificial organs and transplants.
- familiar the principles of implant design with a case study.
- explain the implant design parameters and solution in use.
- study about various blood interfacing implants.
- study about soft tissue replacement and hard tissue replacement.

UNIT I ARTIFICIAL ORGANS AND TRANSPLANTS 9

Introduction - outlook for organ replacements, design consideration, evaluation process.

TRANSPLANTS: -Overview, Immunological considerations, Blood transfusions; Individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN 9

Principles of implant design; Clinical problems requiring implants for solution; Permanent versus absorbable devices; The missing organ and its replacement; Tissue engineering - scaffolds, cells and regulators, criteria for materials selection; Case study of organ regeneration.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION 9

Biocompatibility; Local and systemic effects of implants; Design specifications for tissue bonding and modulus matching; Degradation of devices - Natural and synthetic polymers, corrosion, wear and tear, implants for Bone; Devices for nerve regeneration.

UNIT IV BLOOD INTERFACING IMPLANTS 9

Neural and neuromuscular implants- Heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers; Artificial kidney- dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS 9

Gastrointestinal system; Dentistry- Maxillofacial and craniofacial replacement; Soft tissue repair-Replacement and augmentation, recent advancement and future directions.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- gain adequate knowledge about artificial organs and transplants.
- get clear idea about implant design and its parameters and solution.

- have in-depth knowledge about blood interfacing implants.
- explain different types of soft tissue replacement and hard tissue replacement.
- undergo the applications of implantable medical devices and organs.

TEXT BOOKS

1. Nadey S. Hakim, Artificial Organs, Springer London, 28 Oct 2010.
2. Park J.B., —Biomaterials Science and Engineering‖, Springer US, 23 Jan 2014.

REFERENCES

1. J D Bronzino, Biomedical Engineering Handbook, Fourth Edition, (CRC Press), 3 Oct 2018.
2. R S Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, 16 June 2014.
3. Roderic S. Lakes, Joon B Park, Biomaterials – An Introduction, Springer US, 28 Nov 2012.
4. Yannas, I. V, —Tissue and Organ Regeneration in Adults‖, New York, NY: Springer, 2001. ISBN:9780387952147.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO 3	3	3		3									3	3	3
CO 4	2	3		2	3							1	3	3	3
CO 5	3			3	3				1				3	3	3

MD19552 **BODY AREA NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- introduce the basic concepts of BAN
- know the hardware requirement of BAN
- understand the communication and security aspects in the BAN
- explore the coexistence issues with BAN
- know the applications of BAN in the field of medicine

UNIT I INTRODUCTION **9**

Definition- BAN and Healthcare; Technical Challenges- Sensor design, biocompatibility, Energy supply; Optimal Node placement- Number of nodes, System security and reliability, BAN Architecture Introduction.

UNIT II HARDWARE FOR BAN **9**

Processor- Low Power MCUs, Mobile Computing MCUs, Integrated processor with radio transceiver, Memory; Antenna- Flexible PCB antenna, Wire antenna, Ceramic antenna, External antenna, Sensor Interface; Power sources- Batteries and fuel cells for sensor nodes.

UNIT III WIRELESS COMMUNICATION AND NETWORK **9**

RF communication in Body; Antenna design and testing- Propagation, Base Station; Network topology- Stand Alone BAN Wireless personal Area Network Technologies- IEEE 802.15.1, IEEE P802.15.13, IEEE 802.15.14, Zigbee.

UNIT IV COEXISTENCE ISSUES WITH BAN **9**

Interferences- Intrinsic and Extrinsic Effect on transmission; Counter measures on physical layer and data link layer; Regulatory issues; Medical Device regulation in USA and Asia; Security and Self-protection - Bacterial attacks, Virus Infection, Secured protocols, Self-protection.

UNIT V APPLICATIONS OF BAN USING IoT **9**

Monitoring patients with chronic disease - Hospital patients, Elderly patients, Cardiac arrhythmias monitoring, Multi Patient monitoring systems; Multichannel Neural recording - Gait analysis, Sports medicine, Electronic Pill.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- comprehend and appreciate the significance and role of this course in the present contemporary world.
- design a BAN for appropriate application in medicine.

- assess the efficiency of communication and the security parameters.
- describe the need for medical device regulation and regulations followed in various regions.
- extend the concepts of BAN for medical applications.

TEXT BOOKS

1. Annalisa Bonfiglio, Danilo De Rossi, "Wearable Monitoring Systems", Springer, 2011
2. Sandeep K.S. Gupta,Tridib Mukherjee, Krishna Kumar Venkata Subramanian, "Body Area Networks Safety, Security, and Sustainability'', Cambridge University Press, 2013.

REFERENCES

1. Mehmet R. Yuce, Jamil Y.Khan, "Wireless Body Area Networks Technology, Implementation, and Applications", Pan Stanford Publishing Pte. Ltd., Singapore, 2012.
2. Zhang, Yuan-Ting, "Wearable Medical Sensors and Systems'', Springer, 2013.
3. Guang-Zhong Yang(Ed.), "Body Sensor Networks'', Springer, 2006.
4. Wireless Body Area Networks: Technology, Implementation, and Applications" by Mehmet R Yuce and Jamil Khan

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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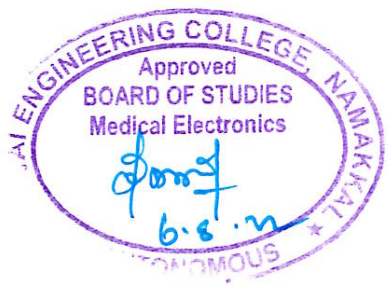
CO 4	2	3		2	3								3	3	3
CO 5	3	2		3					1				3	3	3



MD19553 **MEDICAL ETHICS AND SAFETY** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- achieve familiarity with some basic ethical framework& understand how these ethical frameworks can help us to think through contemporary questions in medical ethics.
- know about Medical Standards and Regulations
- know about the legal and ethical principles and application of these principles in health care settings
- gain knowledge about the medical standards that to be followed in hospitals.
- learn about suitable principles of medical equipment safety standards in hospitals

UNIT I INTRODUCTION TO MEDICAL ETHICS **9**

Definition of Medical ethics; Scope of ethics in medicine; International code of Ethics for occupational health professionals - CMA code of ethics; Fundamental Responsibilities - The Doctor and The Patient, The Doctor and The Profession; Professional Independence - The Doctor And Society.

UNIT II CODE OF ETHICS FOR BIOMEDICAL ENGINEERS **9**

Bioethics - The principle of Double effect, Code of Hammurabi, Engineering Competence; Ethical Issues in biomedical research - Cloning and stem cell research, Neuro ethic; Organ Transplantation; Hypothetic co-deductive method; Research Conflict of Interest; Medical device failure - Five failure types; Bio-terrorism; Sustainable Bioethics - Life cycles and Concurrent Engineering, Environmental Health; case studies.

UNIT III MEDICAL DEVICES STANDARDS **9**

Medical Standards and Regulations - Device classification, Registration and listing, Declaration of conformance to a recognized standard, Investigational Device Exemptions; Institutional Review Boards - IDE format, Good laboratory practices, Good manufacturing practices.

UNIT IV HOSPITAL SAFETY STANDARDS **9**

Life Safety Standards - Protecting Occupants, Protecting the Hospital From Fire, Smoke, and Heat, Protecting Individuals From Fire and Smoke; Providing and Maintaining Fire Alarm Systems - Systems for Extinguishing Fires Environment of Care Standards, Minimizing EC Risks, Smoking Prohibitions; Managing Hazardous Material and Waste; Maintaining Fire Safety Equipment - Features, Testing, Maintaining, and Inspecting Medical Equipment.

UNIT V HOSPITAL ACCREDITATION STANDARDS 9

Accreditation - JCI Accreditation & its Policies; Patient centered standards; Healthcare Organization management standards; Indian Perspective.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- apply legal and professional guidelines for the health professions.
- perform social responsibility in healthcare systems.
- categorize bioethics and engineers role.
- illustrate medical device maintenance.
- perform safety aspects.

TEXT BOOKS

1. William Charney, "Handbook of Modern Hospital Safety'', CRC Press, 2nd Edition, 2009.
2. Almira Badnjevic, Mario Cifrek, Ratko Magjarevic, Zijad Dzemic, "Inspection of Medical Devices: For Regulatory Purposes", Springer Nature, 2018.

REFERENCES

1. Eileen E.Morrison, "Ethics in Health Administration: A Practical Approach for Decision Makers'',Jonnes and Bartletts' Publication, 2nd Edition, 2011.
2. Robert M Veatch, "Basics of Bio Ethics'', Prentice- Hall, Inc., 2nd Edition, 2003.
3. Joint Commission Accreditation Standards for Hospitals ,2nd Edition, 2003.
4. Domiel A Vallero , "Biomedical Ethics for Engineers", Elsevier Pub.1st Edition, 2007.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO 4	3	2	2	2	2								3	3	3
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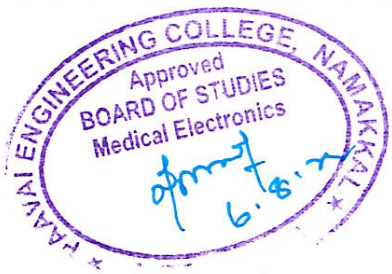

MD19554	EMBEDDED SYSTEMS AND INTERNET OF THINGS IN HEALTHCARE	3	0	0	3

COURSE OBJECTIVES

To enable students to

- learn the internal architecture and programming of an embedded processor.
- introduce interfacing I/O devices to the processor.
- introduce the evolution of Internet of Things (IoT).
- build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/open platform.
- apply the concept of Internet of Things in real world scenario.

UNIT I 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller-Architecture, Instruction Set and Programming, Programming Parallel Ports, Timers and Serial Port; Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING 9

Memory And I/O Devices Interfacing – Programming Embedded Systems in C; Need For RTOS – Multiple Tasks and Processes, Context Switching, Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING 9

ARM Processor – Introduction to the Concept of IoT Devices, IoT Devices Versus Computers, IoT Configurations, Basic Components; Introduction to Arduino – Types of Arduino – Arduino Tool chain – Arduino Programming Structure – Sketches – Pins – Input/Output pins using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols- Bluetooth , Wi-Fi, ZigBee; GPS – GSM modules, Open Platform (like Raspberry Pi), Architecture, Programming, Interfacing, Accessing GPIO Pins, Sending and receiving signals using GPIO Pins, Connecting to the Cloud.

UNIT V APPLICATIONS 9

Complete Design of Embedded Systems – Development of IoT Applications, Home Automation, IoT based health care, Physiological monitoring system, healthcare ECHO with IoT.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- understand and compare various embedded processors.
- design and deploy timers and interrupts.
- write embedded C programs.

- design simple embedded applications.
- design portable IoT using Arduino/Raspberry Pi open platform.

TEXT BOOKS

1. Muhammed Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014.
2. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons, 2014.

REFERENCES

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
3. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
4. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO 5	3	3		3	3	1				1			3	3	3

MD19651 **VIRTUAL BIOINSTRUMENTATION** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- understand what Virtual instrumentation is and to realize the architecture of VI.
- familiarize with the VI software and learn programming in VI.
- enlighten the concepts in programming, automation and measurement
- study various Instrument Interfacing and data acquisition methods.
- design various analysis tools and develop programs for Process control applications

UNIT I INTRODUCTION **9**

History of Virtual Instrumentation (VI)- Advantages, Block diagram, Architecture of a virtual instrument; Programming paradigms– Virtual Instrumentation- Lab VIEW software, Lab VIEW basics, Lab VIEW environment..

UNIT II PROGRAMMING TECHNIQUES **9**

VIS and sub-VIS; Loops and charts- Arrays, Clusters, Graphs; Case and sequence structures- Formula modes, Local and global variable, String and file input; Publishing measurement data in the web.

UNIT III DATA ACQUISITION AND CONTROL IN VI **9**

Plug-in DAQ boards– Organization of the DAQVI System; Performing analog input and analog output- Scanning multiple analog channels, Driving the digital I/Os, Buffered data acquisition, Simple problems.

UNIT IV INSTRUMENT INTERFACES **9**

Current loop- RS 232C/RS 485, GPIB; System basics- interface basics, USB, PCMCIA; Networking basics for office and industrial application- VISA and IVI; Image acquisition and processing; Motion Control, ADC, DAC, DIO, DMM, Waveform generator.

UNIT V APPLICATIONS OF HEALTHCARE **9**

Design of virtual applications - Electrocardiography (ECG), Electromyography (EMG), Air Flow and Lung Volume, Heart Rate variability analysis; Noninvasive Blood Pressure Measurement- Biofeedback, Virtual Reality and 3 D graphical modeling, Virtual Prototyping.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- comprehend and appreciate the significance and role of this course in the present contemporary world

- identify salient traits of a virtual instrument
- understand the use of VI for data acquisition.
- experiment analyze and document different types of interfaces.
- apply the virtual instrumentation technologies for medical applications.

TEXT BOOKS

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2003.
2. Gary Johnson, LAB VIEW Graphical Programming, 4th Edition, McGrawHill, 2006

REFERENCES

1. Jeffrey Travis, Jim Kring, "LABVIEW for Everyone", Prentice Hall, 2015.
2. Data Acquisition and Process Control Using Personal Computers, CRC Press, 2017
3. Sanjay Gupta and Joseph John, "Virtual Instrumentation using Lab VIEW", Tata McGraw – Hill Publishing Company Limited ,New Delhi, 1st Edition, 2010.
4. Technical Manuals for DAS Modules of Advantech and National Instruments.

CO/PO MAPPING :

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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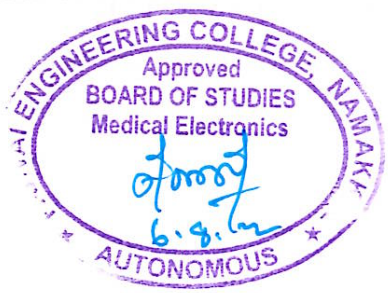

MD19652 **DIGITAL VIDEO PROCESSING** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- provide an introduction to the fundamental principles and techniques in Video processing.
- offer an overview of video enhancement and restoration algorithms
- deliver details about video Tracking.
- incorporate processing with artificial intelligence.
- review latest trends and future technologies in video computing.

UNIT I FUNDAMENTALS OF VIDEO PROCESSING 9

Video Formation- Perception and Representation, Video Capture and Display, Principles of Color Video, Video Cameras, Video Display and Composite versus Component Models and Gamma Correction; Analog Video Raster – Progressive vs Interlaced scans, Digital Video, Notation – ITU, R.BT.601; Digital Video Format and Applications.

UNIT II DIGITAL VIDEO ENHANCEMENT AND SEGMENTATION 9

Video Sampling - Basics of the Lattice Theory, Sampling of Video Signals over Lattices, Filtering Operations in Cameras and Display Devices; Video Segmentation Algorithms – Median Cut, Graph Cut and EM Algorithms; Active Contour models.

UNIT III MOTION ESTIMATION 9

Two-Dimensional Motion Estimation - Optical Flow; General Methodologies - Motion Representation, Motion Estimation Criteria, Optimization Methods; Pixel-Based Motion Estimation - Block-Matching Algorithm, Exhaustive Block-Matching Algorithm, Phase Correlation Method and Multiresolution Motion Estimation.

UNIT IV VIDEO ANALYSIS AND TRACKING 9

Typical Tracker – Localization, Optical Flow - Object Tracking and analysis, Kalman Filtering; Video Tracking- Bayesian Approach, Particle Filter – Trackers, Evaluation; Video in painting – restoration; Video Mining; Video Search Engines and retrieval; Visual Event Detection; Video Surveillance and Security.

UNIT V VIDEO CLASSIFICATION AND RECOGITION 9

Video Classification – Classification and Clustering models; Video Annotation, Video Summarization, Action Recognition; Visual Event Detection.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- implement basic algorithms related to digital video.
- familiarize with the MATLAB and its equivalent open source tools for processing video.
- design and implement some basic video related applications in domains like biometrics object .
- traction and in Industrial environment.
- critically analyze the role of video in modern technologies.

TEXT BOOKS

1. A. Murat Tekalp ,"Digital Video Processing", Pearson, 2010.
2. Oge Marques „Practical Image and Video processing using Matlab", IEEE Press, 2011.

REFERENCES

1. Maggio E., Cavallaro A., Video Tracking, Wiley, 2011.
2. Michael A. Smith, Takeo Kanade, Multimodal Video Characterization and Summarization, The Kluwer International Series in Video Computing, 2005.
3. Alan Bovik C "The Essential Guide to Video Processing", Academic Press Inc, 2009.
4. Niels Niels Haering, Niels Da Vitoria Lobo, Visual Event Detection, The International Series in Video Computing, Springer US, 2001.

CO/PO MAPPING :

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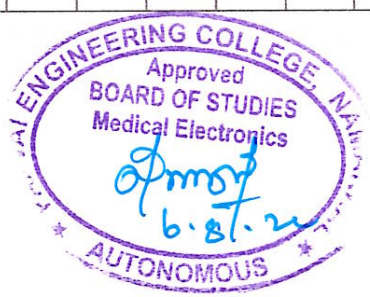

MD19653 QUALITY CONTROL IN BIOMEDICAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn overview of various methodologies used for management in health care.
- understand the various Quality standards and regulations used for health care.
- gain the knowledge about management methodologies in medical Engineering.
- achieve the various tools.
- gain knowledge in regulatory bodies.

UNIT I INTRODUCTION **9**

Philosophy of Quality Management, Customer Focus, Top Management Commitment, Team work, Quality control Tools; Problem solving methodologies; New Management Tools; work habits, strategic Quality planning.

UNIT II QUALITY DEVELOPMENT **9**

Quality policy development; quality function development; designing for Quality; Manufacturing for Quality.

UNIT III QUALITY STANDARDS **9**

Need for standardization- Regional, National, International standardization; classification of equipment, Methods of Testing standardization, Maintenance of standardization and Recalibration.

UNIT IV QUALITY REGULATION **9**

FDA Regulations; Joint Commission, Accreditation of hospitals, other Regulatory codes.

UNIT V REGULATORY BODIES **9**

Need for ISO 9000 System, Advantages, clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality Auditing, Case studies.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- know the overview of various methodologies used for management in health care.
- gain the knowledge about management methodologies in medical Engineering.
- understand the knowledge in regulatory bodies
- know the overview of various methodologies used for management in health care.
- gain the knowledge about management methodologies in medical Engineering.

TEXT BOOKS

1. Rose, J.E., "Total Quality Management", Kogan Page Ltd., 1993.
2. Cesar A. Cacere & Albert Zana, "The Practice of clinical Engineering", Academic Press, Newyork, 1977.

REFERENCES

1. John Bank, "The Essence of Total Quality Management", Prentice Hall of India, 1999.
2. Webster J.G and Albert M.Cook, "Clinical Engineering, Principles & Practices", Prentice Hall Inc., Engle wood cliffs, NewJersy, 2011.
3. "Quality control" by Kulkarni. A.K. and Bewoor. V.A. Published by Wiley India Pvt. Ltd
4. "Handbook on Quality Assurance & Quality Control in Construction" by Jude D'Silva.

CO/PO MAPPING :

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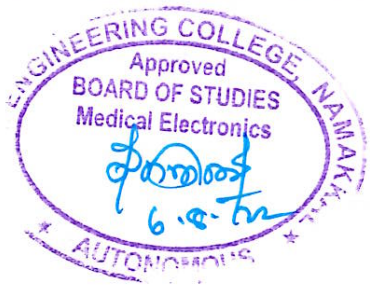

MD19654 BRAIN COMPUTER INTERFACE AND ITS APPLICATIONS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basic concepts of brain computer interface
- study the various signal acquisition methods
- study the signal processing methods used in BCI
- learn the various types of feature translation methods
- learn the various applications of BCI

UNIT I INTRODUCTION TO BCI **9**

Fundamentals of BCI – Structure of BCI system, Classification of BCI, Invasive, Non-invasive and Partially invasive BCI; EEG signal acquisition; Signal Preprocessing; Artifacts removal.

UNIT II ELECTROPHYSIOLOGICAL SOURCES **9**

Sensori motor activity – Mu rhythm; Movement Related Potentials; Slow Cortical Potentials- P300, Visual Evoked Potential, Activity of Neural Cells, Multiple Neuro mechanisms.

UNIT III FEATURE EXTRACTION METHODS **9**

Time/Space Methods – Fourier Transform, PSD, Wavelets; Parametric Methods – AR,MA,ARMA models,PCA;Linear and Non-Linear Features.

UNIT IV FEATURE TRANSLATION METHODS **9**

Linear Discriminant Analysis; Support Vector Machines; Regression; Vector Quantization–Gaussian Mixture Modeling, Hidden Markov Modeling; Neural Networks.

UNIT V APPLICATIONS OF BCI **9**

Functional restoration using Neuroprosthesis; Functional Electrical Stimulation; Visual Feedback and control - External device control; Case study- Brain actuated control of mobile Robot.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- describe BCI system and its potential applications.
- analyze event related potentials and sensory motor rhythms.
- compute features suitable for BCI.
- design classifier for a BCI system.
- implement BCI for various applications.

TEXT BOOKS

1. R. Spehlmann, "EEG Primer", Elsevier Biomedical Press, 1999.
2. Bernhard Graimann, Brendan Allison, Gert P Furtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2011.

REFERENCES

1. Arnon Kohen, "Biomedical Signal Processing", Vol I and II, CRC Press Inc, Boca Rato, Florida, 1986.
2. Bishop C.M., "Neural Networks for Pattern Recognition", Oxford, Clarendon Press, 1995.
3. "Brain-Computer Interfaces and Human-Computer Interaction" by Desney Tan and Anton Nijholt- SpringerLink.
4. Brain-Computer Interfacing: An Introduction Hardcover – 30 September 2013 by Rajesh P. N. Rao.

CO/PO MAPPING :

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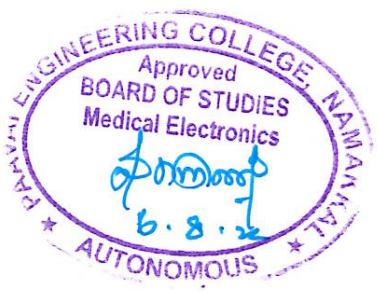
CO 1	3	3		3	2				2				3	2	2
CO 2	2				3						2		3	3	3
CO 3	3	3		3		1							3	3	3
CO 4	2	3		2	3								3	3	3
CO 5	3	3			3		2					1	3	3	3



MD19903 PRODUCT DESIGN AND DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basic concepts of product design.
- infer product features and its architecture.
- apply knowledge in common features.
- incorporate the products in a specific place.
- understand the planning and principles of prototypes.

UNIT I INTRODUCTION 9

Need for IPPD; Strategic importance of Product development - integration of customer, designer, material supplier and process planner; Competitor and customer behavior analysis - Understanding customer, promoting customer, involve customer in development and managing requirement; Organization process-management and improvement.

UNIT II CONCEPT GENERATION, SELECTION AND TESTING 9

Plan and establish product specifications task; Structured approaches – clarification, search-externally and internally, explore systematically; reflect on the solutions and processes - concept selection, methodology, benefits; Implications - Product change, variety, component standardization, product performance, manufacturability; Concept Testing Methodologies.

UNIT III PRODUCT ARCHITECTURE 9

Product development management - establishing the architecture, creation, clustering, geometric layout development; Fundamental and incidental interactions; Related system level design issues - secondary systems, architecture of the chunks, creating detailed interface specifications; Portfolio Architecture

UNIT IV INDUSTRIAL DESIGN 9

Integrate process design - managing costs, robust design, integrating CAE, CAD, CAM tools; Simulating product performance and manufacturing processes electronically; Need for industrial design impact; Design process, investigation of customer needs, conceptualization, refinement, management of the industrial design process; Technology driven products – user, driven products, assessing the quality of industrial design.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9

Definition - Estimation of Manufacturing cost, reducing the component costs and assembly costs, Minimize system complexity; Prototype basics - principles of prototyping, planning for prototypes; Economic Analysis - understanding and representing tasks, baseline project planning, accelerating the project, project execution.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- understand the integration of customer requirements in product design
- apply structural approach to concept generation, selection and testing
- understand various aspects of design such as industrial design, design for manufacture, economic analysis and product architecture.
- know the design and function of product architecture.
- basics of project planning and analysis.

TEXT BOOKS

1. Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, McGraw –Hill International Edns.1999.

REFERENCES

1. Concurrent Engg./Integrated Product Development. Kemnneth Crow, DRM Associates, 6/3,ViaOlivera, Palos Verdes, CA 90274(310) 377.
2. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewoo 1992,ISBN, 1-55623-603-4.
3. Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing, Newyork NY,1991, ISBN 0-202-41639-5 4. www.me.mit/2.7444.

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PAVAI ENGINEERING COLLEGE, NAMAKKAL
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Medical Electronics
AUTONOMOUS

MD19904	ELECTRICAL SAFETY AND QUALITY ASSURANCE IN HEALTHCARE	3	0	0	3

COURSE OBJECTIVES

To enable students to

- provide basic knowledge on the concept of Healthcare Quality management towards continuous improvement of patient care.
- learn and understand regulatory requirements for healthcare
- aware of the role of biomedical engineer in hospitals.
- educate the management of electrical supply, maintenance of electrical safety.
- access the quality of healthcare and the hospital services

UNIT I STANDARDIZATION OF QUALITY MEDICAL CARE IN HOSPITALS 9

Definition of Medical ethics; Scope of ethics in medicine; International code of Ethics for occupational health professionals; CMA code of ethics; Fundamental Responsibilities- The Doctor and The Patient, The Doctor and The Profession, Professional Independence, The Doctor And Society.

UNIT II REGULATORY REQUIREMENT FOR HEALTHCARE 9

FDA regulations, Accreditation for hospitals - JCI, NABH and NABL, regulatory Codes.

UNIT III HOSPITAL SAFETY 9

Security and Safety of Hospital -Property, Staff and Patients, Radiation safety, Safety precautions, hazardous effects of radiation, allowed levels of radiation; ICRP regulations for radiation safety; Disposal of Biological waste.

UNIT IV ELECTRICAL AND FIRE SAFETY 9

Sources of shocks; Macro and Micro shocks - hazards, monitoring and interrupting the operation from leakage current- Elements of fire, causes of fire, Action to be taken in case of fire in a Hospital.

UNIT V ASSESSING QUALITY HEALTHCARE 9

Patient Safety Organization- Governmental and Independent, Measuring Quality care – Evaluation of hospital services – six sigma way, Quality Assurance in Hospitals Sop's – Patient Orientation for Total Patient Satisfaction. 5S techniques

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- understand the scope of need and significance of quality practices in healthcare industry.
- discuss the system of regulatory measures and accreditation.
- differentiate the level of safety and security measures and significance.

- understand the concepts of Electrical and Fire Safety Hazards Mitigations
- understand the assessing quality practices using tools.

TEXT BOOKS

1. B.M.Sakharkar, Principles of Hospital administration and Planning, JAYPEE Brothers, Medical Publishers (P) Ltd. 24.
2. T2: K.Shridhara Bhat, Quality Management, Himalaya Publishing House Cesar A. Cacere & Albert.

REFERENCES

1. Webster J.G and Albert M.Cook, Clinical Engg, Principles & Practices, Prentice Hall Inc., Englewood Cliffs, New Jersy, 1979.
2. Joint Commission International Accreditation Standards for Hospitals, 6th edition, july2017.
3. Sharon Myers —Patient Safety & Hospital Accreditation - A Model for Ensuring SuccesslSpringer Publishers 2012 7. Joseph F Dyro —Clinical Engineering Handbook— Elsevier Publishers,2004.
4. Zana, The Practice of Clinical Engg. Academic press, New York, 1977.

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