E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai Accredited by NAAC with „AGrade | Accredited by NBA (CSE, EEE, MECH, ECE, CIVIL, IT)

NAGAPATTINAM – 611002

B.E. Biomedical Engineering

Full Time Curriculum and Syllabus

Final Year – Eighth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
1902BM801	Radiological Equipments	3	0	0	3	40	60	100
1903BM018	Professional Elective – IV Wearable systems	3	0	0	3	40	60	100
1903BM021	Professional Elective – V - Biometric system	3	0	0	3	40	60	100
1904BM851	Project Work	-	-	14	07	50	50	100
Total		**09**	**0**	**14**	**16**	**170**	**230**	**400**

1902BM801		**RADIOLOGICAL EQUIPMENTS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

1. To get the clear understanding of X-ray generation, radio isotopes and various techniques used for visualizing organs..
2. To study about the functioning of X-ray tubes and method by which fogginess can be reduced
3. To study about the different types radio diagnostic unit, transverse tomography and types of radio detection.
4. To understand the function of X ray generation and radio isotopes.
5. To know the concepts of MRI functionality and imaging various sections of body.

UNIT I	**X – RAY MACHINES & DIGITAL RADIOGRAPHY**	**12 Hours**

Basis Of Diagnostic Radiology, Nature Of X-Rays, Production Of X-Rays,X-Ray Machine, Visualization Of X-Rays, Dental X-Ray Machines, Portable And Mobile X-Ray Units,Physical Parameters For X-Ray Detectors, Digital Radiography.

UNIT II	**COMPUTER TOMOGRAPHY**	**12 Hours**

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors-Viewing systems-spiral CT scanning – Ultra fast CT scanners. Advantages of computed radiography over film screen radiography: Time, Image quality, Lower patient dose, Differences between conventional imaging equipment and digital imaging equipment: Image plate, Plate readers, Image characteristics, Image reconstruction techniques- back projection and iterative method. Spiral CT, 3D Imaging and its application.

UNIT III	**MAGNETIC RESONANCE IMAGING & SPECTROCOPY**	**12 Hours**

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), and shim coils, Electronic components, fMRI.

UNIT IV	**NUCLEAR MEDICAL IMAGING SYSTEMS**	**12 Hours**

Nuclear imaging – Anger scintillation camera –Nuclear tomography – single photon emission computer tomography, positron emission tomography – Recent advances .Radionuclide imaging,Bone imaging, dynamic renal function, myocardial perfusion. Non imaging technique,shematological measurements, Glomerular filtration rate, volume measurements, clearance measurement, whole -body counting, surface counting

UNIT V	**HUMAN RADIOBIOLOGY**	**12 Hours**

Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments,Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

	Total:	**45+15 Hours**

Further Reading:

Radiation Therapy

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Explain the different radio diagnostic and therapeutic techniques
2. Illustrate the principle computed tomography.
3. Interpret the technique used for visualizing various sections of the body using magnetic resonance imaging
4. Demonstrate the applications of radio nuclide imaging.

5. Outline the methods of radiation safety.

Text Books:

1. Steve Webb, ―The Physics of Medical Imaging‖, Adam Hilger, Philadelpia, 1988 (Units I, II, III & IV).
2. R.Hendee and Russell Ritenour ―Medical Imaging Physics‖, Fourth Edition William, WileyLiss, 2002.

References:

1. William R. Hendee, E. Russel Ritenour," Medical Imaging Physics", Third Edition, Mosby Year Book, St. Louis, 1992.(Unit- II,III,IV)
2. R. S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1997.(Unit-I,III,V)
3. Chesney D.N~ and Chesney M.O., "X-Ray Equipments for Students Radiographer", Blackwell Scientific Publications, Oxford, 1971.

1903BM018		WEARABLE SYSTEMS	L	T	P	C
			3	0	0	3
		(For B.E.,BME)				

Course Objectives:	The student should be made to:
	1.Study about sensors and its application in wearable systems
	2.Learn about applications of wearable systems

UNIT I	**SENSORS**	**9 Hours**
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 Hours**
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 Hours**
Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.		
UNIT IV	**WIRELESS HEALTH SYSTEMS**	**9 Hours**
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 Hours**
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics		
	Total:	**45 Hours**

Further Readings:	**Nil**

Course Outcomes:

After completion of the course, Student will be able to

1. Discuss about the various sensors and its need for wearable systems
2. Analyze the wearability issues it signal processing, signal design, signal acquisition and data mining.
3. Describe about various energy harvesting systems for wearable devices.
4. Identify the need for wireless monitoring, body area network and wireless communication techniques.
5. Explain the need of wireless health systems and the application of wearable systems.

Text Books:

1. Annalisa Bonfiglio,Danilo De Rossi ,"Wearable Monitoring Systems", Springer, 2011.
2. Sandeep K.S. Gupta,TridibMukherjee,Krishna Kumar Venkatasubramanian, "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,JamilY.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 eHealth systems for Personalised Health Management - State of the art and future challenges ' IOS press, The Netherlands, 2004.

1903BM021		**BIOMETRIC SYSTEMS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
		(For B.E.,BME)				

Course Objectives: The student should be made to:

1. To understand the general principles of design of biometric systems and the underlying trade-offs.
2. To understand the technologies of fingerprint identification technology
3. To explain face recognition representations and determination
4. To Discuss speech recognition and evaluations.
5. To recognize multi biometrics and design aspects.

UNIT I	**INTRODUCTION TO BIOMETRICS**	**9 Hours**

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometrics Vs traditional techniques – Benefits of biometrics - Operation of a biometric system– Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, FTA rate and rate- Need for strong authentication – Protecting privacy and biometrics and policy – Biometric applications

UNIT II	**FINGERPRINT IDENTIFICATION TECHNOLOGY**	**9 Hours**

Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width between two ridges - Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: Fingerprint Classification, Matching policies.

UNIT III	**FACE RECOGNITION**	**9 Hours**

Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition, Representation and Classification, Kernel- based Methods and 3D Models, Learning the Face Spare, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.

UNIT IV	**VOICE SCAN**	**9 Hours**

Introduction, Components, Features and Models, Addition Method for managing Variability, Measuring Performance, Alternative Approaches, Voice Scan Strengths and Weaknesses, NIST Speaker Recognition Evaluation Program, Biometric System Integration

UNIT V	**FUSION IN BIOMETRICS**	**9 Hours**

Introduction to Multibiometric - Information Fusion in Biometrics - Issues in Designing a Multibiometric System - Sources of Multiple Evidence - Levels of Fusion in Biometrics - Sensor level, Feature level, Rank level, Decision level fusion - Score level Fusion. Examples – biopotential and gait based biometric systems.

Total: 45 Hours

Course Outcomes:

After completion of the course, Student will be able to

1. Demonstrate knowledge engineering principles underlying biometric systems.
2. Analyze design basic biometric system applications.
3. Explain face recognition representations and determination
4. Discuss speech recognition and evaluations.
5. Recognize multi biometrics and design aspects

Further Readings:

Germany Weighs Biometric Registration Options for Visa Applicants

Text Books:	
1.	James Wayman, Anil Jain, Davide Maltoni, Dario Maio, ―Biometric Systems, Technology Design and Performance Evaluation‖, Springer, 2005.
2.	David D. Zhang, ―Automated Biometrics: Technologies and Systems‖, Kluwer Academic Publishers, New Delhi, 2000.
3.	Arun A. Ross , Karthik Nandakumar, A.K.Jain, ―Handbook of Multibiometrics‖, Springer, New Delhi, 2006.
References:	
1.	James Wayman, Anil Jain, Davide Maltoni, Dario Maio, ―Biometric Systems, Technology Design and Performance Evaluation‖, Springer, 2005.
2.	David D. Zhang, ―Automated Biometrics: Technologies and Systems‖, Kluwer Academic Publishers, New Delhi, 2000.
3.	Paul Reid, ―Biometrics for Network Security‖, Pearson Education, 2004.
4.	Nalini K Ratha, Ruud Bolle, ―Automatic fingerprint Recognition System‖, Springer, 2003.
5.	L C Jain, I Hayashi, S B Lee, U Halici, ―Intelligent Biometric Techniques in Fingerprint and Face Recognition‖ CRC Press, 1999.

1904BM851		**PROJECT WORK**	**L**	**T**	**P**	**C**
			0	**0**	**14**	**7**
		(For B.E.,BME)				
Course Objectives:						
	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Headof the Department.					
OUTCOMES: On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.						