E.G.S. PILLAY ENGINEERING COLLEGE (Autonomous)

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

NAGAPATTINAM – 611002

B.E. BIO MEDICAL ENGINEERING

SEMESTER VII									
Course Code	**Course Name**	**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
						CA	**ES**	**Total**	
Theory Course									
1902BM701	Diagnostic and Therapeutic Equipment- II	3	0	0	3	40	60	100	PC
1902BM702	Rehabilitation Engineering	3	0	0	3	40	60	100	PC
1902MGX07	Universal Human values and ethics	3	0	0	3	40	60	100	PC
1903BM014	Professional Elective - III	3	0	0	3	40	60	100	PE
1903BM012	Open Elective	3	0	0	3	40	60	100	OE
Laboratory Course									
1902BM751	Hospital Training	0	0	2	1	100	-	100	EEC
1904BM752	In-plant Training/ Internship Presentation	0	0	0	1	100	-	100	EEC
1904GE751	Life Skills : Comprehensive Viva	2	0	0	1	100	-	100	EEC
Total		**20**	**0**	**2**	**18**	**590**	**410**	**1000**	

1902BM701	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT – II	L	T	P	C
		3	0	0	3

Course Objectives:	
	1. Understand the devices used in ICU and principles of Telemetry.
	2. Describe types of diathermy and its uses
	3. Demonstrate applications of ultrasound in medicine
	4. Explain extracorporeal devices used in critical care
	5. Discuss the importance of patient safety against electrical hazard

Unit I	**PATIENT MONITORING AND BIOTELEMETRY**	**9 Hours**

Patient monitoring systems, ICU/CCU Equipments, bed side monitors, Infusion pumps, Central consoling controls. Radio Telemetry (single, multi), Portable and Landline Telemetry unit, Applications in ECG and EEG Transmission.

Unit II	**DIATHERMY**	**9 Hours**

IR and UV lamp and its application. Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures..

Unit III	**ULTRASONIC EQUIPMENTS**	**9 Hours**

Diagnosis: Tissue Reaction, Basic principles of Echo technique, display techniques A, B and M mode, B Scan, Application of ultrasound as diagnostic tool – Echocardiogram, Echoencephalogram, abdomen, obstetrics and gynecology, ophthalmology.

Unit IV	**EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES**	**9 Hours**

Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenators, finger pump, roller pump, electronic monitoring of functional parameters. Hemo Dialyser unit, Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy, Otoscopes. Thermography – Recording and clinical application.

Unit V	**PATIENT SAFETY**	**9 Hours**

Physiological effects of electricity – important susceptibility parameters – Macro shock – Micro shock hazards – Patient's electrical environment – Isolated Power system – Conductive surfaces – Electrical safety codes and standards – IEC 60601-1 2005 standard, Basic Approaches to Protection against shock, Protection equipment design, Electrical safety analyzer – Testing the Electric system

	Total:	**45 Hours**

Further Reading:	CT, MRI Scanning Diagnostic

Course Outcomes:	
	Discuss the various equipment used in ICU and applications of telemetry.
	Explain the types of diathermy and its applications.
	Express the basics of ultrasound and its application in medicine
	Discuss the various extracorporeal and special diagnostic devices used in hospitals
	Outline the importance of patient safety against electrical hazard

TEXT BOOKS:

1. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India PvtLtd,New Delhi, 2015

2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2012.

References:

1Leslie Cromwell, "Biomedical Instrumentation and measurement", 2nd edition, Prentice hall of India, New Delhi, 2015.

2. Richard Aston "Principles of Biomedical Instrumentation and Measurement", Merril Publishing Company,

1990
3. . L.A Geddas and L.E.Baker “Principles of Applied Biomedical Instrumentation” 2004.
4. . Myer Kutz “Standard Handbook of Biomedical Engineering & Design”, McGraw-Hill Publisher, 2003.
5. Khandpur R.S, “Handbook of Biomedical Instrumentation”, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.

1902BM702	REHABILITATION ENGINEERING	L	T	P	C
		3	0	0	4

Course Objectives:	
	1.To develop an understanding of the various rehabilitation aids so as to enable the student.
	2. To design and apply them with confidence, to help the challenged people.
	3. To understand the Electronic oriented Mobility Aids
	4. To study the Auditory and speech devices
	5. To understand the Visual sensory sytem and Augumentation

Unit I	**INTRODUCTION TO REHABILITATION**	**9 Hours**

Definition, Concept of Rehabilitation: Types of Physical Impairments, Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles, Key Ergonomic Principles, Engineering Concepts in Sensory & Motor rehabilitation

Unit II	**ORTHOTICS & PROSTHETICS IN REHABILITATION**	**9 Hours**

Types of orthosis -FO,AFO,KAFO,HKAFO and prosthesis ,Partial Foot Prostheses- Foot-ankle assembly, Trans femoral Prostheses, Prosthetic Hand, Advance and automated prosthetics and orthosis, Externally powered and Controlled orthotics & prosthetics, -FES system, Restoration of Hand function, Restoration of standing and walking.

Unit III	**MOBILITY AIDS**	**9 Hours**

Electronic Travel Appliances (ETA) : Path Sounder, Laser Cane, Ultrasonic Torch, Sonic Guide, Light Probes, Nottingham Obstacle Sensors, Electro cortical Prosthesis, Polarized Ultrasonic Travel aids, Materials used for wheel chairs, Type of Wheel Chairs, design of wheel Chair, Walking frames, Parallel bars, Rollators, Quadripods, Tripods & walking sticks, Crutches.

Unit IV	**AUDITORY AND SPEECH ASSIST DEVICES**	**9 Hours**

Types of deafness, hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, speech trainer

Unit V	**SENSORY AUGMENTATION AND SUBSTITUTIONS**	**9 Hours**

Classification of Visual Impairments, Prevention and cure of visual impairments, Visual Augmentation, Tactile vision substitution, auditory substitution and augmentation, tactile auditory substitution, Assistive devices for the visual impaired

	Total:	**45 Hours**

Further Reading:	
	Acquire experience in building and trouble-shooting simple electronic analog circuits

Course Outcomes:	
	1.Adapt at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the node method.
	2.Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.

References:

1. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor & Francics ,CRC press, 2006.
2. Joseph D.Bronzino,The Biomedical Engineering Handbook,Third Edition: Three Volume Set,CRC Press,2006
3. .MacLachlan M. and Gallagher P. Enabling Technologies – Body Image and Body Function, Churchill Livingstone, 2004
4. .Mann W.C. (ed). Smart Technology for Aging, Disability, and Independence – The State of The Science, Wiley, New Jersey, 2005.
5. .Muzumdar A. Powered Upper Limb Prostheses – Control, Implementation and Clinical Application. Springer, 2004

1901MGX07	Universal Human Values and Ethics	L	T	P	C
		3	0	0	3

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Unit I	**Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation**	**9 Hours**

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit II	**Understanding Harmony in the Human Being - Harmony in Myself**	**9 Hours**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Swasthya.

Unit III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**	**9 Hours**

13. Understanding harmony in the Family- the basic unit of human interaction
14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;
Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals

	18. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family!	
Unit IV	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence**	**9 Hours**
	19. Understanding the harmony in the Nature 20. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature 21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space 22. Holistic perception of harmony at all levels of existence	
Unit V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**9 Hours**
	23. Natural acceptance of human values 24. Definitiveness of Ethical Human Conduct 25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 26. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models 27. Case studies of typical holistic technologies, management models and production systems 28. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations	
	Total:	**45+15 Hours**
Further Reading:		
	Human values in Public domain	
Course Outcomes:		
	1. Understand the significance of value inputs in a classroom and start applying them in their life and profession	
	2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc..	
	3. Understand the value of harmonious relationship based on trust and respect in their life and profession	
	4. Understand the role of a human being in ensuring harmony in society and nature.	
	5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	
Text Book		
1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.		
References:		
1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA		
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.		

3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books
12. B L Bajpai, 2004, Indian Ethos and Modern Management.

1902BM751 **HOSPITAL TRAINING** **L T P C**

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OBJECTIVES:

The student should be made to

- Observe medical professionals at work in the wards and the roles of Allied Health Professionals;
- Provide access to healthcare Professionals to get a better understanding of their work; Demonstrate patient-care in a hospital setting.

ASSESSMENT:

- Students need to complete training in any leading Multi-speciality hospital for a period of 15 days. They need to prepare an extensive report and submit to their respective course incharges during the session.
- Out of the following departments, it is mandatory to complete training in any 10. The students can give a presentation of the remaining departments during laboratory hours.

S.No.	Departments for visit
1	Cardiology
2	ENT
3	Ophthalmology
4	Orthopaedic and Physiotherapy
5	ICU/CCU
6	Operation Theatre
7	Neurology
8	Nephrology
9	Radiology
10	Nuclear Medicine
11	Pulmonology
12	Urology
13	Obstetrics and Gynaecology
14	Emergency Medicine
15	Biomedical Engineering Department
16	Histo Pathology
17	Biochemistry
18	Paediatric/Neonatal
19	Dental
20	Oncology
21	PAC’s
22	Medical Records / Telemetry

TOTAL : 15 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Advocate a patient-centred approach in healthcare
- Communicate with other health professionals in a respectful and responsible manner Recognize the importance of inter-professional collaboration in healthcare.
- Propose a patient-centred inter-professional health improvement plan based upon the patient's perceived needs
- Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.

1904BM752	In-plant Training/ Internship Presentation	L T P C
		0 0 0 1

Course Objectives:

- To provide hands-on experience at site where biomedical equipment are manufactured and utilized (Hospitals).

Course outcomes:

1. Learner will be able to gather a first hand experience on usage of various biomedical equipment.
2. Learner will be able to get familiar with various medical imaging techniques.
3. Learner will be able to gain some practical experience in servicing the equipment.

INDUSTRIAL TRAINING III

Students have to undergo two weeks practical training in biomedical equipment manufacturing companies or hospitals. At the end of the training student will submit a report as per the prescribed format to the department.