

GUJARAT TECHNOLOGICAL UNIVERSITY

BIO-MEDICAL ENGINEERING (03)

REHABILITATION ENGINEERING

SUBJECT CODE: 2160310

B.E. 6th SEMESTER

Type of course: Elective

Prerequisite: Human Anatomy & Physiology, Designing Concept

Rationale: Purpose to learn the basic concepts of rehabilitation engineering and assist devices and to understand the importance of biomedical engineering in rehabilitation.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	<u>Introduction to Rehabilitation Engineering:</u> Introduction to Rehabilitation Engineering - PHAATE model – Universal design - Design based on human ability - Standards for assistive technology - Test for best design.	6	10%
2	<u>Orthotic & Prosthetic Devices:</u> Anatomy of upper & lower extremities - Classification of amputation types, Prosthesis prescription - Components of upper limb prosthesis - Fabrication of prosthesis - Components of lower limb prosthesis, different types of models for externally powered limb prosthetics – Orthoses: It's need and types - Lower extremity- and upper extremity- orthoses - mobility aid, Slints – materials used.	10	25%
3	<u>Wheel Chair:</u> Seating Assessment - Interventions in seating system - Biological aspects of tissue health - Support surface classification - Manual wheelchairs – Electric power wheelchairs - Power assisted wheelchairs - Wheel chair standards & tests - Wheel chair transportation.	6	13%
4	<u>Assistive Technology Used for Sensory Augmentation and Substitution:</u> Anatomy of eye, Categories of visual impairment - Cortical & retinal implants - Auditory Information Display - Blind mobility aids – reading writing & graphics access- Braille Reader, Tactile devices for visually challenged, Text voice converter, screen readers, Orientation & navigation Aids – Ultra sonic and laser canes. Anatomy of ear – hearing functional assessment, Types of deafness - Surgical and non surgical hearing aids, Cochlear implants - Assistive technology solutions for hearing Tactile - Information Display, Voice	8	25%

	synthesizer, speech trainer.		
5	Rehabilitation Aids for Mentally Impaired: Sleeping Aids, Walking Aids, Seating Aids, Postural Aids.	5	7%
6	Medical Stimulator: Muscle and nerve stimulator, Location for Stimulation, Functional Electrical Stimulation, Sensory Assist Devices, Design issues.	5	10%
7	Advanced Applications: Robots in rehabilitation - Rehabilitation in sports -Daily living aids - Assistive technology for dyslexia.	5	10%

Suggested Specification table with marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	35%	25%	20%	10%	0

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Rehabilitation Engineering, Robinson. C. J.
2. Rehabilitation Technology, Ballabio. E.
3. Assistive Technology- Principles & Practice- Cook & Hussey.
4. Marion A Hersh, Michael A, Johnson, "Assistive Technology for Visually impaired and blind people", Springer Publications, First edition, 2008.
5. Essentials of Assistive Technologies, By Albert M. Cook, Janice Miller Polgar.
6. Assistive Technology for Blindness and Low Vision edited by Roberto Manduchi, Sri Kurniawan

Course Outcome:

After learning the course the students should be able to:

1. Build basic understanding of Rehabilitation Engineering.
2. Apply basic design principles to model various types of Wheel Chairs for varied needs.
3. Understand various assistive technologies for vision & hearing.
4. To study various orthotic & prosthetic devices for upper and lower extremities.
5. Understand the recent developments in the field of rehabilitation engineering.

List of Experiments: (Outlines)

1. The study design, components and fabrication of upper limb prosthesis.
2. The study design, components and fabrication of lower limb prosthesis.
3. The study of upper limb orthosis design.
4. The study of lower limb orthosis design.
5. The study of Hybrid Assistive System.
6. The study of MARCUS- Intelligent Hand Prosthesis.
7. The study of various mobility aids.

Design based Problems (DP)/Open Ended Problem:

To design rehabilitative devices for varied assistive and replacement purposes such as:

- a. Travel aid for the Blind using Infrared, Laser and Ultrasound.
- b. Sign Language Aid for Deaf& Dumb.
- c. Hearing Aid.
- d. Electronic Goniometer for sports rehabilitation application.

Active Learning Assignments: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding of theory and practical work. The faculty will assign topics from which students can grasp knowledge about current scenario of the Diagnostic Instrumentation. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.