402544A: Robotics: Cognitive & Medical (Elective- III)					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	3 Hrs/Week	**Theory**	3	**In-Semester**	30 Marks
				End-Semester	70 Marks

Prerequisites: Industrial Robotics,Robot Kinematics

Course Objectives:

1. To provide knowledge on the application of robotics in health care
2. Sensor requirements for localization, control and tracking
3. Understand the design aspects of medical robots

Course Outcomes:

On completion of the course the learner will be able to;

CO1: IDENTIFY the type of medical robots and the concepts involved in it.
CO2: DEFINE the applications of surgical robotics
CO3: PURPOSE of Rehabilitation interface
CO4: CLASSIFY the types of assistive robots.
CO5: ANALYZE the design characteristics, methodology and technological choices for medical robots.

Course Contents

Unit 1	**Introduction to Medical Robotics**

Introduction to medical robotics : applications and paradigms – Role of AI in medical robotics – Potential impact of medical robots, types of medical robots and level of human intervention – growing healthcare challenges

Unit 2	**Image-Guided Interventions**

Medical imaging modalities (e.g., MRI, US, X-ray, CT) - Robot compatibility with medical imagers – Image segmentation and modeling - Tracking devices - Frames and transformations - Surgical navigation - Calibration Rigid and non-rigid registration – Radiosurgery

Unit3	**Surgical Robotics**

Medical robots: History, Characteristics of medical robots, Automation and Navigation Challenges - robotics in surgery: Laparoscopic and Endoscopic Manipulators, Oncology robotics, Physically assistive robotics, Socially assistive robotics

Unit 4	**Minimally Invasive Surgery (MIS)**

Human-machine interfaces - Teleoperation - Cooperative manipulation -Port placement for MIS - Robot design concepts - Video images in MIS - Augmented reality - Minimally invasive surgery training

Unit 5	**Rehabilitation Robotics**

Physiological basis of neuromotor recovery, Framework for neuro-rehabilitation robotics: implication and recovery, Actuators and sensors and prosthetic robots, Assistive controllers and

modalities, Exoskeletons for upper limb and lower limb rehabilitation, Software platforms for integrating robots and virtual environments, Wearable robotic applications for neuro-rehabilitation	
Unit 6	**Medical robotics-applications, controversies and outcomes**
Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical –Gynaecology, Orthopaedics, Neurosurgery, Controversies and outcomes	
Books and other resources	
Text Books: 1. Robert Schilling, Fundamentals of Robotics-Analysis and control, Prentice Hall, 2003. 2. Paula Gomes, "Medical robotics- Minimally Invasive surgery", Woodhead, 2012. 3. J.J.Craig, Introduction to Robotics, Pearson Education, 2005 4. Roberto Colombo Vittorio Sanguineti, Rehabilitation Robotics, 1st Edition, Imprint: Academic Press Published Date: 10th March 2018, Springer	
References Books: 1. R. D. Howe and Y. Matsuoka, “Robotics for surgery,” Annual Review of Biomedical Engineering, vol. 1, pp. 211–240, 1999 2. A. R. Lanfranco, A. E. Castellanos, J. P. Desai, and W. C. Meyers, “Robotic surgery: a current perspective,” Annals of Surgery, vol. 239, no. 1, pp. 14–21, 2004. 3. Introduction to Robotics : Mechanics and Control John J. Craig	