INDIAN INSTITUTE OF INFORMATION TECHNOLOGY DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

INTRODUCTION OF NEW COURSE

Course Title	**Medical Imaging Systems**	Course Code				
Dept./ Specialization	Science and Humanities	Structure (LTPC)	3	1	0	4
To be offered for	UG, PG/DD and PhD	Status	Core ☐		Elective ■	
Faculty Proposing the course	Dr. Pal Uttam Mrinal	Type	New		Modification	
Recommendation from the DAC		Date of DAC				
External Expert(s)	1. Dr. Hari Varma, Associate Professor, Indian Institute of Technology Bombay 2. Dr. Hardik J. Pandya, Assistant Professor, Indian Institute of Science Bangalore					
Pre-requisite		Submitted for approval				
Learning Objectives	The student will learn about the working principle of medical devices currently being used in healthcare settings. The fundamentals, instrumentation, algorithm, constraints, research directions, project work, and specific case studies of translating advanced a device from lab to market will be discussed in detail.					
Learning Outcomes	On the successful completion of the course, the student will acquire the understanding of medical devices such as X-Rays, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Sonography, Optical imaging, and other advance techniques. The students will implement the knowledge gained in the course by working on a project and visit hospital as case studies.					
Contents of the course *(With approxima*	**Introduction to Medical Imaging Systems:** Regulatory requirements of a medical device, signal acquisition procedure and safety, diagnosis and therapeutics, classification between commercial and medical devices. **(L2 +T1)** **X-ray:** X-ray physics, interaction of radiation with matter, X-ray production, X-ray tubes, dose, exposure, screen-film radiography, digital radiography, X-ray mammography, X- ray Computed Tomography (CT). **(L10+T3)** **Computed Tomography:** Basic principles of CT, single and multi-slice CT. Tomographic image reconstruction, filtering, image quality, contrast					

te break-up of hours for L/T/P)	resolution, CT artifacts. **(L10+T3)** **Magnetic Resonance Imaging (MRI)**: MRI physics. Nuclear Magnetic Resonance: basics, localization of MR signal, gradient selection, encoding of MR signal, T1 and T2 relaxation, k-space filling, MR artifacts. **(L10+T2)** **Sonography**: Ultrasound basics, interaction of ultrasound with matter, generation and detection of ultrasound, resolution. **(L4+T2)** **Optical techniques:** Near infrared spectroscopy, Fluorescence imaging, Diffuse optical imaging, Hyperspectral imaging, Optical Coherence Tomography, Photoacoustic imaging. **(L4+T2)** **Recent trends in Medical Imaging Systems:** In-house development of ultrasound, piezoelectric, and piezoresistive sensors, newer MRI contrast agents, and application of machine learning. **(L2 +T1)**
Textbooks	1. Bushberg, J.T., Seibert, J.A., Leidholdt, E.M. Jr., and Boone, J.M., The Essential Physics of Medical Imaging, Second Edn, Lippincott Williams and Wilkins Publishers, Philiadelphia, 2002. 2. Wolbarst, A.B., Physics of Radiology, Second Edn, Medical Physics Publishing, Madison, WI, 2005. 3. Avinash C. Kak and Malcolm Slaney, Principles of Computerized Tomographic Imaging, 1987. 4. Quantitative Biomedical Optics Theory, Methods, and Applications, Irving J. Bigio and Sergio Fantini, Cambridge Texts in Biomedical Engineering (2016).
Reference Books	1. Medical Devices and Human Engineering (The Biomedical Engineering Handbook, Joseph D. Bronzino, Donald R. Peterson, CRC Press, 2014.