

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

Course Title	Materials Design for Sensor Systems	Course No	INT6XXX			
Department/ Specialization	Mechanical, Electronic and Design Engineering	Credits	L 3	T 1	P 0	C 4
Offered for	PG/DD and PhD	Status	Core <input type="checkbox"/>	Elective <input checked="" type="checkbox"/>		
Faculty proposing the course	Dr. Y. Ashok Kumar Reddy	Type	New <input type="checkbox"/>	Revision <input checked="" type="checkbox"/>		
Recommendation from the DAC		Date of DAC	07-12-2020			
External Expert(s)	Dr. K.R. Gunasekhar, Principle Scientist, IISc Bangalore Prof. S.P. Venkateshan, Professor Emeritus, IIT Madras					
Prerequisite	Consent of Teacher (COT)	Submitted for approval	45 th Senate			
Learning Objectives	<ul style="list-style-type: none"> To study the materials design perspectives for device fabrication To understand the concepts of Photodetectors and Infrared Sensors for energy/defence applications 					
Learning Outcomes	<ul style="list-style-type: none"> This course aims to learn the advanced design and fabrication techniques of the devices It can be mainly useful for PG/DD and PhD students towards making the Photodetectors and Infrared Sensors for bio-medical, energy and defence applications 					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	<p>I. Material Properties, Device Fabrication Techniques and Issues: Material properties – Structural, Optical, and Electrical properties Advanced techniques for materials design – Physical and Chemical approaches Device fabrication methods – Lithography and Etching Fabrication related issues – Residual stress, Micro cracks, and Surface oxidation (L12+T3 h)</p> <p>II. Photodetectors: Introduction to photodetectors & Architectures – M-S-M, Heterojunction, Bi-layers Materials selection and fabrication of devices – M-S-M, M-I-S, Photo-multiplier tubes; Figures of merit – Responsivity, Detectivity, External quantum efficiency Photodetectors for next generation – Energy, Bio-medical imaging and Defence areas (L14+T4 h)</p> <p>III. Infrared (IR) Sensors: Type of IR detectors – Photon (cooled) detectors, Thermal (un-cooled) detectors Metal and Superconductor based materials (Ti, Pt, YBaCuO), Semiconductor based materials (a-Si, VO_x, TiO_x); Fabrication and design of IR image sensor device Testing of IR sensors performance – Resistivity, Temperature Co-efficient of resistance (TCR), noise, Responsivity, and Detectivity Future trends of IR sensor materials – Military-night vision, Civil-security and surveillance, Gas detection and Imaging (L16+T5 h)</p>					
Essential Reading	<ol style="list-style-type: none"> Photodetectors: Materials, Devices and Applications, A. Ahmadiwand, J.E. Bowers et al., B. Nabet (eds.), Woodhead Publishing, 1st ed., 2015. Infrared detectors, Antoni Rogalski, CRC Press Taylor and Francis group, 2nd ed., 2010. 					
Supplementary Reading	<ol style="list-style-type: none"> Materials Science of Thin Films: Deposition and Structure, Milton Ohring, D. Gall, S.P. Baker, Academic Press Inc, 3rd ed., 2014. Photodetectors: Devices, Circuits, and Applications, S. Donati, Prentice Hall PTR, 2011. Fundamentals of Infrared Detector Materials, M.A. Kinch, SPIE Press book, USA, 2007. 					