INTRODUCTION OF NEW COURSE

Course Title	**Smart Materials and Applications**	Course No *(will be assigned)*				
		Structure (LTPC)	3	0	0	3
Offered for	Final Year UG/PG/PhD	Status	Core ☐		**Elective** ☒	
Faculty (Not more than two)	Dr M Sreekumar	Type	New ☒		Modification ☐	
Pre-requisite	COT	To take effect from				
Submission date		Date of approval by AAC				

Objectives	The course introduces the student to the basic principles and mechanisms of smart materials and devices and provides a spring board for further study. The student will be able to demonstrate knowledge and understanding of the physical principles and mechanisms underlying the behavior of various smart materials, actuators and transducers developed based on smart materials and their applications.
Contents of the course *(With approximate break up of hours)*	**INTRODUCTION (8Hrs)** Overview of Smart and functional materials, smart systems, smart structures and smart MEMS **SHAPE MEMORY ALLOYS and POLYMERS (8Hrs)** Principle of actuation; types; one-way, two-way and superelastic effects; constitutive, hysteresis and finite element modeling; temperature dynamics and control. **PIEZOELECTIC, ELECTROSTRICTIVE and MAGNETOSTICTIVE MATERIAS (6Hrs)** PZT, PMN, Terfenol-D and Galfenol- Nonlinearity, hysteresis and dynamic characteristics. **ELECTROACTIVE POLYMERS and GELS (6 Hrs)** Principles of operation; types; performance analysis; Dynamic modeling; EAPs as artificial muscles. **ER and MR FLUIDS (5 Hrs)** Functions and physical mechanisms, Winslow effect, water bridge model; temperature dependence, particle size & shape and heat transfer effects. **APPLICATIONS (12Hrs)** Medical, non-medical and industrial applications; chemical indicating devices, energy storage devices; applications in nanotechnology and biomimetics; smart structures and actuators; smart sensors.
Reference Books	1. Mel Schwartz , Smart materials, CRC Press, 2008 2. Otsuka K, Wayman CM, Shape memory materials. UK: Cambridge University Press; 1998. 3. Vijay K Varadan, Vinoy K J and Gopalakrishnan S, Smart Material Systems and MEMS-Design, Development and Methodologies, John Wiley & sons Ltd., 2006 4. Gandhi M.V. , Thompson B.S , Smart Materials and Structures, Kluwer Academic Publishers, 1992 5. Lagoudas D C., Shape Memory Alloys: Modeling and Engineering Applications, Springer 2008 6. Kohl M, Shape Memory Microactuators, Springer 2004 7. Kim K J and Tadakoro S (Eds), Electroactive Polymers for Robotic Applications-Artificial muscles and sensors, Springer-Verlag, 2007