

Course code	Course name	L-T-P-Credits	Year of Introduction
AE364	MEMS/NEMS	3-0-0-3	2016
Prerequisite : Nil			
Course objectives			
<ul style="list-style-type: none"> To introduce the concept of MEMS and Microsystems. To understand the diverse technological and functional approaches and applications To provide an insight of micro sensors, actuators and micro fluidics. 			
Syllabus			
Microsystems - Micro Manufacturing Techniques - Micro Actuators - Micro Sensors - Micro/Nano Fluids - Microsystem Design and Packaging			
Expected outcome			
On completion of the course, the students will be able to			
<ol style="list-style-type: none"> Become familiar with micro fabrication techniques Assess whether using a MEMS based solution is the relevant and best approach Select the most suitable manufacturing process and strategies for micro fabrication 			
Text Book			
<ul style="list-style-type: none"> Maluf, Nadim "An introduction to Microelectromechanical Systems Engineering" AR Tech house, Boston 2000. 			
Reference Books:			
<ol style="list-style-type: none"> Mohamed Gad – el – Hak "MEMS Handbook" Edited CRC Press 2002 Sabrie Solomon "Sensors Handbook", Mc Graw Hill, 1998 Marc F Madou, "Fundamentals of micro fabrication," CRC Press 2002 2nd Edition Francis E.H Tay and W. O. Choong, "Micro fluidics and bio MEMS application" IEEE Press New York 1997 Trimmer William S, "Micromechanics and MEMS", IEEE Press, New York 1997 			
Course Plan			
Module	Contents	Hours	Semester Exam Marks
I	Foundation in Microsystems : Review of microelectronics manufacture and introduction to MEMS- Overview of microsystems technology, Laws of scaling- The multi-disciplinary nature of MEMS- Survey of materials central to micro engineering- Applications of MEMS in various industries	6	15%
II	Micro Manufacturing Techniques : Photolithography- Film deposition, Etching Processes-Bulk micro machining, silicon surface micro machining	6	15%
FIRST INTERNAL EXAMINATION			
III	Micro Actuators : Energy conversion and force generation- Electromagnetic Actuators, Reluctance motors, piezoelectric actuators, bi-metal-actuator Friction and wear	7	20%
IV	Micro Sensors : Transducer principles-Signal detection and signal processing-Mechanical and physical sensors- Acceleration sensor, pressure sensor, Sensor arrays.	7	15%

SECOND INTERNAL EXAMINATION			
V	Introduction to Micro/Nano Fluids : Fundamentals of micro fluidics- Micro pump – introduction – Types - Mechanical Micro pump – Non mechanical micro pumps, Actuating Principles, Design rules for micro pump – modeling and simulation, Verification and testing – Applications	8	20%
VI	Microsystem Design and Packaging : Design considerations-Mechanical Design, Process design, Realization of MEMS components using Intellisuite. Micro system packaging-Packing Technologies-Assembly of Microsystems- Reliability in MEMS.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100

Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)