Course Number and Name
BGE012 – MEMS AND NANOTECHNOLOGY
Credits and Contact Hours
3&45
Course Coordinator's Name
Dr.Shanmuganandh
Text Books and References

TEXT BOOKS:

1. Mark Ratner & Daniel Ratner , Nano Technology, Pearson Education,2003.
2. Tai – Ran Hsu, " MEMS & MICROSYSTEMS Design and Manufacturing", TATA McGRAW- HILL, 2002
3. S.M. Sze, Semiconductor Sensors, John Wiley & Sons, INC., 1994.

REFERENCES:

1. Marc J. Madou, "Fundamentals of Microfabrication", II Edition, CRC Press, 2002.
2. Mohamed Gad-el-Hak, The MEMS Handbook, CRC Press, 2002
3. M.Elwenspoek, R.Wiegerink, Mechanical Microsensors, Springer-Verlag Berlin Heidelberg, 2001.
4. David Ferry, Transport in Nanostructures, Cambridge University Press, 2000.
5. S. Datta, Electron Transport in Mesoscopic Systems, Cambridge University Press, 1995.
6. Beenaker and Van Houten, Quantum Transport in Semiconductor Nanostructures, in Solid State Physics v. 44, eds. Ehernreich and Turnbull, Academic Press, 1991.
7. P. Rai-Choudhury, Handbook of Microlithography, Micromachining &Microfabrication, SPIE, 1997.
8.www.springer.com/us/book/9783319007793

Course Description
To inspire the students to expect to the trends in development and synthesizing of nano systems and measuring systems to nano scale. To expose the students to the evolution of Nano systems, to the various fabrication techniques. Also to impart knowledge to the students about nano materials and various nano measurements techniques.

Prerequisites	Co-requisites
Nil	Rapid Prototyping
required, elective, or selected elective (as per Table 5-1)	
Non Major Elective	
Course Outcomes (COs)	
CO1	The students are expected to understand MEMS
CO2	Methods for Processing MEMS materials
CO3	Characteristic techniques of micro system fabrication process
CO4	To expose the students to the evolution of Nano technology
CO5	Also to impart knowledge to the students about nano materials and various nano measurements techniques
CO6	Introduction of nano scale manufacturing
Student Outcomes (SOs) from Criterion 3 covered by this Course	

COs/SOs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M											
CO2					H			M				H
CO3	M											H
CO4					H					L		H
CO5	M		H		H							H
CO6	M											

List of Topics Covered

UNIT – I INTRODUCTION **9**

Historical background development of microelectronics, evolution of micro sensors, MEMS, emergence of micro machines.

Micro sensors: Introduction, thermal sensors, mechanical sensors, flow sensors and Introduction to SAW DEVICES

UNIT – II MEMS MATERIALS AND PROCESSING **9**

Overview, metals, semiconductors, ceramic, polymeric and composite materials, Microstereolithography: Introduction, Scanning Method, Projection Method, Applications. LIGA Process: Introduction, Basic Process and Application.

UNIT – III MICRO SYSTEM FABRICATION PROCESSES **9**

Photolithography, Chemical Vapor Deposition, Etching, Bulk and Surface Micro Manufacturing.

UNIT – IV NANO-TECHNOLOGY 9

Introduction to Nanotechnology, The nanoscale. Consequences of the nanoscale for technology and society. - Technologies for the Nanoscale, Top-down versus bottom-up assembly. Visualisation, manipulation and characterisation at the nanoscale, Proximal probe technologies. Self-assembly.

UNIT – V NANO SCALE MANUFACTURING: **9**

Nanomanipulation, Nanolithography - An introduction to tribology and its industrial applications – Nanoscale Materials and Structure, Nanocomposites, Safety issues with nanoscale powders - Applications, Applications in energy, informatics, medicine, etc