

SSLC, HSE, DIPLOMA, B.E/B.TECH, M.E/M.TECH, MBA, MCA

Notes

Syllabus

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OMT751 MEMS AND NEMS

DETAILED SYLLABUS

OBJECTIVE:

To develop the basic knowledge about the MEMS system and to know about the concepts and principles of MEMS & NEMS with various applications.

UNIT I INTRODUCTION

Fundamentals – Micro systems and microelectronics - working principle of microsystems – Micro sensors, acoustic sensor, Bio sensor, chemical sensor, pressure sensor, Temperature sensor - micro actuation techniques – Actuation using thermal forces, actuation using SMA, Actuation using piezo electric effect, Actuation using electro static forces – micro gripper – micro motors – micro valves – micro pumps, types – micro heat pipes.

UNIT II MICRO FABRICATION AND MANUFACTURING TECHNIQUES

Materials for micro systems – Substrates and wafer- Silicon, Quartz, Piezoelectric crystals, polymers - Photo Lithography – Diffusion- Oxidation – CVD- PVD, Etching, types - Bulk micro manufacturing – Surface micro machining - Micro system packaging-materials, die level, device level, system level - Packaging techniques – die preparation - Surface bonding-wire bonding - sealing.

UNIT III MECHANICS FOR MICRO SYSTEM DESIGN AND APPLICATIONS

Basic concepts – Bending of thin plates – Mechanical vibration – Thermo mechanics - Fracture mechanics – Fluid mechanics at micro systems- Design considerations - Process design-mask layout design – Mechanical Design-Applications of micro system in automotive industry, bio medical, aerospace and telecommunications.

UNIT IV NANO ELECTRONICS

Basics of nano electronics – Nano electronics with tunneling devices – Nano electronics with super conducting devices - Molecular nano technology – Applications of MNT - Direct self-assembly device assembly - Electrostatic self-assembly-nano tubes – Nano wire and carbon-60 - Dielectrophoretic nano assembly.

UNIT V ARCHITECTURE AND APPLICATIONS

Architecture of MEMS – Requirements of nano systems - Development of nano electronics and structuring – Application of NEMS – Deposition of coatings – Three dimensional materials – Dewatering.

OUTCOMES:

CO1: Understand the Fundamentals and working principles of microsystems and microelectronics

CO2: Knowledge on both micro fabrication and manufacturing techniques

CO3: Acquiring knowledge about micro system design and its various applications

CO4: Study about the basic concepts of Nano electronics with various devices and also discusses with its applications

CO5: Realizing the various application of NEMS and Architecture of MEMS

TEXT BOOKS:

1. Goser.K , Dienstuhl .J , “ Nano Electronics & Nanosystems ” , Springer International Edition, 2008.
2. Michael Pycraft Inrushes, “Nano Electro Mechanics in Engineering & biology”, CRC press New York, 2002.
3. Tai – Ran Hsu, “MEMS & Microsystems: Design and Manufacture “ , second edition Tata Mc Graw Hill, 2008.

REFERENCES

1. Charles P.Poojlejr Fran K J.Owners , “ Introduction to Nano Technology ” , Willey student Edition 2008.
2. Gregory Timp, “Nano Technology”,Spinger International Edition , 1999.
3. Julian W.Gardner,Vijay K.Varadan,Osama O.Awadel Karim, Microsensors MEMS and Smart Devices, John Wiby & sons Ltd.,2001.
4. Mohamed Gad – el- Hak,The MEMS HAND book,CRC press 2005