**REFERENCE BOOKS:**


1. **Financial Management,** I. M. Pandey, Vikas Publication House ISBN 0-7069-5435-1. 2002
2. **Financial Management,** Abrish Gupta, Pearson.
3. **Financial Decision Making,** Humpton. 2000
4. **Financial Management,** Theory and Practice, Prasanna Chandra TMH ISGN -07-462047-9, 3rd edition 2002


## MICRO AND SMART SYSTEMS TECHNOLOGY

| | | | |
|---|---|---|---|
| **Subject Code** | **: 10ME768** | **IA Marks** | **: 25** |
| **Hours/Week** | **: 04** | **Exam Hours** | **: 03** |
| **Total Hours** | **: 52** | **Exam Marks** | **: 100** |

### PART – A

**UNIT - 1**

**Introduction To Micro And Smart Systems:**

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

b) What are microsystems? Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.

**05 Hours**

**UNIT - 2**

**Micro And Smart Devices And Systems: Principles And Materials:**

a) Definitions and salient features of sensors, actuators, and systems.

b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.

c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print-head, electrostatic comb-drive and micromotor, magnetic micro relay, shape-memory-alloy based actuator, electro-thermal actuator

d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin

**08 Hours**

**UNIT - 3**

**Micro-Manufacturing And Material Processing:**

a) Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.

b) Silicon micromachining: surface, bulk, moulding, bonding based process flows.

c) Thick-film processing:

d) Smart material processing:

e) Processing of other materials: ceramics, polymers and metals

f) Emerging trends

**07 Hours**

**UNIT - 4**

**Modeling:**

a) Scaling issues.

b) Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.

c) Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators.

**06 Hours**

**PART – B**

**UNIT - 5**

**Computer-Aided Simulation And Design:**

Background to the finite element method. Coupled-domain simulations using Matlab. Commercial software.

**08 Hours**

**UNIT - 6**

**Electronics, Circuits And Control:**

Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from microsystems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micromachined accelerometer or a thermal cycler.

**08 Hours**

**UNIT - 7**

**Integration And Packaging Of Microelectro Mechanical Systems:**

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low-temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples.

**06 Hours**

**UNIT - 8**

**Case Studies:**

BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam.

**04 Hours**

**PART – C**

**UNIT - 9**

**Mini-projects and class-demonstrations (not for Examination)**

**09 Hours**

a) CAD lab (coupled field simulation of electrostatic-elastic actuation with fluid effect)
b) BEL pressure sensor
c) Thermal-cycler for PCR
d) Active control of a cantilever beam

**TEXT BOOKS AND A CD-SUPPLEMENT:**

1. "Micro and Smart Systems" by Dr. A.K.Aatre, Prof. Ananth Suresh, Prof.K.J.Vinoy, Prof. S. Gopalakrishna,, Prof. K.N.Bhat.,John Wiley Publications
2. **MEMS & Microsystems: Design and Manufacture,** Tai-Ran Tsu, Tata Mc-Graw-Hill.

**REFERENCE BOOKS:**

1. Animations of working principles, process flows and processing techniques, A CD-supplement with Matlab codes, photographs and movie clips of processing machinery and working devices.
2. **Laboratory hardware kits for** (i) BEL pressure sensor, (ii) thermal-cycler and (iii) active control of a cantilever beam.

3. **Microsystems Design,** S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.
4. **Analysis and Design Principles of MEMS Devices,** Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.
5. **Design and Development Methodologies,** Smart Material Systems and MEMS: V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.
6. **MEMS-** Nitaigour Premchand Mahalik, TMH 2007

## PRODUCT LIFE CYCLE MANAGEMENT

| | | | |
|---|---|---|---|
| **Subject Code** | **: 10ME769** | **IA Marks** | **: 25** |
| **Hours/Week** | **: 04** | **Exam Hours** | **: 03** |
| **Total Hours** | **: 52** | **Exam Marks** | **: 100** |

### PART – A

**UNIT – 1**

**Introduction to Product Life Cycle Management(PLM)** : Definition, PLM Lifecycle model, Threads of PLM, Need for PLM, Opportunities and benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning.

**4 Hours**

**UNIT – 2**

**PLM Concepts, Processes and Workflow**:

Characteristics of PLM, Environment driving PLM,PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.

**6 Hours**

**UNIT – 3**

**Product Data Management (PDM) Process and Workflow:**PDM systems and importance, reason for implementing a PDM system, financial justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and workflow.

**10 Hours**