

Code No: 118CY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year II Semester Examinations, May - 2019

MEMS DESIGN

(Mechanical Engineering (Mechatronics))

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.  
 Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) Explain the role of nanotechnology in MEMS fabrication. [2]
- b) Differentiate between structural and sacrificial materials. [3]
- c) List out the basic modeling elements in electrical system. [2]
- d) What are the features of passive electronic systems? [3]
- e) Explain the working principle of peltier effect heat pump. [2]
- f) Give the characteristics of shape memory alloy. [3]
- g) What are the uses of beam splitter? [2]
- h) Explain the principle of optical switch. [3]
- i) What are the applications of MEMS inductors? [2]
- j) Explain the working of MEMS based phase shifter. [3]

**PART - B****(50 Marks)**

- 2.a) Describe bio and chemo devices.
  - b) Explain various stages at which impurity doping is done in MEMS fabrication. [5+5]
- OR**
- 3.a) Explain the steps involved in photolithography.
  - b) Differentiate between bulk and surface micromachining. [5+5]
- 4.a) Explain the features of passive mechanical systems.
  - b) Describe the basic modeling elements of fluid systems. [5+5]
- OR**
5. Explain the steps involved in the modeling of pure mechanical system with spring, damper and mass. [10]
  6. With the help of suitable diagrams explain how flow measurement can be done using integrated paddle-cantilever structure. [10]
- OR**
7. Explain the steps involved in the fabrication of micro-machined thermocouple probe and explain its working. [10]

# Mems Question Papers

**Patrick Vollmar**



## **Mems Question Papers:**

*Microelectromechanical Systems* National Research Council, Division on Engineering and Physical Sciences, National Materials Advisory Board, Commission on Engineering and Technical Systems, Committee on Advanced Materials and Fabrication Methods for Microelectromechanical Systems, 1998-01-01 Microelectromechanical systems MEMS is a revolutionary field that adapts for new uses a technology already optimized to accomplish a specific set of objectives The silicon based integrated circuits process is so highly refined it can produce millions of electrical elements on a single chip and define their critical dimensions to tolerances of 100 billionths of a meter The MEMS revolution harnesses the integrated circuitry know how to build working microsystems from micromechanical and microelectronic elements MEMS is a multidisciplinary field involving challenges and opportunities for electrical mechanical chemical and biomedical engineering as well as physics biology and chemistry As MEMS begin to permeate more and more industrial procedures society as a whole will be strongly affected because MEMS provide a new design technology that could rival perhaps surpass the societal impact of integrated circuits 26 *Electronics Science* Mocktime Publication, 101-01-01 generated by python docx

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*Microfabricated Systems and MEMS VII* ,2004      [MEMS and Microstructures in Aerospace Applications](#) Robert Osiander,M. Ann Garrison Darrin,John L. Champion,2018-10-03 The promise of MEMS for aerospace applications has been germinating for years and current advances bring the field to the very cusp of fruition Reliability is chief among the challenges limiting the deployment of MEMS technologies in space as the requirement of zero failure during the mission is quite stringent for this burgeoning field MEMS and Microstructures in Aerospace Applications provides all the necessary tools to overcome these obstacles and take MEMS from the lab bench to beyond the exosphere The book begins with an overview of MEMS development and provides several demonstrations of past and current examples of MEMS in space From this platform the discussion builds to fabrication technologies the effect of space environmental factors on MEMS devices and micro technologies for space systems instrumentation communications thermal control guidance navigation and control and propulsion Subsequent chapters explore factors common to all of the described systems such as MEMS packaging handling and contamination control material selection for specific applications reliability practices for design and application and assurance practices Edited and contributed by an outstanding team of leading experts from industry academia and national laboratories MEMS and Microstructures in Aerospace Applications illuminates the path toward qualifying and integrating MEMS devices and instruments into future space missions and developing innovative satellite systems

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 each product requires a unique process technology This book provides a comprehensive insight into the tools necessary for  
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Michael S. Farbman,Ramsay Muir,Hugh F. Spender,1926      **Advances in Micro/Nano Electromechanical Systems and Fabrication Technologies** Kenichi Takahata,2013-05-29 MEMS technology is increasingly penetrating into our lives and improving our quality of life In parallel to this advances in nanotechnology and nanomaterials have been catalyzing the rise of NEMS Consisting of nine chapters reviewing state of the art technologies and their future trends this book focuses on the latest development of devices and fabrication processes in the field of these extremely miniaturized electromechanical systems The book offers new knowledge and insight into design fabrication and packaging as well as solutions in these aspects for targeted applications aiming to support scientists engineers and academic trainees who are engaged in relevant research In the chapters practical issues and advances are discussed for flexible microdevices bioMEMS intelligent implants optical MEMS nanomachined structures and NEMS and others Most of the chapters also focus on novel fabrication packaging processes including silicon bulk micromachining laser micromachining nanolithography and packaging for implantable microelectronics enabled by nanomaterials      **Micromachined Circuits and Devices** Shiban Kishen Koul,Sukomal Dey,2022-02-07 This book presents the design of different switching and resonant devices using the present state of the art radio frequency RF micromachining MEMS technology Different topologies of MEMS switches have been discussed considering optimum performances over microwave to millimeter wave frequency range Wide varieties of micromachined switching networks starting from single pole double throw SPDT to single pole fourteen throw SP14T are discussed utilizing vertical and lateral actuation movements of the switch Different transduction mechanisms of micromachined resonators are highlighted that includes capacitive piezoelectric and piezoresistive types The book provides major design guidelines for the development of MEMS based digital phase shifters tunable filters and antennas with extensive measurement data Apart from the radio frequency RF requirements an extensive guideline is given for the improvement of the reliability of micromachined switches and digital phase shifters where multiple switches are operating simultaneously It takes multiple iterations and extensive characterizations to conclude with a reliable MEMS digital phase shifter and these aspects are given one of the prime attentions in this book Detailed performance analysis of metamaterial inspired MEMS switches is then discussed for application in millimeter wave frequency bands up to about 170 GHz The book concludes with future research activities of RF MEMS technology and its potential in space defense sensors and biomedical applications      **Proceedings of the International Conference on Smart Materials, Structures and Systems** ,1999

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