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Question Paper Code: BCC210



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech II Semester End Examinations(Regular) - July, 2018

Regulation: IARE – R16

Design for Manufacturing MEMS and Micro Systems

Time: 3 Hours

(CAD/CAM)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

- (a) Provide an account of evolution of micro fabrication and miniturization of MEMS. [7M]

(b) List out the applications of MEMS in automobile industries. [7M]
- (a) Discuss the working principle of micro accelerometers. [7M]

(b) Why are electrostatic forces used to run micro motors rather than conventional electromagnetic forces? Explain why this actuation technique is not used in macrodevices and machines. [7M]

UNIT – II

- (a) Explain the role of electrochemistry in micro fabrication highlighting advantages and disadvantages. [7M]

(b) Discuss why atomic structure of matter is considered as a decisive factor in micro systems design. [7M]
- (a) Explain the plasma physics in detail and discuss how plasma generator works with a neat sketch. [7M]

(b) The resistivity of the doped silicon at the depth of $6 \mu m$ is $10^{-2} \Omega - cm$. Calculate the time required to dope born into the silicon substrate. [7M]

UNIT – III

- (a) Explain the static bending theory applied to microsystems and deduce the equations. [7M]

(b) Provide a detailed notes on the application of finite element stores analysis in microsystems design. [7M]
- (a) Summarize the applications of FEM in the field of MEMS. [7M]

(b) The vibration of the mass is initiated by a small “pull” downwards by an amount $\delta_{st} = 10 \mu m$. The balanced mass spring system with spring constants $K_1=K_2$. Find the values of amplitude and frequency of 10-mg mass suspended from a spring with a spring constant $k= 7 \times 10^{-7} N/m$. [7M]

UNIT – IV

7. (a) Summarize the steps involved in design of a silicon die for pressure design for microsystem design with a neat sketch. [7M]
- (b) Explain the phenomenon of incompressible fluid flow in micro conducts. [7M]
8. (a) Discuss the heat conduction process in multilayered thin films [7M]
- (b) List out and discuss the design considerations of micro pressure sensor. [7M]

UNIT – V

9. (a) With the help of a suitable sketch discuss the process of ion implantation. [7M]
- (b) Differentiate ranging from bulk micro manufacturing and surface micromachining. [7M]
10. (a) What are the different materials used in MEMS fabrication process and explain each one with their properties and applications. [7M]
- (b) Write short notes on LIGA process and silicon piezoresistors. [7M]