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**Question Paper Code: 99374**

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

Open elective

Civil Engineering

19UEE974 - MEMS

(Common to CSE, ECE, MECH, IT , Chemical and bio medical Engineering branches)

(Regulation 2019)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. \_\_\_\_\_ defined as a change in electrical resistance of solids when subjected to stress fields. CO1- U  
(a) Piezoelectric      (b) Photo resist      (c) Piezo resistance      (d) none
2. In the \_\_\_\_\_, a change in the cantilever's z-displacement indicates a change in load or intrinsic stress CO1- U  
(a) Dynamic mode      (b) Static mode      (c) Pseudo static      (d) Pseudo Dynamic
3. Hall effect sensors are an application of \_\_\_\_\_ law CO2- App  
(a) Ampere's      (b) Gauss's      (c) Lorentz's      (d) Lenz's
4. Which of the following is not an example for actuator CO2- U  
(a) Optical fiber      (b) Shape memory alloys  
(c) Magneto-strictive materials      (d) Electro-/Magneto-rheological fluids
5. A piezo-electrical crystal generates ----- when subjected to \_\_\_\_\_ force. CO3- U  
(a) Voltage, Electrical      (b) Voltage, Mechanical  
(c) Current, Gravity      (d) Current, non electrical
6. Piezoelectric crystals produce \_\_\_\_\_ CO3- Ana  
(a) no voltage      (b) low voltage      (c) high voltage      (d) very high voltage

7. Etching refers to the removal of material from \_\_\_\_\_ CO4- R  
 (a) the soft surface (b) the hard surface (c) the sticky surface (d) the wafer surface
8. \_\_\_\_\_ is used to protect the remaining area of the wafer CO4- R  
 while machining.  
 (a) Tin foil (b) Wood (c) Photo resist layer (d) Sodium bicarbonate
9. Which of the following monomers are unsuitable for condensation CO5- R  
 polymerization?  
 (a) propanoic acid and ethanol (b) butane-dioic acid and glycol  
 (c) diamines and dicarboxylic acids (d) hydroxy acids
10. Which among the following polymers have lowest solubility? CO5-R  
 (a) polyethylene (b) polystyrene (c) nylon 6 (d) epoxy resin

PART – B (5 x 2= 10 Marks)

11. What is actuator? CO1- U
12. Describe comb drive device? CO2- U
13. What is meant by piezo resistive sensor CO3- U
14. Define Etching. CO4- U
15. What are the relative merits of optical MEMS devices CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) Describe in general about intrinsic stress in MEMS. CO1- U (16)  
 Or  
 (b) Discuss in detail about torsional deflections. CO1- U (16)
17. (a) Explain the operation of magnetic actuators with micro magnetic CO2-App (16)  
 components.  
 Or  
 (b) With block diagram explain the functionality of CO2-U (16)  
 (i) Microgripper  
 (ii) Micro Motors
18. (a) List the properties and applications of piezoelectric materials. CO3-Ana (16)  
 Or  
 (b) With suitable diagram explain the principles of piezoelectric micro CO3-Ana (16)  
 cantilever beam.

19. (a) Write short notes on isotropic and anisotropic etching process. CO4- App (16)  
Or  
(b) With neat diagrams explain the different etching processes in detail. CO4- App (16)
20. (a) Classify about optical MEMS and its applications. CO5- Ana (16)  
Or  
(b) Explain about different optimal MEMS mirrors/Lenses. CO5- Ana (16)

