



B.E DEGREE EXAMINATIONS: APRIL/MAY 2016

(Regulation 2009)

Eighth Semester

MECHATRONICS ENGINEERING

MCT154: Micro Electro Mechanical Systems

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The standard followed to manufacture MEMS is ---
 - a) Top to bottom approach
 - b) Bottom to top approach
 - c) Combination of a and b
 - d) No such standard
2. Si has ----- number of atoms
 - a) 14
 - b) 18
 - c) 16
 - d) 19
3. Bio Sensor uses
 - a) Biological entities
 - b) Biological substances
 - c) Diagnostic equipments
 - d) FDA approval for sales.
4. Which of the following waves are not used in acoustic wave sensors----
 - a) Surface waves
 - b) Lamb waves
 - c) Shear waves
 - d) Saw tooth waves
5. The thickness of photo resist is
 - a) 0.5-2 μ m
 - b) 1-2 μ m
 - c) less than 3 μ m
 - d) Thickness is not commonly considered.
6. ---- law related to mass transfer governs diffusion process
 - a) Fick's law
 - b) Plancks law
 - c) Stefan- Boltzman law
 - d) Both A and B
7. --- type of electrolyte is used in Nickel electroplating
 - a) NiCl
 - b) NiCl₂
 - c) NiSO₄
 - d) NiOH

8. Selectivity ratio is defined by-----
- a) Etching rate of silicon/Etching rate of material b) Etching rate of material/ Etching rate of silicon
- c) Etching rate of platinum/ Etching rate of material d) Etching rate of platinum/ Etching rate of silicon
9. --- type of photo resist is used in LIGA process
- a) Sensitive to X-ray radiation b) Good thermal stability at 140°C
- c) Un exposed part must be soluble d) Should have porosity
10. ----- is an example of eutectic bonding material.
- a) Germanium b) Titanium gold
- c) Silicon d) Both a & b

PART B (10 x 2 = 10 Marks)

11. List few materials which are used to convert plastic as conductive material.
12. Interpret Paschen's effect in your own words.
13. Chemiresistors are preferred than chemicapacitor sensors: Argue whether the statement is correct or wrong.
14. Why electrostatic system is preferred over electromagnetic in constructing micro motors?
15. List few chemical etchants used in MEMS manufacturing.
16. What kinds of problems are anticipated in local oxidation techniques? Justify your answer.
17. What parameters are essential to be considered in the design of Microsystems?
18. Justify, why micro assembling is challenging?
19. Define die- passivation.
20. Why encapsulation is important in micro system design and manufacturing?

PART C (5 x 14 = 70 Marks)

- 21 a) Explain scaling laws of electromagnetic, electrostatic and fluid flow with neat sketches.
- (OR)**
- b) Explain the Czochralski method for Si preparation and also explain why Si is widely used.
22. a) Lasith Malinga of Srilankan cricket team is having susceptible bowling action. However, International Cricket Council (ICC) wants to assess whether he is bowling as per the norms given by ICC or not. As a MEMS engineer, you have been provided with a job to fabricate such sensor to be fixed in his body to assess his bowling action. What kind of sensor do you suggest for this application and explain how it can be manufactured?

(OR)

- b) Alkalinity of water can be measured using bio medical sensors whereas pH can be measured using biosensor. If you are provided with a problem of measuring the sugar level in the body, which method do you prefer and explain its working principle.

23. a) With neat sketches, explain the process of Photo Lithography

(OR)

- b) Explain the various etching process.

24. a) Explain the process of surface micro machining and also discuss about the problems associated with this process.

(OR)

- b) Explain various encapsulation, bonding and sealing methods used in MEMS manufacturing.

25. a) Choose an appropriate sensor used in airbag deployment system of automobiles and also explain how it is manufactured.

(OR)

- b) Explain various design parameters to be considered in MEMS manufacturing.
