Register Number: ……..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Sixth Semester

MECHATRONICS ENGINEERING

MCT154**:** Microelectro Mechanical System

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The application of the scaling laws in miniaturization is to assess the consequences on
   a) the physical effect b) the economic effect
   c) the market effect on miniaturized d) none of the above
2. For order 1 scaling such as surface-to-volume scaling the acceleration varies
   a) linearly b to the square power
   c) to the cubic power d) none of the above
3. Dry etching involves the use of
   a) wet air b. dry air
   c) dry toxic gas d. plasma to remove the substrate materials
4. X ray lithography in a LIGA process produces
   a) the outline b. the actual geometry
   c) the duplicate of a mems component d. limited to ceramics
5. _____ is a justification for effective of CVD process of material depositing over silicon substrates
   a) is thermally activated b. combines mechanical and chemical diffusion
   c) combines thermal diffusion and chemical reaction c. independent of temperature
6. Typical thickness of photo resists in a photolithographic process is
   a) 0.1 to 1.0 µm b) 0.5 to 2.0 µm
   c) 1 to 2 µm d) 3 to 4 µm
7. The most favored orientation for micromaching is the
   a) <100> b) <110>
   c) <111> d) <101>
8. SLIGA is an improvement of the LIGA process with the provision of
   a) slicing the base plate from the finished products b) a sacrificial layer for ready separation of the base plate from the product
   c) a clean product d) none of these
9. The most commonly used substrate materials in Microsystems is _____
   a) silicon b) GaAs
   c) quartz d) titanium
10. Advection is a physical phenomenon that involves a moving substance that changes its
    a) pressure b) temperature
    c) phase during the movement d) none of these

PART B (10 x 2 = 20 Marks)

11. List the types of scaling laws
12. Define trimmer force scaling vector
13. Why MEMS is not successful other than automotive and biomedical industries?
14. Define stress intensity factors
15. Differentiate between bulk manufacturing and surface micromachining.
16. What is the common problem anticipated in local oxidation.
17. What are the limitations of the height (depth) of microstructures that can be produced by bulk manufacturing technique?
18. Why is electroplating necessary in a LIGA process?
19. Apply mask design procedure to fabricate cantilever beam.
20. Why signal transduction is necessary in both microsenors and actuators?

PART C (5 x 14 = 70 Marks)

21. a) How down scaling is done with respect to :
    (i) Geometry (4)
    (ii) Rigid body dynamics (8)
    (iii) Explain born the phenomena's with examples. (2)

    (OR)

    b) (i) Why electro static systems are prepared in MEMS over electromagnetic systems. Justify with scaling concepts. (8)
    (ii) Enumerate the process of downscaling fluid dynamic systems. (6)

22. a) Explain detail about the working principle of biomedical sensors and biosensor.

    (OR)

b) Classify any three types of microactuators and explain them in detail with neat sketch.

23. a) Explain the photolithography process and ion implantation process with a neat sketch?

(OR)

b) Differentiate the CVD process from enhanced CVD process with equations and sketchs.

24. a) Explain in detail the LIGA process with neat sketch.

(OR)

b) Explain in detail the tree level of microsystem packaging system with neat sketch

25. a) Write briefly about the microsystem in automotive and telecommunication application

(OR)

b) Discuss the design process and consideration in microsystem design.

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