

8. (a) What do you understand by nanoelectronics ? How do the properties of semiconducting materials change upon nano-sizing ? Describe the technique of lithography in nanoscale design of circuits and components.
- (b) Write down the different stamping techniques for nano-fabrication with their materials and etchants for the formation of micro contact printing with proper diagram. **10+10**

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- (iii) MEMS and NEMS
- (iv) Nanostructured materials.
- (b) What are the active and passive micro-fluidics devices and their advantages and disadvantages over each other ? Explain the working of one active and one passive micro-fluidice devices with proper diagrams. **12+8**
- 2. (a) Write down the isotropic and anisotropic etchants with their marking materials during the etching process in the formation of MEMS and NEMS devices.
- (b) Describe the techniques of MEMS packaging and reliability for different sensors. What are the major challenges in this area ? **10+10**
- 3. (a) What is Micro-fluidics ? What are the applications for which microfluidics is useful ? Describe the construction of a microfluidics device.

- (b) What are the types of fluids ? What are the types of fluids flows ? What are the parameters used to characteristics fluids and fluids flows ? **10+10**
- 4. (a) Write down the basic principle Lab On chip concept. Describe its applications in the fabrication of devices at nano-scale.
- (b) Describe using examples, the utility in medicine of nanoparticles of :
  - (i) Gold
  - (ii) Silver
  - (iii) Mangetic ferrites. **10+10**
- 5. (a) Define the terms sensor and nanosensor. Very briefly describe a specific nanosensor, explaining how it meets your definition of the term.
- (b) For a sensor, describe the meanings of the following terms :
  - (i) Sensitivity
  - (ii) Selectivity

- (iii) Resolution
- (iv) Response time
- (v) Calibration
- (vi) Linearity
- (vii) Repeatability
- (viii) Stability **4+16**

6. (a) Write a short note on nano-cutting tools.
- (b) Write down the different components of sensor and their applications in different areas.
- (c) What are the specific advantages of Nanosensors over larger sensors ? **20**
7. (a) Explain the applications of MEMS devices as a pressure sensor and as an accelerometer.
- (b) Describe the basic principles and explain the working of a temperature sensor and a smoke sensor. Name the important materials/material classes involved. **10+10**

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**5771**

**M. Tech. EXAMINATION, Dec. 2018**

(Third Semester)

(B. Scheme) (Main & Re-appear)

(MSN)

MSN-701

**NANODEVICES AND NANOSENSORS**

*Time : 3 Hours]*

*[Maximum Marks : 100*

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Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

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**Note :** Attempt any *Five* questions. All questions carry equal marks.

1. (a) Define and describe :
- (i) Nanoscience
  - (ii) Nanotechnology

**(3-40/13)M-5771**

**P.T.O.**