Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, DEC 2018

SUBJECT: MICROELECTROMECHANICAL SYSTEMS [MTE 4102]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed with justification

1A. Sketch and explain working of micro accelerometer using a vibrating beam signal transducer. Determine the equivalent spring constant k and the natural frequency ω_n of a cantilever beam element of length 1000μm with cross-section 10μm x 50μm in a microaccelerometer. Assume the proof mass to be 10mg and E=190GPa. **6**

1B. Suggest and explain the micro-manufacturing process used to manufacture non silicon based microstructures. Illustrate using suitable example and diagrams. **4**

2A. Suggest a suitable material for masks for deep etching in manufacturing optical waveguides. Justify your selection of material. **3**

2B. Suggest a technique, used to control anisotropic etching. Sketch and explain its working principle. **3**

2C. Explain the physical vapour deposition process and mention its application. **4**

3A. With the help of schematic diagram explain the process used to apply photoresist onto the surface of substrates. **4**

3B. Plan a surface micromachining process for the production of comb drive actuator as shown in Fig.3B. **6**

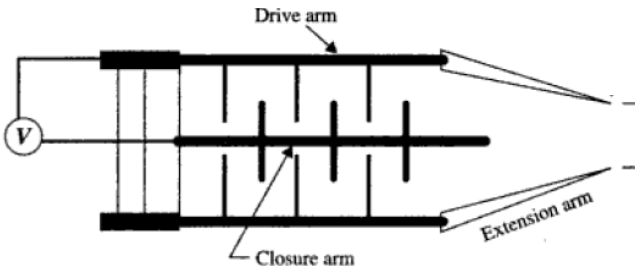

Figure 3B.

4A. Differentiate between the dry etching and wet etching in bulk micromachining. **4**

4B. Derive and justify the use of electrostatic force in micro actuation compared to electromagnetic force in macro actuation devices. **6**

5A. What are the different planes of cut in silicon wafers? Mention the number of atoms and their corresponding properties in each plane. **2**

5B. Suggest a MEMS sensor used to detect concentration of glucose in the blood sample. With a sketch explain its working principle. **4**

5C. Discuss about the mechanical problems associated with surface micromachining. **4**