

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BE
BRANCH: ECE/MECH**

**SEMESTER : VII/ADD
SESSION : MO/18**

SUBJECT: MEC2019 MICRO-ELECTRO-MECHANICAL-SYSTEMS

TIME: 3 HRS.

FULL MARKS: 60

INSTRUCTIONS:

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
 2. Candidates may attempt any 5 questions maximum of 60 marks.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) Why silicon is the most promising material for MEMS structures? [2]
Q.1(b) How the scaling down of the structure increases the physical phenomena? Explain with examples. [4]
Q.1(c) What are the reasons to develop stress into thin film? How the stress can damage the MEMS device? [6]
- Q.2(a) Write down the different techniques to reduce the stiction in MEMS fabrication. [2]
Q.2(b) Describe the DRIE technique steps with the appropriate diagrams. What are the characteristics of DRIE? [4]
Q.2(c) Describe the process steps with diagrams to design cantilever beam using surface micromachining. [6]
- Q.3(a) Why crystallographic orientation is important for anisotropic wet etching? [2]
Q.3(b) What are the major properties of micro-sensor? Briefly explain how we can achieve those for piezo-resistive sensor? [4]
Q.3(c) What do you understand by electrostatic sensing and electrostatic actuation? Describe both with appropriate examples with diagrams. [6]
- Q.4(a) Define the transition time of RF switch. [2]
Q.4(b) Why MEMS based RF switches is becoming a potential solution to design RF systems? [4]
Q.4(c) Draw the series RF MEMS switches. Describe the working principle of series RF MEMS switch. Analyse the advantages of series RF MEMS switch. [6]
- Q.5(a) RF MEMS is becoming a potential solution for RF design. Justify the statement. [2]
Q.5(b) Why the Q-factor of the inductor using MEMS technology is better than that of the CMOS technology? Explain you answer with appropriate diagrams. [4]
Q.5(c) Describe three techniques to increase the tuning range of variable capacitor implemented using MEMS technology. [6]
- Q.6(a) How to improve the performance of microstrip patch antenna using MEMS technology? Illustrate with appropriate diagrams. [2]
Q.6(b) Describe the process steps to fabricate an array of micro sized horn antennas. Write down the possible application areas of this antenna? [4]
Q.6(c) What do you understand by phase shifter? How to design a MEMS based phase shifter? Describe with appropriate diagram. [6]
- Q.7(a) What are the advantages of monolithic integration of MEMS and its CMOS processing circuits? [2]
Q.7(b) What are the advantages and limitations of ceramic packages for MEMS packaging? [4]
Q.7(c) What is flip-chip assembly for MEMS packaging? Describe with appropriate diagram. Why is it favourable for high-frequency applications? [6]

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