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

CLASS: BE   SEMESTER : VII
BRANCH: EEE/ECE/BT/ME/CE   SESSION : MO/19

SUBJECT: MEC2019 MICRO-ELECTRO-MECHANICAL-SYSTEMS

TIME: 3.00Hrs.   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.

Q.1(a)	What are the different components of a MEMS based system?	[2]
Q.1(b)	How can you use wet etching technique to get anisotropic etching?	[4]
Q.1(c)	Describe the steps with appropriate diagrams to make a rectangular hole in SiO2 layer deposited on silicon substrate using positive photoresist.	[6]
Q.2(a)	What are the advantages and disadvantages of surface micromachining?	[2]
Q.2(b)	How silicon wafer can be bonded with Glass wafer for MEMS devices using fusion bonding? Explain with appropriate diagram.	[4]
Q.2(c)	What is RIE? Describe with diagrams. What are the advantages of RIE? Describe with appropriate reason.	[6]
Q.3(a)	Why Semiconductors are better Piezoresistive materials than that of the metals?	[2]
Q.3(b)	What do you understand by Piezoresistive sensor? Summarize the governing equations necessary for the Piezoresistive sensors.	[4]
Q.3(c)	What is the "Pull-in" condition for an electrostatic actuator? Evaluate the expression of the "Pull-in" voltage of an electrostatic actuator?	[6]
Q.4(a)	Define the isolation of RF switch.	[2]
Q.4(b)	Describe the three critical parameters of RF MEMS switch with an example.	[4]
Q.4(c)	Briefly summarize the electromechanical and RF design considerations of the RF MEMS switches.	[6]
Q.5(a)	Why Aluminum is coated on the surface of the Silicon structure to design the RF MEMS capacitor?	[2]
Q.5(b)	Why the Q-factor of the capacitor using MEMS technology is better than that of the CMOS technology? Explain you answer with appropriate diagrams.	[4]
Q.5(c)	Draw MEMS gap tuning capacitor. Describe its operation. What are the important parameters of your implemented capacitor?	[6]
Q.6(a)	Design digital phase shifter using MEMS technology. Describe its operation.	[2]
Q.6(b)	What are the advantages of MEMS based phase shifter over semiconductor based phase shifter?	[4]
Q.6(c)	Give an example of micro machined reconfigurable antenna. Explain its operation. Investigate the advantages of using MEMS technology in this antenna.	[6]
Q.7(a)	What are the main functions of a MEMS package?	[2]
Q.7(b)	What are the issues of MEMS packaging? Briefly describe the thermal considerations for MEMS packaging.	[4]
Q.7(c)	What is Wafer bonding for MEMS packaging? Justify its use with an example.	[6]