University Institute of Engineering & Technology

(Recognised Under Section 2(f) and 12B of UGC)

Kurukshetra University, Kurukshetra

TIME – 3 Hrs 15 Min

THEORY EXAMINATION – JAN 2021	
B.TECH - ECE	SEMESTER - V

M.M. – 56

PAPER - ECP-3

SUBJECT- Introduction to MEMS

INSTRUCTIONS TO BE FOLLOWED

- **Allotted time for examination is 3 hours 15 minutes that includes time for downloading the question paper, writing answers, scanning of answer sheets and E-mailing the PDF files to the designated Email ID.**
- **For ECE-A Regular Students, the Email ID is:- btech5thecea@kuk.ac.in**
- **For ECE-B Regular Students, the Email ID is:- btech5theceb@kuk.ac.in**
- **The candidates will be required to attempt 75% of the question paper (maximum) by choosing to their any best questions accumulating 56 marks.**
- **The PDF files should be saved as Roll No. and Subject Code. Proper attention should be given while sending the email and in the subject line, the Roll Number and Subject Code should be mentioned.**
- **Maximum Page Limit should be 20 (Twenty) for attempting the question paper on A4 sheets which could be downloaded and printed from the sample sheets given in the Kurukshetra University Examination guidelines.**
- **Over-attemptation should be avoided.**
- **Handwriting should be neat and clean and diagrams should be clear and contrasted.**
- **The candidate should not write their Mobile No. otherwise Unfair Means Case will be made.**
- **While attempting the paper, the candidate will use blue/black pen only.**
- **Before attempting the paper, the candidate will ensure that he/she has downloaded the correct question paper. No complaint for attempting wrong question paper by the candidate will be entertained.**
- **Candidate must ensure that he/she has put his/her signature on each page of the answer sheet used by him/her. Answer sheet without the signature of the candidate will not be evaluated.**

PART-A

1 Answer the following questions. **15x1=15**

(i)	Why silicon is used in Microsystems realization?
(ii)	List out at least four distinct advantages of miniaturization of machines and devices?
(iii)	Compare conventional ICs Vs MEMS Chips?
(iv)	A substrate is ________________________________.
(v)	What should be the estimated value of the Reynolds number for Laminar Flow……………and turbulence flow………………..
(vi)	Why electromagnetic forces are NOT commonly used in MEMS and microsystems as preferred actuation force/ mechanism?
(vii)	Differentiate between patterning and etching?
(viii)	What do you mean by wet etching and dry etching?
(ix)	Volumetric Flow (Q) in a tube from Hagen-Poiseuille's equation is defined by equation Q= πa4 ΔP/ 8μL,by what factor will be the reduction in volumetric flow if inner radius (a) is reduced to a/2?
(x)	Scaling in Electrostatic Force guides us that a 5 times reduction of the linear size of electrodes will result in……….times reduction in potential energy?
(xi)	List four factors affecting sputtering yield ?
(xii)	Differentiate between Thermal Stress and Strain Analysis?
(xiii)	Write application area of Razor blade test?
(xiv)	Write full name of MCM-C?
(xv)	Write name of any three sacrificial layer materials used in the MEMS device fabrication?

PART-B

2	Describe the three principal signal transduction methods for micro-pressure sensors?	**5**
3	Explain the MEMS Thermal sensors/ Thermal Imagers?	**5**
4	Distinguish between Passivation and Encapsulation?	**5**
5	List common four geometries of MEMS components used in the mechanical design of Microsystems?	**5**

PART-C

6	Analyse Capacitive Accelerometer (Inertial sensors)with the help of neat diagram and explain its working	**10**
7	Multidisciplinary nature of MEMS give example of at least two sensors each of electrical, optical, biological and acoustic type?	**10**
8	Examine the scaling in Electrostatic Force, for 10 times reduction of the linear size of Electrodes how much time would be the reduction in potential energy?	**10**
9	Illustrate Scaling in thermal systems with the help of neat diagram?	**10**
10	Illustrate the steps involved in LIGA technique for MEMS fabrication with the help of suitable sketches?	**10**
11	Explain Anodic Wafer Bonding process with the help of schematic diagram and physics behind it?	**10**
12	Develop application of thermal expansion of Bi-strip materials in MEMS?	**10**
13	Write an overview of Simple Mechanical Vibration Systems?	**10**