Registration No : | | | | | | | | | | |

Total Number of Pages : 02

Course: B.Tech
Sub_Code: REI6D001

6th Semester Regular/ Back Examination: 2022-23
SUBJECT: Micro Electronic Mechanical Systems
BRANCH(S): AEIE,ECE,ETC
Time : 3 Hour
Max Marks : 100
Q.Code : M319

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What do you mean by RE consumption?
b) Illustrate the difference between isotropic and anisotropic wet etching techniques.
c) Write various applications of smart materials and microsystems.
d) What do you understand by impurity doping?
e) Enlist RF-MEMS advantages over the traditional non-MEMS based RF devices.
f) Briefly explain the advantages and typical applications of micro actuators.
g) How many basic elements exist in case of a thermal system?
h) What do you mean by capacitive coupling in MEMS switches?
i) What is a phase shifter? Enlist the applications of phase shifters.
j) What do you understand from System-in-a-Chip (SOC) technology?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Define machining and micromachining processes of MEMS devices.
b) Briefly discuss the advantages of plasma etching over the wet etching.
c) Describe in detail the process of photolithography and two types of photoresists by using suitable schematic diagram.
d) What do you understand from microfluidic system? Enlist important building blocks of microfluidic systems.
e) Illustrate the process of the Deep Reaction Ion Etching (DRIE) with neat diagram.
f) Define the term spring, damper and mass of an elemental mechanical system.
g) What do you mean by piezomechanics? How does it differ from piezoelectricity?
h) Discuss in detail about different actuation mechanisms in MEMS switches.
i) Explain the working principle of capacitive accelerometer with neat diagram.
j) How does an MEMS gyroscope work? Define coriolis force and coriolis acceleration.
k) What do you mean by a wafer? What kind of material is commonly used for wafer? Enlist various wafers for different applications.
l) Discuss the principle of operation of the following mechanical MEMS elements. (a) Beam and cantilever (b) Diaphragm

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Discuss in detail the need of the actuators and the type of the actuators typically used for the active optical MEMS applications using suitable diagrams. **(8x2)**

b) Enlist the functional units of a typical PECVD system and explain the functions of each unit using neat sketches.

Q4 **a)** How many basic elements exist in case of a Fluid system? Define fluid resistance and fluid capacitance. **(8x2)**

b) Write the gauss law and coulombs law of electrostatics field in RF switch with necessary equations. Draw the Electric potential and field curves for the RF switch geometry.

Q5 **a)** Describe the Young's modulus (E), Bulk modulus (K), Shear modulus (G) and Poisson's ratio and discuss about their relationship. **(8x2)**

b) Explain in detail about the basic modeling elements of a mechanical elements with necessary equations and diagrams.

Q6 How can continuous fluid flow be achieved by using a micropump? What are the important parts of a typical micropump? Draw the schematic diagram of a diaphragm based micropump and explain its principle of operation. **(16)**