Program: BE Electronics Engineering

Curriculum Scheme: Revised 2016/

Examination: Final Year Semester VIII

Course Code: ELXDLO8042 and Course Name: MEMST

Time: 1hour Max. Marks: 50

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============================================================================= Note to the students:- All the Questions are compulsory and carry equal marks .

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| Q1.  | \_\_\_\_\_\_\_\_ combines material science,clinical science,chemical science |
| Option A: | BioMems |
| Option B: | OptoMems |
| Option C: | Ic Technology |
| Option D:  | VLSI |
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| Q2. | Which one is not challenge in MEMS ? |
| Option A: | Standard |
| Option B: | Packaging  |
| Option C: | Testing |
| Option D: | Material |
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| Q3. | In an experiment to determine the Young’s Modulus of a wire ,the length of the wire and the suspended mass are doubled. Then the Young’s Modulus of the wire? |
| Option A: | becomes Double |
| Option B: | becomes Four times  |
| Option C: | remains Unchanged  |
| Option D: | becomes Half |
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| Q4. | How much will a 500 µm long bar of aluminum expand if it is heated 2000C above ambienttemperature?(Coefficient of Thermal expansion of Al=22ppm/°C) |
| Option A: | 1.5µm  |
| Option B: |  4.5 µm |
| Option C: | 2.2 µm  |
| Option D: |  1.1 µm |
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| Q5. | A polysilicon Cantilever beam has a thickness of h=2µm and a length of L=500 µm. Find its basic natural vibration frequency. (E= 1.7\*1011Pa , ρ = 2330 Kg/m3). |
| Option A: | 5 kHz  |
| Option B: | 10 kHz  |
| Option C: |  17kHz  |
| Option D:  | 11kHz |
|  |  |
| Q6. | Lorentz constant has units as  |
| Option A: | J/kg.K  |
| Option B: | J/mol.K |
| Option C: | J.ohm/sec.K2 |
| Option D:  | W/m.K |
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| Q7.  | Select the Silicon material **NOT** used for masks in Micro fabrication processes. |
| Option A: | Si3N4  |
| Option B: | SiC |
| Option C: | SiO2 |
| Option D:  | polysilical |
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| Q8.  | Which device require the conversion of non-mechanical energy to kinetic energy to supply the fluid with momentum. |
| Option A: | Non-mechanical micropumps |
| Option B: | Mechanical micropumps |
| Option C: | Micro Valves |
| Option D:  | Non-mechanical Micro Valves |
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| Q9. | The operation principle is based on the electrostatic rolling of the thin metallic film on the ferroelectric film surface |
| Option A: | Micro Grippers |
| Option B: | Micro Motor |
| Option C: | Micro Valves |
| Option D:  | Micro Pumps |
|  |  |
| Q10.  | A shape-memory alloy is an alloy that can be deformed when …… |
| Option A: | cold |
| Option B: | hot |
| Option C: | At zero degree celsius |
| Option D:  | At room temperature |
|  |  |
| Q11.  | The basic principle of the ……….. is to use a strain gauge made from a conductive material that changes its electrical resistance when it is stretched.  |
| Option A: | pressure sensor |
| Option B: | piezoresistive pressure sensor |
| Option C: | piezoelectric pressure sensor |
| Option D:  | Temperature sensor |
|  |  |
| Q12.  | A large thin diaphragm is sensitive to noise from vibration at ………. |
| Option A: | low pressures |
| Option B: | high pressures |
| Option C: | low temperature |
| Option D: | high temperature |
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| Q13. | \_\_\_\_\_\_\_\_\_\_\_Used for connecting a chip or die to the inner lead frame of the package |
| Option A: | Anodic bonding  |
| Option B: | Wire bonding |
| Option C: | Silicon fusion bonding |
| Option D:  | Metal bonding |
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| Q14.  | Die attach is method to attach \_\_\_ to a\_\_\_\_. |
| Option A: | wire , Wafer |
| Option B: | die, wire |
| Option C: | wire, Package |
| Option D:  | Die , package |
|  |  |
| Q15. | \_\_\_\_\_\_\_\_\_\_ is process by which die are separated from wafer.  |
| Option A: | Wire bonding |
| Option B: | Wafer dicing |
| Option C: | Wafer bonding |
| Option D:  | packaging |
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| Q16.  | For silicon fusion Bonding process temperature required is |
| Option A: | >800 |
| Option B: | <800 |
| Option C: | Abosolute  |
| Option D:  | Minus |
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| Q17. | For anodic bonding \_\_\_\_\_\_\_\_voltage is given |
| Option A: | AC |
| Option B: | DC |
| Option C: | High  |
| Option D: | LOW |
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| Q18. | MEMS device consisting of an array of microcantilever transducers is called |
| Option A: | Inkjet printerhead |
| Option B: | Actuators |
| Option C: | Accelerometers |
| Option D:  | Chemical Sensor Array  |
|  |  |
| Q19.  | which is used as MEMS fusion bonding media and have proved very successful for the bonding of polyimide |
| Option A: | polymethylmethacrylate |
| Option B: | Polyethylene |
| Option C: | poly aluminium chloride (PAC) |
| Option D:  | Polypropylene (PP) |
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| Q20. | which is usually based around thin membranes with sealed gas or vacuum-filled cavities on one side of the membrane and the pressure to be measured on the other side. |
| Option A: | MEMS pressure sensors |
| Option B: | chemical sensors |
| Option C: | Temperature Sensors |
| Option D: | Accelerometer |
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| Q21. | The most common material used in fabrication of microcantilevers is |
| Option A: | Silicon |
| Option B: | Manganese |
| Option C: | Mercury |
| Option D:  | Germanium |
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| Q22.  | Gas leak detectors used in automobiles,airplanes,space shuttles and the space station is based on the application of  |
| Option A: | Accelerometer |
| Option B: | pressure sensor |
| Option C: | Microcantilever sensors |
| Option D:  | Micro heaters |
|  |   |
| Q23. | When a compressive force is applied to a quartz crystal then \_\_\_\_\_\_\_\_\_\_\_\_ |
| Option A: | positive charges are induced |
| Option B: | negative charges are induced |
| Option C: | no charge is induced |
| Option D:  | both positive and negative charges are induced |
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| Q24.  | A packaging which prevents the diffusion of moisture and water vapor through its walls is called as\_\_\_\_\_\_. |
| Option A: | Thermal packaging |
| Option B: |

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| Hermetic packaging |
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| Option C: | Stress isolation packaging |
| Option D:  | Wafer dicing |
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| Q25. | Which phenomenon is associated with multilayer films in MEMS Device. |
| Option A: |

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| a)Delamination phenomenon  |
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| Option B: | Physical mechanism |
| Option C: | Chemical mechanism  |
| Option D:  | Adhesive phenomenon |
| Q26 | DMD Stands for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| Option A: | Discrete Mirror Device |
| Option B: | Digital Mirror Device |
| Option C: | Digital Micromirror Device |
| Option D:  | Discrete Micromirror Device |
| Q27.  | Heat treatment process used to increase the ductility and reduce the hardness of a material is called as, |
| Option A: | Annealing |
| Option B: | Hardening |
| Option C: | PCR |
| Option D:  | Evaporation |
| Q28.  | In DMD ON and OFF of a pixel is represented by,\_\_\_\_\_. |
| Option A: | Tilting of mirror by -10degree and +10degree. |
| Option B: | Tilting of mirror by +10degree and -10degree. |
| Option C: | Tilting of mirror by -30degree and +30degree. |
| Option D:  | Tilting of mirror by +30degree and -30degree. |
| Q29.  | What is TCR? |
| Option A: | Time Constant Resistance  |
| Option B: | Time Coefficient of Resistance |
| Option C: | Thermal Constant Resistance |
| Option D:  | Thermal Coefficient of Resistance |
| Q30. | A packaging which prevents the diffusion of moisture and water vapor through its walls is called as\_\_\_\_\_\_. |
| Option A: | Thermal packaging |
| Option B: | Hermetic packaging |
| Option C: | Stress isolation packaging |
| Option D:  | Wafer dicing |
| Q31. | Gyroscopes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Option A: | Voltage sensors |
| Option B: | Pressure sensors |
| Option C: | Inertial sensors |
| Option D: | Humidity sensors |
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| Q32 | Which of the following is not a piezo electric sensor? |
| Option A: | PZT |
| Option B: | Roscelle salt |
| Option C: | Quartz |
| Option D: | Microheater |
| Q33 | Packaging of microelectronics and MEMS devices are  |
| Option A: | Same |
| Option B: | Single packaging on chip |
| Option C: | Different packaging as MEMS has sensors & actuators are on one chip |
| Option D:  | Cannot be predicted |
| Q35 | Barometer is which type of sensor\_\_\_\_\_\_\_\_ |
| Option A: | Pressure sensor |
| Option B: | Touch sensor |
| Option C: | Temperature sensor |
| Option D:  | Humidity sensor  |
| Q36 | What does the accelerometer measure? |
| Option A: | Mass |
| Option B: | Acceleration |
| Option C: | Velocity |
| Option D:  | Distance |
|  |  |
| Q37 | What is maximum temperature of Microheater? |
| Option A: | 500oC |
| Option B: | 800oC |
| Option C: | 1000oC |
| Option D: | 1800oC |
| 38 | A piezo-electrical crystal generates voltage when subjected to \_\_\_\_ force.1. Electrical (b) Mechanical (c) Gravity (d) Static
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| 39 | MEMS is an acronym for(a)Micro Energy Manufacturing Systems(b)Micro electro mechanical Systems(c)Microelectronics Memory Systems(d)Micro Electron Machines and Semiconductors |
| 40 | Size of the component is comparatively big in the following process (a) Mechanical micro machining (b) MEMS based processes (c) NEMS based processes (d) Ultra precision machining |
| 41 | Following is a high production rate process. (a)Mechanical micro machining (b)MEMS based processes (c) Ultra precision machining (d)Additive manufacturing processes |
| 42 | What is the class of Intel’s fabrication facility? (a)Class 100 (b) Class 1 (c) Class 10 (d) Class 1000 |
| 43 | In Semiconductor transition from valence to conduction band isPhotovoltaic Effect (b) Photoelectric Effect (c) mechanical movement (d) Inductive  |
| 44 | In order to form more complex and larger MEMS structures, micromachined silicon wafers can be bonded to other materials in a process known as \_\_\_\_\_\_\_\_\_\_\_\_.(a)HARM (b) LIGA (c) Dry etching (d) Fusion bonding  |
| 45 | Which is not a step of cleaning of Si wafer (100 orientation) before patterning?1. Dip the wafer into HF (b) Cleaning it with DI water

 (c) Purging N2 gas (d ) Dip wafer into TMAH (Tetramethylammonium hydroxide) at 80 C |
| 46 | What does ‘G’ represent in the given equation for Piezo resistor ? 1. Gravitational constant (b) Strain factor (c) Gauge factor (d) Stress factor
 |
| 47 | Select the Silicon material **NOT** used for masks in Micro fabrication processes.( a) Si3N4 (b) SiC (c) SiO2 (d) Poly Silicon  |
| 48 | If a micro cantilever is displaced from its equilibrium position by an external force which is suddenly removed, the micro cantilever is likely to a) maintain its displaced position b) oscillate about its equilibrium position at a well-defined frequency c) oscillate about its displaced position at a well-defined frequency d) break in half |
| 49 | The IMP34DT05 is a low-power, omnidirectional, digital MEMS microphone built with a sensing element and an IC interface. What type of sensing element does it have?1. Piezoelectric (b) Inductive (c) Resonant (d) Capacitive
 |
| 50 | A nozzle of 10 µm square is to be etched in wafer of 300 µm thickness. Find the size of window opening ‘W’. (a) 807 µm (b) 434.2 µm c) 966 µm (d) 766 µm |
| 51 | Microheaters are generally fabricated on a diaphragm structure. Why? To achieve high resistivity None of the above  (a) For achieving higher sensitivity ( b) For achieving desired temperature by applying lower voltage (c) To achieve high resistivity (d) To achieve high conductivity |
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| The finite element analysis (FEA) model "Microcantilever Displacement under Stress" illustrates the displacement of a microcantilever due to a……………..on the cantilever's surface |
| a)Unstability |
| b) Thermal strain  |
| c)Thermal stress  |
| d)Low conductivity |

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| One problem in gripping microcomponents is |
| a)The required gripping pressure |
| b)The mitigation of chemical and electrostatic forces |
| c)High gripping sensitivity |
| d)Low gripping sensitivity |

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| Pressure Sensor work on the principle of |
| a)Deflecting a thin diaphragm |
| b)Heating of a thin diaphragm |
| c)Magnetizing a thin diaphragm |
| d)Energizing a thin diaphragm |

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| There are ------- levels packaging in microsystems. |
| a)Two |
| b)Three |
| c)Four |
| d)Five |

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| The wire bonding technique that operates at ambient temperature is |
| a)Thermocompression |
| b)Thermosonic Gold Ball Bonding |
| c)Thermosonic Bump Bonding |
| d)Wedge Ultrasonic Bonding |

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| In a Piezoresistive strain gauge sensors,the resistors are connected in …………………... , which allows very accurate measurement of changes in resistance.  |
| a)parallel network |
| b)series network |
| c)Wheatstone bridge network |
| d)both in series parallel network |

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| The one which can be created by combining piezoelectric thin films with micromachined silicon membranes is |
| a)Microelectromechanical systems |
| b)Mechanical systems |
| c)Micro mechanical systems |
| d)Electrical Systems |

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| Pressure sensor measuring pressure relative to vacuum is |
| a)Differential pressure sensor  |
| b)Absolute pressure sensor |
| c)Gauge pressure sensor |
| d)Both absolute and gauge pressure sensor |

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| Failure due to excessive deformation is controlled by \_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| a)Yield strength  |
| b)Tensile strength  |
| c)Young’s modulus  |
| d)Yield stress  |

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