Program: BE Biomedical Engineering
Curriculum Scheme: Revised 2016
Examination: Final Year Semester VIII
Course Code: BMC801 and Course Name: Biomedical Microsystems
Time: 1 hour **Max Marks:50**

1 Type of silicon wafers are
(a) n-type, p-type
(b) S-type, n-type
(c) a-type, b-type
(d) c-type, z-type
2 Silicon Wafers are of the shape
(a) Hexagonal
(b) Rectangle
(c) Circle
(d) Square
3 A change in electrical resistance of solids when subjected to stress is known as
(a) piezoelectricity
(b) piezocrystal
(c) piezocapacitance
(d) piezoresistance
4 Silicon wafer is made up of
(a) silicon nitride
(b) silicon dioxide
(c) pure silicon
(d) silicon monoxide
5 Dopant used for polyphenylene sulfide is
(a) HCl
(b) NaCl
(c) AsF5
(d) H2O
6 ULPA filter is
(a) Ultra Light Particulate Air
(b) Ultra Light Particle Air
(c) Ultra Low Particulate Air
(d) Ultra Low Pressure Air
7 Which of the following is a MEMs device or component?
(a) Micro gear
(b) inductor
(c) microscope
(d) transformer
8 Common p-type dopant for silicon is
(a) boron
(b) phosphorus
(c) arsenic
(d) antimony
9 Micromotors are most commonly produced by
(a) etching
(b) AFM
(c) LIGA process
(d) CVD
10 Toxic gases such as CO, CO2, NO, O3 can be detected using
(a) Pressure sensor
(b) Thermal sensor
(c) Chemical sensor
(d) Optical sensor
11 Smaller systems tend to move more quickly than larger systems because of
(a) smaller displacement
(b) lower inertia of mass
(c) less workdone
(d) higher frequencies associated
12 In MEMs Silicon nitride is used as
(a) lens
(b) actuator
(c) Insulator

(d) sensor
13 Select the appropriate material for wafer
(a) Silicon
(b) Pure gold
(c) Platinum
(d) Aluminium
14 Silicon wafer orientation is defined by the
(a) quality
(b) Miller index
(c) packing material
(d) type of silicon used
15 Equal amount of gallium and arsenic atoms ____
(a) makes a metal
(b) makes a liquid
(c) makes gallium arsenide
(d) is not a good substrate
16 Which of the following material is used in MEMs for its optical property
(a) silicon
(b) argon
(c) PDMS
(d) helium
17 HEPA filters are used in
(a) clean room
(b) air dryer
(c) water purifier
(d) HCl filtering
18 Wafers are produced by slicing
(a) condiments
(b) glass
(c) Silicon cylindrical ingots
(d) Sand
19 Silicon is as light as
(a) Aluminium
(b) gold
(c) iron
(d) steel
20 Silicon has same Young's modulus as
(a) Aluminium
(b) gold
(c) iron
(d) steel
21 Silicon wafer orientation is defined by the
(a) quality
(b) Miller index
(c) packing material
(d) type of silicon used
22 As per scaling law in electricity current and length possesses following relation
(a) inverse
(b) cube
(c) square
(d) square root
23 ____ is an optical technique used for determination of the dielectric properties of thin films
(a) AFM
(b) TEM
(c) SEM
(d) Ellipsometer
24 In ____, transmitted electrons are involved to view thin specimens
(a) TEM
(b) Profilometer
(c) Ellipsometer
(d) AFM
25 _____ is a resist used in electron beam lithography
(a) PDMS
(b) conducting polymer
(c) polyaniline
(d) PMMA

26 Typical spin speed of photoresists depends on
(a) velocity
(b) viscosity
(c) intensity
(d) pressure
27 dry etching involves the creation of
(a) plasma
(b) SiO2
(c) photoresist
(d) metal
28 RIE stands for
(a) Resonative ion etching
(b) Reactive ion etching
(c) Reaction ion etching
(d) Reflective ion etching
29 Role of photosensitive film is to produce _____ on substrate
(a) coating
(b) pattern
(c) defects
(d) etching
30 The most popular light source for photolithography
(a) mercury vapour lamp
(b) LCD
(c) incandescent lamp
(d) LED
31 The wet etching technique
(a) removes unmasked area
(b) removes masked area
(c) add material on masked area
(d) add material on unmasked area
32 ____ technique is based on the emission of secondary electrons from the surface of a specimen
(a) AFM
(b) SEM
(c) Profilometer
(d) Ellipsometer
33 DRIE stands for
(a) deep reactive ion etching
(b) diode reactive ion etching
(c) deep regenerative ion etching
(d) deep reflective ion etching
34 Common light sources used in photolithography have wavelength in ____ range
(a) 100 - 250 nm
(b) 300 - 500 nm
(c) 500 - 700 nm
(d) 850 - 1000 nm
35 Ion implantation is implanting foreign substances by
(a) slow diffusion
(b) melting
(c) insertion by force
(d) diffusion
36 RCA is used for the cleaning substrate
(a) Glass
(b) PMMA
(c) Silicon
(d) PDMS
37 Following deposition methods used for Silicon dioxide
(a) Spinning
(b) Spray
(c) Wet Oxidation
(d) Electroplating
38 Thermal Deposition is popular for the following material
(a) Polymers
(b) Dielectrics
(c) Semi-conductors
(d) Metals
39 Select the appropriate technique for coating of polymers

(a) Spin coating
(b) Chemical Vapour Depositing
(c) Physical Vapour Depositing
(d) Electroplating
40 Following is a type of chemical vapour deposition
(a) Electroplating
(b) Evaporation
(c) LPCVD
(d) PVD
41 What is the evaporation temperature of copper in degree Celsius?
(a) 200
(b) 1516
(c) 0
(d) 25
42 Following doping can be carried out at lower temperature
(a) spraying
(b) oxidation
(c) ion implantation
(d) diffusion
43 In MEMs fabrication, following type of water is used
(a) tap water
(b) filtered water
(c) salted water
(d) DI water
44 In MEMs fabrication, following is a critical environmental parameter for patterning submicron devices
(a) size of the dust particle
(b) size of silicon wafer
(c) type of silicon wafer
(d) size of the room
45 In photolithography, sensitivity of resist depends on
(a) shape of substrate
(b) size of substrate
(c) type of substrate
(d) wavelength of light
46 In which technique of deposition step coverage is poor
(a) Evaporation
(b) DC sputter
(c) RF sputter
(d) PECVD
47 Which of the following deposition technique grain size is minimum
(a) Thermal Evaporation
(b) Sputtering
(c) electron beam evaporation
(d) Electroplating
48 Which of the following deposition technique uses electrochemical reaction
(a) evaporation
(b) electroplating
(c) PECVD
(d) Sputtering
49 Followings is a dielectric layer deposition techniques
(a) Spin coating
(b) Electrolessplating
(c) Chemical Vapour Deposition
(d) Electroplating
50 One of the major problems of surface micromachining is
(a) Absorption
(b) Adhesion of layers
(c) Epitaxy
(d) Evaporation
51 Sacrificial layer is an essential component in _____
(a) Bulk micromachining
(b) LIGA
(c) Surface micromachining
(d) wet etching
52 _____ lithography technique can pattern nonplanar substrate, unusual materials and large areas
(a) X- ray

(b) Photo
(c) soft
(d) electron beam
53 ____ is a common metal used in the process steps of LIGA.
(a) Nickel
(b) Aluminium
(c) Steel
(d) Cobalt
54 Micro-contact Printing is a technique related to _____
(a) photolithography
(b) electron beam lithography
(c) X- ray lithography
(d) soft lithography
55 Stamp, mold, or mask having relief structures on its surface is the key element of _____
(a) X- ray lithography
(b) soft lithography
(c) photolithography
(d) electron beam lithography
56 Lithography, Electroforming, molding are essential steps of _____
(a) Bulk micromachining
(b) LIGA
(c) Surface micromachining
(d) Evaporation
57 Select appropriate material for substrate in LIGA
(a) Glass with thin metal layer
(b) Glass
(c) Dielectric
(d) polymer
58 Replica molding can be used in _____
(a) photolithography
(b) electron beam lithography
(c) X- ray lithography
(d) soft lithography
59 µTAS systems comprised of
(a) only result analysis
(b) a sampling unit, a microfluidic unit, a detector system and an electronic controller
(c) only separation and detection of samples
(d) only sample analysis
60 In µTAS, separation methods used
(a) Titration
(b) Capillary electrophoresis
(c) Sedimentation
(d) Centrifugation
61 Detection technique used in µTAS is
(a) Fluorescence
(b) Dielectrophoresis
(c) Electrophoresis
(d) Chromatography
62 What is the full form of µTAS?
(a) Mini Thermal Analytical System
(b) Micro Total Analysis System
(c) Micro Transfer Analytical System
(d) Micro Total Analytics Signal
63 In thermal microactuator, change in length depends on
(a) temperature
(b) flow
(c) width of channel
(d) size of channel
64 In electroosmotic flow, direction of flow depends on
(a) concentration of ion
(b) DC supply polarity
(c) particle size
(d) frequency of supply
65 In µTAS, following technique does not require charged particle
(a) Electro osmosis
(b) electrophoresis

(c) Dielectrophoresis
(d) capillary
66 In microsyringe pump, dispense capacity depends on
(a) displacement of stem
(b) material of stem
(c) diameter of stem
(d) shape of stem
67 In µTAS, micro channels is made up of
(a) silver
(b) gold
(c) PDMS
(d) fluoride
68 The sampling subsystem should contain a micro filter consists of
(a) filter paper
(b) conventional polymer membrane
(c) metal filter
(d) muslin cloth
69 The immobilization of bioreceptor is achieved by
(a) Assimilation
(b) Adsorption
(c) Adhesion
(d) cohesion
70 Which of the following is present in glucose biosensors
(a) amino acids
(b) glucose oxidase
(c) nucleic acid
(d) galactose
71 In case of Biosensors, ____ can be a biorecognition element
(a) Oxide
(b) Enzyme
(c) metals
(d) ceramics
72 Which of these biosensors use the principle of heat released or absorbed by a reaction
(a) Potentiometric biosensor
(b) Optical biosensors
(c) Piezo-electric biosensors
(d) Calorimetric biosensors
73 In glucose biosensor, a measure of change in _____ is a measure of the glucose value.
(a) carbons dioxide
(b) oxygen
(c) nitrogen
(d) ammonia
74 Following acts as detector in Optical sensor
(a) Light emitting diode
(b) Transistor
(c) light pipe
(d) Photo diode
75 For microencapsulation of bioreceptor ____ can be utilized
(a) liposomes
(b) glucose
(c) Urea
(d) Urease
76 Nanoparticles that are used as drug delivery systems are called as _____
(a) nanocarriers
(b) nanotubes
(c) nanosensors
(d) nanoarray
77 A characteristic of DNA biosensors is _____
(a) formation of DNA recognition layer
(b) detection of the change in light absorption
(c) detection of the photon out for luminescent
(d) detection of the angle at which electrons are emitted
78 Coat and poke drug delivery approach is followed in _____
(a) Drug-coated microneedle
(b) Solid microneedle
(c) Dissolving microneedle

(d) Hollow microneedle
79 In case of Biosensors, ____ is the most important component.
(a) display
(b) metals
(c) ceramics
(d) biorecognition element
80 In biosensor, ____ is the physico-chemical component
(a) Enzymes
(b) Anti-bodies
(c) Transducer
(d) Cells or tissues
81 What is an Analyte?
(a) Any molecule may be protein, toxin, antigen, etc.
(b) The concentration of the molecule
(c) The component which should not be detected
(d) The component which gives background noise
82 Polymer membrane permeation is a type of ____
(a) intravenous drug delivery
(b) oral drug delivery
(c) injection
(d) Transdermal drug delivery system
83 Which of the following is a painful way of drug delivery?
(a) Topical cream
(b) Transdermal patch
(c) Hypodermic needle
(d) Microneedle
84 The simplest amperometric biosensors for glucose detection involve _____
(a) pH electrode
(b) Clark oxygen electrode
(c) Carbon dioxide electrode
(d) copper electrode
85 Magnetic bio sensor is widely used for _____
(a) Blood detection
(b) DNA detection
(c) particle detection
(d) photo detection
86 The generation of ions by various chemical events that change the electrical properties of the analyte solution is detecte
(a) Ion Sensitive Biosensors
(b) Colorimetric biosensors
(c) Magnetic Biosensors
(d) Electrochemical Biosensors
87 Self assembled closed colloidal structures composed of lipid bilayers are called as _____.
(a) dendrimers
(b) liposomes
(c) polymers
(d) GNP
88 Poke and patch drug delivery approach is seen in _____
(a) Drug-coated microneedle
(b) Solid microneedle
(c) Dissolving microneedle
(d) Hollow microneedle
89 Transdermal devices deliver the drug through the___
(a) Eye
(b) nose
(c) mouth
(d) Skin
90 ____ is Level 3 of microsystems packaging
(a) Die
(b) Device
(c) System
(d) Card
91 ____ levels of packaging are there in microsystems packaging
(a) Three
(b) Two
(c) One
(d) Four

92 ____ level is Level 2 of microsystems packaging
(a) Die
(b) Device
(c) System
(d) Card
93 ____ levels of packaging are there in electronic systems packaging

(a) Three
(b) Two
(c) One
(d) Four

94 Sawing the wafer is related to ____
(a) surface bonding
(b) Wire bonding
(c) sealing
(d) die preparation

95 ____ of microsystem component is challenging in microsystems packaging compared to microelectronics packaging
(a) bonding
(b) cutting
(c) sawing
(d) dicing

96 ____ level is Level 1 of microsystems packaging
(a) Die
(b) Device
(c) System
(d) Card

97 Wafer dicing means
(a) sawing the wafer
(b) printing the wafer
(c) implanting the wafer
(d) surface bonding

98 In die bonding, ___ are used for better die isolation
(a) solder alloys
(b) epoxy resin
(c) silicon carbide
(d) silicon rubber

99 Self assembled closed colloidal structures composed of lipid bilayers are called as _____.
(a) dendrimers
(b) liposomes
(c) polymers
(d) GNP

100 The packaging of MEMS or microsystems together with signal processing is known as ___
(a) lab on a chip
(b) lab on a computer
(c) lab on a silicon
(d) lab in a chip