Roll No. ....

O. M. R. Serial No. | | | | | | | |

Question Booklet Number

M. Sc. (Electronics) (Fourth Semester) (NEP) EXAMINATION, 2025-26

PROCESSES IN DEVICE FABRICATION

Paper Code							
B	1	4	1	0	0	6	T

Questions Booklet Series
A

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

(Remaining instructions on the last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

(Only for Rough Work)

1. Electronic grade silicon used in semiconductor fabrication typically has a purity of :

   (A) 99%

   (B) 99.9%

   (C) 99.9999%

   (D) 90%

2. The most widely used method for single crystal silicon growth is :

   (A) Zone refining

   (B) Czochralski method

   (C) Bridgman method

   (D) Sol-gel method

3. In the Czochralski process, the seed crystal is used to :

   (A) Melt silicon

   (B) Initiate crystal growth with proper orientation

   (C) Remove impurities

   (D) Cool the melt

4. The primary purpose of zone refining is :

   (A) Purification of silicon

   (B) Doping

   (C) Crystal shaping

   (D) Wafer polishing

5. In zone refining, impurities tend to :

   (A) Remain stationary

   (B) Move with molten zone

   (C) Evaporate

   (D) Crystallize first

6. Silicon wafers are sliced from ingots using :

   (A) Chemical etching

   (B) Ion implantation

   (C) Thermal oxidation

   (D) Diamond saw

7. Lapping and polishing of wafers are done to :

   (A) Increase thickness

   (B) Improve surface smoothness

   (C) Add impurities

   (D) Change crystal orientation

8. Which defect arises due to missing atoms in a lattice ?

   (A) Interstitial defect

   (B) Grain boundary

   (C) Line defect

   (D) Vacancy defect

9. Dislocations in crystals are classified as :
   (A) Line defects
   (B) Surface defects
   (C) Point defects
   (D) Volume defects

10. Epitaxial growth refers to :
   (A) Growth of amorphous layer
   (B) Growth of polycrystalline layer
   (C) Growth of single crystal layer on substrate
   (D) Growth of oxide layer

11. Vapour Phase Epitaxy (VPE) involves :
   (A) Liquid reactants
   (B) Solid diffusion
   (C) Gas phase chemical reactions
   (D) Ion beams

12. Liquid Phase Epitaxy (LPE) uses :
   (A) Liquid melt
   (B) Plasma
   (C) Vacuum deposition
   (D) Ion implantation

13. Molecular Beam Epitaxy (MBE) operates under :
   (A) Atmospheric pressure
   (B) High pressure
   (C) Ultra-high vacuum
   (D) Liquid medium

14. The growth rate in MBE is :
   (A) Very high
   (B) Moderate
   (C) Very slow and controlled
   (D) Uncontrolled

15. Which technique provides the highest control over layer thickness ?
   (A) MBE
   (B) VPE
   (C) LPE
   (D) Zone refining

16. In VPE, the silicon source gas is commonly :
   (A) Oxygen
   (B) Argon
   (C) Nitrogen
   (D) Silane (SiH_4)

17. Epitaxial defects include :
   (A) Voids only
   (B) Dislocations and stacking faults
   (C) Only vacancies
   (D) Only interstitials

18. Buried layers in semiconductor devices are used to :
   (A) Reduce substrate interaction
   (B) Improve isolation
   (C) Increase resistance
   (D) Increase thickness

19. Thermal oxidation of silicon produces :
   (A) Si_3N_4
   (B) SiO_2
   (C) SiC
   (D) SiH

20. Dry oxidation uses :
   (A) Water vapour
   (B) Oxygen gas
   (C) Nitrogen gas
   (D) Hydrogen gas

21. Wet oxidation uses :
   (A) Oxygen
   (B) Helium
   (C) Nitrogen
   (D) Steam (H_2O vapour)

22. Oxide growth rate is faster in :
   (A) Wet oxidation
   (B) Dry oxidation
   (C) Vacuum oxidation
   (D) Plasma oxidation

23. The Deal-Grove model describes :
   (A) Crystal defects
   (B) Oxidation kinetics
   (C) Epitaxy growth
   (D) Zone refining

24. Wafer flat/notch indicates :
   (A) Thickness
   (B) Doping level
   (C) Crystal orientation
   (D) Surface roughness

25. Chemical Mechanical Polishing (CMP) is used to :
   (A) Increase wafer thickness
   (B) Remove oxide
   (C) Achieve planar surface
   (D) Add impurities

26. Plasma oxidation advantage includes :
   (A) Low temperature processing
   (B) High thermal budget
   (C) High defect density
   (D) Slow growth

27. Chlorine in oxidation ambient reduces :
   (A) Temperature
   (B) Oxidation rate
   (C) Interface trap density
   (D) Oxide thickness

28. Initial oxide growth deviates from Deal-Grove model due to :
   (A) Doping
   (B) Pressure changes
   (C) Stress relaxation
   (D) Thin oxide effects and interface kinetics

29. The Deal-Grove model assumes :
   (A) Non-steady-state diffusion
   (B) Steady-state diffusion through oxide
   (C) Plasma reactions
   (D) No diffusion

30. Polysilicon oxidation differs from single crystal silicon because :
   (A) No stress formation
   (B) Lower diffusivity
   (C) Grain boundaries enhance oxidation rate
   (D) No oxidation occurs

31. OISF density increases with :
   (A) Higher oxidation temperature
   (B) Lower oxygen concentration
   (C) Lower temperature
   (D) Short oxidation time

32. Oxidation Induced Stacking Faults (OISF) are caused by :
   (A) Mechanical polishing
   (B) Ion implantation
   (C) Plasma damage
   (D) Excess silicon interstitials

33. High-quality oxide is characterized by :
   (A) High defect density
   (B) High stress
   (C) Low interface trap density
   (D) High leakage

34. Oxide stress arises mainly due to :
   (A) Thermal mismatch and volume expansion
   (B) Doping concentration
   (C) Wafer size
   (D) Pressure variation

35. Mobile ionic charges in oxide are commonly due to :
   (A) Oxygen ions
   (B) Sodium ions
   (C) Silicon atoms
   (D) Hydrogen gas

36. Fixed oxide charges are typically located :
   (A) In silicon bulk
   (B) In metal layer
   (C) At $Si\text{-}SiO_2$ interface
   (D) In gas phase

37. Oxide masking property is used in :
   (A) Etching
   (B) Metallization
   (C) Polishing
   (D) Diffusion and ion implantation blocking

38. Crystal orientation affects oxidation rate such that :
   (A) (111) oxidizes slower than (100)
   (B) (100) oxidizes faster than (111)
   (C) Both are same
   (D) Orientation has no effect

39. Heavily doped silicon oxidizes :
   (A) Slower than intrinsic silicon
   (B) At the same rate
   (C) Independently of doping
   (D) Faster than intrinsic silicon

40. In ion implantation, the projected range (Rp) of implanted ions primarily depends on :
   (A) Ion energy
   (B) Substrate temperature
   (C) Oxide thickness
   (D) Ambient pressure

41. Which of the following is the main advantage of ion implantation over diffusion ?
   (A) Lower cost
   (B) Precise control of dopant concentration and depth
   (C) Higher throughput
   (D) No lattice damage

42. The damage caused to the crystal lattice during ion implantation is typically repaired by :
   (A) Oxidation
   (B) Etching
   (C) Annealing
   (D) Lithography

43. Which phenomenon describes ions travelling deeper along crystallographic directions due to fewer collisions :

(A) Scattering

(B) Diffusion

(C) Sputtering

(D) Channelling

44. The dose in ion implantation is defined as :

(A) Number of ions per unit area

(B) Energy per ion

(C) Depth of penetration

(D) Implantation time

45. The diffusion of dopants in silicon primarily follows which law :

(A) Ohm's Law

(B) Newton's Law

(C) Fick's Laws

(D) Stefan's Law

46. Which diffusion mechanism involves dopant atoms moving through vacant lattice sites ?

(A) Interstitial diffusion

(B) Vacancy diffusion

(C) Grain boundary diffusion

(D) Surface diffusion

47. In constant source diffusion, the dopant profile is best described by :

(A) Gaussian distribution

(B) Linear distribution

(C) Exponential decay

(D) Error function (erfc)

48. Which factor does NOT significantly affect the diffusion rate in silicon ?

(A) Temperature

(B) Dopant concentration

(C) Crystal defects

(D) Wafer colour

49. Etching in IC fabrication is primarily used for :

(A) Doping the semiconductor

(B) Removing selected material from the wafer surface

(C) Depositing thin films

(D) Growing oxide layers

50. Which of the following is an example of wet etching :

(A) Plasma etching

(B) Reactive ion etching (RIE)

(C) Chemical solution etching

(D) Sputtering

51. After CZ process we get :

(A) wafer

(B) Ingot

(C) Si- Die

(D) None of above

52. Anisotropic etching is characterized by :

(A) Equal etching in all directions

(B) No material removal

(C) Only surface cleaning

(D) Faster etching in vertical direction than lateral

53. Which etching technique provides the best directionality and control :

(A) Reactive Ion Etching (RIE)

(B) Wet etching

(C) Chemical cleaning

(D) Isotropic etching

54. Selectivity in etching refers to :

(A) Speed of etching

(B) Ability to etch only one material over another

(C) Temperature control

(D) Ion energy

55. Which gas is commonly used in plasma etching of silicon :

(A) Oxygen

(B) Nitrogen

(C) CF_4

(D) Hydrogen

56. Undercutting is a common issue in :

(A) Wet isotropic etching

(B) Anisotropic etching

(C) Dry etching

(D) Ion implantation

57. Lithography in IC fabrication is primarily used for :

(A) Doping silicon

(B) Pattern transfer onto wafer

(C) Oxidation of silicon

(D) Crystal growth

58. Which lithography technique uses UV light for pattern transfer :

(A) Electron beam lithography

(B) X-ray lithography

(C) Optical lithography

(D) Ion implantation

59. Photoresists used in optical lithography are generally :

(A) Light-sensitive materials

(B) Conductors

(C) Insulators

(D) Magnetic materials

60. A positive photoresist becomes :

(A) Harder when exposed to light

(B) Insoluble after exposure

(C) Unaffected by light

(D) More soluble in developer after exposure

61. Contact printing in lithography refers to :

(A) Mask placed far from wafer

(B) Mask touching wafer surface

(C) Mask inside wafer

(D) No mask used

62. The major disadvantage of contact printing is :

(A) Mask damage

(B) Low resolution

(C) High cost

(D) Slow process

63. The delay fault considered as :

(A) Electrical fault

(B) Logical fault

(C) Physical fault

(D) None the above

64. In proximity printing, the gap between mask and wafer is typically :

(A) Zero

(B) Very large

(C) Infinite

(D) Small (few micrometers)

65. Projection printing uses :

(A) Direct contact

(B) Lenses to project image

(C) Magnetic fields

(D) Ion beams

66. Resolution in optical lithography is limited by :

(A) Wavelength of light

(B) Temperature

(C) Pressure

(D) Voltage

67. The main component used for pattern definition in lithography is :

(A) Wafer

(B) Mask

(C) Furnace

(D) Diffuser

68. Electron beam lithography uses :

(A) UV light

(B) X-rays

(C) Focused electron beam

(D) Laser only

69. A key advantage of electron beam lithography is :

(A) Very high resolution

(B) High throughput

(C) Low cost

(D) Simple masks

70. The main limitation of electron beam lithography is :

(A) Poor resolution

(B) Slow writing speed

(C) High defect rate

(D) Low accuracy

71. In electron beam lithography, pattern writing is typically :

(A) Serial

(B) Parallel

(C) Random

(D) Optical

72. X-ray lithography uses radiation with :

(A) Long wavelength

(B) Medium wavelength

(C) No wavelength

(D) Very short wavelength

73. The main advantage of X-ray lithography is :

(A) Low cost

(B) High throughput

(C) High resolution and low diffraction

(D) Simple equipment

74. A major challenge in X-ray lithography is :

(A) Mask fabrication

(B) Wafer cleaning

(C) Low temperature

(D) Ion diffusion

75. Electron beam resists are typically :

(A) Magnetic materials

(B) Electron-sensitive polymers

(C) Metals

(D) Oxides

76. Mask generation in electron beam lithography is mainly used for :

(A) Creating photomasks

(B) Direct wafer patterning

(C) Doping

(D) Etching

77. One major limitation common to advanced lithography techniques is :

(A) Low precision

(B) High cost of equipment

(C) No need for masks

(D) Low resolution

78. Which process is used to define metal patterns after deposition ?

(A) Lithography and Etching

(B) Diffusion

(C) Oxidation

(D) Annealing

79. The barrier layer in metallization is mainly used to :

(A) Improve conductivity

(B) Prevent diffusion of metal into silicon

(C) Increase oxide thickness

(D) Reduce capacitance

80. Which metal is increasingly used in advanced ICs due to its lower resistivity compared to aluminium ?

(A) Silver

(B) Nickel

(C) Platinum

(D) Copper

81. What is the main disadvantage of allumium metallization ?

(A) Electromigration

(B) High resistivity

(C) Poor adhesion

(D) Low melting point

82. Which technique is widely used for depositing metal layers in IC fabrication ?

(A) Chemical Vapour Deposition (CVD)

(B) Physical Vapour Deposition (PVD)

(C) Oxidation

(D) Ion Implantation

83. The primary purpose of metallization in IC fabrication is to :

(A) Dope the semiconductor
(B) Form insulating layers
(C) Grow oxide layers
(D) Create electrical interconnections

84. Which material is most commonly used for metallization in IC fabrication ?

(A) Aluminum
(B) Gold
(C) Copper
(D) Tungsten

85. Thickness of thin films is most accurately measured using :

(A) SEM
(B) XRD
(C) UV-VIS
(D) Ellipsometer

86. The principle of I-V measurement is based on :

(A) Ohm's law
(B) Capacitance variation
(C) Diffraction
(D) Polarization

87. In C-V measurement, capacitance is measured as a function of :

(A) Temperature
(B) Voltage
(C) Frequency only
(D) Current

88. In two-probe method, measured resistance includes :

(A) Only sample resistance
(B) Contact resistance only
(C) Sample + contact resistance
(D) No resistance

89. The four-probe technique is mainly used to measure :

(A) Resistivity
(B) Thickness
(C) Capacitance
(D) Dielectric constant

90. Spreading resistance technique is used for :

(A) Surface imaging
(B) Thickness measurement
(C) Optical analysis
(D) Depth profiling of resistivity

91. Dielectric constant is measured using :

(A) C-V technique

(B) I-V technique

(C) SEM

(D) XRD

92. XRD is primarily used to determine :

(A) Electrical properties

(B) Crystal structure

(C) Surface roughness

(D) Optical absorption

93. The working principle of XRD is based on :

(A) Electron emission

(B) Ohm's law

(C) Beer-Lambert law

(D) Bragg's law

94. UV-VIS spectrometer is used to study :

(A) Optical absorption

(B) Crystal defects

(C) Surface morphology

(D) Resistivity

95. Raman spectroscopy is based on :

(A) Elastic scattering

(B) Inelastic scattering of light

(C) Electron emission

(D) Capacitance variation

96. A glass photomask consist of :

(A) Transparent part

(B) Opaque part

(C) Both (A) and (B)

(D) None of above

97. In I-V measurement, breakdown voltage is obtained from :

(A) Linear region

(B) Saturation region

(C) Reverse bias region

(D) Threshold region

98. Which technique is non-destructive for thickness measurement :

(A) Profilometry

(B) Etching

(C) Spreading resistance

(D) Ellipsometry

99. SEM uses which type of beam :

(A) Electron beam

(B) Light beam

(C) X-ray beam

(D) Ion beam

100. Which is the software used in VLSI :

(A) Xilinx

(B) Cadence

(C) LOON

(D) Both (A) & (B)

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर–A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।