Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Fourth Semester)
(NEP) EXAMINATION, 2025-26
PHYSICS
(Condensed Matter Physics—II) (Elective)

Paper Code							
B	0	1	1	0	0	4	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.

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।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. Point imperfection refers to an imperfection that is associated with :
   (A) Line
   (B) Plane
   (C) Single lattice point
   (D) Surface

2. Vacancy and Interstitial imperfection occurs respectively when :
   (A) Dislocation in plane, atom leaves lattice
   (B) Missing atom at lattice site, atom occupies interstitial space
   (C) Extra atom present, atom moves to surface
   (D) Impurity atom present, crystal breaks

3. In which of the following does the Frenkel imperfection occur ?
   (A) AgCl
   (B) NaCl
   (C) Copper
   (D) Diamond

4. Schottky imperfection involves :
   (A) Interstitial atom
   (B) Vacancy of anion only
   (C) Vacancy of cation only
   (D) Vacancy of both anion and cation

5. An example of a crystal that exhibits a Schottky imperfection is :
   (A) AgBr
   (B) KCl
   (C) Silicon
   (D) None of the above

6. Factors that influence the formation of colour centers in ionic crystals cause them :
   (A) Interstitial atoms
   (B) Lattice vacancies with trapped electrons
   (C) Missing electrons
   (D) All of the above

7. F-center is :
   (A) Ion trapped in vacancy
   (B) Hole trapped in vacancy
   (C) Electron trapped in anion vacancy
   (D) Electron trapped in cation vacancy

8. Elastic and plastic deformation is respectively :
   (A) Temporary and Permanent deformation
   (B) Permanent and Temporary deformation
   (C) Reversible and Temporary deformation
   (D) Reversible and Permanent deformation

9. Dislocation is classified as a type of :

(A) Point imperfection

(B) Surface imperfection

(C) Volume imperfection

(D) Line imperfection

10. Edge dislocation is caused by :

(A) Impurity

(B) Vacancy

(C) Missing plane

(D) Extra half plane of atoms

11. The Burgers vector representing a fundamental concept in crystallography is :

(A) Force

(B) Magnitude and direction of dislocation

(C) Stress

(D) Strain

12. Screw dislocation produces :

(A) Thermal stress

(B) Tensile stress

(C) Compressive stress

(D) Shear stress

13. In FCC crystals, slip plane occurs along :

(A) (111) plane

(B) (100) plane

(C) (110) plane

(D) (210) plane

14. The unit that defines critical resolved shear stress is :

(A) Joule

(B) Pascal

(C) Newton

(D) Meter

15. The characteristics of elastic energy depend on which factors ?

(A) Volume

(B) Strain

(C) Stress

(D) All of the above

16. The Frank-Read source has a connection to which aspects ?

(A) Vacancies

(B) Point defects

(C) Surface defects

(D) Dislocation multiplication

17. Stacking fault is encountered due to :

(A) Impurity atoms

(B) Irregular stacking of atomic planes

(C) Missing atom

(D) Extra atom

18. Grain boundary is recognized as the region between :

(A) Two vacancies

(B) Two dislocations

(C) Two atoms

(D) Two crystals of different orientation

19. In the tilt boundary, the misorientation axis is defined as follows :

(A) Random

(B) At 45° to boundary

(C) Perpendicular to boundary plane.

(D) Parallel to boundary plane

20. Twin boundary is also referred to as :

(A) Grain boundary

(B) Slip boundary

(C) Reflection boundary

(D) Mirror boundary

21. The high strength of whiskers is attributed to :

(A) Large size

(B) Presence of many defects

(C) Absence of defects

(D) Impurities

22. The most commonly used technique to observe :

(A) Ultrasonic testing

(B) TEM

(C) SEM

(D) Optical microscopy

23. SEM is represented by the abbreviation :

(A) Scattering Electron Microscope

(B) Scanning Electron Microscope

(C) Surface Energy Microscope

(D) Secondary Electron Microscope

24. Grain boundaries are observed using which of the following ?

(A) Transmission Electron Microscope

(B) Scanning Electron Microscope

(C) Optical Microscope

(D) All of the above

25. Dislocations affects which of the properties of the crystal ?

(A) Optical properties

(B) Electrical properties

(C) Mechanical properties

(D) All of the above

26. The etch pit method is utilized to observe :

(A) Electrons

(B) Dislocations

(C) Interstitials

(D) Vacancies

27. What change occurs in the X-ray diffraction pattern due to dislocation ?

(A) No change

(B) Shape change

(C) Colour change

(D) Line broadening

28. The term for the process of glass formation is referred to as :

(A) Solidification

(B) Vitrification

(C) Crystallization

(D) Condensation

29. Example of oxide glass former is :

(A) K_2O

(B) CaO

(C) Na_2O

(D) SiO_2

30. An example of metallic and Borosilicate glass respectively is given as follows :

(A) Fe-B alloy and B_2O_3

(B) B_2O_3 and Fe-B alloy

(C) SiO_2 and B_2O_3

(D) B_2O_3 and SiO_2

31. Glass that is made from sulfur, selenium, or tellurium is referred to as :

(A) Oxide glass

(B) Soda glass

(C) Metallic glass

(D) Chalcogenide glass

32. Glass transition temperature (T_g) is always :

(A) Zero only

(B) Equal to melting temperature

(C) Higher than melting temperature

(D) Lower than melting temperature

33. Glass transition is observed in :

(A) Liquids only

(B) Metals

(C) Crystalline solids

(D) Amorphous solids

34. Radial distribution function $g(r)$ is mainly used for :

(A) Liquids and amorphous solids

(B) Crystalline solids

(C) Amorphous solids

(D) Liquids only

35. Amorphous semiconductors have :

(A) Long range order

(B) Short range order only

(C) Both (A) and (B)

(D) No structure

36. In amorphous solids, the energy bands are :

(A) Absent

(B) Broadened

(C) Sharp and well defined

(D) Continuous and perfect

37. The forbidden energy region in amorphous solids is referred to as :

(A) Energy band

(B) Conduction band

(C) Mobility gap

(D) Valence band

38. The boundary that is separating localized and extended states is called :

(A) Mobility edge

(B) Fermi level

(C) Band gap

(D) Energy gap

39. Anderson localization explains :

(A) Nuclear motion.

(B) Localization due to disorder

(C) Free electron motion

(D) Atomic vibration

40. Mobility edge exists in :

(A) Amorphous solids only

(B) Crystalline solids only

(C) Both in amorphous and crystalline solids

(D) Liquids

41. Density of states in 3 Dimension is proportional to :

(A) E

(B) $\sqrt{E}$

(C) E^2

(D) 1/E

42. Density of state in metals at Fermi level is :

(A) Negative

(B) Zero

(C) Very high

(D) Infinite

43. Electrical conduction in extended and localized states occurs respectively by :

(A) Direct conduction only

(B) Tunneling only

(C) Hopping mechanism and Free movement of electrons

(D) Free movement of electrons and Hopping mechanism

44. Localized state transport is common in :

(A) Amorphous semiconductors

(B) Pure metals

(C) Vacuum

(D) Perfect crystals

45. Optical band gap in amorphous semiconductors is determined using :

(A) Hall effect

(B) Resistivity

(C) Absorption coefficient

(D) Density

46. Optical properties are helped to be determined by :

(A) Defects

(B) Electronic structure

(C) Band gap

(D) All of the above

47. The bond between monomers in polymers is mainly :

(A) Ionic bond

(B) Covalent bond

(C) Nuclear bond

(D) Metallic bond

48. Polymerization is the process of :

(A) Joining monomers to form polymer

(B) Breaking polymers

(C) Breaking atoms

(D) Forming crystals

49. Thermal properties of polymers are studied using :

(A) SEM

(B) DSC

(C) TEM

(D) XRD

50. Molecular weight of polymers is commonly determined by which of the following :

(A) Thermometer

(B) Optical microscope

(C) Gel permeation chromatography

(D) X-ray diffraction

51. Optical absorption is caused by :

(A) Neutron transitions

(B) Electron transitions

(C) Nuclear transitions

(D) Proton transitions

52. Above the glass transition temperature (T_g) , a polymer is transformed into :

(A) Soft and flexible

(B) Brittle

(C) Liquid

(D) Liquid crystal

53. Electrical conduction in polymers is caused by :

(A) Ions

(B) Free electrons

(C) Neutrons

(D) Both electrons and ions

54. Polymers are used as dielectric materials because they have :

(A) Low conductivity

(B) Low density

(C) High conductivity

(D) High dielectric strength

55. Liquid crystals are sensitive to which of the following properties ?

(A) Temperature

(B) Electric field

(C) Magnetic field

(D) All of the above

56. In the nematic phase, the molecules are observed to be arranged in a distinct manner :

(A) Parallel aligned

(B) Circular

(C) Perpendicular

(D) Randomly oriented

57. Quasi crystals show which type of symmetry forbidden in periodic crystals ?

(A) 2-fold symmetry

(B) 3-fold symmetry

(C) 5-fold symmetry

(D) 6-fold symmetry

58. Quasi crystals are characterized by their distinct properties and arrangements :

(A) Random atomic arrangement

(B) Periodic atomic arrangement

(C) Completely amorphous structure

(D) Ordered but non-periodic arrangement

59. Structural features are present in nanostructured materials within the size range :

(A) 1-100 μm
(B) 1-100 nm
(C) 1-100 mm
(D) 1-100 pm

60. Nanomaterials are classified based on :

(A) Pressure
(B) Temperature
(C) Density
(D) Dimension

61. Which of the following classified as a Zero, One, and Two dimensional nanomaterial respectively ?

(A) Nanowire, Thin film, Quantum dot
(B) Quantum dot, Nanowire, Thin film
(C) Quantum dot, Thin film, Nanowire
(D) Thin film, Nanowire, Quantum dot

62. Example of natural and artificial nanomaterial respectively :

(A) Fullerenes and Butterfly wings
(B) Butterfly wings and Fullerenes
(C) Graphene and Butterfly wings
(D) Fullerenes and Graphene

63. Which method is commonly utilized for thin film nanomaterials ?

(A) Ball milling
(B) Grinding
(C) Cutting
(D) Chemical Vapor Deposition (CVD)

64. Which method is used for the synthesis of nanoparticles in a liquid medium ?

(A) Lithography
(B) Etching
(C) Sol-gel
(D) Rolling

65. Which technique is used to give surface topography at the atomic level ?

(A) SEM
(B) TEM
(C) STM
(D) XRD

66. AFM and SEM are respectively represented by :

(A) Atomic Force Microscope and Scanning Electron Microscope
(B) Atomic Field Microscope and Scanning Energy Microscope
(C) Atomic Focus Microscope and Scattered Electron Machine
(D) Atomic Focus Microscope and Scanning Electron Microscope

67. Quantum size effect is observed when the size of material becomes comparable to :

(A) Debye length

(B) Nuclear size

(C) De Broglie wavelength

(D) Mean free path

68. Quantum size effect is considered to be significant when size is less than :

(A) 100 nm

(B) 1 mm

(C) 1 μm

(D) 1 cm

69. Colour of quantum dots depends on which of the property ?

(A) Mass

(B) Size

(C) Volume

(D) Density

70. Blue shift in nanomaterials is caused by :

(A) Increase in density

(B) Increase in size

(C) Decrease in size

(D) Increase in mass

71. The number of pentagons and hexagons contained in C_{60}, is respectively :

(A) 12 and 20

(B) 20 and 12

(C) 10 and 20

(D) 20 and 10

72. C_{80} and C_{240} are examples of :

(A) Graphene

(B) Nanotube

(C) Higher fullerenes

(D) Small fullerenes

73. Hybridization of carbon atoms in C_{80} is :

(A) sp^2

(B) sp^3

(C) sp

(D) sp^3d

74. Structure of graphene is :

(A) Cubic

(B) Orthorhombic

(C) Tetragonal

(D) Hexagonal

75. Single Wall Carbon Nano Tube (SWCNT) behaves as :

(A) Metal

(B) Semiconductor

(C) Insulator

(D) Both (A) and (B)

76. Structure of Multi Wall Carbon Nano Tube (MWCNT) is like :

(A) Cube

(B) Single cylinder

(C) Multiple concentric cylinders

(D) Sphere

77. Which method is commonly employed in the process of synthesizing CNTs ?

(A) Electrolysis

(B) Distillation

(C) Arc discharge

(D) Filtration

78. Common catalyst used in CNT growth is known to be :

(A) Gold

(B) Iron

(C) Silver

(D) Aluminium

79. Photonic crystals are understood to be the optical analog of :

(A) Atomic crystals

(B) Semiconductor crystals

(C) Liquid crystals

(D) Electronic crystals

80. Photonic crystals can reflect :

(A) Only UV

(B) Only IR

(C) Specific wavelength

(D) All light

81. Thin film is defined as a layer of material with thickness :

(A) More than 1 m

(B) More than 1 cm

(C) More than 1 mm

(D) Between 1 nm and 1 μm

82. Thin film resistance depends on :

(A) Material

(B) Thickness

(C) Temperature

(D) All of the above

83. Surface atoms have :

(A) Infinite coordination

(B) Same coordination number

(C) Maximum coordination number

(D) Minimum coordination number

84. Multiple beam interferometry is based on the principle of :

(A) Reflection

(B) Polarization

(C) Interference

(D) Diffraction

85. What is the order for measuring surface irregularities ?

(A) meter

(B) angstrom

(C) cm

(D) mm

86. Multiple beam interferometry is mainly utilized for study of :

(A) Electrical properties

(B) Magnetic properties

(C) Surface topography

(D) Bulk properties

87. When thickness increases, what effect is observed on the frequency of the quartz crystal ?

(A) Becomes zero

(B) Remains constant

(C) Increases

(D) Decreases

88. Thickness is defined by the equation Thickness = Mass / (Density × Area) This method is referred to as :

(A) Gravimetric method

(B) Optical method

(C) Electrical method

(D) Magnetic method

89. Fizeau fringes are usually found like :

(A) Random

(B) Straight or parallel

(C) Zigzag

(D) Circular

90. Fringes of Equal Chromatic Order (FECO) are observed using :

(A) Monochromatic light

(B) White light

(C) X-rays

(D) Electron beam

91. Miller indices of a surface are expressed in writing as :

(A) [*hkl*]

(B) (*hkl*)

(C) {*hkl*}

(D) <*hkl*>

92. Surface atoms have been observed to have :

(A) Minimum bonding

(B) Maximum bonding

(C) No bonding

(D) Infinite bonding

93. TEM is based on the principle of :

(A) Reflection of light

(B) Electron transmission

(C) Polarization

(D) Refraction

94. The AFM image is obtained by using :

(A) Electron emission

(B) X-ray diffraction

(C) Force interaction

(D) Light reflection

95. Vacuum evaporation method requires :

(A) Low pressure

(B) High pressure

(C) Atmospheric pressure

(D) No pressure

96. Which of the following is mainly explained by the Boltzmann transport equation ?

(A) Nuclear decay

(B) Crystal growth

(C) Optical reflection

(D) Electrical conduction

97. In which of the following regions are surface states found ?

(A) Core level

(B) Forbidden energy gap

(C) Conduction band only

(D) Valence band only

98. Surface states in the semiconductor are formed due to which of the factor ?

(A) Excess electrons

(B) Excess neutrons

(C) Broken bonds

(D) Perfect bonding

99. Localized vibrations are confined to in which of the region ?

(A) Region near defect

(B) Entire crystal

(C) Surface only

(D) Vacuum

100. Exciton is formed due to the reason :

(A) Magnetic force

(B) Coulomb attraction

(C) Nuclear force

(D) Gravitational force

(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।