

ENTRANCE EXAMINATIONS 2026
Ph.D. (Nanoscience and Technology)

Marks: 70

Time: 2 h

Hall Ticket No:

- I. Write your Hall Ticket Number on the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the Space provided above.
 - II. Read the following instructions carefully before answering the questions.
 - III. This Question paper has TWO parts: PART 'A' and PART 'B'
1. Part 'A': It consists of 20 objective type questions of **1.75** marks each.
 2. Part 'B': It consists of 35 objective questions of **1** mark each.
 3. All questions are to be answered. Answers for these questions are to be entered on the OMR sheet, filling the appropriate circle against each question. For example, if the answer to a question is D, it should be marked as below:



No additional sheets will be provided. Rough work can be done in the question paper itself.

4. Hand over the OMR answer sheet at the end of the examination to the invigilator.
5. Only non-programmable (only scientific) calculators are permitted inside the Examination Hall.
6. This book contains 12 pages including this cover sheet.

F-26

THIS PAGE IS INTENTIONALLY LEFT BLANK

PART A

1. ISRO launches a satellite of mass 500 kg in an orbit 100×10^6 m from the centre of the earth. The mass of the earth is 6.0×10^{24} kg. The force of attraction on the satellite by the earth is (Universal Gravitational constant, $G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$)
 - A. 20 N
 - B. 40 N
 - C. 80 N
 - D. 100 N

2. When a body of density ρ and volume V is floating in a liquid of density σ , then ("g" being the acceleration due to gravity)
 - A. the loss in its weight is $V\sigma g$
 - B. its true weight is $V\sigma g$
 - C. its apparent weight is zero
 - D. its density ρ is greater than that of liquid density σ

3. In general, as the binding energy of a material increases, the melting point
 - A. increases
 - B. decreases
 - C. remains constant
 - D. becomes independent of atomic size

4. The general solution to the differential equation $y'' - y = 0$ is (c_1 and c_2 are constants)
 - A. $y(t) = c_1 e^{-2t} + c_2 e^{-2t}$
 - B. $y(t) = c_1 e^{-2t} + c_2 e^{-t}$
 - C. $y(t) = c_1 e^t + c_2 e^{-t}$
 - D. $y(t) = c_1 e^{-t} + ic_2 e^t$

5. If (326) are the Miller indices of a plane, the intercepts made by the plane on the three crystallographic axes are
 - A. (2a, 3b, c)
 - B. (a, b, c)
 - C. (a, 2b, 3c)
 - D. (3a, 2b, c)

6. The inner product of the two matrices $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ and $\begin{pmatrix} 2 & 0 \\ 1 & 1 \end{pmatrix}$ is
 - A. 0
 - B. 1
 - C. 2
 - D. 3

7. Rajeev buys good worth Rs. 6650. He gets a rebate of 6% on it. After getting the rebate, he pays sales tax @ 10%. The amount he will have to pay for the goods is
- A. Rs. 6876
 - B. Rs. 6999
 - C. Rs. 6654
 - D. Rs. 7000
8. A panel of 4 members is to be formed from a group of 7 engineers and 3 advocates. If every selection is equally likely, then the probability that at least one advocate is included in the panel is
- A. 0.75
 - B. 0.83
 - C. 0.90
 - D. 0.96
9. A train travels from City X to City Y at a speed of 75 km/h and returns along the same route at a speed of 50 km/h. On the return journey, the train halts midway for 20 minutes. If the total travel time including the halt is 2.5 hours, what is the distance between City X and City Y?
- A. 60 km
 - B. 65 km
 - C. 72 km
 - D. 81 km
10. P's score in an exam is 85. Q's score is 62, and R's score is 77. S scored higher than R but lower than P. T scored lower than Q. From the information given, what is the possible score for S?
- A. 60
 - B. 76
 - C. 81
 - D. 88
11. In a laboratory, five instruments P, Q, R, S, and T are arranged in a row, in the following manner
- Q is to the right of P
 - R is to the left of S
 - T is between Q and S
- Which instrument is in the middle?
- A. P
 - B. Q
 - C. T
 - D. S

12. A car is moving at a speed of 30 m/s. If the driver applies the brakes and the car stops uniformly in a distance of 90 m, how far would the car travel before stopping if its initial speed had been 60 m/s instead, assuming the same braking force and road conditions?
- A. 90m
B. 180m
C. 270m
D. 360m
13. A force of 200 N is applied perpendicularly over an area of 4 m². What is the thrust and pressure exerted?
- A. Thrust = 50 N, Pressure = 50 Pa
B. Thrust = 200 N, Pressure = 50 Pa
C. Thrust = 200 N, Pressure = 800 Pa
D. Thrust = 800 N, Pressure = 200 Pa
14. A grocer has a sale of Rs. 6435, Rs. 6927, Rs. 6855, Rs. 7230 and Rs. 6562 for 5 consecutive months. How much sale must he have in the sixth month so that he gets an average sale of Rs. 6500?
- A. Rs. 4991
B. Rs. 5991
C. Rs. 6001
D. Rs. 6991
15. A large cube is formed from the material obtained by melting three smaller cubes of sides 3, 4 and 5 cm. What is the ratio of the total surface areas of the smaller cubes and the large cube?
- A. 2 : 1
B. 3 : 2
C. 25 : 18
D. 27 : 20
16. If $x > y > 1$, which of the following must be true?
- (i) $\ln x > \ln y$
(ii) $\exp(x) > \exp(y)$
(iii) $yx > xy$
(iv) $\cos x > \cos y$
- A. (i) and (ii)
B. (i) and (iii)
C. (iii) and (iv)
D. (ii) and (iv)

17. In a 60 litres mixture, the ratio of milk and water is 2 : 1. If this ratio is to be 1 : 2, then the quantity of water to be further added is
- 20 litres
 - 30 litres
 - 40 litres
 - 60 litres
18. The principal argument of the complex number $-1 - i$ is
- $\frac{3\pi}{4}$
 - $\frac{-\pi}{4}$
 - $\frac{-3\pi}{4}$
 - $\frac{\pi}{4}$
19. Sakshi invests a part of Rs. 12,000 in 12% stock at Rs. 120 and the remainder in 15% stock at Rs. 125. If his total dividend per annum is Rs. 1360, how much does he invest in 12% stock at Rs. 120?
- Rs. 4000
 - Rs. 4500
 - Rs. 5500
 - Rs. 6000
20. The Hamiltonian in quantum mechanics is
- $H = -\frac{h^2 \nabla^2}{8\pi^2 m}$
 - $H = \frac{h^2 \nabla^2}{8\pi^2 m}$
 - $H = -\frac{8h^2 \nabla^2}{\pi^2 m}$
 - $H = -\frac{h^2 \nabla^2}{\pi^2 m}$

Part B

21. The phenomenon of melting point depression is most pronounced when the particle size is below
- A. 1000 nm
 - B. 500 nm
 - C. 50 nm
 - D. 50 mm
22. If the distance between a Na ion and a Cl ion in NaCl crystal is 0.28 nm, then the lattice parameter of the crystal is
- A. 0.8 nm
 - B. 0.56 nm
 - C. 0.28 nm
 - D. 0.14 nm
23. The Fermi level of intrinsic semiconductor lies in the
- A. middle of the band gap
 - B. below the middle of the bandgap
 - C. above the middle of the bandgap
 - D. in the middle of the valence band
24. Which of the following statements is true about the eigenvectors of a real symmetric matrix corresponding to distinct eigenvalues?
- A. They are always parallel
 - B. They are always orthogonal
 - C. They are always identical
 - D. They are always zero
25. In the electromagnetic spectrum which of the following has the lowest energy?
- A. Radio waves
 - B. Microwaves
 - C. Ultraviolet radiation
 - D. Visible light
26. The second law of thermodynamics introduces which of the following state properties?
- A. Temperature
 - B. Entropy
 - C. Internal energy
 - D. Heat capacity

27. With regard to arrangement of metal ions in the unit cell of ZnFe_2O_4 , which of the following is true?
- A. $\frac{1}{2}$ of the tetrahedral sites (A sites) and $\frac{1}{8}$ th of the Octahedral sites (B sites) are occupied
 - B. $\frac{1}{8}$ th of the tetrahedral sites (A sites) and $\frac{1}{2}$ of the Octahedral sites (B sites) are occupied
 - C. $\frac{1}{2}$ of the tetrahedral sites (A sites) and $\frac{1}{2}$ of the Octahedral sites (B sites) are occupied
 - D. $\frac{1}{8}$ th of the tetrahedral sites (A sites) and $\frac{1}{8}$ th of the Octahedral sites (B sites) are occupied
28. NiFe_2O_4 is known to have inverse spinel structure, whereas ZnFe_2O_4 normal spinel structure. If 10% NiFe_2O_4 is substituted with ZnFe_2O_4 then the net magnetic moment of the mixed Ni-Zn ferrite ($0.9\text{NiFe}_2\text{O}_4\text{-}0.1\text{ZnFe}_2\text{O}_4$) is,
- A. $1.8 \mu_B/\text{molecule}$
 - B. $2.8 \mu_B/\text{molecule}$
 - C. $7.3 \mu_B/\text{molecule}$
 - D. $5.8 \mu_B/\text{molecule}$
29. In non-metals, heat conduction is mainly due to
- A. electrons
 - B. phonons
 - C. ions
 - D. photons
30. For a n-type semiconductor the Hall coefficient (R_H) is
- A. negative
 - B. positive
 - C. zero
 - D. infinity
31. At the equilibrium spacing of a diatomic molecule, the resultant force and potential energy is
- A. zero and minimum, respectively
 - B. minimum and zero, respectively
 - C. zero and maximum, respectively
 - D. maximum and zero, respectively
32. Which of the following metals is the most noble in character in the galvanic series?
- A. Pt
 - B. Au
 - C. Ag
 - D. Ti

33. Matthiessen's rule is based on
- A. electrons only
 - B. phonons only
 - C. both electrons and phonons
 - D. protons only
34. Which of the following solids has the highest elastic modulus?
- A. NaCl
 - B. Graphite
 - C. Diamond
 - D. Polyethylene
35. Which of the following conditions is necessary for Galvanic corrosion to occur between two dissimilar metals?
- A. The two metals must have identical standard electrode potentials
 - B. The two metals must be perfectly insulated from each other
 - C. The two metals must be in electrical contact and exposed to a common electrolyte
 - D. Both metals must be noble metals (e.g., gold and platinum)
36. The bonding in carbon nanotubes is primarily:
- A. ionic
 - B. metallic
 - C. covalent
 - D. van der Waals
37. A plane intercepts at a , $b/2$, $3c$ in a simple cubic unit cell. The Miller indices of the plane are
- A. (261)
 - B. (361)
 - C. (123)
 - D. (132)
38. Which of the following statement is correct?
- A. The kinetic energy of a system cannot be changed without changing the momentum
 - B. The kinetic energy of a system can be changed without changing the momentum
 - C. The momentum of a system cannot be changed without changing its kinetic energy
 - D. A system cannot have energy without having momentum
39. Which of the following oxides prevents steel from corrosion?
- A. Fe_2O_3
 - B. Fe_3O_4
 - C. Cr_2O_3
 - D. FeO

40. Nanoparticles are useful in catalysis, because
- A. they have higher specific surface to volume ratio
 - B. they are less reactive than bulk materials
 - C. catalytic activity decreases with particle size
 - D. they have less number of atoms on surface
41. Which of the following statements about quantum dots is false?
- A. Quantum dots are very small, electrons within them are confined, leading to discrete energy levels rather than continuous bands
 - B. Quantum dots are less photostable than organic dyes
 - C. Quantum dots are utilized as single-photon sources
 - D. Quantum dots are zero dimensional entity
42. The colour of nanoparticle suspensions changes with particle size because of
- A. reflection of light
 - B. scattering of light
 - C. refraction of light
 - D. diffraction of light
43. In a crystalline solid, the smallest repeating structural unit is called
- A. grain
 - B. lattice point
 - C. unit cell
 - D. basis
44. The reciprocal lattice is mainly used to discuss
- A. heat transfer studies
 - B. crystal growth
 - C. diffraction analysis
 - D. mechanical testing
45. What is the driving force in Bottom-Up approach?
- A. Increment in internal stress of material
 - B. Increment in internal strain of material
 - C. Decrease in surface energy
 - D. Increase in surface energy
46. Which of the following crystallographic textures is most desirable in steels used for electrical transformer applications?
- A. Random texture
 - B. Brass texture
 - C. Goss texture
 - D. Copper texture

47. In FCC metals, dislocation slip predominantly occurs on which of the following crystallographic planes and directions?
- A. $\{100\}\langle 110\rangle$
 - B. $\{111\}\langle 110\rangle$
 - C. $\{110\}\langle 111\rangle$
 - D. $\{112\}\langle 111\rangle$
48. Ionic compounds are insoluble in CCl_4 because
- A. it is a polar solvent
 - B. it is a non-polar solvent
 - C. it is a semi-polar solvent
 - D. it is an organic solvent
49. The band gap of Si at room temperature is
- A. 1.1 eV
 - B. 2.1 eV
 - C. 0.1 eV
 - D. 0 eV
50. For n-type semiconductors, which of the following is correct?
- A. Negative charge carriers dominate
 - B. Positive charge carriers dominate
 - C. Both positive and negative charge carriers dominate
 - D. Neither positive nor negative charge carriers dominate
51. Which of the following is not a ceramic material?
- A. SiO_2
 - B. SiC
 - C. Al_2O_3
 - D. NiW
52. Strain hardening is the increase of _____ with plastic deformation
- A. dislocation density
 - B. Young's modulus
 - C. Shear modulus
 - D. Bulk modulus
53. Which of the following microscopes is generally preferred for Electron Backscatter Diffraction (EBSD) texture measurements?
- A. Transmission electron microscope
 - B. Laser confocal microscope
 - C. Scanning electron microscope
 - D. Optical microscope

54. Which of the following properties is not concerned with plasticity?
- A. Ductility
 - B. Toughness
 - C. Resilience
 - D. Tensile strength
55. Which of the following is the requirement for cross-slip movement of dislocation?
- A. Preferred slip plane
 - B. Preferred slip direction
 - C. No preferred slip plane
 - D. No preferred slip direction

University of Hyderabad
Entrance Examinations - 2026
Ph.D. Admissions

School: School of Engineering Sciences and Technology

Course : Ph.D. Subject : Nano Science Technology (F26)

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	A /	26	B /	51	D /
2	C /	27	B /	52	A /
3	A /	28	B /	53	C /
4	C /	29	B /	54	C /
5	A /	30	A /	55	C /
6	D /	31	A /		
7	A /	32	A /		
8	B /	33	C /		
9	B /	34	C /		
10	C /	35	C /		
11	C /	36	C /		
12	D /	37	B /		
13	B /	38	B /		
14	A /	39	C /		
15	C /	40	A /		
16	A /	41	B /		
17	D /	42	B /		
18	C /	43	C /		
19	A /	44	C /		
20	A /	45	C /		
21	C /	46	C /		
22	B /	47	B /		
23	A /	48	B /		
24	B /	49	A /		
25	A /	50	A /		

Note/Remarks :


 Signature
 School/Department/Centre
 Dr. Prakash Gautam
 Professor, SEST
 University of Hyderabad
 Hyderabad-500 046.