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ENTRANCE EXAMINATIONS 2025
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 **10** pages including this cover sheet.

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PART A

1. A ball is dropped from the top of a tower 100 m high and at the same time another ball is projected vertically upwards from the ground with a velocity of 25 ms^{-1}. The height from the ground where the two balls will meet is (Acceleration due to gravity, g = 9.8 ms^{-2})
   A. 21.6 m
   B. 2.16 m
   C. 1.26 m
   D. 12.6 m
2. Two bodies have masses in the ratio 3:4. When a force is applied on the first body, it moves with an acceleration of 6 ms^{-2}. The acceleration the same force will produce in the other body is
   A. 5.4 ms^{-2}
   B. 3.5 ms^{-2}
   C. 4.5 ms^{-2}
   D. 5.3 ms^{-2}
3. A force of 100 N displaces an object through 0.2 m and does a work of 10 joules. The angle between the force and the displacement is
   A. 30^0
   B. 45^0
   C. 90^0
   D. 60^0
4. What comes next in the sequence? 1, 4, 13, 40, 121, ___
   A. 364
   B. 365
   C. 363
   D. 366
5. A committee of 3 members is to be formed from a group of 4 engineers and 2 designers. If every selection is equally likely, then the probability that at least one designer is included in the committee is _____
   A. 0.60
   B. 0.70
   C. 0.75
   D. 0.80
6. The average weight of three objects is 72 kg. The average weight of the second and third object (with the third repeated) is 78 kg. If the weight of the third object is 84 kg, then the weight of the first object as a percentage of the third is _____.
   A. 75%
   B. 78.5%
   C. 80%
   D. 85%

7. The area of an equilateral triangle is $\sqrt{3}$. What is the perimeter of the triangle?
   A. 2
   B. 4
   C. 6
   D. 8
8. P, Q, R and S are to be uniquely coded using α and β. If P is coded as α and Q as $\alpha\beta$ then R and S can be respectively coded as
   A. $\beta\alpha$ and $\alpha\beta$
   B. $\beta\beta$ and $\alpha\alpha$
   C. $\alpha\beta$ and $\beta\beta$
   D. $\beta\alpha$ and $\beta\beta$
9. A set of 4 parallel lines intersect with another set of 5 parallel lines. How many parallelograms are formed?
   A. 20
   B. 48
   C. 60
   D. 72
10. If the 1st term of an Arithmetic progression is 5 and the common difference is 3, then, the 20th term will be
   A. 42
   B. 62
   C. 72
   D. 82
11. Three cubes of gold whose edges are 6 cm, 8 cm and 10 cm respectively are melted and formed into a single cube. The edge of the new cube formed is
   A. 16 cm
   B. 18 cm
   C. 12 cm
   D. 14 cm
12. The sum of the digits of a two-digit number is 15. If the number formed by reversing the digits is less than the original number by 27, find the original number
   A. 69
   B. 96
   C. 66
   D. 99
13. Find the volume of cube whose surface area is 384 cm^2
   A. 320 cm^3
   B. 384 cm^3
   C. 256 cm^3
   D. 512 cm^3

14. For a real 2×2 matrix X, if det(X) = 6 and Trace(X) = 4, then, Trace(X2) is
    A. 2
    B. 16
    C. 4
    D. 10
15. In a uniaxial tensile test on an isotropic material, the principal stress direction is
    A. 90 degrees to loading direction
    B. 60 degrees to loading direction
    C. 45 degrees to loading direction
    D. along the loading direction
16. The deflection of a cantilever beam loaded by a concentrated force at the free end is
    A. independent of the length of the beam
    B. inversely proportional to the length of the beam
    C. directly proportional to the cube root of the length of the beam
    D. directly proportional to the cube of the length of the beam
17. A null hypothesis is a
    A. hypothesis that cannot be tested
    B. hypothesis that has no significance
    C. hypothesis that can neither be proved or disproved
    D. hypothesis of no difference
18. The spread of experimental data is captured by
    A. mean
    B. variance
    C. median
    D. mode
19. Which of the following statements is not true regarding random error in experimental data?
    A. It cannot be reduced by averaging
    B. It can be caused by observer bias
    C. It can be caused by instrumental error
    D. It can be caused by environmental factors
20. If the standard deviation of a dataset is 10 and the mean is 20, what is the coefficient of variation?
    A. 10%
    B. 20%
    C. 50%
    D. 100%

Part B

21. If E_1 is the energy of the lowest state in a one-dimensional potential box of length "a" and E_2 is the energy of the lowest state when the length of the box is halved, then
    A. $E_2 = E_1$
    B. $E_2 = 3E_1$
    C. $E_2 = 4E_1$
    D. $E_2 = 2E_1$
22. The diamagnetic susceptibility is always
    A. positive
    B. negative
    C. zero
    D. infinite
23. The ratio of the diffusion constant to the mobility of holes in a semiconductor is proportional to the absolute temperature (T) as
    A. T
    B. T^2
    C. $1/T$
    D. $1/T^2$
24. The induced dipole moment per unit volume is known as
    A. flux density
    B. electric polarization
    C. electric field
    D. dielectric constant
25. When white light passes through a sodium vapor lamp and is then converted into a spectrum of colors, the spectrum will contain
    A. wavelengths or colors that are emitted by sodium
    B. wavelengths or colors that are refracted by sodium
    C. missing wavelengths or colors that are absorbed by sodium
    D. wavelengths or colors that are scattered by sodium
26. Which of the following is true about the determinant of a square matrix?
    A. It is always positive
    B. It is always zero
    C. It is commutative
    D. It is multiplicative
27. A square is formed by joining the midpoints of the sides of a rhombus. What is the side length of the square formed in terms of the diagonal of the rhombus?
    A. $1/2$ times the length of the diagonal
    B. $1/\sqrt{2}$ times the length of the diagonal
    C. $\sqrt{2}$ times the length of the diagonal
    D. Equal to the length of the diagonal

28. A unary phase diagram (P vs T) shows
    A. the stable phases of a substance under different pressure and temperature conditions
    B. the effect of pressure and temperature on the chemical composition of the substance
    C. the effect of temperature and composition on the phase of the substance
    D. the metastable states of a substance
29. Which of the following occurs in a conventional solar power plant using photovoltaic cells?
    A. Light energy from the Sun is converted to electrical energy
    B. Thermal energy from the Sun is used to generate steam, which drives turbines
    C. Kinetic energy of the sunlight is converted to electrical energy
    D. Energy from nuclear fission in the Sun is converted to electrical energy
30. Carnot discovered that the efficiency of an engine depends solely on
    A. heat supplied by source/ Heat supplied by the sink
    B. temperature of the sink/ Temperature of the source
    C. temperature of the source
    D. temperature of the sink
31. The Gibbs free energy change of a process at constant temperature and pressure determines
    A. the rate at which the reaction occurs
    B. the spontaneity of the reaction
    C. the maximum temperature the system can reach
    D. the heat absorbed by the system
32. A long oil pipeline made of steel is suspected to have developed a scale on the inner surface due to corrosion. Which of the following non-destructive techniques is the most suitable for detecting and quantifying such a defect?
    A. Dye penetrant test
    B. Ultrasonic inspection
    C. Magnetic particle inspection
    D. Acoustic emission
33. A steel is plastically worked in the temperature range below the nose of the Time-Temperature-Transformation (TTT) curve and above Martensitic start temperature (Ms), followed by quenching to produce fine martensite. What is this process called?
    A. Martempering
    B. Inter-critical forming
    C. Ausforming
    D. Normalizing

34. Consider the following properties:
(P) temperature (Q) specific gravity (R) chemical potential (S) volume
The option which lists ALL the intensive properties is
A. P
B. P and Q
C. P, Q and R
D. P, Q, R and S

35. For a chemical reaction, the ratio of rate constant at 500 K to that at 400 K is 2.5. Given R = 8.314 J mol^{-1} K^{-1}, the value of activation energy (in kJ/mol) is
A. 10.5
B. 12.0
C. 15.2
D. 18.4

36. The Pourbaix diagram is a plot between
A. potential and pH
B. free energy and temperature
C. temperature and composition
D. enthalpy and temperature

37. The resonance frequency (f_0) of a series resonant circuit is given as
A. $f_0 = \sqrt{C\,R}$
B. $f_0 = 2\pi\sqrt{L\,C}$
C. $f_0 = 2\pi\sqrt{R\,C}$
D. $f_0 = 1/\,2\pi\sqrt{L\,C}$

38. In nanomaterials, quantum confinement effects become significant when the particle size is comparable to
A. the speed of light
B. the electron mean free path
C. the wavelength of the electron
D. the size of the nucleus

39. The Stokes line corresponds to which of the following?
A. The incident frequency < Emitted frequency
B. The incident frequency > Emitted frequency
C. The incident frequency = Emitted frequency
D. The incident frequency ≥ Emitted frequency

40. Crystal structure of GaAs is
A. BCC
B. FCC
C. SC
D. HCP

41. Depth of focus is
A. proportional to the wavelength
B. inversely proportional to wavelength
C. does not depend on wavelength
D. proportional to the square of the wavelength

42. The dispersion strengthened alloys usually offer good resistance to creep deformation at elevated temperature because
    A. the nano-size dispersoids maintain coherency with matrix and are stable at elevated temperature
    B. the nano-size dispersoids don't maintain coherency with matrix and are stable at elevated temperature
    C. the nano-size dispersoids are agglomerated at elevated temperature
    D. the nano-size dispersoids are dissolved at elevated temperature
43. The phenomenon of 'Green-Spring' in powder compacting process is attributed to
    A. elastic recovery of the compacted material
    B. plastic deformation of the compacted material
    C. interconnected porosity in the compacted material
    D. interlocking of particles
44. For a material system to exhibit precipitation hardening through solution treatment followed by ageing treatment, its phase diagram should satisfy which of the following criteria?
    A. With increasing the temperature, the solid solubility of the solute should increase
    B. With increasing the temperature, the solid solubility of the solute should decrease
    C. With increasing temperature, the solid solubility of the solute should not get effected
    D. There should be no solid solubility for the solute at any temperature
45. The term recrystallization refers to
    A. change in crystal structure of the material
    B. formation of very small, equiaxed and stress-free grains in the material
    C. formation of highly stressed columnar grains in the material
    D. re-orientation of strengthening phases in the material
46. The Brass is an alloy of
    A. Copper and Zinc
    B. Copper and Tin
    C. Copper and Titanium
    D. Copper and Tungsten
47. Which of the following is not a method of synthesis for graphene?
    A. Blow moulding
    B. Exfoliation
    C. Epitaxial growth
    D. Hummers method
48. Which of the following is one dimensional nanomaterial (1D)
    A. Carbon Nanowire
    B. Graphene
    C. C_{60}
    D. Sintered metallic alloys

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49. The number of molecules of nitrogen in 2000 cm^3 of nitrogen measured at STP are
    A. 5.38×10^{24} molecules
    B. 5.38×10^{22} molecules
    C. 4.38×10^{24} molecules
    D. 4.38×10^{22} molecules
50. With melting points given in brackets, identify the one that will creep significantly at 200 °C
    A. Pb (600 K)
    B. W (3683 K)
    C. Ni (1728 K)
    D. Nb (2750 K)
51. In the Griffith criterion, the fracture stress is proportional to (c is crack length):
    A. $c^{1/2}$
    B. $c^{-1/2}$
    C. $c^{3/2}$
    D. $c^{-3/2}$
52. Which of the following methods will not improve the fatigue resistance of a steel?
    A. Decarburizing
    B. Grain refinement
    C. Shock peening
    D. Shot peening
53. Which of the following is an undesirable attribute of an oxide film?
    A. Continuous oxide film
    B. Porous oxide film
    C. Low electrical conductivity
    D. Passive nature
54. In parabolic rate of oxidation, the oxide thickness is proportional to (t=time):
    A. $t^{1/2}$
    B. $t^{-1/2}$
    C. t^2
    D. $t^{-1/2}$
55. In nanomaterials, high surface-to-volume ratio leads to
    A. higher total Gibbs free energy
    B. lower total Gibbs free energy
    C. no change in Gibbs free energy
    D. zero Gibbs free energy

University of Hyderabad
Entrance Examinations - 2025
Ph.D. Admissions

School: School of Engineering Sciences and Technology
Course : Ph.D. Subject : Nano Science Technology (E21)

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

Note/Remarks :

16/6/2025

Signature
School/Department/Centre