

C-42 ✓

ENTRANCE EXAMINATIONS 2023  
Ph.D. (Materials Engineering)

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. Mobile phones, log tables and calculators of any type are NOT permitted inside the Examination Hall.
6. This book contains 11 pages including this cover sheet.

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**PART A**

1. Austin lives 10 km away from where I live. Mustaq lives 5 km away and Babu lives 7 km away from where I live. Raj is farther away than Mustaq but closer than Babu from where I live. From the information provided here, what is the possible distance (in km) at which I live from Raj's place?
  - A. 3
  - B. 4.99
  - C. 6.02
  - D. 7.01
2. P, Q, R, and S are working on a project. Q can finish the task in 25 days, working alone for 12 hours a day. R can finish the task in 50 days, working alone for 12 hours per day. Q worked 12 hours a day but took sick leave in the beginning for two days. R worked 18 hours a day on all days. What is the ratio of work done by Q and R after 7 days from the start of the project?
  - A. 10:11
  - B. 11:10
  - C. 20:21
  - D. 21:20
3. At what time between 6 am and 7 am will the minute hand and hour hand of a clock make an angle closest to  $60^\circ$ ?
  - A. 6:22 AM
  - B. 6:27 AM
  - C. 6:38 AM
  - D. 6:45 AM
4. A container originally contains 10 litres of pure juice. From this container 1 litre of juice is replaced with 1 litre of water. Subsequently, 1 litre of the mixture is again replaced with 1 litre of water and this process is repeated one more time. How much juice (in L) is now left in the container?
  - A. 7.29
  - B. 8.36
  - C. 5.42
  - D. 9.00
5. Hook's law is not applicable to which of the following?
  - A. Young's modulus
  - B. Spring constant
  - C. Stretching of atomic bonds
  - D. Breaking of atomic bonds

6. The Vande Bharat express between Bengaluru and Hyderabad crosses Lingampally station, without stopping, in 20 seconds and the total length of the train is 400 m. What would be the speed of the train at Lingampally station?
- A. 70 km/hr
  - B. 72 km/hr
  - C. 74 km/hr
  - D. 76 km/hr
7. Different angles of a triangle are found to be in the ratio of 2:3:5. What could be the smallest angle in such a triangle?
- A.  $9^\circ$
  - B.  $18^\circ$
  - C.  $36^\circ$
  - D.  $72^\circ$
8. A ladder of length 100 m is making an angle of  $45^\circ$  with a vertical wall. If the bottom end of the ladder and the wall are at the same ground level, what would be the height of the wall?
- A. 25 m
  - B. 50 m
  - C. 100 m
  - D. 200 m
9. Find the value of  $t$  in the equation,  $\log_{0.25} t = 16$
- A.  $4^{-16}$
  - B.  $4^{16}$
  - C.  $16^4$
  - D.  $16^{-4}$
10. In some mathematical code, if "UOH" is denoted as "368", what would be the code for the "EARTH"?
- A. 51928
  - B. 15289
  - C. 59281
  - D. 91825
11. A block of mass  $M$  is kept on a weighing machine placed on the floor of an elevator. With what acceleration the elevator should descend so that the block exerts a force of  $Mg/10$  on the weighing machine? ( $g$  - acceleration due to gravity)
- A. 0.1  $g$
  - B. 0.9  $g$
  - C. 0.6  $g$
  - D. 0.3  $g$

12. The force exerted by the floor of an elevator on the foot of a person standing there is less than the weight of the person if the elevator is
- A. going down and speeding up
  - B. going down and slowing down
  - C. going up and speeding up
  - D. going up at constant speed
13. A gun fires a bullet of mass 50g with a velocity of  $30 \text{ ms}^{-1}$ . Because of this, the gun is pushed back with a velocity of  $1 \text{ ms}^{-1}$ . Mass of the gun is
- A. 30 kg
  - B. 20 kg
  - C. 1.5 kg
  - D. 3.5 kg
14. A motor boat is having a steady speed of  $20 \text{ ms}^{-1}$ . If the water resistance to the motor boat is 600 N, then the power is
- A. 12 kW
  - B. 1200 kW
  - C. 120 kW
  - D. 9.8 kW
15. The mass of the moon is about 1.2% of the mass of the earth. Compared to the gravitational force that the earth exerts on the moon, the gravitational force the moon exerts on the earth
- A. is smaller
  - B. is same
  - C. is greater
  - D. varies with its phase
16. A piece of copper having an internal cavity weighs 261g in air and 221g in water. If density of copper is  $9 \text{ g/cc}$ , then the volume of the cavity is
- A. 5 cc
  - B. 10 cc
  - C. 22 cc
  - D. 11 cc
17. The temperature at which the reading of Fahrenheit thermometer will be double that of a centigrade thermometer is
- A.  $160^\circ\text{C}$
  - B.  $100^\circ\text{C}$
  - C.  $32^\circ\text{C}$
  - D.  $180^\circ\text{C}$

18. Two solid spheres of same radius,  $R$ , of a metal are placed in contact by touching each other. The gravitational force acting between them is proportional to
- A.  $R$
  - B.  $R^2$
  - C.  $R^3$
  - D.  $R^4$
19. The required power of an engine to lift 9 metric tons of coal per hour from a mine of 200 m depth is ( $g = 9.8 \text{ ms}^{-2}$ )
- A. 4.9 kW
  - B. 49 kW
  - C. 98 kW
  - D. 9.8 kW
20. Initial volume of an etchant is 9 ml. It contains 50% acid+50% alcohol. How much alcohol is needed to make it 30% acid+70% alcohol? The final volume of the etchant can be more than 9 ml.
- A. 3ml
  - B. 4ml
  - C. 5ml
  - D. 6ml

**PART B**

21. In Fe-C system, eutectic reaction occurs at which of the following temperatures?
- A. 1420 K
  - B. 1763 K
  - C. 996 K
  - D. 873 K
22. Alloys get softened during which of the following processes?
- A. Tempering
  - B. Carburizing
  - C. Cyaniding
  - D. Straining
23. Which one of the following is a liquid at room temperature?
- A. Gum metal
  - B. Mercury metal
  - C. Zinc metal
  - D. Gold metal
24. Which one of the following has HCP crystal structure?
- A. Tungsten
  - B. Niobium
  - C. Tantalum
  - D. Cadmium
25. Which of the following is the lightest metal?
- A. Lithium
  - B. Magnesium
  - C. Aluminium
  - D. Titanium
26. The density of energy states having energy values between  $E$  and  $E+dE$  is proportional to
- A.  $E$
  - B.  $E^{3/2}$
  - C.  $E^{-1}$
  - D.  $E^{1/2}$
27. On increasing the impurity concentration in the metal, the residual part of the resistivity
- A. increases
  - B. decreases
  - C. remains constant
  - D. may increase or decrease depending on the concentration of the impurity

28. If an electron is accelerated by 74 volts, the wavelength associated with the electron is
- A. 1.4 nm
  - B. 0.14 nm
  - C. 14 nm
  - D. 114 nm
29. The number of ions in the unit cell of NaCl crystal is
- A. 6
  - B. 4
  - C. 8
  - D. 2
30. In a simple cubic lattice  $d_{100} : d_{110} : d_{111}$  is
- A.  $6 : 3 : \sqrt{2}$
  - B.  $6 : 3 : 2$
  - C.  $\sqrt{6} : \sqrt{3} : \sqrt{4}$
  - D.  $\sqrt{6} : \sqrt{3} : \sqrt{2}$
31. Which of the following solids are always opaque to visible radiation?
- A. Metallic
  - B. Covalent
  - C. Ionic
  - D. Van der waals
32. The correct relationship between moment of inertia, torque, and angular acceleration is
- A. Angular acceleration = torque  $\times 2 \times$  moment of inertia
  - B. Angular acceleration = torque  $\times$  moment of inertia
  - C. Angular acceleration = torque / moment of inertia
  - D. Angular acceleration = torque / (2  $\times$  moment of inertia)
33. The coordination number of  $\text{Na}^+$  and  $\text{Cl}^-$  in the rock salt structure is
- A. 6 and 8
  - B. 8 and 6
  - C. 6 and 6
  - D. 4 and 4
34. The rank of the matrix,  $A = \begin{pmatrix} 5 & 10 & 10 \\ 1 & 0 & 2 \\ 3 & 6 & 6 \end{pmatrix}$  is
- A. 0
  - B. 1
  - C. 2
  - D. 3



35. Three fair cubical dice are thrown simultaneously. The probability that all three dice have the same number of dots on the faces showing up is (up to third decimal place)
- A. 0.027
  - B. 0.208
  - C. 0.371
  - D. 0.115
36. The eigenvalues of the matrix  $\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -3 & -4 \end{pmatrix}$  are
- A. (0,-1,-3)
  - B. (0,-2,-3)
  - C. (0,2,3)
  - D. (0,1,3)
37. Curl of vector  $V(x, y, z) = 2x^2i + 3z^2j + y^3k$  at  $x = y = z = 1$  is
- A.  $-3i$
  - B.  $3i$
  - C.  $3i-4j$
  - D.  $3i-6k$
38. Kinetic energy of all particle constituents of a material is part of its
- A. Kinetic energy
  - B. Potential energy
  - C. Internal energy
  - D. Charge
39. Carnot's engine
- A. takes in heat energy and converts it to electrical energy
  - B. has equal efficiency to any other reversible engine
  - C. involves isochoric and isobaric steps
  - D. involves only one isothermal step
40. H<sub>2</sub>O phase diagram indicates the stability range of physical states in
- A. composition and volume space
  - B. composition and pressure space
  - C. pressure and temperature space
  - D. composition and temperature space
41. Kinetics of a reaction/transformation is not concerned with which of the following?
- A. Rate constant
  - B. Efficiency of a catalyst
  - C. Thermodynamic feasibility
  - D. Nucleation rate

42. Which of the following is the correct expression for the Hall voltage?
- A.  $V_H = R_H / I H t$
  - B.  $V_H = R_H I / H t$
  - C.  $V_H = R_H H / I t$
  - D.  $V_H = R_H I H / t$
43. In solid state diffusion, diffusivity does not depend on
- A. Vibrational frequency of atoms
  - B. Jump frequency of atoms
  - C. Interatomic distance
  - D. Heat transfer coefficient
44. Which one of the following is the correct expression for dielectric displacement (D) with E as the electric field and P as the polarization?
- A.  $D = E - 4\pi P$
  - B.  $D = E + 4\pi P$
  - C.  $D = E - 4P$
  - D.  $D = E + 4P$
45. The Clausius inequality holds good for
- A. Any process
  - B. Only reversible process
  - C. Any cycle
  - D. Only reversible cycle
46. Thermal conductivity (k) of materials depends on
- A. both the electron and phonon transport
  - B. electron transport
  - C. phonon transport
  - D. neither electron nor phonon transport
47. Which of the following details about equilibrium phases is not available in a binary phase diagram?
- A. Name
  - B. Composition
  - C. Fraction
  - D. Morphology
48. Which one of the following has the widest Band gap?
- A.  $\text{Bi}_2\text{Te}_3$
  - B.  $\text{VO}_2$
  - C. InSb
  - D. GaP
49. Crystallographic anisotropy develops in rolling deformation due to
- A. Changes in dimension
  - B. Grain orientation
  - C. Crystal defects
  - D. Grain boundaries

50. Pearlite is an aggregate of
- A. Ferrite and cementite
  - B. Martensite and ferrite
  - C. Ferrite and austenite
  - D. Austenite and martensite
51. Metal forming operations like forging, rolling and extrusion are performed under which of the following type of stress condition?
- A. Compressive
  - B. Tensile
  - C. Hydrostatic
  - D. Bending
52. Which phase represents the matrix of a Ni-base superalloy?
- A. Gamma
  - B. Gamma prime
  - C. Gamma double prime
  - D. Carbide
53. In the homogeneous nucleation during solidification, nucleation rate is maximum
- A. At melting point
  - B. Above melting point
  - C. Above boiling point
  - D. Below melting point
54. Hydrostatic stress component is used in the calculation of
- A. Creep resistance
  - B. Bulk modulus
  - C. Shear modulus
  - D. Young's modulus
55. Blast furnace uses which of the following process to extract iron from ore?
- A. Metallurgical reduction
  - B. Carbothermic reduction
  - C. Fused salt electrolysis
  - D. Oxidation

**University of Hyderabad**  
**Ph.D. Entrance Examinations - 2023**


School: School of Engineering Sciences and Technology

Course: Ph.D.

Subject: Material Engineering

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	C	26	D	51	A
2	C	27	A	52	A
3	A	28	B	53	D
4	A	29	C	54	B
5	D	30	D	55	B
6	B	31	A	56	
7	C	32	C	57	
8	B	33	C	58	
9	A	34	C	59	
10	A	35	A	60	
11	B	36	A	61	
12	A	37	A	62	
13	C	38	C	63	
14	A	39	B	64	
15	B	40	C	65	
16	D	41	C	66	
17	A	42	D	67	
18	D	43	D	68	
19	A	44	B	69	
20	D	45	C	70	
21	A	46	A		
22	A	47	D		
23	B	48	D		
24	D	49	B		
25	A	50	A		

Note/Remarks :

  
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