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ENTRANCE EXAMINATIONS 2025
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. 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. Four friends Ria, Sam, Tia, and Vik each like a different fruit: Apple, Banana, Mango, and Orange. Ria does not like Mango or Orange. The person who likes Banana is not Sam. Tia likes a fruit that starts with the same letter as her name. Which fruit does Vik like?
   A. Orange
   B. Mango
   C. Banana
   D. Apple
2. 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
3. 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%
4. Four balls are dropped gently from the top of a tower at time gap of one second. The first ball reaches the ground after 4 seconds of dropping. The distance between the 3rd and 4th ball is (Acceleration due to gravity, g = 9.8 ms^{-2})
   A. 34.3 m
   B. 14.7 m
   C. 24.5 m
   D. 73.5 m
5. Trent Boult bowls a cricket ball of mass 120 g with a velocity of 12 ms^{-1}. Rohit Sharma hits the ball, it turns back and moves with a velocity of 20 ms^{-1}. If the hitting force acts for 0.02 s, the magnitude of force is
   A. 48 N
   B. 96 N
   C. 192 N
   D. 384 N
6. If $x^2 + x - 1 = 0$ what is the value of $x^4 + 1/x^4$?
   A. 1
   B. 5
   C. 7
   D. 9

7. For $0 \leq x \leq 2\pi$, $\sin x$ and $\cos x$ are both decreasing functions in the interval _____.
   A. $(0, \pi/2)$
   B. $(\pi/2, \pi)$
   C. $(\pi, 3\pi/2)$
   D. $(3\pi/2, 2\pi)$
8. The radius as well as the height of a circular cone increases by 10%. The percentage increase in its volume is
   A. 17.1
   B. 21.0
   C. 33.1
   D. 72.8
9. If $(x + y + z) = 0$, then the value of $(x^3+y^3+z^3)$ is
   A. 0
   B. 3
   C. 3xyz
   D. xyz/3
10. The population of a town is increasing at the rate of 5% per annum. What will be the population of the town on this basis after 2 years, if the current population is 16000?
   A. 17640
   B. 16740
   C. 67140
   D. 76140
11. The lateral surface area of a hollow cylinder is 4224 cm^2. It is cut along its height to form a rectangular sheet of width 32 cm. The perimeter of the resultant rectangular sheet is
   A. 382 cm
   B. 238 cm
   C. 328 cm
   D. 283 cm
12. Accuracy of a measuring instrument refers to
   A. the closeness with which a measurement can be read
   B. a measure of how close the reading is to the true size
   C. the difference between measured value and actual value
   D. none of the above
13. The determinant of the product of two square matrices AA and BB of the same order is
   A. equal to the product of their traces
   B. equal to the product of their determinants
   C. always zero
   D. always one

14. A quadrilateral is formed by joining the midpoints of the sides of a rectangle with dimensions 4 units and 6 units. What is the area of the largest circle that can be inscribed within this quadrilateral?
    A. 6
    B. 8
    C. 4
    D. 9
15. How many words can be formed from the letters of the word SIGNATURE if the vowels always come together?
    A. 720
    B. 14400
    C. 2880
    D. 17280
16. A number, when 35 is subtracted from it, becomes 80% of its original value. What is four-fifths of that number?
    A. 140
    B. 90
    C. 120
    D. 70
17. An aeroplane flies along the four sides of a square at the speeds of 200,400,600, and 800 km/hr. Find the average speed of the plane around the field.
    A. 550 km/hr
    B. 384 km/hr
    C. 500 km/hr
    D. 400 km.hr
18. The solution of differential equation $\frac{dy}{dx} = 3x^2$ is:
    A. $y = x^3 + C$
    B. $y = x^2 + C$
    C. $y = x^3/3 + C$
    D. $y = 3x + C$
19. The order and degree of the differential equation $\frac{d^2y}{dx^2} + y^2 + 1 = 0$ is
    A. 1,1
    B. 2,1
    C. 1, 2
    D. 2,2
20. For a dataset that shows normal distribution, two standard deviations above and below the mean will include
    A. 63 % of the data
    B. 90 % of the data
    C. 95 % of the data
    D. 99 % of the data

Part B

21. Factor of safety is an important number in the design of structures that refers to
    A. (Strength of the material) ÷ (working stress)
    B. (Strength of the material) − (working stress)
    C. (Strength of the material) ×(working stress)
    D. (Strength of the material) + (working stress)
22. Which of the following materials is commonly used for making the patters in investment casting process to realize highly complex shapes?
    A. Aluminium
    B. Copper
    C. Wax
    D. Zinc
23. Objects from refractory materials having high melting temperatures are usually manufactured through
    A. powder metallurgy route
    B. investment casting route
    C. isothermal forging route
    D. solid state welding route
24. Inert gas atomized powder shall have _____ particle morphology
    A. dendritic
    B. highly Irregular
    C. acicular
    D. near spherical
25. When light emitted from a hot, dense object passes through a cool gas and is then analyzed with a spectroscope, the resulting spectrum will show
    A. only emission lines produced by the cool gas
    B. only the continuous spectrum of the hot object
    C. missing wavelengths where the gas has absorbed specific energies
    D. a random distribution of bright and dark lines
26. In an ideal gas, the internal energy depends only on
    A. the volume of the gas
    B. the temperature of the gas
    C. the pressure of the gas
    D. the temperature and pressure of the gas
27. Which of the following occurs in a conventional nuclear power plant?
    A. The chemical energy of uranium is converted to electrical energy directly.
    B. The kinetic energy of neutrons is converted to thermal energy.
    C. The nuclear energy of uranium is converted to heat energy, which is then used to generate steam.
    D. The potential energy of uranium is converted to electrical energy directly.

28. Which of the following is a direct consequence of the second law of thermodynamics?
    A. The total energy of a system is conserved in all processes
    B. Heat will never flow from a colder body to a hotter body spontaneously
    C. The entropy of an isolated system remains constant
    D. Energy can be completely converted into work
29. Which of the following statements is true about the Gibbs free energy change for a reaction?
    A. It determines whether a reaction is spontaneous or not
    B. It indicates the amount of heat released during a reaction
    C. It is the energy required to overcome the activation energy barrier
    D. It measures the change in enthalpy during a reaction
30. The value of electric permittivity of a vacuum is
    A. 8.854 * 10-12 C/(V m)
    B. 9.854 * 10-12 C/(V m)
    C. 7.854 * 10-12 C/(V m)
    D. 6.854 * 10-12 C/(V m)
31. The degree of transmission is indicated by the terms
    A. transparency, translucency and opacity
    B. transparency and translucency
    C. only transparency
    D. only opacity
32. If n- the number of charge carriers, then the drift current is
    A. proportional to n
    B. inversely proportional to n
    C. does not depend on n
    D. proportional to the square of n
33. Semiconductor materials have
    A. ionic bond
    B. covalent bond
    C. metallic bond
    D. hydrogen bond
34. Magnetically saturated ferrites can
    A. cause large hysteresis
    B. interact with ultrasonic heat radiation
    C. produce low eddy current
    D. interact with electromagnetic waves
35. In a semiconductor, diffusion current is proportional to the
    A. applied electric field
    B. square of the applied electric field
    C. concentration gradient of charge carriers
    D. inverse of the applied electric field

36. The equation, $N\alpha/3\varepsilon_0 = (\varepsilon_r - 1)/(\varepsilon_r + 2)$, is known as
    A. Einstein relation
    B. Clausius-Mosotti relation
    C. Lorentz relation
    D. Debye relation
37. With regard to energy storage capability,
    A. fuel cell has higher power density but lower energy density
    B. dielectric capacitor has higher power density but lower energy density
    C. fuel cell has lower power density and lower energy density
    D. dielectric capacitor has higher power density and higher energy density
38. Which of the following materials are protected from corrosion by a protective passive film?
    P. Aluminium alloys Q. Mild steel R. Stainless steel S. Pure iron
    A. P & Q
    B. Q & R
    C. Q & S
    D. P & R
39. The carbide that is primarily responsible for intergranular corrosion in austenitic stainless steel is
    A. $Cr_{23}C_6$
    B. Fe_3C
    C. SiC
    D. Mn_3C
40. Beach marks are commonly observed on the fracture surface of metals subjected to
    A. creep test
    B. fatigue test
    C. impact test
    D. compression test
41. The length of internal cracks in two samples of the same glass is measured to be c_1= 0.5 mm and c_2= 2 mm. The ratio of the fracture strength of the two samples is
    A. 0.5
    B. 1
    C. 2
    D. 4
42. An aluminum single crystal is loaded in tension along the $[1\bar{1}0]$ axis. Among the following slip systems, the one that will be activated first is
    A. $(1\bar{1}\bar{1})[0\bar{1}1]$
    B. $(\bar{1}\bar{1}1)[011]$
    C. $(\bar{1}\bar{1}1)[1\bar{1}0]$
    D. $(\bar{1}\bar{1}1)[101]$

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43. A heavily cold worked metal will
    A. yield a coarser recrystallized grain size
    B. possess a lower driving force for recrystallization
    C. have a higher energy barrier for nucleation of recrystallized grains
    D. recrystallize at lower temperature
44. Which plane will be present in the X ray diffraction pattern of a body-centred cubic system
    A. (1 0 0)
    B. (1 1 0)
    C. (1 1 1)
    D. (0 1 0)
45. At the Absolute Zero temperature, Si behaves as
    A. metal
    B. insulator
    C. superconductor
    D. semiconductor
46. Identify the slip system among the following
    A. {111} <110>
    B. {111} {110}
    C. <111> <110>
    D. None of these
47. In the Hall-Petch equation, the units of Hall-Petch constant is
    A. None
    B. MN $m^{-3/2}$
    C. MN m^{-2}
    D. MN m^{2}
48. Copper is ductile because
    A. it is a perfect crystal
    B. it contains a very high density of dislocations
    C. it has amorphous structure
    D. it requires low stress to move a dislocation
49. Which of the following is not used to increase the yield strength of a crystalline material?
    A. Grain refinement
    B. Annealing
    C. Solute additions
    D. Precipitation hardening
50. In the iron-carbon phase diagram, which of the following phases is a soft and ductile form of iron?
    A. Cementite
    B. Ferrite
    C. Austenite
    D. Pearlite

51. The necking phenomenon occurs
    A. during elastic deformation
    B. after yielding and just before fracture
    C. before yielding
    D. after fracture
52. Which of the following statements is true about TTT diagrams?
    A. TTT diagrams are plotted for continuous cooling
    B. TTT diagrams are plotted for isothermal transformations
    C. TTT diagrams show stress-strain behavior
    D. TTT diagrams are independent of alloy composition
53. Hydrogen bond is stronger than
    A. ionic bond
    B. covalent bond
    C. metallic bond
    D. van der Waals forces
54. A tensile load of 100 N is applied to an aluminium-boron fiber reinforced composite of 1.0 mm^2 cross-sectional area. The volume of the parallel Boron fiber is 30%. When the above said tensile load axis is perpendicular to the fiber, the stress experienced by the fibers will be
    A. 200 MN/m^2
    B. 150 MN/m^2
    C. 100 MN/m^2
    D. 300 MN/m^2
55. The depletion width of a P-N junction diode
    A. increases with heavy doping
    B. decreases with light doping
    C. increases under reverse bias
    D. decreases under reverse bias

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

School: School of Engineering Sciences and Technology
Course : Ph.D. Subject : Materials Engineering (E20)

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

Note/Remarks :

16/6/2025

Signature
School/Department/Centre