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Entrance Examination – 2019

Ph.D. (Materials Engineering)

Marks: 70
Time: 2.00 hrs

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 questions of **1.75** marks each.
   There is a negative marking of **0.50** marks for every wrong answer.
2. Part 'B: It consists of **35** questions of one mark each with no negative marking.
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 to the invigilator at the end of the examination.

5. Mobile phones, log tables and calculators of any type are NOT permitted inside the Examination Hall.

6. This book contains 12 pages including this cover sheet.

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PART A

1. If the radius of a wheel is 2 ft then the approximate number of revolutions required to travel a distance of 6280 feet is (assume that the wheel does not slip)
   A. 3240
   B. 250
   C. 1000
   D. 500

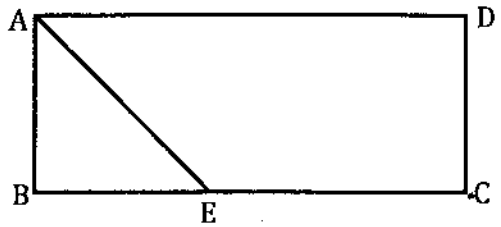
2. The ratio of the length of a rod to its shadow is 1: $\sqrt{3}$. The angle of elevation of the sun is
   A. 30°
   B. 45°
   C. 60°
   D. 90°

3. If the length of a rectangle is increased by 60%, then the percentage change in width required to keep the area same is

   A. Decrease by 37.5%
   B. Decrease by 62.5%
   C. Increase by 37.5%
   D. Decrease by 40%

4. The area of a triangle whose vertices are (a, a), (a+1,0), (a+2, a) is
   A. a^3
   B. a
   C. a^2
   D. 1

5. ABCD is a rectangle. If the area of the isosceles right triangle ABE=7 cm^2 and EC=3BE, then area of ABCD (in cm^2) is



   A. 21
   B. 28
   C. 42
   D. 56

6. P+Q means P is the brother of Q.
   P × Q means P is the father of Q.
   P-Q means P is the sister of Q.
   Which of the following represents the statement S is the niece of T

   A. T×M+S-K
   B. K-S×M+T
   C. T+M×S-K
   D. T×S+M-K

7. Five friends A, B, C, D and E are sitting on a bench in such a way that A is sitting next to B; C is sitting next to D; D is not sitting with E; E is on the left end of the bench; C is on the second position from the right; A is on the right of B and E; and A and C are sitting together, then what is the position of D?

   A. Extreme left
   B. Extreme right
   C. Third from left
   D. Second from left

8. At what time between 9 and 10 o'clock will the hands of a watch be together

   A. 45 min past 9
   B. 50 min past 9
   C. $49\frac{1}{11}$ min past 9
   D. $48\frac{2}{11}$ min past 9

9. Which number replaces the '?' in the figure below

2	3
6	4
8	12
24	?

   A. 20
   B. 22
   C. 16
   D. 21

10. Nagina is taller than Priyanka but not as tall as Manish. Ramesh is taller than Namita but not as tall as Priyanka. Who among them is the tallest?

A. Manish
B. Priyanka
C. Namita
D. Nagina

11. 21 coupons numbered 1 to 21 are mixed up and then a coupon is drawn at random. What is the probability that the coupon drawn has a number which is a multiple of 2 or 3?

A. 70/21
B. 10/21
C. 17/21
D. 7/21

12. 'X' can do a work in 10 days and 'Y' can do the same work in 20 days. If they work together for 3 days, then the fraction of work that is still left is

A. 9/20
B. 11/20
C. 3/20
D. 17/20

13. If the selling price is doubled the profit is tripled. The profit percent is

A. 26.33
B. 75.25
C. 105.67
D. 100

14. If standard deviation of a set of data is 0.2, then variance is equal to

A. 0.20
B. 2.00
C. 0.40
D. 0.04

15. 3 solid metal cubes with sides 1, 2, and 3 cm are melted and a large cube is made. What is approximately the total surface area of this larger cube, assuming no loss of material?

A. 65.34 cm^2
B. 60.00 cm^2
C. 50.00 cm^2
D. 55.34 cm^2

16. University of Hyderabad has some deer and peacocks in its campus. If the number of heads are 48 and number of feet are 140, then the total number of peacocks will be

A. 22
B. 24
C. 26
D. 28

17. The next pattern in the series, SCD, TEF, UGH, VIJ will be

A. WKL
B. WLK
C. WLW
D. WKW

18. Which letter replaces the '?' in the figure below

E	J	O	T
Z	S	?	Y
U	N	I	D
P	K	F	A

A. W
B. Q
C. S
D. X

19. There is a family of six persons, viz. A, B, C, D, E and F. They are lawyer, teacher, doctor, salesman, engineer and accountant. There are two married couples in the family. D, the salesman is married to the lady teacher. The doctor is married to the lawyer. F, the accountant, is the son of B and brother of E. C, the lawyer, is the daughter-in-law of A. E is the unmarried engineer. A is the grandmother of F. What is the profession of B?

A. Teacher
B. Doctor
C. Lawyer
D. Engineer

20. Which one of the following curves does not pass through the origin

A. $x = y$
B. $x^2 = 4ay$
C. $xy = 1$
D. $y^2 = 4ax$

PART B

21. If a magnetic needle is kept in a non-uniform magnetic field, it experiences

A. a force and a torque
B. a force but not a torque
C. a torque but not a force
D. an electric field also

22. Porosity in casting occurs due to which of the following reasons?
A. Temperature gradient and super-cooling
B. Gas evolution and shrinkage
C. Density difference and convection currents
D. Inoculation

23. Which of the following NDT techniques is suitable for detecting crack nucleation phenomena?
A. Radiography
B. Ultrasonography
C. Acoustic emission
D. Eddy current testing

24. Two samples P and Q of a brittle material have crack lengths in the ratio of 4:1. The ratio of fracture strength of P and Q measured normal to the crack will be
A. 1:4
B. 1:2
C. 2:1
D. 4:1

25. The process by which a screw dislocation may leave slip plane is called
A. Climb
B. Twin
C. Cross-slip
D. Diffusion

26. The volume of NH_3 formed when 100 ml of N_2 combined with 400 ml of H_2 (volume measured at NTP) as per the following equation is

$$N_2\,(g) + 3\,H_2\,(g) = 2\,NH_3\,(g)$$

A. 200 ml
B. 500 ml
C. 100 ml
D. 400 ml

27. If the H^+ concentrations, $[H^+]$ for three solutions are 4×10^{-4}, 1×10^{-7} and 4×10^{-10} M then the solutions are respectively,

A. Acidic, Acidic, Neutral
B. Acidic, Basic, Neutral
C. Basic, Neutral, Acidic
D. Acidic, Neutral, Basic

28. The type of point defect created in the host lattice by doping Al_2O_3 in MgO is

A. $Al_{Mg}^{\bullet}$
B. $Al_{Mg}^{'}$
C. $Mg_{Al}^{\bullet}$
D. $Mg_{Al}^{'}$

29. Pilling-Bedworth ratio, a good indicator of whether a metal oxide layer is protective is expressed as

A. $\frac{Molar\ volume\ of\ the\ metal}{Molar\ volume\ of\ the\ oxide}$
B. $\frac{Molar\ volume\ of\ the\ oxide}{Molar\ volume\ of\ the\ metal}$
C. $\frac{Thickness\ of\ the\ metal}{Thickness\ of\ the\ oxide}$
D. $\frac{Thickness\ of\ the\ oxide}{Thickness\ of\ the\ metal}$

30. Which of the following transformations can be considered as displacive transformation
A. Melting
B. Crystallisation
C. t-ZrO_2 to m-ZrO_2
D. Evaporation

31. For turbulent fluid flow in a pipe with radius 'r', the expression for Prandtl one seventh power law, describing the velocity 'V_x' at a distance 'x' from the wall w.r.t. the maximum centerline velocity 'V_{max}' is

A. $\frac{V_x}{V_{max}} = (\frac{x}{r})^{\frac{1}{7}}$
B. $\frac{V_x}{V_{max}} = (\frac{r}{x})^{\frac{1}{7}}$
C. $\frac{V_x}{V_{max}} = (x.r)^{\frac{1}{7}}$
D. $\frac{V_x}{V_{max}} = (x.r)^{-\frac{1}{7}}$

32. The minimum recommended baffle spacing in a shell (of diameter 'D') and tube heat exchanger is about
    A. 0.66D
    B. 0.20D
    C. 0.50D
    D. 0.80D

33. For a 'zero order reaction', concentration of product increases with
    A. Increase in reactant concentration
    B. Increase in reaction time
    C. Increase in total pressure
    D. Decrease in total pressure

34. Chemically, mullite refractory is
    A. $3Al_2O_3.2SiO_2$
    B. $2Al_2O_3.3SiO_2$
    C. $Al_2O_3.3SiO_2$
    D. $2Al_2O_3.SiO_2$

35. A capacitor in an RC circuit can be considered as fully charged after the
    A. Seventh time constant
    B. Fifth time constant
    C. Third time constant
    D. First time constant

36. The voltage at which the current starts to flow in a reverse biased p-n junction is known as
    A. Bias voltage
    B. Barrier potential
    C. Forward voltage
    D. Breakdown voltage

37. In order to produce a vacancy in a crystal, the bonds between atoms are broken by providing an energy of 4eV. If the coordination number of the atoms in the crystal is 8, then the breaking energy required per bond is
    A. 0.5 eV
    B. 0.1 eV
    C. 0.8 eV
    D. 2eV

38. The crystal structure of white Sn is
    A. BCC
    B. DC
    C. BCT
    D. FCC

39. If an ionic crystal is constituted by two different ions of the same radius then the coordination number in the ionic crystal is?

A. 3
B. 4
C. 6
D. 12

40. Frank-Read mechanism is related to the

A. Multiplication of vacancies in a crystal under stress
B. Annihilation of vacancies in a crystal under stress
C. Multiplication of dislocations in a crystal under stress
D. Annihilation of dislocations in a crystal under stress

41. $\frac{sin\theta+sin2\theta}{1+cos\theta+cos2\theta}=$

A. $\tan\theta$
B. $\cos\theta$
C. $\sin\theta$
D. $\cot\theta$

42. The probability of getting a total score of 7 when two unbiased dice are thrown simultaneously is

A. 7/36
B. 29/36
C. 5/6
D. 1/6

43. The minimum value of the quadratic expression, $x^2+2bx+c$, is

A. cb^2
B. c^2b
C. $c+b^2$
D. $c-b^2$

44. The eigen values of the matrix $\begin{bmatrix}1 & 4\\3 & 2\end{bmatrix}$ are

A. 1,4
B. 3,2
C. 5,-2
D. 4,2

45. A polycrystalline (BCC) material with a lattice parameter of 2.83Å was subjected to X-ray diffraction using a monochromatic X-ray beam. If the (110) reflection for this material appears at a 2θ value of 60°. The wavelength of the beam used is approximately

A. 0.2 nm
B. 0.15 nm
C. 0.1 nm
D. 2 nm

46. The specific heat capacity of diamond can be expressed as

$$C_p = 20.54 + 36.72 \times 10^{-3}T$$

C_p is in J/mol.K ; T in K

What would be the change in enthalpy when this sample is heated from room temperature (25°C) to 500°C?

A. 15.46 kJ/mol
B. 26.09 kJ/mol
C. 48.12 kJ/mol
D. 36.89 kJ/mol

47. Which of the following metal forming operations involves plane strain compression?

A. Cold rolling
B. Wire drawing
C. Stretch forming
D. Extrusion

48. Pearlite is obtained when carbon steel is

A. Quenched in oil
B. Cooled in still air
C. Slowly cooled in furnace
D. Quenched in water

49. If the dimension of matrix A is 2×3 and that of matrix B is 3×2, the dimension of the product matrix AB is

A. 6×6
B. 2×2
C. 3×2
D. 2×3

50. Which of the following metals deforms by twinning at room temperature

A. Fe
B. Cu
C. Ni
D. Mg

51. The radius and height of a cylinder are increased by 5% and 10% respectively, what is the % increase in the volume of the cylinder?

A. 18.4%
B. 21.4%
C. 33.4%
D. 44.4%

52. If $f(x) = 4x^3 + 3x^2 + 2x + 1$, value of $f''(2)$ =

A. 12
B. 54
C. 62
D. 78

53. A magnet of mass 0.072kg has a magnetic moment of 6×10^{-7} A/m^2. If the density of the magnet is 7200 kg/m^2, the intensity of magnetization is

A. 6 A/m
B. 60 A/m
C. 0.06 A/m
D. 0.072 A/m

54. The relative permeability of a paramagnetic substance is

A. Slightly less than unity
B. Slightly more than unity
C. Equal to unity
D. Equal to that of a ferromagnetic material

55. The incidence of which wavelength of electromagnetic radiation can cause the transition of electrons between two electronic states of energy difference 5eV?

A. 250 nm
B. 350 nm
C. 440 nm
D. 700 nm

University of Hyderabad

Entrance Examinations - 2019

Revised Key

School/Department/Centre : School of Engineering Sciences and Technology

Course/Subject : Ph.D. (Materials Engineering)

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

- Based on the revised key all students will receive the benefit for question 11

4/6/19

M. Thanashyam
4/6/19.