# ENTRANCE EXAMINATIONS, 2017
## QUESTION PAPER

## Ph. D. (Materials Engineering)

Marks: 80  (Ph. D Admission - January' 2018 Session)

Time: 2.00 hrs                     Hall Ticket no: [                    ]

I. Write 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 **two marks** each.
There is negative marking of **0.66** marks for every wrong answer.
The marks obtained by a candidate in this part will be used for resolving tie cases.

2. Part 'B':    It consists of 32 objective type questions of **1.25 marks** each.
There is negative marking of **0.25** marks for every wrong answer.

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:

$$\textbf{A} \qquad \textbf{B} \qquad \textbf{C} \qquad \bullet$$

4. No additional sheets will be provided. Rough work can be done in the question paper itself and rough work sheets provided at the end of the booklet.

5. Hand over the OMR answer sheet at the end of the examination.

6. Any type of calculators, Log tables and Mobile phones are NOT permitted inside the Examination Hall.

7. This book contains 10 pages including this cover sheet.

# PART A

1. The circumference of a unit circle is
    A. 1
    B. 2
    C. $\pi$
    D. $2\pi$

2. Pythagoras constant is
    A. $\sqrt{1}$
    B. $\sqrt{2}$
    C. 1
    D. 2

3. If L is any linear dimension in an object the volume V of the object scales as
    A. $L^{1/3}$
    B. $L^{2/3}$
    C. $L^3$
    D. L

4. If f(x) is a function that describes a moving body confined in a volume (V) defined by $-\infty$ to $\infty$, then the expression $\int_{-\infty}^{+\infty} |f(x)|^2 dV = \infty$ means that
    A. The body does not exist
    B. The body is everywhere simultaneously
    C. The body is at x=0
    D. The body is x =$\infty$

5. How many circles (each of diameter 1.8Å) can be put side by side (without any gap) on a straight line of length 1.98 nm?
    A. 11
    B. 110
    C. 1100
    D. 11000

6. In a system of moving and stationary bodies, if $1/10^{th}$ of them are moving towards the right, $2/5^{th}$ of them are moving towards the left and the remaining 100 of them are stationary then the number of bodies moving towards the right are?
    A. 50
    B. 40
    C. 400
    D. 200

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7. Which of the following is the standard form of a Gaussian integral?
   A. $\int_{-\infty}^{+\infty} e^{-x} dx = \sqrt{\pi}$
   B. $\int_{-\infty}^{+\infty} e^{x} dx = \sqrt{\pi}$
   C. $\int_{-\infty}^{+\infty} e^{-x^2} dx = \sqrt{\pi}$
   D. $\int_{-\infty}^{+\infty} e^{x^2} dx = \sqrt{\pi}$

8. Two different types of examinations are conducted for the same set of students in order to check the viability of replacing one examination with the other. If the results in the two different types of examinations are well correlated, then we have
   A. Face validity
   B. Predictive validity
   C. Concurrent validity
   D. Content validity

9. The findings in a experimental research are statistically significant with a statistical level set at 0.01. Which one of the following statements is correct?
   A. 99 %of the time, the outcome will be wrong
   B. The difference in the outcome is likely to be found 1 time or even less out of 100.
   C. The difference in the outcomes is likely to be found slightly more than 1 time out of 100.
   D. The difference in the outcome is likely to be found slightly more than 10 times out of 100.

10. If f(x) is a distribution function, the weighted average value is
    A. Mean
    B. Mode
    C. Most probable value
    D. Both B and C

11. If a complex number is conjugated twice, we get
    A. $\sqrt{}$original complex number
    B. (Original complex number) $^2$
    C. The original complex number itself
    D. (Original complex number) $^{1/5}$

12. Which of the following relations are binary
    A. "Is greater than" and "Is orthogonal to"
    B. "Divides" and "is adjacent to"
    C. "Is congruent to"
    D. All of the above

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13. The subset {3} of the set {3,4,5} is
    A. Not a member of the set {3,4,5} but 3 is the member of the set {3,4,5}
    B. A member of the set {3,4,5} but 3 is not the member of the set {3,4,5}
    C. A member of the set {3,4,5} and 3 is also a member of the set {3,4,5}
    D. Not a member of the set {3,4,5} and 3 is also not the member of the set{3,4,5}.

14. Every linear polynomial has
    A. Greater than one root
    B. Exactly "2" roots
    C. Only one root
    D. No roots at all

15. The next number in the series 97, 97, 84, 84, 71, 71, __?
    A. 68
    B. 58
    C. 48
    D. 38

16. What number should fill the blank in the series VIII, XI, ____, XVIII
    A. XV
    B. XVI
    C. XVII
    D. XIII

17. Simple linear regression involves
    A. Only one independent variable and only one dependent variable.
    B. Only one independent variable and exactly two dependent variables.
    C. Exactly two independent variables and only one dependent variable.
    D. At least one independent variable and more than one dependent variable.

18. In a question paper there are twelve questions in total out of which only six are to be answered. Six questions have one alternative each. Each question has four parts, only three of which are to be answered. How many questions including parts are there in the question paper?
    A. 48
    B. 24
    C. 96
    D. 72

19. Cube is related to square in the same way as square is related to
    A. Plane
    B. Line
    C. Triangle
    D. Point

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20. A family of six members P, Q, R, S, T and U. There are two married couples. Q is a doctor and father of T. U is the grandfather of R and is a contractor. S is the grandmother of T and is a housewife. There is one doctor, one contractor, one nurse, one housewife and two students in the family. Who is the husband of P?

   A. Q

   B. R

   C. U

   D. S

## PART B

21. Which of the following statements is correct (G is the Gibbs free energy, T is the temperature, S is the entropy, P is the pressure and n is the number of moles)?
    A. $(\partial G/\partial T)_{P,n} = -S$
    B. $(\partial G/\partial T)_{P,n} = S$
    C. $(\partial G/\partial T)_{P,n} = 1/S$
    D. $\partial G/\partial T)_{P,n} = -1/S$

22. In a single-component condensed system, if the degree of freedom is zero, then the maximum number of phases that can co-exist is.
    A. 0
    B. 1
    C. 2
    D. 3

23. With increasing carbon content, Ms temperature of a steel
    A. Decreases
    B. Increases
    C. Will not change
    D. First increases and then decreases

24. Materials having Hexagonal closed packed crystal structure are not very ductile at room temperature due to
    A. high dislocation density.
    B. limited number of slip systems.
    C. many slip systems.
    D. low dislocation density.

25. If a material has been subjected to two incremental true strains namely $\varepsilon 1$ and $\varepsilon 2$ then total true strain would be
    A. $\varepsilon 1 * \varepsilon 2$
    B. $\varepsilon 1 + \varepsilon 2$
    C. $\varepsilon 1 - \varepsilon 2$
    D. $\varepsilon 1 / \varepsilon 2$

26. Which one of the following elements will increase the stability of austenite phase?
    A. Nitrogen
    B. Molybdenum
    C. Vanadium
    D. Tungsten

27. Magnetic transformation in iron takes place at
    A. $723^0 C$
    B. $770^0 C$
    C. $920^0 C$
    D. $1050^0 C$

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28. The hot shortness in steels is caused by the presence of
    A. $Fe_3C$
    B. FeS
    C. MnS
    D. $Fe_2MnS$

29. Low angle tilt grain boundary is an array of
    A. Parallel edge dislocations
    B. Parallel screw dislocations
    C. Set of screw dislocations
    D. Disoriented grains

30. Cone of negative segregation can be found in the
    A. Bottom part of ingot
    B. Top part of ingot
    C. Middle part of ingot
    D. Edge of the Ingot

31. Massive transformation is sometimes referred to as
    A. Diffusional military transformation
    B. Diffusionless military transformation
    C. Diffusional civilian transformation
    D. Diffusionless civilian transformation

32. The number of nearest neighbours for octahedral sites in FCC or HCP materials is
    A. 12
    B. 8
    C. 6
    D. 4

33. Electrical steels are alloys of
    A. Fe -Si
    B. Fe-Al
    C. Fe-Mn
    D. Fe-Cr

34. If n is the index of refraction of medium between a point source and lens, relative to free space, then the resolution ($\delta$) in a perfect optical system is proportional to
    A. n
    B. $n^2$
    C. $1/n$
    D. $1/n^2$

35. Which of the following elements is not paramagnetic ?
    A. Re
    B. Tl
    C. Os
    D. Fr

36. Ferrite ceramics are
    A. Ferromagnetic
    B. Ferrimagnetic
    C. Antiferromagnetic
    D. Diamagnetic

37. The maximum densification of a ceramic body takes place in the
    A. final stage of sintering
    B. initial stage of sintering
    C. intermediate stage of sintering
    D. calcination stage

38. Which of the following is an example of an interstitial hydride
    A. Ammonia
    B. Palladium Hydride
    C. Sodium Hydride
    D. Aluminium Hydride

39. In a X-ray powder pattern of a simple cubic crystal the second peak corresponds to
    A. (100)
    B. (111)
    C. (110)
    D. (200)

40. Which one of the following is water insoluble
    A. Magnesium fluoride
    B. Beryllium fluoride
    C. Sodium fluoride
    D. Potassium fluoride

41. Which one of the following element is not used as a sacrificial anode for cathodic protection of buried steel pipelines?
    A. Zn
    B. Mg
    C. Cu
    D. Al

42. Metal at the top of electromotive series is,
    A. Most stable
    B. Least active
    C. Most Noble
    D. Most Active

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43. Galvanizing is the process of coating iron with
    A. Tin
    B. Zinc
    C. Copper
    D. Nickel

44. Which one of the following has the highest value of thermal conductivity?
    A. Copper
    B. Silver
    C. Diamond
    D. Gold

45. When a solid copper sphere is heated, the largest percentage increase will be in its
    A. Radius
    B. Mass
    C. Area
    D. Volume

46. A solution having a pH of 5 is less acidic than one having a pH of 2 by a factor
    A. 3
    B. 100
    C. 1000
    D. 300

47. If the bulk modulus of water is $2 \times 10^9$ N/m² then the pressure required to increase the volume of water by 0.1%, in N/m², is
    A. $2 \times 10^9$
    B. $2 \times 10^6$
    C. $2 \times 10^4$
    D. $2 \times 10^3$

48. Three unequal resistors are connected in parallel resulting in equivalent resistance of 1 ohm. If two of them are in the ratio 1: 2 and no resistance value is fractional, the largest of the three resistances in ohms is
    A. 2
    B. 3
    C. 4
    D. 6

49. Consider two similar magnets P and Q, each of magnetic moment M and pole strength m. If P is cut along its axial line and Q is cut along its equatorial line, then which of the following statements is true for the resulting four pieces so obtained
    A. The pole strength of each piece is m
    B. The pole strength of each piece is m/4
    C. The magnetic moment of each piece is M/2 ·
    D. The magnetic moment of each piece is M

50. In Young's double slit interference experiment if the wavelength of light used is 600 nm. If the path difference between waves reaching a point P on the screen is 1500 nm then at the point P the
    A. second order bright fringe occurs
    B. first order dark fringe occurs
    C. third order dark fringe occurs
    D. third order bright fringe occurs

51. The IUPAC name of $CH_3COOC_6H_4COOH$ is

    A. ethoxy propane
    B. 1,1- dimethyl ether
    C. 2- ethoxy benzoic acid
    D. 2-Acetoxybenzoic acid

52. If the acid hydrolysis of X yields two different compounds, then which one of the following is X
    A. $CH_3COOC_2H_5$
    B. $CH_3COOH$
    C. $CH_3CONH_2$
    D. $(CH_3CO)_2O$