# INSTITUTE OF ENGINEERING

# Model Entrance Exam

# (Set-4)

## Instructions:

There are 100 multiple-choice questions, each having four choices of which only one choice is correct.

**Date: 2080/03/09**                                      **Duration: 2 hours**
   **(June-24)**                                          **Time: 8 AM – 10 AM**

## Section-A (1 marks)

1) A majority of us _____ in the elections.
   a) have voted        b) are voting        c) has voted        d) were voting
2) They shouldn't risk _____ so fast.
   a) to drive          b) driving           c) for driving      d) drive
3) The movie on television _____ at 2 o'clock in the afternoon today.
   a) begins            b) began             c) had began        d) is beginning
4) He talked about the competition as if he _____ part in it.
   a) had taken         b) took              c) takes            d) has taken
5) The Prime Minister has full command _____ the army.
   a) over              b) of                c) off              d) at
6) Fulminate (Synonym):
   a) gather            b) oppose strongly   c) fumble           d) favour strongly
7) Tremulous (Antonym):
   a) quick             b) steady            c) shaky            d) quiver
8) Convert the following simple sentence into compound sentence:
   "Besides being rude, he was also arrogant."
   a) He was rude and arrogant.              b) He was not only rude but also arrogant.
   c) He was being rude and arrogant.        d) He was not only arrogant but also rude.
9) She handles all tasks efficiently.
   a) All tasks are handled efficiently by her.
   b) All tasks were handled efficiently by her.
   c) All tasks have been handled efficiently by her.
   d) All tasks are being handled efficiently by her.
10) To have a bash at something means _____.
   a) to be secretive   b) to hesitate       c) to attempt       d) to quarrel constantly
11) The phonetic transcription of the word 'journey' is:
   a) /dʒrni/           b) /dʒrni/           c) /jɜːrni/         d) /dʒɜːni/
12) The correct grammatical pattern of the given sentence is:
   "I kept a copy of the letter in my desk.'
   a) S + V + C         b) S + V + O         c) S + V + A        d) S + V + O + A
13) In the electrolysis of NaCl solution for the manufacture of NaOH, the ion discharged at cathode is:
   a) $Na^+$            b) $Cl^-$            c) $H^+$            d) $O^{2-}$
14) The central atom in a molecule is in $sp^2$ hybrid state. The shape of molecule will be:
   a) pyramidal                              b) tetrahedral
   c) octahedral                             d) trigonal planar
15) Maximum number of electrons in a subshell with $l = 3$ and $n = 4$ is:
   a) 14                b) 6                 c) 10               d) 2
16) Molarity of liquid HCl, if density of solution is 1.17 g/cc is:
   a) 36.5              b) 18.25             c) 32.05            d) 42.10
17) The strongest conjugate base is:
   a) $NO_3^-$          b) $Cl^-$            c) $SO_4{}^{2-}$    d) $CH_3COO^-$
18) The electronic configuration of an element is $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$. What is the atomic number of the element, which is present just below the above element in the periodic table?
   a) 33                b) 34                c) 36               d) 49
19) The oxidation state of 'P' in H₄P₂O₆ is:
   a) +3                b) +4                c) +5               d) -3
20) Pure nitrogen is prepared in the laboratory by heating a mixture of:
   a) NH₄OH + NaCl                           b) NH₄NO₃ + NaCl
   c) NH₄Cl + NaOH                           d) NH₄Cl + NaNO₂

21) The method used to remove temporary hardness of water is:
a) Clark's method
b) Ion-exchange method
c) Synthetic resins method
d) Calgon's method

22) The Lassaigne's extract is boiled with conc. $HNO_3$ while testing for halogens. By doing so it:
a) helps in the precipitation of AgCl
b) increases the solubility product of AgCl
c) increases the concentration of $NO_3^-$ ions
d) decomposes $Na_2S$ and NaCN, if formed

23) Liquid hydrocarbons can be converted to a mixture of gaseous hydrocarbons by:
a) oxidation
b) cracking
c) distillation under reduced pressure
d) hydrolysis

24) Out of the following, the only pair that does not have identical dimensions is:
a) angular momentum and Planck's constant
b) moment of inertia and moment of a force
c) work and torque
d) impulse and momentum

25) Which of the following is not a scalar quantity?
a) Temperature
b) Coefficient of friction
c) Charge
d) Impulse

26) The relation $\vec{F} = m\vec{a}$ cannot be deduced from Newton's second law if:
a) force depends on time
b) momentum depends on time
c) acceleration depends on time
d) mass depends on time

27) The direction of angular velocity vector is along:
a) the tangent to the circular path
b) the inward radius
c) the outward radius
d) the axis of rotation

28) If the Earth stops rotating, the value of acceleration due to gravity at the equator:
a) increase
b) decrease
c) remains same
d) cannot be determined

29) A solid sphere falls with a terminal velocity v in air. If it is allowed to fall in vacuum, then:
a) terminal velocity of sphere = v
b) terminal velocity of sphere < v
c) terminal velocity of sphere > v
d) sphere never attains terminal velocity

30) A gas in an airtight container is heated from 25 °C to 90 °C. The density of gas will:
a) increase slightly
b) increase considerably
c) remain same
d) decrease slightly

31) If a gas is compresses adiabatically by doing work of 150 J, the change in internal energy of the gas is:
a) 100 J          b) 150 J          c) -100 J          d) -150 J

32) The frequency of a tuning fork is 256 Hz. It will not resonate with a fork of frequency:
a) 768 Hz          b) 738 Hz          c) 512 Hz          d) 256 Hz

33) What will happen when we rub a glass rod with silk cloth?
a) some of the electrons from the glass rod are transferred to the silk cloth.
b) the glass rod gets negative charge and silk cloth gets positive charge.
c) new charges are created in the process of rubbing.
d) both a and b are correct.

34) The deflection in a moving coil galvanometer is:
a) directly proportional to the torsional constant of the spring
b) independent of the torsional constant of the spring
c) inversely proportional to the area of coil
d) directly proportional to the number of turns in the coil

35) Some electric bulbs are connected in series across a 220 V supply in a room. If one bulb is fused then remaining bulbs are connected again in series across the same supply. The illumination in the room will:
a) increase          b) decrease          c) remains same          d) not be continuous

36) A solenoid is connected to a battery so that a steady current flows through it. If an iron core is inserted into the solenoid, the current will:
a) increase        b) decrease        c) remains same        d) first increase then decrease

37) Which of the following electromagnetic waves has smallest wavelength?
a) X-rays        b) Microwaves        c) $\gamma$-rays        d) Radiowaves

38) Critical angle of light passing from glass to air is minimum for:
a) red light        b) yellow light        c) green light        d) violet light

39) Young's double slit experiment uses a monochromatic source of light. The shape of interference fringes formed on the screen is:
a) parabola        b) straight line        c) circle        d) hyperbola

40) Silicon is a semiconductor. If a small amount of As is added to it, then its electrical conductivity:
a) decreases        b) increases
c) remains unchanged        d) becomes zero

41) If $\sin^{-1}\left(\frac{5}{x}\right) + \sin^{-1}\left(\frac{12}{13}\right) = \frac{\pi}{2}$, then $x =$
a) 12        b) 14        c) 10        d) 13

42) In a triangle ABC, if $\angle A = 30°, b = 8, a = 6$ and $B = \sin^{-1} x$, then x is equal to:
a) 1        b) 1/2        c) 1/3        d) 2/3

43) The number of solutions of $\cos x = |1 + \sin x|, 0 \le x \le 3\pi$ is:
a) 3        b) 2        c) 4        d) 1

44) If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a} + \vec{b} - \vec{c} = 0$, then the angle between $\vec{a}$ and $\vec{b}$ is:
a) $\pi/6$        b) $\pi/3$        c) $\pi/2$        d) $2\pi/3$

45) If the sum of roots of the equation $(a + 1)x^2 + (2a + 3)x + 3a + 4 = 0$ is -3, then the product of roots is:
a) 1        b) 4        c) 3        d) -2

46) $\sum_{n=0}^{\infty} \frac{x^{2n+1}}{(2n+1)!} =$
a) $\sin hx$        b) $\cos hx$        c) $e^x + e^{-x}$        d) $\tan hx$

47) If a, b, c, d, e, f are in A.P., then e-c equals:
a) 2(c-a)        b) 2(d-c)        c) 2(f-d)        d) 2d-c

48) The imaginary part of $\frac{(1+i)^2}{i(2i-1)}$ is:
a) 4/5        b) 0        c) 2/5        d) -4/5

49) Total number of ways in which six '+' and four '-' signs can be arranged in a line such that no two '-' signs occur together is:
a) 35        b) 18        c) 15        d) 42

50) The domain of $\sin^{-1}\left(\frac{2x+1}{3}\right)$ is:
a) [-1, 1]        b) [-2, 1]        c) R        d) $[0, \infty]$

51) If A and B are two sets, then $A \cap (B \cup A)^c$ is equal to:
a) A        b) B        c) $\phi$        d) A-B

52) $\lim_{x \to 0} x \, logx$ equals:
a) e        b) 1/e        c) 1        d) 0

53) If $u = \sin^{-1}(x - y)$, where $x = 3t, y = 4t^3$, then $\frac{du}{dt} =$
a) $\frac{1}{t^2-1}$        b) $t^2 - 1$        c) $\frac{3}{\sqrt{1-t^2}}$        d) $\frac{2}{\sqrt{1-t^2}}$

54) The tangent to a given curve is perpendicular to x-axis if:
a) $\frac{dy}{dx} = 0$        b) $\frac{dy}{dx} = 1$        c) $\frac{dx}{dy} = 0$        d) $\frac{dx}{dy} = 1$

55) $\int_{\pi/6}^{\pi/3} \frac{dx}{\sin 2x} =$
a) $\frac{1}{2}\log 10$        b) $\log 3$        c) $\log \sqrt{3}$        d) $\log \sqrt{2}$

56) The slope of the line joining two points on the curve $y = x^2 + 2x$ with abscissae 1 and 3 is:
     a) 6                 b) 5                 c) 4                 d) 3

57) The area of portion of the circle $x^2 + y^2 - 4y = 0$ lying below x-axis is:
     a) 0                 b) $2\pi$              c) $3\pi$              d) $4\pi$

58) Vertex of parabola $x^2 + 2y = 8x - 7$ is:
     a) $\left(\frac{9}{2}, 0\right)$          b) $\left(4, \frac{9}{2}\right)$          c) $\left(2, \frac{9}{2}\right)$          d) $\left(4, \frac{7}{2}\right)$

59) The equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ represents a vertical ellipse if:
     a) $a^2 = b^2$          b) $a^2 < b^2$          c) $a^2 > b^2$          d) $a^2 = 2b^2$

60) If a line joining the points (a, 1, 2) and (0, -1, 3) is perpendicular to the line joining points (1, b, 3) and (3, 0, 5), then a-b is equal to:
     a) 1                 b) -1                c) 2                d) -2

# Section-B (2 marks)

Read the following passages and answer the questions given below.

During last year's Christmas period, shops had less than half the number of visitors they had experienced just three years before. This drop demonstrates a fundamental shift in the way people are now shopping and buying.

Whilst there were concerns about online trading in the early days, this has declined now and as confidence in the internet continues to grow and grow, so too does online shopping. Consumers have busy lives and they are only getting busier. They have less time to visit the shops as they traditionally did. Whilst a trip to the shops is still regarded by many as an enjoyable past-time, it is also regarded as a luxury. By shopping online, consumers can shop when it suits them and can also use price comparison and review websites to ensure they are getting the best deal.

61) Which of the following would best replace the word 'fundamental' in the second sentence?
     a) declining                               b) major
     c) worrying                               d) trending

62) Which of the following statement best describes the trend in online shopping?
     a) At first, consumers thought it a great idea, but since then, they have become less sure.
     b) Consumers cannot decide whether they prefer online or traditional shopping.
     c) People have been forced to shop online in order to grab the best bargains.
     d) People were initially wary about online shopping, but are more confident now.

63) Which of the following statements can be inferred from the passage? People now regard internet shopping as _____:
     a) A way to fit more into their busy lives.     b) An easier way to buy luxury goods.
     c) An expensive but useful way to shop.      d) A way to avoid the Christmas crowds.

64) Which of the following statement is false, based on the information in the passage?
     a) There appear to have been very few changes in the way people shop in the last few years.
     b) There are still many people who enjoy taking a trip to the shops nowadays.
     c) Price comparison websites can help shoppers research where the best deals are.
     d) Shopping online creates opportunities to shop at a time that suits you.

65) 25 mL of N/10 caustic soda solution exactly neutralizes 20 mL of an acid solution containing 7.875 g of acid per litre. The equivalent mass of the acid is:
     a) 49                 b) 63                c) 126              d) 98

66) When 10 g of 90% pure limestone is heated, the volume of $CO_2$ (in litre) liberated at STP is:
     a) 22.4 L             b) 2.24 L            c) 20.16 L          d) 2.016 L

67) The pH of a buffer solution prepared by adding 10 mL of 0.1 M $CH_3COOH$ and 20 mL of 0.1 M sodium acetate will be ($pK_a$ of $CH_3COOH = 4.74$):
   a) 4.74          b) 3.4          c) 5.04          d) 9.26

68) Amongst the elements with following electronic configurations, which one may have the highest ionization energy?
   a) $[Ne]3s^2 3p^3$          b) $[Ne]3s^2 3p^2$
   c) $[Ar]3d^{10}4s^2 4p^3$          d) $[Ne]3s^2 3p^1$

69) Which amongst the following is the most stable carbocation?

   a) $CH_3 - \overset{+}{\underset{\underset{CH_3}{|}}{C}} - H$          b) $CH_3 - \overset{+}{\underset{\underset{CH_3}{|}}{C}} - CH_3$

   c) $\overset{+}{CH_3}$          d) $CH_3\overset{+}{C}H_2$

70) The IUPAC name of the organic compound is:

$$CH_3 - \underset{\underset{OH}{|}}{CH} - CH_2 - \underset{\underset{CH_3}{|}}{CH} - \overset{\overset{O}{\|}}{C} - H$$

   a) 4-hydroxy-1-methyl-pentanal          b) 4-hydroxy-2-methyl-pentanal
   c) 3-hydroxy-2-methyl-pentanal          d) 3-hydroxy-3-methyl-pentanal

71) An electrolytic cell contains a solution of $Ag_2SO_4$ and have platinum electrodes. A current is passed until 1.6 gm of $O_2$ has been liberated at anode. The amount of silver deposited at cathode would be:
   a) 107.88 g          b) 1.6 g          c) 0.8 g          d) 21.60 g

72) In a triangle ABC, $3\sin A = 6\sin B = 2\sqrt{3}\sin C$, then angle A is:
   a) 30°          b) 60°          c) 90°          d) 120°

73) If sum of coefficients in the expansion of $(1 - 3x + 10x^2)^n$ is p and that in the expansion of $(1 + x^2)^n$ is q, then:
   a) $q = p^3$          b) $p = q^3$          c) $p = q$          d) $q = 3p$

74) Three number are in GP. If we double the middle term, we get an AP. The, the common ratio of GP equals:
   a) $2 \pm \sqrt{3}$          b) $3 \pm \sqrt{2}$          c) $3 \pm \sqrt{5}$          d) $5 \pm \sqrt{3}$

75) The value of k for which the set of equations $3x + ky - 2z = 0$, $x + ky + 3z = 0$ and $2x + 3y - 4z = 0$ has a non-trivial solution is:
   a) 15          b) 16          c) $\frac{31}{2}$          d) $\frac{33}{2}$

76) The polar form of the complex number $i + \sqrt{3}$ is:
   a) $\frac{1}{\sqrt{2}}\left(\sin\frac{\pi}{6} + i\cos\frac{\pi}{6}\right)$          b) $2\left(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6}\right)$
   c) $\frac{1}{2}\left(\sin\frac{\pi}{6} + i\cos\frac{\pi}{6}\right)$          d) $4\left(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6}\right)$

77) Let $f: N \to N$ be defined by $f(x) = 2x$, for all $x \in N$, where N is the set of natural numbers, then $f$ is:
   a) one to one          b) one to one and onto
   c) into          d) one to one but not onto

78) The value of $\lim\limits_{x \to 0} \frac{\tan x - \sin x}{x^3}$ is equal to:
   a) $\frac{1}{2}$          b) $\frac{1}{3}$          c) $\frac{1}{4}$          d) $\frac{1}{5}$

79) If $x^y = e^{x-y}$, then $\frac{dy}{dx} =$
   a) $\frac{y}{(1+\log x)^2}$          b) $\frac{x}{(1+\log x)^2}$          c) $\frac{(1+\log x)^2}{\log x}$          d) $\frac{\log x}{(1+\log x)^2}$

80) $\int_0^1 \frac{1}{(x^2+1)^{3/2}} dx =$

a) $\frac{1}{2}$          b) $\frac{1}{\sqrt{2}}$          c) 1          d) $\sqrt{2}$

81) Gas is escaping from a spherical balloon at the rate of 2 cc/min, when the radius is 12 cm, then the surface area is decreasing at the rate of:

a) $3\ cm^2/min$      b) $6\ cm^2/min$      c) $4\ cm^2/min$      d) $\frac{1}{3}\ cm^2/min$

82) The area in square units of the region bounded by the curve $x^2 = 4y$, the line $x = 2$ and x-axis is:

a) 1          b) 2/3          c) 4/3          d) 8/3

83) If the line pairs $ax^2 + 2hxy + by^2 = 0$ and $a'x^2 + 2h'xy + b'y^2 = 0$ have same bisector, then:

a) $h(ab) = h'(a'b')$          b) $h(a - b) = h'(a' - b')$
c) $h^2(ab) = h'(a^2b^2)$          d) $h(a' - b') = h'(a - b)$

84) The equation of the circle concentric with circle $x^2 + y^2 - 2x - 4y + 7 = 0$ and passing through the point (3, 4) is:

a) $x^2 + y^2 - 2x + 4y - 3 = 0$          b) $x^2 + y^2 + 2x + 4y + 9 = 0$
c) $x^2 + y^2 + 2x - 4y + 9 = 0$          d) $x^2 + y^2 - 2x - 4y - 3 = 0$

85) The equation of the ellipse with its centre at (0, 3), directrix parallel to x-axis, the major axis 12 and eccentricity 1/2 is:

a) $\frac{x^2}{36} + \frac{(y-3)^2}{27} = 1$          b) $\frac{x^2}{27} + \frac{(y-3)^2}{36} = 1$
c) $\frac{x^2}{36} + \frac{y^2}{27} = 1$          d) $\frac{(x-3)^2}{27} + \frac{y^2}{36} = 1$

86) If the plane $2x - 3y + 6z - 11 = 0$ makes an angle $\sin^{-1}(\lambda)$ with the X-axis, then $\lambda$ is equal to:

a) $\sqrt{3}/5$      b) $\sqrt{2}/3$      c) 2/7      d) $5/\sqrt{3}$

87) A body starts from rest with an acceleration a₁. After 2 seconds, another body B starts from rest with an acceleration a₂. If they travel equal distances in the $5^{th}$ second, after the start of A, then the ratio a₁:a₂ is equal to:

a) 5:9          b) 5:7          c) 9:5          d) 9:7

88) A hiker stands on the edge of a cliff 490 m above the ground and throws a stone horizontally with a speed of 15 ms⁻¹. The time taken by the stone to reach the ground is:

a) 5 s          b) 10 s          c) 12 s          d) 15 s

89) A ball falls under gravity from a height of 10 m with an initial downward velocity u. It collides with the ground, losses 50% of its energy in collision and then rises back to the same height. The initial velocity u (in m/s) is:

a) 7          b) 25          c) 14          d) 28

90) The surface tension of a soap solution at a temperature 20°C is $2.5 \times 10^{-2}\ Nm^{-1}$. The excess pressure (in Pa) inside a bubble of soap solution of radius 6 mm is:

a) 12.5          b) 14.2          c) 15.5          d) 16.7

91) The volume of a metal sphere increases by 0.24% when its temperature is raised by 40°C. The coefficient of linear expansion of the metal is:

a) $2 \times 10^{-5\circ}C^{-1}$     b) $6 \times 10^{-5\circ}C^{-1}$     c) $18 \times 10^{-5\circ}C^{-1}$     d) $1.2 \times 10^{-5\circ}C^{-1}$

92) 1 mole of gas expands isothermally at 37°C. The amount of heat absorbed by it until its volume is doubled is $(R = 8.31\ Jmol^{-1}K^{-1})$:

a) 411.25 cal      b) 418.50 cal      c) 420.25 cal      d) 425.40 cal

93) The acceleration due to gravity on the surface of the moon is $1.7\ ms^{-2}$. The time period of a simple pendulum on the moon if its time period on the earth is 3.5 s is:

a) 2.2 s          b) 4.4 s          c) 8.4 s          d) 16.8 s

94) The equation of a wave is given by $y = 10\sin\left(\frac{2\pi}{45}t + \alpha\right)$. If the displacement is 5 cm at $t = 0$, then the total phase at $t = 7.5\ s$ is:

a) $\pi/3$          b) $\pi/2$          c) $\pi/6$          d) $\pi$

95)     A capacitor of capacitance $C_1$ is charged to a potential V and then connected in parallel to an uncharged capacitor of capacitance $C_2$. The final potential difference across each capacitor will be:

a) $\frac{C_1 V}{C_1 + C_2}$          b) $\frac{C_2 V}{C_1 + C_2}$          c) $1 + \frac{C_2}{C_1}$          d) $1 + \frac{C_2}{C_1}$

96)     When a current of 2 A flows in a battery from negative to positive terminal, the potential difference across it is 12 V. If a current of 3 A flowing in the opposite direction produces a potential difference of 15 V, the emf of the battery is:

a) 12.6 V          b) 13.2 V          c) 13.5 V          d) 14.0 V

97)     The vertical component of Earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component, the value of angle of dip at this place is:

a) 30°          b) 45°          c) 60°          d) 90°

98)     An alternating supply of 220 V is applied across a circuit with resistance 22 Ω and impedance 44 Ω. The power dissipated in the circuit is:

a) 1100 W          b) 550 W          c) 2200 W          d) (2200/3) W

99)     A concave lens is placed in contact with a convex lens of focal length 25 cm. The combination produces a real image at a distance of 80 cm. If an object is at a distance of 40 cm, the focal length of concave lens is:

a) -400 cm          b) -200 cm          c) +400 cm          d) +200 cm

100)    The threshold frequency of a certain metal is $3.3 \times 10^{14}$ Hz. If light of frequency $8.2 \times 10^{14}$ Hz is incident on the metal, then the cut-off voltage for photoelectric emission is:

a) 2 V          b) 4 V          c) 6 V          d) 8 V

Thank You!!!!!!