



INSTITUTE OF ENGINEERING

Model Entrance Exam

(Set-3)

Instructions:

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

- 36) Which has maximum molecules?
 a) 7 g N₂ b) 16 g O₂ c) 2 g H₂ d) 16 g NO₂
- 37) The value of n and l for the last electron of Fe³⁺ is:
 a) 2 and 3 b) 3 and 3 c) 3 and 2 d) 4 and 2
- 38) The highest oxidation state of Mn is shown by:
 a) K₂MnO₄ b) KMnO₄ c) MnO₄²⁻ d) Mn₂O₂
- 39) The conjugate acid of HPO₄²⁻ is:
 a) H₂PO₄⁻ b) PO₄³⁻ c) H₂PO₄ d) H₃PO₃
- 40) Solubility of salt M₂X₃ is x molL⁻¹. The solubility product of the salt will be:
 a) x⁵ b) 16x² c) 96x⁵ d) 108x⁵
- 41) In ΔABC, right angle at C, tan A + tan B =
 a) $\frac{b^2}{ac}$ b) a + b c) $\frac{a^2}{bc}$ d) $\frac{c^2}{ab}$
- 42) The least value of 4sin²θ + 5cos²θ is:
 a) 1 b) 2 c) 4 d) 5
- 43) If cos⁻¹(2x² - 1) + 2 cos⁻¹ x = 360°, then x lies in the interval:
 a) [0, 1] b) $[\frac{1}{2}, \frac{1}{4}]$ c) [-1, 0] d) $[-1, -\frac{1}{2}]$
- 44) If $\vec{a} + \vec{b} + \vec{c} = 0$, then the angle between \vec{b} and \vec{c} is given by:
 a) $\cos \theta = \frac{a^2 - b^2 - c^2}{2bc}$ b) $\cos \theta = \frac{b^2 + c^2 - a^2}{2bc}$
 c) $\cos \theta = \frac{a^2 + b^2 - c^2}{2ab}$ d) $\cos \theta = \frac{a^2 + c^2 - b^2}{2ac}$
- 45) If a, b are the roots of the equation x² - px + q = 0, then $\frac{1}{a} + \frac{1}{b} =$
 a) $\frac{1}{p}$ b) $\frac{1}{q}$ c) $\frac{1}{2p}$ d) $\frac{p}{q}$
- 46) If $x = 1 + \frac{1}{1!} + \frac{4}{2!} + \frac{8}{3!} + \dots$, then x⁻¹ is equal to:
 a) \sqrt{e} b) e² c) e⁻² d) e⁻¹
- 47) The nth term of a GP is 128 and the sum of its n terms is 255. If its common ratio is 2, then its first term is:
 a) 1 b) 2 c) 3 d) 4
- 48) The complex number $\frac{1+2i}{1-i}$ lies in:
 a) first quadrant b) second quadrant c) third quadrant d) fourth quadrant
- 49) If A and B are square matrices such that AB = B and BA = A, then A² + B² is equal to:
 a) 2AB b) 2BA c) A + B d) AB
- 50) If $f(x) = \frac{1-x}{1+x}$, then f[f(cos 2θ)] =
 a) tan 2θ b) sec 2θ c) cos 2θ d) cot 2θ
- 51) Which one of the following is a void set?
 a) A = {x: x ∈ R, x² - 1 = 0} b) B = {x: x ∈ R, x² + 1 = 0}
 c) C = {x: x ∈ R, x² - 9 = 0} d) D = {x: x ∈ R, x² = x + 2}
- 52) $\lim_{x \rightarrow 1} (1-x) \tan \frac{\pi x}{2} =$
 a) $\frac{\pi}{2}$ b) $\frac{2}{\pi}$ c) π d) $\frac{1}{\pi}$
- 53) If y = x + e^x, then $\frac{d^2y}{dx^2} =$
 a) y - x b) x/y c) y/x d) x - y
- 54) x³ - 3x² + 6x + 7 has:
 a) a maximum but no minima b) a minima but no maxima
 c) both maxima and minima d) no maxima and no minima

- 55) $\int_0^\pi \cos^3 x \, dx =$
 a) -1 b) 0 c) 1 d) π
- 56) If a line with y-intercept 2 is perpendicular to the line $3x - 2y = 6$, then its x-intercept is:
 a) 1 b) 2 c) 3 d) 4
- 57) If the circles $x^2 + y^2 + ax + 1 = 0$ and $x^2 + y^2 - 3x + y + 5 = 0$ intersect orthogonally, the value of a is:
 a) -4 b) 4 c) -2 d) 2
- 58) If $(\pm 1, 0)$ and $(\pm 2, 0)$ are respectively the foci and vertices of an ellipse, then the length of its minor axis is:
 a) 2 b) 4 c) $2\sqrt{3}$ d) $2\sqrt{5}$
- 59) The eccentricity of the hyperbola whose asymptotes are $3x + 4y = 2$ and $4x - 3y + 5 = 0$ is:
 a) 1 b) 2 c) $\sqrt{2}$ d) 3
- 60) Dc's of line joining points $(4, 3, -5)$ and $(-2, 1, -8)$ are:
 a) 6, 2, 3 b) 2, 4, -13 c) $6/7, 2/7, 3/7$ d) $5/12, 7/12, 11/12$

Section-B (2 marks)

Read the following passages and answer the questions given below.

An earthquake comes like a thief in the night, without warning. It was necessary, therefore to invent instruments that neither slumbered nor slept. Some devices were quite simple. One, for instance, consisted of rods of various lengths and thicknesses which would stand up on end like ninepins. When a shock came it shook the rigid table upon which these stood. If it were gentle, only the more unstable rods fell. If it were severe, they all fell. Thus, the rods by falling and by the direction in which they fell, recorded for the slumbering scientist, the strength of a shock that was too weak to waken him and the direction from which it came. But, instruments far more delicate than that were needed if any really serious advance was to be made.

The ideal to be aimed at was to devise an instrument that could record with a pen on paper the movements, of the ground or of the table, as the quake passed by. While I write my pen moves but the paper keeps still. With practice, no doubt, I could, in time, learn to write by holding the pen still while the paper moved. That sounds a silly suggestion, but that was precisely the idea adopted in some of the early instruments (seismometers) for recording earthquake waves. But when table, penholder and paper are all moving how is it possible to write legibly? The key to a solution of that problem lay in an everyday observation. Why does a person standing in a bus or train tend to fall when a sudden start is made? It is because his feet move on, but his head stays still.

- 61) Why was it necessary to invent instruments to observe an earthquake?
 a) Because the earthquake comes like a thief in the night
 b) To make people alert about earthquake during their conscious as well as unconscious hours
 c) To prove that we are technically advanced
 d) To experiment with the control of man over nature
- 62) A simple device which consisted of rods that stood up on end like ninepins was replaced by a more sophisticated one because it failed:
 a) to measure a gentle earthquake b) to measure a severe earthquake
 c) to record the direction of earthquake d) to record the facts with a pen or paper
- 63) The everyday observation referred to in the passage relates to:
 a) a moving bus or train
 b) the sudden start of a bus
 c) the tendency of a standing person to fall when a bus or train moves suddenly
 d) people standing in a bus or train

- 64) The early seismometers adopted the idea that in order to record the earthquake, it is:
a) the pen that should move just as it moves when we write on paper
b) the pen that should stay still and the paper should move
c) both pen and paper that should move
d) neither pen nor paper that should move
- 65) A 175 m long train is travelling along a straight track with a velocity of 72 km/hr. A bird is flying parallel to the train in opposite direction with a velocity 18 km/hr. The time taken by the bird to cross the train is:
a) 35 s b) 27 s c) 11.6 s d) 7 s
- 66) A solid cylinder of mass 20 kg and radius 20 cm rotates about its axis with an angular speed of 100 rad s⁻¹. The angular momentum of the cylinder about its axis is:
a) 40 J s b) 400 J s c) 20 J s d) 200 J s
- 67) A block of wood floats in water with $\left(\frac{4}{5}\right)^{th}$ of its volume submerged. If the same block just floats in a liquid, the density of the liquid (in kg m⁻³) is:
a) 1250 b) 600 c) 400 d) 800
- 68) A body of mass 20 g connected to a spring of spring constant k, executes simple harmonic motion with a frequency of $(5/\pi)$ Hz. The value of spring constant is:
a) 4 N m⁻¹ b) 3 N m⁻¹ c) 2 N m⁻¹ d) 5 N m⁻¹
- 69) A policeman blows a whistle with a frequency of 500 Hz. A car approaches him with a velocity of 15 ms⁻¹. The change in frequency as heard by the driver of the car as he passes the policeman is:
(Given, speed of sound in air is 300 ms⁻¹)
a) 25 Hz b) 50 Hz c) 100 Hz d) 150 Hz
- 70) 10 g of ice at 0°C is mixed with 100 g of water at 50°C in a calorimeter. The final temperature of the mixture is:
a) 31.2 °C b) 32.8 °C c) 36.7 °C d) 38.2 °C
- 71) The fall in temperature of helium gas initially at 20°C when it is suddenly expanded to 8 times its original volume is ($\gamma = \frac{5}{3}$):
a) 70.25 K b) 71.25 K c) 72.25 K d) 73.25 K
- 72) A conducting sphere of radius 10 cm has unknown charge. If the electric field at a distance 20 cm from the centre of the sphere is 1.2×10^3 NC⁻¹ and points radially inwards. The net charge on the sphere is:
a) -4.5×10^{-9} C b) 4.5×10^{-9} C c) -5.3×10^{-9} C d) 5.3×10^{-9} C
- 73) In a potentiometer, a cell of emf 1.5 V gives a balanced point at 32 cm length of the wire. If the cell is replaced by another cell, then the balance point shifts to 65 cm, then the emf of second cell is:
a) 3.05 V b) 2.05 V c) 4.05 V d) 6.05 V
- 74) A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.35 T experiences a torque of magnitude equal to 4.5×10^{-2} Nm. The magnitude of magnetic moment of the given magnet is:
a) 26 JT⁻¹ b) 2.6 JT⁻¹ c) 0.26 JT⁻¹ d) 0.026 JT⁻¹
- 75) A 0.2 kΩ resistor and 15 μF capacitor are connected in series to a 220 V, 50 Hz ac source. The impedance of the circuit is:
a) 250 Ω b) 268 Ω c) 29.15 Ω d) 291.5 Ω
- 76) Light from a point source in air falls on a spherical glass surface whose radius of curvature and refractive index are 20 cm and 1.5 respectively. If the distance of light source from the glass surface is 100 cm, at what position image will be formed?
a) 25 cm b) 50 cm c) 100 cm d) 200 cm
- 77) A screen is placed 50cm from a single slit which is illuminated with light of wavelength 6000 Å. If the distance between the first and third minima in the diffraction pattern is 3.00 mm. The width of the slit is:
a) 1×10^{-4} m b) 2×10^{-4} m c) 0.5×10^{-4} m d) 4×10^{-4} m

- 95) $\int \frac{dx}{e^x + e^{-x+2}} =$
a) $\frac{1}{e^{x+1}} + c$ b) $\frac{-1}{e^{x+1}} + c$ c) $\frac{2}{e^{x+1}} + c$ d) $\frac{-2}{e^{x+1}} + c$
- 96) The area enclosed within the curve $|x| + |y| = 1$ is:
a) 1 b) $2\sqrt{2}$ c) $\sqrt{2}$ d) 2
- 97) If one of the lines given by $ax^2 + 2hxy + by^2 = 0$ passes through (2,3) and the other passes through (4,5), then $a + 2h + b$ is equal to:
a) 0 b) 1 c) 2 d) -1
- 98) The equation of circle concentric to the circle $2x^2 + 2y^2 - 3x + 6y + 2 = 0$ and having area double the area of this circle is:
a) $8x^2 + 8y^2 - 24x + 48y - 13 = 0$ b) $16x^2 + 16y^2 + 24x - 48y - 13 = 0$
c) $16x^2 + 16y^2 - 24x + 48y - 13 = 0$ d) $8x^2 + 8y^2 + 24x - 48y - 13 = 0$
- 99) If $x + y - a = 0$ is a tangent to the parabola $y^2 - y + x = 0$, then its point of contact is:
a) $(a, 0)$ b) $(1, 0)$ c) $(0, 1)$ d) $(0, -1)$
- 100) If the product of distance of point $(1, 2, -1)$ from planes $2x - 3y + z + k = 0$ and $x + 2y + 3z = 0$ is 1, then k equals:
a) 12 b) 14 c) 10 d) 8



Thank You!!!!!!