Question Booklet No.: Question Booklet Series: **A**

# ENTRANCE TEST - 2025

## School of Engineering Sciences

## 4-year B. Tech. Programme

**Total Questions: 60** **Roll No.** | | | | | | |

**Time Allowed: 70 Minutes**

**Important Instructions for Candidates:**

1. Candidates shall compulsorily use only **blue/ black ball point pen**. In no case gel/ink pen or pencil should be used.
2. Compulsorily write your **roll number** in the space provided at the top of this page of the question booklet.
3. Fill up the necessary information in the spaces provided on OMR Answer sheet including **Question Booklet Number** and **Question Booklet Series**.
4. OMR Answer sheet has an original copy and a candidate's copy glued beneath it at the top. While making entries in the original copy, candidate should ensure that the **two copies are aligned properly** so that the entries made in the original copy against each item are exactly copied in the candidate's copy.
5. All entries in the OMR Answer Sheet, including answers to questions, are to be recorded in the Original Copy only.
6. **Choose only one correct/most appropriate response** for each question among the options A, B, C, D and darken the circle of the appropriate response completely. Incompletely darkened circle is not correctly read by the OMR scanner and no complaint to this effect shall be entertained.
7. **Do not darken more the one circle of option for any question. A question with more than one darkened response shall be considered wrong.**
8. **There will be negative marking for wrong answers. Each wrong answer will lead to deduction of 0.25 marks per wrong answer from the score.**
9. Only those candidates who obtain **positive score** in Entrance Test shall be eligible for admission.
10. Do not make any stray mark on the OMR answer sheet as this may lead to errors while scanning.
11. OMR answer sheet must be handled carefully and it should not be folded or mutilated, as in such case it will not be properly evaluated by the machine.
12. No Electronic gadgets including calculators, mobiles, smart watches, blue tooth etc. shall be permitted inside the examination hall.
13. Rough work, if any, should be done on the blank sheets provided with the question booklet.
14. Ensure that the OMR Sheet is signed by the Examinee as well as by the invigilator.
15. At the end of the examination, fold the OMR Sheet along the crease on the top and tear off the top strip to separate the Original OMR Sheet from the Duplicate Copy.
16. Hand over the Original OMR answer sheet to the invigilator and retain the candidate's copy of OMR, Question Booklet and Admit card for your reference.
17. If any of the information in the response Sheet/Question Paper has been found missing or not mentioned as stated above, the candidate is solely responsible for that lapse.
18. Any deficiency on the OMR shall be the responsibility of the candidate himself/herself.

Q1: The basic building block of an element is
(a) Atom
(b) Molecule
(c) Ion
(d) Electron

Q2: The sub-atomic particle responsible for the atomic number is
(a) electron
(b) proton
(c) neutron
(d) all the above

Q3: Which of the following pH values corresponds to a strong acid?
(a) 3
(b) 6
(c) 7
(d) 14

Q4: Which among the following factors do not disturb the chemical equilibrium
(a) temperature
(b) pressure
(c) concentration
(d) catalyst

Q5: The reaction in which there are two reactants but the concentration of one of the reactants is so large that it's change in concentration does not affect the overall rate of a reaction are called as:
(a) First order reactions
(b) second order reaction
(c) pseudo-first order reactions
(d) zero order reactions

Q6: The rate constant of a reaction as per Arrhenius equation depends on which of the following factors
(a) Activation energy
(b) Temperature
(c) frequency
(d) All of the above

Q7: The solubility of gases in liquids with increase in temperature
(a) increases
(b) decreases
(c) doubles
(d) remains constant

Q8: which of the following colligative properties is used to determine the molar mass of proteins
(a) freezing point depression
(b) boiling point elevation
(c) osmotic pressure
(d) vapor pressure lowering

Q9: which is not an extensive property among the following
(a) mass
(b) volume
(c) enthalpy
(d) molar volume

Q10: At constant temperature for a spontaneous process the change in Gibb's free energy is
(a) positive
(b) negative
(c) zero
(d) either positive or negative

Q11: The oxidation number of Mn in $KMnO_4$ is
(a) +5
(b) +6
(c) +7
(d) +4

Q12: Which among the following parameters is not involved in Nernst equation
(a) reaction coefficient
(b) temperature
(c) gas constant
(d) enthalpy change

Q13: The EMF of an electrochemical cell is given by the relation

(a) $E_{cell} = E_{cathode} - E_{anode}$
(b) $E_{cell} = E_{anode} - E_{cathode}$
(c) $E_{cell} = E_{left} - E_{right}$
(d) None of the above

Q14: The variable valency is exhibited by

(a) Na
(b) Mg
(c) Fe
(d) Ne

Q15: The type of hybridization associated with trigonal bipyramidal geometry is

(a) sp
(b) $sp^2$
(c) $sp^3$
(d) $sp^3d$

Q16: The geometry of the molecule with central atom connected to four bond pairs and no lone pair is

(a) Linear
(b) Tetrahedral
(c) Trigonal planar
(d) octahedral

Q17: For a substance to be paramagnetic it should possess

(a) paired electrons
(b) unpaired electrons
(c) one unpaired electron
(d) two unpaired electrons

Q18: The coordination number of Pt in the complex $[Pt(NH_3)_2Cl_2]$ is

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

Q19: which carbocation is most stable

(a) primary
(b) Secondary
(c) Tertiary
(d) methyl carbocation

Q20: Which electron displacement effect is responsible for the stability of benzene

(a) inductive effect
(b) electromeric effect
(c) resonance effect
(d) hyper-conjugation effect

Q21: A car accelerates uniformly from rest and covers a distance of 50 meters in 10 seconds. The acceleration of the car is

a) 1 $m/s^2$
b) 20 $m/s^2$
c) 15 $m/s^2$
d) 5 $m/s^2$

Q22: If $\vec{A} = \hat{\imath} + \hat{\jmath}$ and $\vec{B} = \hat{\imath} + \hat{k}$, then the angle between $\vec{A}$ and $\vec{B}$ is……..

a) 30°
b) 45°
c) 60°
d) 90°

Q23: In projectile motion, time of flight, $T = \frac{2v \sin\theta}{g}$. It is the largest for…….

a) 30°
b) 45°
c) 60°
d) 90°

Q24: The coefficient of friction between two surfaces is 0.5. The angle of friction is

a) $\sin^{-1}(2)$
b) $\cos^{-1}(2)$
c) $\cot^{-1}(2)$
d) $\tan^{-1}(2)$

Q25: A force of 10 N acts on a body of weight 10 N. What is the acceleration produced in $m/s^2$? (Take g = 10 $m/s^2$)

a) 1 $m/s^2$
b) 3 $m/s^2$
c) 5 $m/s^2$
d) 10 $m/s^2$

Q26: A force of $\vec{F} = 8\hat{\imath} - 6\hat{\jmath} - 10\hat{k}$ N produces an acceleration of 2 m/ $s^2$ in a body. The mass of the body is

a) 10 kg
b) $10\sqrt{2}$ kg
c) $5\sqrt{2}$ kg
d) 5 kg

Q27: A system is accelerating upwards with an acceleration of 3g. What is the apparent weight of a body with mass m in this system?

a) mg N
b) 2mg N
c) 3mg N
d) 4mg N

Q28: When a particle is subjected to a constant force, it experiences constant acceleration. The power in this situation is

a) Zero
b) Positive
c) Increasing uniformly with time
d) Decreasing uniformly with time

Q29: Consider a ball that is dropped from a height h and reaches a height of $h_n$ after n rebounds. Then

a) $h_n = e^{2n}h$
b) $h_n = e^n h$
c) $h_n = e^2 h$
d) $h_n = eh$

Q30: In a pure resistive circuit (here E is the voltage and I is the current)

a) E and I are out of phase
b) E and I are in phase
c) I lags behind E by 90°
d) E lags behind E by 90°

Q31: A cyclist moving along a circular path of radius r must lean away from the vertical by an angle θ so that

a) $\tan\theta = \frac{v}{rg}$
b) $\tan\theta = \frac{vr}{g}$
c) $\tan\theta = \frac{v^2}{rg}$
d) $\tan\theta = \frac{vg}{r}$

Q32: The rotational kinetic energy of a body about an axis is

a) $\frac{1}{2}I\omega^2$
b) $\frac{1}{2}I\omega$
c) $\frac{1}{2}I\omega^3$
d) $\frac{1}{2}I\omega^4$

Q33: The variation of acceleration due to gravity with depth d is given by

a) $g_d = g_s\left[1 - \frac{R}{d}\right]$
b) $g_d = g_s\left[1 - \frac{d}{R}\right]$
c) $g_d = g_s\left[1 - \frac{1}{dR}\right]$
d) $g_d = g_s\left[1 - \frac{2R}{d}\right]$

Q34: The escape velocity of a body is given by

a) $v_e = \sqrt{gR}$
b) $v_e = \sqrt{3gR}$
c) $v_e = \sqrt{2gR}$
d) $v_e = \sqrt{4gR}$

Q35: The velocity of a particle in SHM is maximum

a) At the extreme position
b) At the Mean position
c) Between the mean and extreme positions
d) None of the above

Q36: The electric field due to an infinite plane sheet of charge is…. (Here, $\sigma$ is the surface charge density of the sheet and $\varepsilon_o$ is the permittivity of free space)

a) $\sigma/2\varepsilon_o$
b) $\sigma/\varepsilon_o$
c) $2\sigma/\varepsilon_o$
d) $\sigma\varepsilon_o/2$

Q37: Which of the following statements about charge is correct?

a) Charge is conserved
b) Charge is quantized
c) Charge can be positive or negative
d) All of the above

Q38: Relation between current and drift velocity is……. (Here, I is the electric current, n is the number density of charge carriers, A is the cross-sectional area of the conductor, e is the elementary charge and $v_d$ is the drift velocity of the charge carriers)

a) $I = neA/v_d$
b) $I = ne/Av_d$
c) $I = neAv_d$
d) $I = n/eAv_d$

Q39: A charge q is placed at the centre of a cube with edge length a. The electric flux (Ø) through each face would be……. (Here, $\varepsilon_o$ is the permittivity of free space)

a) $\emptyset = {}^{q}/_{\varepsilon_o}$
b) $\emptyset = {}^{q}/_{8\varepsilon_o}$
c) $\emptyset = {}^{q}/_{2\varepsilon_o}$
d) $\emptyset = {}^{q}/_{6\varepsilon_o}$

Q40: The magnetic field at a distance r from an infinitely long, straight, current-carrying conductor is…… (Here, $\mu_o$ is permeability of free space)

a) $B = {}^{\mu_o I}/_{2r}$
b) $B = {}^{\mu_o I}/_{2\pi r}$
c) $B = {}^{\mu_o I\pi}/_{2r}$
d) $B = {}^{\mu_o I}/_{\pi r}$

*Q41* What is the number of subsets of a set containing 5 elements?

a) 5
b) 25
c) 32
d) 64

*Q42* Which of the following is a real-valued function?

a) f(x) = |x|
b) $f(x) = x^2 + 2$
c) f(x) = sin(x)
d) all of the above

*Q43* The square root of $i$ (where $i = \sqrt{-1}$) is:

a) $\pm(1+i)/\sqrt{2}$
b) $\pm i$
c) $\pm\sqrt{i}$
d) $\pm(i-1)/\sqrt{2}$

*Q44* In linear programming, which of the following represents an optimal solution?

a) the point inside the feasible region
b) any point on the objective function
c) the point at which the objective function is maximized or minimized
d) none of the above

*Q45* The sum of an infinite geometric progression where the first term is 6 and the common ratio is 1/3 is:

a) 12
b) 9
c) 18
d) 8

*Q46* The coefficient of $x^3$ in the expansion of $(2x+1)^5$ is:

a) 160
b) 80
c) 60
d) 40

*Q47* If $\sin(\alpha+\beta)=1$, then which of the following must be true?

a) $\alpha+\beta=90^\circ$

b) $\alpha+\beta=180^\circ$

c) $\alpha=\beta=45^\circ$

d) none of the above

*Q48* The general solution of the equation $\cos x=-1$ is:

a) $x=(2n+1)\pi$

b) $x=2n\pi$

c) $x=2n\pi+\pi/2$

d) $x=n\pi$

*Q49* The determinant of the matrix $\begin{bmatrix}2 & 3\\ 1 & 4\end{bmatrix}$ is:

a) 5

b) 7

c) 8

d) 6

*Q50* If the product of two non-zero matrices is a zero matrix, which of the following is true?

a) the matrices are invertible

b) the matrices are commutative

c) the matrices are singular

d) none of the above

*Q51* The limit $\lim_{x\to 2}\frac{x^2-4}{x-2}$ is:

a) 2

b) 4

c) 0

d) 6

*Q52* The derivative of $\sin^2(x)$ with respect to $x$ is

a) $2\sin(x)\cos(x)$

b) $\cos^2(x)$

c) $2\cos^2(x)$

d) $\sin(2x)$

*Q53* What is the value of $\int_0^1(3x^2+2x)dx$?

a) $2$

b) $\frac{5}{2}$

c) $\frac{7}{2}$

d) $3$

*Q54* The solution to the differential equation $\frac{dy}{dx}=y$ is:

a) $y=e^x+C$

b) $y=Ce^x$

c) $y=x+C$

d) $y=e^{-x}+C$

*Q55* The distance between the points $(1,2)$ and $(4,6)$ is:

a) 5

b) $\sqrt{13}$

c) $\sqrt{25}$

d) 10

*Q56* If the standard equation of a circle is $(x-h)^2+(y-k)^2=r^2$, what is the radius of the circle with equation $x^2+y^2-4x+6y-12=0$?

a) 4

b) 5

c) 3

d) 2

*Q57* The variance of the data set $3, 5, 7, 9$ is:

a) 4

b) 5

c) 6

d) 2

*Q58* What is the probability of drawing a king or a queen from a deck of cards?

a) $\frac{1}{13}$

b) $\frac{2}{13}$

c) $\frac{4}{52}$

d) $\frac{2}{52}$

*Q59* The scalar (dot) product of vectors $\mathbf{a} = 2\hat{i} + 3\hat{j}$ and $\mathbf{b} = \hat{i} - 4\hat{j}$ is:

a) $-10$

b) $5$

c) $-2$

d) $14$

*Q60* The shortest distance between two skew lines is determined by:

a) the cross product of their direction ratios

b) the sum of their position vectors

c) their dot product

d) their slopes