BITSAT 2023 Question Paper May 22 Shift 1

Time Allowed :3 Hours	**Maximum Marks :**390	**Total Questions :**130

General Instructions

1. The examination is conducted in **Computer-Based Test (CBT)** mode. All questions will appear on the computer screen.
2. The total duration of the examination is **3 hours**. No extra time will be granted under any circumstances.
3. The question paper consists of **Multiple Choice Questions (MCQs)**, each having four options with only one correct answer.
4. Candidates must read each question carefully before selecting the answer. Answers can be changed only within the allotted test duration.
5. The examination follows a **negative marking scheme**. Marks will be deducted for incorrect answers, while unattempted questions will not carry any penalty.
6. Use of **calculators, mobile phones, smart watches, Bluetooth devices, or any other electronic gadgets** is strictly prohibited inside the examination hall.
7. Rough work must be done only on the rough sheets provided at the test center. These sheets must be returned after the examination.
8. Candidates must ensure that they have logged in using the correct credentials. Any discrepancy should be reported immediately to the invigilator.
9. No candidate will be allowed to leave the examination hall before the completion of the test duration.
10. Candidates must maintain discipline and follow all **instructions given by the invigilators**.
11. Any form of **unfair means, impersonation, or misconduct** will lead to immediate disqualification.
12. In case of any technical issue during the examination, candidates should remain seated and inform the invigilator without panic.

Mathematics

1. Find the general solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = x^2$.

2. Find the distance of the point $(1, 2)$ from the line $3x - 4y + 10 = 0$.

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3. Find the area of the solution region (feasible region) for the LPP constraints $x + y \leq 4$, $x \geq 0$, and $y \geq 0$.

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4. If $f(x) = e^x$ and $g(x) = \ln(x)$, find the composite function $fog(x)$.

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5. Evaluate the definite integral $\int_0^{\pi/2} \sin^5 x \, dx$ using Wall's formula.

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6. Given $P(A) = 0.3$ and $P(A \cup B) = 0.8$. If events A and B are independent, find $P(B)$.

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7. Given $P(A) = 0.2$ and $P(A \cup B) = 0.6$. If events A and B are mutually exclusive, find $P(B)$.

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8. Evaluate $\int_a^b \frac{f(x)}{f(x)+f(a+b-x)} \, dx$.

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9. Evaluate $\int_0^{\pi/2} \sin 4x \cos 2x \, dx$.

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10. Find the sum of binomial coefficients: $C_0 + C_1 + C_2 + \cdots + C_n$.

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11. How many cases are possible if a batsman can hit 0, 1, 2, 3, 4, 6 on 6 balls to make a total score of 30?
(A) 64
(B) 71
(C) 82
(D) 56
(E) 45

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12. If the vectors $3\hat{j} + 5\hat{k}$, $\hat{i} - 4\hat{j} + \hat{k}$, and $2\hat{i} + 5\hat{j} - k\hat{k}$ are coplanar, find the value of k.
(A) $k = \frac{71}{3}$
(B) $k = -\frac{71}{3}$
(C) $k = 21$

(D) $k = -21$

Chemistry

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1. Arrange the following 0.1 M solutions in increasing order of pH: Sodium acetate, NH_4Cl, and $NaCl$.
(A) $NH_4Cl <$ $NaCl <$ Sodium acetate
(B) $NaCl <$ $NH_4Cl <$ Sodium acetate
(C) Sodium acetate $<$ $NaCl <$ NH_4Cl
(D) $NH_4Cl <$ Sodium acetate $<$ $NaCl$

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2. Which of the following has the least basic conjugate base?
(A) HCl
(B) HBr
(C) Oxalic acid
(D) Acetic acid

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3. What is the molecular orbital (MO) electronic configuration of the N_2 molecule?
(A) $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 (\pi 2p_x^2 = \pi 2p_y^2)$
(B) $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 (\pi 2p_x^2 = \pi 2p_y^2) \sigma 2p_z^2$
(C) $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 (\pi 2p_x^2 = \pi 2p_y^2) \pi^* 2p_x^1$
(D) $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi^* 2p_x^2$

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4. Is NaOH considered a primary standard titrant in analytical chemistry?
(A) Yes, it is a primary standard.
(B) No, it is a secondary standard.
(C) Yes, because it is highly soluble.
(D) No, because it is a weak base.

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5. In the context of Solid State chemistry/physics, what do Miller indices represent?
(A) The number of atoms in a unit cell.
(B) The orientation of a crystal plane.
(C) The distance between two layers.
(D) The coordination number of an ion.

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6. When Calcium (Ca^{2+}) is titrated with EDTA, what is the typical pH of the buffer solution used?
(A) pH 4
(B) pH 7
(C) pH 10
(D) pH 12

Physics

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1. A ring and a disc of the same mass and radius are allowed to roll down from the same height on an inclined plane without slipping. Which of the following will reach the bottom first?
(A) The Ring
(B) The Disc
(C) Both will reach at the same time
(D) It depends on the angle of inclination

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2. A constant force $\vec{F} = (3\hat{i} + 2\hat{j} + 4\hat{k})$ N acts on a particle and displaces it from point $A(1, 1, 2)$ m to point $B(2, 4, 5)$ m. Calculate the work done by the force.
(A) 15 J
(B) 21 J
(C) 25 J
(D) 10 J

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3. Two large, parallel, thin infinite sheets have uniform surface charge densities of the same value $+\sigma$. What is the net electric field at a point in the region outside the sheets?
(A) $\frac{\sigma}{\epsilon_0}$
(B) $\frac{\sigma}{2\epsilon_0}$
(C) 0
(D) $\frac{2\sigma}{\epsilon_0}$

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4. A solid object floats in two different liquids L_1 and L_2. If the ratio of the volume submerged in L_1 to the volume submerged in L_2 is $V_1 : V_2 = 2 : 3$, what is the ratio of the densities of the liquids $\rho_1 : \rho_2$?
(A) 2 : 3
(B) 3 : 2
(C) 4 : 9
(D) 1 : 1

Other Memory Based Question

1. Find the next number in the following number series:
-3, 7, 31, 127, 511, ?