



General Instructions

- (i) **Duration:** The total duration of the examination is 3 hours (180 minutes).
- (ii) **Total Marks:** The complete paper carries a maximum of 400 marks.
- (iii) **Structure:** The paper consists of three sections. The first section consists of questions from Mathematics, Second section consists of questions from Aptitude and the third section consists of Drawing related questions.
- (iv) **Compulsory Questions:** All 77 questions are compulsory.
- (v) Each question has four options.
- (vi) **Correct Answer:** +4 marks.
- (vii) **Incorrect Answer:** -1 mark (Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

Mathematics

1. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined by $f(x) = \frac{e^{|x|} - e^{-x}}{e^x + e^{-x}}$, then f is:

- (A) one - one and onto.
- (B) one - one but not onto.
- (C) onto but not one - one.
- (D) neither onto nor one - one.

2. If $|z_1| = |z_2| = |z_3| = 1$ and $z_1 + z_2 + z_3 = \sqrt{2} + i$ then the number $z_1\bar{z}_2 + z_2\bar{z}_3 + z_3\bar{z}_1$ is:

- (A) a positive real number
- (B) a negative real number
- (C) always zero
- (D) a purely imaginary number

3. Let $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix}$. If $10A^{10} + \text{adj}(A^{10}) = B$, then $b_1 + b_2 + b_3 + b_4$ is equal to

- (A) 91
- (B) 92
- (C) 111
- (D) 112

4. If $\sum_{k=1}^n \phi(k) = \frac{2n}{n+1}$, then $\sum_{k=1}^{10} \frac{1}{\phi(k)}$ is equal to :

- (A) $\frac{11}{20}$
- (B) 220
- (C) $\frac{55}{18}$
- (D) 10

5. If in the binomial expansion of $(1-x)^m(1+x)^n$, the coefficients of x and x^2 are respectively 3 and -4, then the ratio $m : n$ is equal to :

- (A) 10 : 7
- (B) 8 : 11
- (C) 10 : 13

(D) 7 : 10

6. If $f(x) = \begin{vmatrix} \sin x & \cos x & \tan x \\ x^3 & x^2 & x \\ 2x & 1 & 1 \end{vmatrix}$, then $\lim_{x \rightarrow 0} \frac{f(x)}{x^2}$ is

(A) 1

(B) -1

(C) 0

(D) 2

7. The maximum value of $f(x) = 2 \sin x + \sin 2x$, in the interval $[0, \frac{3}{2}\pi]$ is

(A) $\sqrt{2} + 1$

(B) $2\sqrt{3}$

(C) $\frac{3\sqrt{3}}{2}$

(D) $\sqrt{3}$

8. Let $y(x) = (1+x)(1+x^2)(1+x^4)\dots(1+x^{32})$. Then $\frac{dy}{dx}$ at $x = \frac{1}{2}$, is

(A) $1 - 65\left(\frac{1}{2}\right)^{62}$

(B) $1 - 63\left(\frac{1}{2}\right)^{64}$

(C) $4 - 65\left(\frac{1}{2}\right)^{62}$

(D) $4 - 63\left(\frac{1}{2}\right)^{64}$

9. If $f(x) = \begin{vmatrix} \sin x & \cos x & \tan x \\ x^3 & x^2 & x \\ 2x & 1 & 1 \end{vmatrix}$, then $\lim_{x \rightarrow 0} \frac{f(x)}{x^2}$ is

- (A) 1
 - (B) -1
 - (C) 0
 - (D) 2
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Aptitude

1. If a plan is drawn at 1:100 scale, 1 cm on drawing represents:

- (A) 10 cm
 - (B) 100 cm
 - (C) 1 m
 - (D) 10 m
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2. Which architectural element primarily allows natural ventilation?

- (A) False ceiling
 - (B) Skylight
 - (C) Louvers
 - (D) Parapet
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3. The Lotus Temple in New Delhi is an example of which architectural style?

- (A) Brutalist architecture
- (B) Indo-Saracenic architecture
- (C) Expressionist architecture
- (D) Contemporary symbolic architecture

4. Fly ash is primarily added to cement to improve:

- (A) Initial setting time
- (B) Workability and durability
- (C) Color uniformity
- (D) Density only

5. Which UNESCO World Heritage Site is an outstanding example of Mughal garden-tomb architecture?

- (A) Humayun's Tomb
- (B) Qutub Minar
- (C) Fatehpur Sikri
- (D) Red Fort

6. Which material is most suitable for long-span tensile structures?

- (A) Reinforced concrete
- (B) Structural steel
- (C) PVC-coated polyester fabric
- (D) Burnt clay brick

7. The Lotus Temple in Delhi is constructed mainly using:

- (A) Sandstone
- (B) White Makrana marble
- (C) Granite
- (D) Reinforced steel panels

8. The Golden Ratio (1:1.618) is mainly associated with

- (A) Structural strength
 - (B) Aesthetic proportion
 - (C) Material durability
 - (D) Thermal comfort
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