Maths

(for B.Tech, Integrated B.Tech, B. Sc. (IT)(H)(Bio-Tech), B.Arch)

General instructions

1. Each section comprises of 15 questions.
2. All questions are compulsory.
3. Each right answer would be awarded 4 marks.
4. There is no negative marking.

1. A man standing on a horizontal plane, observes the angle of elevation of the top of a tower to be α. After walking a distance equal to double the height of the tower, the angle of the elevation becomes 2α, then α is equal to

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{12}$ (D) $\frac{\pi}{18}$

2. $\sin\left[2\cos^{-1}\left(-\frac{3}{5}\right)\right]$ is equal to

(A) $\frac{6}{25}$ (B) $\frac{24}{25}$ (C) $\frac{4}{5}$ (D) $-\frac{24}{25}$

3. If $\cos\alpha=\frac{12}{13},\cos\beta=\frac{3}{5},\cos\gamma=\frac{63}{65}$, then $\cos(\alpha+\beta+\gamma)$ is:

(A)1
(B)2
(C)3
(D)0

4. If $|z|<4$, *then* $|iz+3-4i|$ is less than

(A) 4 (B) 5 (C) 6 (D) 9

5. If $4a + 2b + c = 0$, then the equation $3ax^2 + 2bx + c = 0$ has at least one real root lying between
(A) 0 and 1 (B) 1 and 2 (C) 0 and 2 (D) none of these

6. The length of the latus rectum of parabola $4y^2 + 2x - 20y + 17 = 0$ is
(A) 3 (B) 6 (C) ½ (D) 0

7. $\sum_{r=1}^{\infty} \tan^{-1}\left(\frac{1}{r^2+5r+7}\right)$ equals to

(A) $\tan^{-1} 3$ (B) $\frac{\pi}{4}$

(C) $\sin^{-1}\frac{1}{\sqrt{10}}$ (D) $\cot^{-1} 2$

8. $y = 2x + \cot^{-1} x + \log\left(\sqrt{1+x^2} - x\right)$, then y

(A) increases in $[0,\infty)$ only (B) decreases in $[0\ \infty)$

(C) neither increases nor decreases in $[0\ \infty)$ (D) increases in $(-\infty,\infty)$

9. $C_0^2 - C_1^2 + C_2^2 \ldots (-1)C_n^2$, where n is an even integer is

(A) ${}^{2n}C_n$ (B) $(-1)^n\ {}^{2n}C_n$ (C) $(-1)^n\ {}^{2n}C_{n-1}$ (D) None of these

10. One root of the equation

$\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0$ is which of the following?

(A) $\frac{8}{3}$ (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) $\frac{16}{3}$.

11. If $x + y = a + b$, $x^2 + y^2 = a^2 + b^2$, then $x^n + y^n = a^n + b^n$ is true for

(A) $\forall n \in N$ (B) $n \geq 4$ (C) $n \geq 3$ (D) None of these

12. If $1 + |\sin x| + \sin^2 x + |\sin^3 x| + \ldots\ldots\infty = 4 + 2\sqrt{3}, 0 < x < \pi, x \neq \pi/2$, *then*

(A) $x = \frac{\pi}{6}$ (B) $x = \frac{\pi}{3}, \frac{2\pi}{3}$ (C) $x = \frac{2\pi}{3}, \frac{5\pi}{6}$ (D) $x = \frac{5\pi}{6}$

13 For a real number y, let [y] denote the greatest integer less than or equal to y. Then the function $f(x) = \frac{\tan \pi[(x-\pi)]}{1+[x]^2}$ is:

(A) discontinuous at some x

(B) continuous at all x, but the derivative $f'(x)$ does not exist for some x

(C) $f'(x)$ exists for all x, but the derivative $f''(x)$ does not exist for some x

(D) $f''(x)$ exists for all x

14 The value of $\left\{\frac{5^{2n}}{24}\right\}$, $n \in N$ where {.} denotes the fractional part of x, is

(A) 5/24 (B) 9/24 (C) 1/24 (D) None of these

15 $\int \frac{1+(\sin x)^{2/3}}{1+(\sin x)^{4/3}} d(\sin x)^{1/3}$ is equal to

(A) $\frac{1}{\sqrt{2}} \frac{(\sin x)^{2/3}-1}{\sqrt{2}(\sin x)^{1/3}}+c$

(B) $\frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{(\sin x)^{2/3}-1}{\sqrt{2}(\sin x)^{1/3}}\right)+c$

(C) $\frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{(\sin x)^{1/3}-1}{\sqrt{2}(\sin x)^{2/3}}\right)+c$

(D) none of these

Answer Key

1.B

2.D

3.D

4.D

5.C

6.C

7.C

8.D

9.D

10.B

11.A

12.B

13.D

14.C

15.B