CAREER POINT

FACULTY SELECTION TEST

MATHEMATICS

[Time : 1 Hr.] **[Max. Marks : 120]**

INSTRUCTIONS :

1. Attempt all questions.

2. Indicate your answer on the question paper itself.

3. Each question has four options. Out of these only one is the correct answer.

4. Each correct answer carries +4 marks. for each wrong answer 1 marks will be deducted.

Q.1 If the roots of $x^2 + x + a = 0$ exceed a, then

(1) $2 < a < 3$ (2) $a > 3$ (3) $-3 < a < 3$ (4) $a < -2$

Q.2 The value of $\cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{6\pi}{7}$ is

(1) 1 (2) –1 (3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

Q.3 The most general value of θ which satisfies both the equations, $\tan\theta = -1$ and $\cos\theta = 1/\sqrt{2}$, will be-

(1) $n\pi + 7\pi/4$ (2) $n\pi + (-1)^n (7\pi/4)$ (3) $2n\pi + (7\pi/4)$ (4) None of these

Q.4 If $H_1, H_2, ..., H_{20}$ be 20 harmonic means between 2 and 3, then $\frac{H_1+2}{H_1-2} + \frac{H_{20}+3}{H_{20}-3} =$

(1) 20 (2) 21 (3) 40 (4) 38

Q.5 Domain and range of $\sin\left(\log\left(\frac{\sqrt{4-x^2}}{1-x}\right)\right)$ is -

(1) [–2, 1), (–1, 1) (2) (–2, 1), [–1, 1]

(3) (–2, 1), R (4) None of these

Q.6 $\lim_{n\to\infty}\left(\frac{a-1+\sqrt[n]{b}}{a}\right)^n$ equal to -

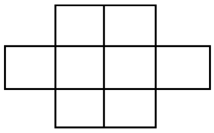
(1) $\sqrt[a]{b}$ (2) $\sqrt[b]{a}$ (3) $\sqrt{b}$ (4) $\sqrt{a}$

Q.7 Let $f(x) = \begin{cases} x+1, & x > 0 \\ 2-x, & x \le 0 \end{cases}$ and

$g(x) = \begin{cases} x+3, & x < 1 \\ x^2-2x-2, & 1 \le x < 2 \\ x-5, & x \ge 2 \end{cases}$, then $\lim_{x\to 0} g(f(x))$ is

(1) 2 (2) 1 (3) –3 (4) does not exists

Q.8 Six 'X's have to be placed in the squares of the figures given below such that each row contains at least one 'X'. The number of ways in which this can be done is –



(1) 26 (2) 27 (3) 22 (4) None of these

Q.9 A fair coin is tossed a fixed number of times. If the probability of getting 7 heads is equal to that of getting 9 heads, then probability of getting 3 heads is -

(1) $35/2^{12}$ (2) $35/2^{14}$ (3) $7/2^{12}$ (4) None

Q.10 The angle of intersection of $x = \sqrt{y}$ & $x^3+6y=7$ at (1, 1) is -

(1) $\frac{\pi}{5}$ (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{2}$

Q.11 In (– 4, 4) the function

$f(x) = \int_{-10}^{x} (t^4 - 4)e^{-4t}\,dt$ has -

(1) no point of extremum (2) one point of extremum

(3) two points of extremum (4) four points of extremum

Q.12 If $z = \left(\frac{1+i\sqrt{3}}{1+i}\right)^{25}$, then arg(z) is equal to -

(1) $\frac{\pi}{12}$ (2) $-\frac{\pi}{12}$ (3) $\frac{7\pi}{12}$ (4) $\frac{3\pi}{12}$

Q.13 $f(x) = \begin{cases} 1+\sin x & , \quad x < 0 \\ x^2 - x + 1 & , \quad x \ge 0 \end{cases}$ then -

(1) f has a local maximum at x = 0 (2) f has a local minimum at x = 0

(3) f is increasing everywhere (4) f is decreasing everywhere

Q.14 $\int \frac{1}{(e^x - 1)^2}\,dx = x + A\log(e^x - 1) + \frac{B}{e^x - 1}$ then

(1) A = 1, B = 1 (2) A = –1, B = –1

(3) A = 1, B = 2 (4) None

Q.15 $I = \int_0^{2\pi} \frac{1}{1+e^{\sin x}}\,dx$ is equal to -

(1) π (2) 2π (3) $\frac{\pi}{2}$ (4) None

Q.16 Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that $\vec{a}.\vec{c} = |\vec{c}|, |\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 30º, then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ is equal to

(1) 2/3 (2) 3/2

(3) 2 (4) 3

Q.17 A variable plane is at a distance 2 from origin O and meets co-ordinate axes at A, B and C. The centroid of tetrahedron OABC lies on $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = k^2$ then k =

(1) 16 (2) 4

(3) 2 (4) 1

Q.18 The minimum value of the sum of real numbers a^{-5}, a^{-4}, $3a^{-3}$, 1, a^8 and a^{10} with a > 0 is -

(1) 5 (2) 6

(3) 7 (4) 8

Q.19 Tangents are drawn to the circle $x^2 + y^2 = 1$ at the points where it is met by the circles, $x^2 + y^2 - (\lambda + 6)x + (8 - 2\lambda)y - 3 = 0$, λ being the variable. The locus of the point of intersection of these tangents is :-

(1) 2x – y +10 = 0 (2) x + 2y – 10 = 0

(3) x – 2y + 10 = 0 (4) 2x + y – 10 = 0

Q.20 A line 4x + y = 1 through the point A(2, –7) meets the line BC whose equation is 3x – 4y + 1= 0 at the point B. If AB = AC, then the equation of the line AC is -

(1) 52 x – 89 y + 519 = 0 (2) 52 x + 89 y – 519 = 0

(3) 52 x + 89 y + 519 = 0 (4) none of these

Q.21 The locus of the midpoints of the chords drawn from the point M(1, 8) to the circle $x^2 + y^2 - 6x - 4y - 11 = 0$, is equal to

(1) $x^2 + y^2 - 4x + 10y - 19 = 0$ (2) $x^2 + y^2 + 4x + 10y - 19 = 0$

(3) $x^2 + y^2 + 4x - 10y - 19 = 0$ (4) $x^2 + y^2 - 4x - 10y + 19 = 0$

Q.22 If two ends of latus rectum of a parabola are the points (3, 6) and (–5, 6), then equation of the parabola is -

(1) $(x + 1)^2 = 8(y - 4)$ (2) $(y - 6)^2 = 8(x - 1)$

(3) $(y - 6)^2 = -8(x + 1)$ (4) $(y - 6)^2 = 8(x + 1)$

Q.23 The locus of the foot of the perpendicular drawn from the centre upon any tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is -

(1) $a^2x^2 + b^2y^2 = (x^2 + y^2)^2$ (2) $a^2x^2 - b^2y^2 = (x^2 - y^2)^2$

(3) $b^2x^2 + a^2y^2 = (x^2 - y^2)^2$ (4) None of these

Q.24 A box contains 2 white balls, 3 black balls and 4 red balls. The number of ways in which three balls can be drawn from the box so that at least one of the balls is black is

(1) 74 (2) 84

(3) 64 (4) 20

Q.25 If ratio of sides in a triangle are 3 : 7 : 8, then R : r is equal to -

(1) 2 : 7 (2) 7 : 2

(3) 3 : 7 (4) None of these

Q.26 Number of seven digit whole numbers in which only 2 and 3 are present as digits if no two 2's are consecutive in any number, is

(1) 26 (2) 33

(3) 32 (4) 53

Q.27 Number of solution of equation $\sqrt{7^{2x^2-5x-6}} = (\sqrt{2})^{3\log_2 49}$

(1) 1 (2) 2

(3) 3 (4) None

Q.28 $\frac{1}{1+\log_b a+\log_b c} + \frac{1}{1+\log_c b+\log_c a} + \frac{1}{1+\log_a b+\log_a c} =$

(1) 1 (2) 0

(3) $\log_a(abc)$ (4) None

Q.29 $\sum_{r=0}^{n-1} \frac{{}^nC_r}{{}^nC_r + {}^nC_{r+1}}$ is equal to -

(1) $\frac{n}{2}$ (2) $\frac{n+1}{2}$

(3) $\frac{n(n+1)}{2}$ (4) $\frac{n(n-1)}{2(n+1)}$

Q.30 The greatest value of the term independent of x in the expansion of $(x \sin \alpha + x^{-1} \cos \alpha)^{10}$, $\alpha \in R$ is -

(1) 2^5 (2) $\frac{10!}{(5!)^2}$

(3) $\frac{1}{2^5}\frac{10!}{(5!)^2}$ (4) None of these