

## Model Question – 8

Subject : Mathematics XII (Mat. 402/008)

Time : 3 hrs

F.M. 75

Attempt all the questions:

### Group “A”

Rewrite the correct option in your answer sheet:

11X1=11

- 1) If  $w$  and  $w^2$  are complex cube roots unity then  $(1 + w + w^2)^5 + (1 - w^2 + w)^5$  equals
  - a. 32
  - b. 8
  - c. 16
  - d. 64
- 2) If  $P(x, 2) = 30$  then  $n$  equals
  - a. 3
  - b. 4
  - c. 5
  - d. 6
- 3) The general values of  $x$  satisfying  $\sin x = -\frac{\sqrt{3}}{2}$  and  $\cos x = \frac{1}{2}$ 
  - a.  $2n\pi + \frac{5\pi}{4}$
  - b.  $2n\pi + \frac{7\pi}{6}$
  - c.  $2n\pi + \frac{5\pi}{3}$
  - d.  $2n\pi - \frac{7\pi}{6}$
- 4) The eccentricity of a hyperbola  $x^2 - y^2 = c^2$  is
  - a. 1
  - b.  $\frac{1}{2}$
  - c.  $\sqrt{2}$
  - d. 2
- 5) Distance of point  $(2, 3, 4)$  from the plane  $3x - 6y + 2z + 11 = 0$  is
  - a. 0
  - b. 1
  - c. 2
  - d. 3
- 6) The angle between  $\vec{a} \times \vec{b}$  and  $\vec{b} \times \vec{a}$  is
  - a.  $90^\circ$
  - b.  $120^\circ$
  - c.  $180^\circ$
  - d.  $360^\circ$
- 7) The mean of a binomial distribution is 12 and standard deviation is 3 then number of trials is
  - a. 12
  - b. 24
  - c. 36
  - d. 48
- 8) The tangent to a given curve is perpendicular to  $x$ -axis if
  - a.  $f'(x) = 0$
  - b.  $f'(x) = 1$
  - c.  $\frac{dx}{dy} = 0$
  - d.  $\frac{dx}{dy} = 1$
- 9)  $\int \frac{dx}{\sqrt{e^{2x} - 1}}$  equals
  - a.  $\sin^{-1}(e^x) + c$
  - b.  $\cos^{-1}(e^x) + c$
  - c.  $\tan^{-1}(e^x) + c$
  - d.  $\sec^{-1}(e^x) + c$
- 10) An LPP is called standard minimization of
  - a. The objective function is to be minimized.
  - b. All decision variables are non- negative.
  - c. All constraints are in the form  $a_i x_i + a_j x_j + \dots + a_n x_n \leq b$
  - d. All
- 11) The product of mass and velocity body is called
  - a. Acceleration
  - b. Momentum

c. Impulse

d. Inertia

**Group "B"**

**Short answer questions:**

**8X5=40**

12)

a) If one root of equation  $ax^2 + bx + c = 0$  be two square of other prove that:

$b^3 + a^2c + ac^2 = 3abc.$  3

b) Let  $P(n)$  be the statement " $n(n+1)$  is divisible by 2" Are  $P(1)$ ,  $P(2)$  and  $P(3)$  true? 2

13)

a) Solve the following system of linear equations by Cramer's rule:

$3x - y + 2z = 9, \quad x - 2y + 3z = 2, \quad 2x - 3y + z = 1$  3

b) If  $C(n+2, 4) = 6 C(n, 2)$  find  $n$ . 2

14)

a) If  $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$  prove that:  $x^2 + y^2 + z^2 + 2xyz = 1$  3

b) Compute  $\sqrt{26}$  to three significant figures. 2

15)

a) If  $n = 6$ ,  $EX = 160$ ,  $Ey = 116$ ,  $Ex^2 = 4480$ ,  $Ey^2 = 2462$  and  $EXY = 3275$ . Compute Karl Pearson's coefficient of correlation between  $X$  and  $Y$ .

b) A dice is thrown 3 times. Turning of 5 or 6 is considered to be success. Find probability of getting (i) 3 success (ii) Exactly 2 success (iii) At least one

16) Find from first principle, the differential coefficient of  $\cos^{-1}x$ . 5

17) Reduce the equation:  $\frac{dy}{dx} + y = xy^2$  to linear form and solve/ 5

18) Max  $Z = 4x + 2y$

Subject to:  $5x + 8y \leq 80$

$3x + 2y \leq 76$

$x, y \geq 0$

19) The extremities of straight weightless pole 4m long rests on two smooth peg at A and B in the same horizontal line. A heavy load hangs from a point C of the pole. If  $AC = 3 BC$  and the pressure at B be 150N more than pressure at A. Find weight of the load. 5

**Group "C"**

**Long answer questions:**

**3X8=24**

20)

a) Prove that:  $\frac{1}{n+1} + \frac{1}{2(n+1)^2} + \frac{1}{3(n+1)^3} + \dots = \frac{1}{n} - \frac{1}{2n^2} + \frac{1}{3n^3}$  4

b) Prove that set of complex number  $C = \{a + ib, a, b \in R, i = \sqrt{-1}\}$  is a group under addition. 4

21)

a)  $\tan x \tan 2x + \sqrt{3} \tan x \tan 2x = \sqrt{3}$  2

b) Show that the angle between the lines whose direction cosines are given by

$l + m + n = 0, l^2 + m^2 - n^2 = 0$  is  $\frac{\pi}{3}$ . 3

c) If  $\vec{a} + \vec{b} + \vec{c} = 0$  prove that:  $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$  3

22)

a) Evaluate:  $\int \frac{dx}{1+2\sin x}$  4

b) Verify Rolle's theorem for  $f(x) = \cos 2x$  in  $x \in [-\pi, \pi]$  stating it. 4

**Answers:**

**Group A**

|        |         |         |        |
|--------|---------|---------|--------|
| 1) (a) | 2) (d)  | 3) (c)  | 4) (c) |
| 5) (b) | 6) (c)  | 7) (d)  | 8) (c) |
| 9) (d) | 10) (d) | 11) (b) |        |

**Group B**

|   |                               |
|---|-------------------------------|
| 12) (b) All True  | 16) $\frac{-1}{\sqrt{1-x^2}}$ |
| 13) (a) (3, 2, 1) (b) 7                                     | 17) $xy + y - cye^x = 1$      |
| 14) (b) 5.099   | 18) 88 at (12, 20)            |
| 15) (a) 0.84 (b) $\frac{1}{27}, \frac{2}{9}, \frac{19}{27}$ | 19) 300N                      |

**Group C**

|   |
|---|
| 21) (a) $(3x+1)\frac{\pi}{9}$   |
| 22)<br><p>(a) <math>\frac{1}{\sqrt{3}} \log \left( \frac{\tan \frac{x}{2} + 2 - \sqrt{3}}{\tan \frac{x}{2} + 2 + \sqrt{3}} \right)</math></p> |