Total No. of printed pages = 6

END SEMESTER REGULAR EXAMINATION
JANUARY – 2025

Semester : 1st (New)

Branch : Common to All

Subject Code : BS –101

MATHEMATICS –I

Full Marks – 60

Time – Three hours

The figures in the margin indicate full marks

for the questions.

Instructions :

(i) Q.Nos. 1, 2 and 3 are compulsory.

(ii) Answer any *five* questions from the rest.

1. Fill in the blanks :   1×5=5

(a) The value of $i^2 + \dfrac{1}{i^2}$ is equal to _____.

(b) The value of $\omega^5 + \omega$ is _____.

(c) The value of $^{10}P_4$ is _____ .

(d) The first term of $(2x+y)^5$ is _____.

(e) If $\log_a 16 = -4$, then a is equal to _____.

2. Write True or False :   1×5=5

  (a) 1.2, 2.4, 3.6, 4.8, 6, 7.2, 8.4,……..is an A.P. Series.

  (b) The matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 3 & 0 & 0 \end{bmatrix}$ is a diagonal matrix.

  (c) When two rows of a determinant are interchanged, the result remains the same.

  (d) If $\tan\theta = c$, then $\sin\theta = \dfrac{c}{\sqrt{c^2+1}}$.

  (e) $\sin^{-1}\dfrac{1}{2} + \cos^{-1}\dfrac{1}{2} = \dfrac{\pi}{2}$.

3. Choose the correct answers :   1×5=5

  (a) Cosine formula implies :

    (i) $2bc\ \cos A = c^2 + a^2 - b^2$

    (ii) $2bc\ \cos A = b^2 + c^2 - a^2$

    (iii) $2bc\ \cos A = a^2 + b^2 - c^2$

    (iv) $2ac\ \cos A = c^2 + a^2 - b^2$

  (b) The volume of an equilateral prism of side 7 inch and height 2 ft. in cub inch is

    (i) $294\sqrt{3}$ (ii) $168\sqrt{3}$

    (iii) 294   (iv) 1176

  (c) The base of a tetrahedron is a

    (i) hexagon   (ii) pentagon

    (iii) square   (iv) triangle

  (d) The polar co-ordinates of $(-1,-1)$ are

    (i) $\left(\sqrt{2}, 45°\right)$ (ii) $\left(\sqrt{2}, 135°\right)$

    (iii) $\left(\sqrt{2}, 225°\right)$ (iv) $\left(\sqrt{2}, 315°\right)$

  (e) A$(-2, -3)$, B$(-3, 10)$ and C$(4, 11)$ are three points which can form

    (i) a straight line

    (ii) an equilateral triangle

    (iii) an isosceles triangle

    (iv) a scalene triangle.

4. (a) Express in the form a + ib and find the modulus of $\dfrac{3+4i}{7+24i}$. 3

(b) Express in the polar form : 2

(1+i) (1+2i) (1+3i).

(c) In how many ways the letters of the word MISSISSIPPI may be arranged ? 2

(d) Find the value of n if $^nP_4 : ^{n-1}P_3 = 9:1$. 2

5. (a) Evaluate : $(1+\omega^2+\omega^4+\omega^6)(1+\omega+\omega^3+\omega^5)$. 2

(b) In how many ways 12 different books can be distributed equally among 3 students ? 2

(c) Find the middle term of $\left(3x-\dfrac{x^3}{6}\right)^8$. 2

(d) Show that : 3

$x^{\log y - \log z} \times y^{\log z - \log x} \times z^{\log x - \log y} = 1$.

6. (a) Insert 3 arithmetic means between 6 and 18. 2

(b) Evaluate : 2

$\log 2 + 16\log \dfrac{16}{15} + 12\log \dfrac{25}{24} + 7\log \dfrac{81}{80}$.

(c) Find the sum to 30-terms of the series :

5 + 8 + 11 + 14 + ... 2

(d) Solve using Crammer's rule : 3

$4x-5y+2z = 0$, $2x-7y+4z = 0$, $x+y+z = 6$

7. (a) If a, b, c are in AP and x, y, z are in GP series, then show that : $x^{b-c} y^{c-a} z^{a-b} = 1$. 3

(b) Prove that : 3

$$\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix} = abc\,(a-b)\,(b-c)\,(c-a).$$

(c) Find the value of x, y, z and t where, 3

$$\begin{bmatrix} x+y & y-z \\ 5-t & 7-x \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 3 & 6 \end{bmatrix}.$$

8. (a) Prove that : $\dfrac{\sin\theta}{1+\cos\theta} + \dfrac{1+\cos\theta}{\sin\theta} = 2\csc\theta$.

3

(b) Find the value of : 3

(i) sec (–75°) (ii) cos 285°.

(c) Prove that : 3

$\tan^{-1}\dfrac{x-y}{1+xy} + \tan^{-1}\dfrac{y-z}{1+yz} + \tan^{-1}\dfrac{z-x}{1+zx} = 0$.

9. (a) The following offsets were taken from a survey line to a hedge : 3

distance from survey line (m) :	0	6	12	18	24	30	36
offsets (m) :		2.0	1.8	3	3.4	3.9	1.5	1.2

(b) Three spheres of radii 3 cm, 4 cm and 5 cm are melted to form a new sphere. Find the radius of the new sphere. 3

(c) If R, r and h be 16 cm, 8 cm and 6 cm respectively of a frustum of a right circular cone, find the volume and the total surface area. 3

10. (a) If two of the vertices of a triangle are (2,7), (6,1) and its centroid is (6,4) , find the third vertex. 2

(b) Change into Cartesian co-ordinate : 2
$r^2 \sin 2\theta = 2a^2$.

(c) Find the slope and y-intercept of the straight line $5x + 2y + 3 = 0$. 2

(d) Find the equation of the straight line passing through the point (2,1) and perpendicular to $3x + 4y - 1 = 0$. 3