Total No. of printed pages = 9

**END SEMESTER EXAMINATION, NOVEMBER-2018**

Semester : 1st

Subject Code : Sc-102

**MATHEMATICS-I**

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

**Instructions :**

1. *All* questions of PART – A are compulsory.
2. Answer any *five* questions from PART – B.



PART – A

Marks – 25

1. Fill in the blanks : $1 \times 10 = 10$

(a) Express $-\frac{1}{2}$ in the a + ib form _____.

(b) What is the value of $i^{87}$? _____.

(c) Equation of a straight line perpendicular to a given line $Ax + By + C = 0$ is _____.

(d) If ${}^{n}P_{3} = 336$, then, ${}^{n}C_{3}$ = _____.

(e) If $A = \begin{bmatrix} 1 & -1 \\ 2 & 5 \end{bmatrix}$, then 5A is _____.

(f) The value of $\cot 15°$ is _____.

(g) The number of ways in which 6 students can be arranged in a circle is _____.

(h) If A is a skew symmetric matrix, then $A^{T}$ is equal to _____.

(i) The lateral surface area of a cylinder is _____.

(j) The value of $\log_{5}25$ is _____.

2. Write true or false : $1 \times 10 = 10$

(a) To convert from Cartesian to polar coordinate we use $r = \sqrt{x^2 + y^2}$ and $\theta = \tan^{-1}\frac{X}{Y}$.

(b) Slope of line passing through (7, 2) and (7, – 5) is not defined.

(c) The x-intercept of $3x + 4y + 5 = 0$ is 4.

(d) If $x = 1 - i$, then the value of $x^2 - 2x + 2 = 0$.

(e) In any triangle ABC, we have $c = b\cos B + c\cos C$

(f) General term for $(x - a)^n$ is $(-1)^n {}^nC_r x^{n-r} a^r$.

(g) The equation of the line which is perpendicular to the line $x + 2y + 1 = 0$ is $2x - y + 2 = 0$.

(h) In a matrix multiplication, for any two square matrices A and B, $AB = BA$.

(i) The value of $\left(\omega^4 + \omega^5 + \frac{1}{\omega^7} + \frac{1}{\omega^8}\right)$ is $-2$, where $\omega$ is the cube root of unity.

(j) The area of the $\Delta ABC$, where $b = 5$, $c = 3$ and $A = 30°$ is 13 sq. units.



3. Choose the correct answer : 1×5=5

(a) Value of $\omega^{46}$ is

(i) 1 (ii) $-\omega$

(iii) $\omega$ (iv) $-1$

(b) Cofactor of $a_{31}$ in $\begin{vmatrix} 2 & -1 & 0 \\ 1 & -2 & 1 \\ 4 & 3 & -1 \end{vmatrix}$ is

(i) $\begin{vmatrix} -1 & 0 \\ -2 & 1 \end{vmatrix}$ (ii) $\begin{vmatrix} -2 & 1 \\ 3 & -1 \end{vmatrix}$

(iii) $\begin{vmatrix} 2 & -1 \\ 1 & -2 \end{vmatrix}$ (iv) $\begin{vmatrix} 1 & -2 \\ 4 & 3 \end{vmatrix}$

(c) The sum of the first 8 terms of the series 2, 6, 18, 54 ..... is

(i) 2320 (ii) 6560

(iii) 4320 (iv) 5670

(d) The curved surface area of cylindrical pillar is $264m^2$ and its volume is $924m^3$. The ratio of its diameter to its height is

(i) 3 : 7 (ii) 7 : 3

(iii) 6 : 7 (iv) 7 : 6

(e) Equation of the straight line passing through $(0, -1)$ and parallel to X-axis is

(i) $y = 0$ (ii) $x = 0$

(iii) $y = -1$ (iv) $x = -1$

## PART – B

Marks – 45

4. Answer the following questions : 3+4+2=9

(a) Find the square root of $7 - 30\sqrt{-2}$ :

(b) Find the conjugate of $\frac{3+i}{2+i}$. Also find the modulus and amplitude of $\frac{1+2i}{1-3i}$.

(c) Find k if $2k + 1$, $k$, $3k + 2$ are in G. P.

5. Answer the following questions : 2+3+4=9

(a) Prove that $(1 + \omega)(1 + \omega^2)(1 + \omega^4)(1 + \omega^8) = 1$, where $\omega$ is the imaginary cube root of unity.

(b) Find the term independent of x in $(2x^2 - \frac{1}{x})^{12}$.

(c) In how many ways can a term of 11 members from 14 players be formed if

(i) one particular player be always included ?

(ii) one particular player is never included ?

6. Answer the following questions : 3+3+3=9

(a) Simplify $\log\frac{81}{8}-2\log\frac{3}{2}+3\log\frac{2}{3}+\log\frac{3}{4}$.

(b) Without expanding determinant prove that,

$$\begin{vmatrix} 1 & 1 & 1 \\ p & q & r \\ p^2 & q^2 & r^2 \end{vmatrix} = 0.$$

(c) Find $A^2-5A+6I$, if $A=\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$.

7. Answer the following questions : 3+4+2=9

(a) Find the coefficient of $x^{17}$ in the expansion of $(x-x^2)^{10}$.

(b) Resolve into partial fractions : $\frac{x^2-3x+1}{(x-1)^2(x-2)}$.

(c) Find the value of n if ${}^nC_2 = 45$.

8. Answer the following questions : 3+3+3=9

(a) If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$ prove that $x + y + z = xyz$.

(b) Prove that $\frac{\sin A + \sin B}{\cos A + \sin B} = \tan\frac{A+B}{2}$.

(c) Prove that $\sin^2 36° + \sin^2 54° = 1$.

9. Answer the following questions : 3+3+3=9

(a) If $A = \begin{bmatrix} 3 & 1 \\ 4 & 1 \\ -5 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 1 & 2 \\ -2 & 0 & 4 \end{bmatrix}$ then find the value of AB.

(b) If $\theta = \frac{a}{b}$, then find the value of $b\cos 2\theta + a \sin 2\theta$.

(c) Find the value of k for which the lines $5x + 4y - 6 = 0$ and $2x + ky + 9 = 0$ are parallel.

10. Answer the following questions : 3+3+3=9

(a) Find the angle between the lines $2x + y + 3 = 0$ and $x + 3y + 4 = 0$.

(b) The slant height of a frustum of a cone is 4cm and the perimeters (circumference) of its circular ends are 18cm and 6cm. Find the curved surface area of the frustum.

(c) Calculate the total area of a field with a base of 60m and ordinates 8, 11, 2, 4, 6, 7, 10, 12, 8, 5, 10 respectively.

11. Answer the following questions : 3+3+3=9

(a) Solve the system of equations by Cramer's rule $5x - y = 9$, $3x + y = 7$ and $x + y + z = 4$.

(b) Find the equation of the straight line, which passes through the point (1, 2) and which is parallel to the straight line $2x + 3y + 6 = 0$.

(c) If $\cos^2 \alpha - \sin^2 \alpha = \tan^2 \beta$, then show that $\cos^2 \beta - \sin^2 \beta = \tan^2 \alpha$.

12. Answer the following questions : 3+3+3=9

(a) Prove that $3\tan^{-1} x = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$.

(b) Prove that $\cos(60° - A)\cos(30° - B) - \sin(60° - A)\sin(30° - B) = \sin(A+B)$..

(c) Find the value of $\cos\left[\frac{\pi}{6} - \cos^{-1}\left(\frac{1}{2}\right)\right]$.

POLYTECHNIC DIPLOMA .IN

# Polytechnic Diploma

www.polytechnicdiploma.in

Available On:



GET IT ON Google Play