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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 : 1×10=10

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

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

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- (c) Equation of a straight line perpendicular to a given line $Ax + By + C = 0$ is _____.
- (d) If ${}^nP_3 = 336$, then, ${}^nC_3 =$ _____.
- (e) If $A = \begin{bmatrix} 1 & -1 \\ 2 & 5 \end{bmatrix}$, then $5A$ is _____.
- (f) The value of $\cot 15^\circ$ 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 : 1×10=10
- (a) To convert from Cartesian to polar coordinate we use $r = \sqrt{x^2 + y^2}$ and $\theta = \tan^{-1} \frac{y}{x}$.
- (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 $(-1)^r {}^nC_r x^{n-r} a^r$.
- (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 ω is the cube root of unity.
- (j) The area of the ΔABC , where $b = 5$, $c = 3$ and $A = 30^\circ$ is 13 sq. units.
3. Choose the correct answer : 1×5=5
- (a) Value of ω^{46} is
- (i) 1 (ii) - ω
- (iii) ω (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

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(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 $\frac{3+i}{2+5i}$. 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 ω is the imaginary cube root of unity.

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

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(c) In how many ways can a team 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 $\sin^2 36^\circ + \sin^2 54^\circ = 1$.

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 $\cos^2 \beta - \sin^2 \beta = \tan^2 \alpha$.

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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 $\cos(60^\circ - A) \cos(30^\circ - B) - \sin(60^\circ - A) \sin(30^\circ - B) = \sin(A+B)$.
- (c) Find the value of $\cos \left[\frac{\pi}{6} - \cos^{-1} \left(\frac{1}{2} \right) \right]$.

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