



Date: 05-04-2019  
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

**PART – A**

(Answer ALL questions) (10  $\hat{=}$  2 = 20)

1. Write down the expansion of  $\sin n\theta$ .
2. What is the expansion of  $\sin \theta$  in a series of ascending powers of  $\theta$ .
3. Show that  $\text{Cosh}^2 x - \text{Sinh}^2 x = 1$ .
4. Find  $\text{Log}(1 - i)$ .
5. When do you say that two matrices are similar?
6. Find the characteristic equation of  $\begin{pmatrix} 4 & 2 \\ 3 & 3 \end{pmatrix}$ .
7. Write the pole of the line  $Ax + By + C = 0$  with respect to the parabola  $y^2 = 4ax$ .
8. What is the condition for the lines  $lx + my + n = 0$  and  $l_1x + m_1y + n_1 = 0$  to be conjugate?
9. Define rectangular hyperbola.
10. Define polar equation of a conic.

**PART – B**

(Answer any FIVE questions) (5  $\hat{=}$  8 = 40)

11. Express  $\frac{\sin 6\theta}{\sin \theta}$  in terms of  $\cos \theta$ .
12. Expand  $\cos^6 \theta$  and  $\cos^5 \theta$  in series of cosines of multiples of  $\theta$ .
13. If  $\sin(A + iB) = x + iy$ , prove that  $\frac{x^2}{\text{Cosh}^2 B} + \frac{y^2}{\text{Sinh}^2 B} = 1$  and  $\frac{x^2}{\text{Sin}^2 A} - \frac{y^2}{\text{Cos}^2 A} = 1$ .
14. Find the general value of  $\text{Log}_{(-3)}(-2)$ .
15. Verify Cayley Hamilton theorem for the matrix  $\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ .

16. Chords of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  touch the ellipse  $\frac{x^2}{\alpha^2} + \frac{y^2}{\beta^2} = 1$ . Find the locus of their poles.
17. Obtain the combined equation of the pair of tangents from the point  $(x_1, y_1)$  to the parabola  $y^2 = 4ax$ .
18. Show that the product of the lengths of the perpendiculars from any point on a hyperbola to its asymptotes is a constant.

### PART – C

(Answer any TWO questions)

(2 × 20 = 40)

19. (a) Express  $\cos 8\theta$  in terms of  $\sin \theta$ .  
 (b) Expand  $\sin^3 \theta \cos^5 \theta$  in a series of sines of multiples of  $\theta$ .
20. (a) Separate the real and imaginary parts  $\tan^{-1}(x+iy)$ .  
 (b) Deduce the expansion of  $\tan^{-1} x$  in powers of  $x$  from the expansion of  $\log(a+ib)$ .
21. Diagonalize the matrix  $\begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ .
22. (a) Tangents to a point  $P$  to  $y^2 = 4ax$  meet the axis of the parabola at  $Q$  and  $R$ . If the area of  $\Delta PQR$  is  $k$ , find the locus of  $P$ .  
 (b) Find the combined equations of the asymptotes of the hyperbola  $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$  and its conjugates.

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