

2018

Time : 3 hours

Full Marks : 80

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer from both the Sections as directed.

Section – I

(Compulsory)

1. Choose the correct alternatives from the following multiple choice objective questions : $2 \times 8 = 16$

(a) If $y = x^n$ then y_n is equal to :

- (i) 1
- (ii) 0
- (iii) $\frac{1}{n}$
- (iv) None of these

(b) If $u = \frac{x+y}{x-y}$ then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is equal to :

- (i) 0
- (ii) 1
- (iii) 2
- (iv) None of these

(c) In a Cartesian curve the length of the subnormal is :

- (i) y/y_1
- (ii) yy_1
- (iii) $y\sqrt{1+y^2}$
- (iv) None of these

(d) Radius of curvature (ρ) is equal to :

- (i) $\frac{ds}{d\psi}$
- (ii) $\frac{dy}{dx}$
- (iii) $r \frac{d\theta}{dy}$
- (iv) None of these

- (e) The focus of the Parabola $x^2 = 8y$ is:
- (0, 1)
 - (0, 2)
 - (0, 3)
 - None of these
- (f) Limiting point of the circle $x^2 + y^2 + 2gx + c = 0$ is:
- (-g, -f)
 - $(\pm\sqrt{g}, 0)$
 - $(\pm\sqrt{e}, 0)$
 - None of these
- (g) The eccentricity of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ is:
- 3/5
 - 4/5
 - 7/5
 - None of these
- (h) $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ will represent:
- $ab - h^2 = 0$

- $ab - h^2 > 0$
- $ab - h^2 < 0$
- None of these

Section - II

Answer any four questions, selecting at least one from each unit:

$$16 \times 4 = 64$$

Unit - I

- State and prove Leibnitz theorem.
 - If $y = \sin(m \sin^{-1}x)$, prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} + (m^2 - n^2)y_n = 0$.
- State and prove Euler's theorem on homogeneous function of two independent variables.
 - If $u = \sin^{-1} \frac{x^2 + y^2}{x + y}$, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \tan u$.
- Prove that $p = r \sin \phi$, where p is the perpendicular distance from Pole to Tangent.

(b) To prove that $\frac{1}{p^2} = u^2 + \left(\frac{du}{d\theta}\right)^2$, where $u = \frac{1}{r}$.

5. (a) Find the radius of curvature of the Cartesian curve $y = f(x)$.
(b) Find the radius of curvature of the curve $y = e^x$ at the point where it crosses the Y-axis.

Unit – II

6. (a) Find the condition that the two circles cut each other orthogonally.
(b) Show that the circle $x^2 + y^2 - 2ax + 2by + c = 0$ and $x^2 + y^2 + 2bx + 2ay - c = 0$ cut one another orthogonally. <https://www.jharkhandstudy.com>
7. (a) Define Radical axis and obtain the equation of the radical axis of two given circles.
(b) Find the radical centre of the three circles $x^2 + y^2 = 9$, $x^2 + y^2 - 2x - 2y = 5$ and $x^2 + y^2 + 4x + 6y = 19$.
8. Define an Ellipse and obtain its equation in standard form.

9. (a) Find the polar equation of any conic when its semi latus rectum ℓ and eccentricity e are equal.
(b) Find the equation of chord joining two points on the conic $\frac{\ell}{r} = 1 - e \cos \theta$.



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