Total No. of Questions : 24
Total No. of Printed Pages : 3

Part - III
MATHEMATICS - PAPER - II (B)
(English Version)

Time : 3 Hours **Max. Marks : 75**

Note : *This question paper consists of three Sections - A, B and C.*

SECTION - A

I. Very short answer type questions : **10x2=20**

(i) Answer *all* the questions.

(ii) Each question carries *two* marks.

1. If the length of the tangent from (2, 5) to the circle $x^2+y^2-5x+4y+k=0$ is $\sqrt{37}$ then find k.

2. Find the equation of the circle whose end points of a diameter are (1, 2), (4, 6).

3. Find the equation of the common chord of the circles $x^2+y^2-4x-4y+3=0$, $x^2+y^2-5x-6y+4=0$.

4. Find the value of k if the line $2y=5x+k$ is a tangent to the parabola $y^2=6x$.

5. If the eccentricity of a hyperbola is $\frac{5}{4}$, then find the eccentricity of its conjugate hyperbola.

6. Evaluate $\int \frac{1}{7x+3}\,dx$ on $I \subset \mathbf{R} \setminus \left\{-\frac{3}{7}\right\}$.

7. Evaluate $\int \sqrt{1-\sin 2x}\,dx$ on $I \subset \left[2n\pi - \frac{3\pi}{4},\ 2n\pi + \frac{\pi}{4}\right]$, $n \in \mathbf{Z}$.

8. Evaluate $\int_0^4 |2-x|\,dx$.

9. Find $\int_0^{\frac{\pi}{2}} \sin^{10} x \, dx$.

10. Find the order and degree of the differential equation $\frac{d^2y}{dx^2} = \left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{5}{3}}$.

SECTION - B

II. Short answer type questions : **5x4=20**

(i) Answer *any five* questions.

(ii) Each question carries *four* marks.

11. Find the length of the chord intercepted by the circle $x^2+y^2-8x-2y-8=0$ on the line $x+y+1=0$.

12. Find the radical centre of the following circles.
$x^2+y^2-4x-6y+5=0$, $x^2+y^2-2x-4y-1=0$, $x^2+y^2-6x-2y=0$

13. Find the length of major axis, minor axis, latus rectum, eccentricity, coordinates of centre, foci and the equations of directrices of the ellipse $9x^2+16y^2=144$.

14. If the normal at one end of a latus rectum of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ passes through one end of the minor axis, then show that $e^4+e^2=1$ (e is the eccentricity of the ellipse).

15. Find the equations of the tangents to the hyperbola $x^2-4y^2=4$ which are (i) parallel (ii) perpendicular to the line $x+2y=0$.

16. Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} \, dx$.

17. Solve $\frac{dy}{dx} - x \tan(y-x) = 1$.

SECTION - C

III. Long answer type questions : **5x7=35**

(i) Answer *any five* questions.

(ii) Each question carries *seven* marks.

18. Show that the circles $x^2+y^2-6x-2y+1=0$, $x^2+y^2+2x-8y+13=0$ touch each other. Find the point of contact and the equation of common tangent at their point of contact.

19. If (2, 0), (0, 1), (4, 5) and (0, c) are concyclic then find c.

20. Prove that the area of the triangle inscribed in the parabola $y^2=4ax$ is $\frac{1}{8a}|(y_1-y_2)(y_2-y_3)(y_3-y_1)|$ sq. units where y_1, y_2, y_3 are the ordinates of its vertices.

21. Obtain the reduction formula for $\int \sin^n x\,dx$ for an integer $n \geq 2$ and deduce $\int \sin^4 x\,dx$.

22. Evaluate $\int \frac{2\sin x + 3\cos x + 4}{3\sin x + 4\cos x + 5}\,dx$.

23. Evaluate $\int_0^1 \frac{\log(1+x)}{1+x^2}\,dx$.

24. Solve $\sqrt{1+x^2}\,\sqrt{1+y^2}\,dx + xy\,dy = 0$.

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