

BENGALURU CITY UNIVERSITY

Second Semester (NEP) Open Elective

Mathematics -2

Model Paper – 1

Time : $2\frac{1}{2}$ Hours

Part – A

max. marks : 60

I ANSWER ANY FIVE QUESTIONS

(5x3=15)

1. Find the quotient and remainder obtained by dividing $3x^3 - 4x^2 + 2x + 1$ by $x - 3$.
2. State Descartes' rule of signs.
3. If α, β are roots of equation $x^2 - 2x + 4 = 0$ then find
 - i. $\sum \left(\frac{1}{\alpha^2}\right)$
 - ii. $\sum \alpha^3$
4. If $u = \sin x \cos y$ find u_{xx}, u_{yy} .
5. Find $\frac{dz}{d\theta}$ if $z = x + y$, where $x = \cos^2 \theta$, $y = \sin^2 \theta$, by using partial differentiation.
6. If $u = 3x + 5y$, $v = 4x - 3y$, find $\frac{\partial(u,v)}{\partial(x,y)}$.
7. Evaluate $\oint_C 5xy \, dx + y^2 \, dy$ where C is the curve $y = 2x^2$ in the xy-plane from (0,0) to (1,2).
8. Evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \int_0^{2\cos(\theta)} r \, dr \, d\theta$
9. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^3 y \, dx \, dy \, dz$

Part – B

UNIT – I

II ANSWER ANY THREE QUESTIONS

(3x5=15)

10. Solve the equation $32x^3 - 48x^2 + 22x - 3 = 0$ given the roots are in AP.
11. Solve $x^3 - 5x^2 - 2x + 24 = 0$, the product of two of its roots being



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12. Solve the reciprocal equation $2x^4 + x^3 - 6x^2 + x + 2 = 0$.
13. If α, β, γ are the roots of the equation $3x^3 - 7x^2 + 6x + 5 = 0$ then find
- $\sum \frac{1}{\alpha}$
 - $\sum \alpha\beta$
 - $\sum \frac{\alpha}{\beta}$
14. Find the multiple roots of $x^4 - 2x^3 - 7x^2 + 20x - 12 = 0$.

UNIT – II

III ANSWER ANY THREE QUESTIONS

(3x5=15)


15. Verify Euler's theorem for $u = \frac{x^2+y^2}{x-y}$
16. If $x = r \cos(\theta)$ and $y = r \sin(\theta)$ verify that $\frac{\partial(x,y)}{\partial(r,\theta)} \cdot \frac{\partial(r,\theta)}{\partial(x,y)} = 1$
17. Expand $e^x \cos(y)$ in a Taylor Series about the point $(1, \frac{\pi}{4})$ upto the 2nd degree term.
18. Expand e^{xy} upto 2nd degree term using Maclaurin Series Expansion.
19. Find extreme values of $f(x, y) = x^3y^2(1 - x - y)$

UNIT – III

IV ANSWER ANY THREE QUESTIONS

(3x5=15)

20. Evaluate $\oint_C (x + 2y) dx + (4 - 2x) dy$ around the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ in the counter clockwise direction.
21. Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dy dx}{1+x^2+y^2}$
22. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by using double integral.
23. Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} \frac{dx dy dz}{\sqrt{a^2-x^2-y^2-z^2}}$
24. Find the volume of the tetrahedron bounded by the coordinate planes and the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$


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Mathematics - 2

MODEL PAPER - 2

Time : $2\frac{1}{2}$ Hours

PART A

max. marks : 60

I. Answer any five questions.

(5×3=15)

1. Solve the equation $x^3 - 9x^2 + 25x - 21 = 0$ given that $3 + \sqrt{2}$ is one of its root.
2. State Factor Theorem.
3. If α and β are the roots of the equation $ax^2 + bx + c = 0$ then find
 - i) $\sum\left(\frac{\alpha}{\beta}\right)$
 - ii) $\sum\left(\frac{\alpha^2}{\beta}\right)$
4. If $u = \log(x + y)$ then prove that $u_{xy} = u_{yx}$
5. Find total derivative of $f(x, y) = x^3y - x^2y^2$
6. If $x = r\cos\theta$ and $y = r\sin\theta$ find $\frac{\partial(x,y)}{\partial(r,\theta)}$
7. Evaluate $\int_{(0,1)}^{(2,3)} [(2xy - 1)dx + (x^2 + 1)dy]$ along the line $y = x + 1$
8. Evaluate $\int_0^{\pi/2} \int_0^{\pi/6} \sin x \cos y dx dy$
9. Evaluate $\int_0^{\pi/2} \int_0^{\pi/6} \int_0^{\pi/3} z \sin x \cos y dz dx dy$

PART B

UNIT - I

II. Answer any three questions.

(3×5=15)

10. Solve the equation $6x^3 - 11x^2 + 6x - 1 = 0$ given that the roots are in H.P.
11. Solve $x^3 + x^2 - 16x + 20 = 0$ such that the difference between two of its roots being 7
12. Solve the reciprocal equation $4x^4 - 20x^3 + 33x^2 - 20x + 4 = 0$
13. Solve $x^4 - 6x^3 + 11x^2 - 10x + 2 = 0$ given that $2 + \sqrt{3}$ is a root.


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14. Find the multiple roots of the equation $x^4 - 6x^3 + 13x^2 - 24x + 36 = 0$

UNIT – II

III. Answer any three questions.

(3×5=15)

15. Verify Euler's theorem for $u = x^3 - 2x^2y + 3xy^2 + y^3$

16. If $u = x + 3y^2 - z^3$, $v = 2x^2 - yz$, $w = 2z^2 - xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at

(1, -1, 0)

17. Expand e^{xy} about (1,1) upto 2^{nd} degree term.

18. Expand $\cos(x + y)$ in powers of x and y upto 3^{rd} degree using Maclaurin's series expansion.

19. Show that $f(x, y) = x^3 + y^3 - 3x - 12y + 20$ has maximum at (-1, -2), minimum at (1, 2) and (1, -2) and (-1, 2) are saddle points.

UNIT – III

IV. Answer any three questions.

(3×5=15)

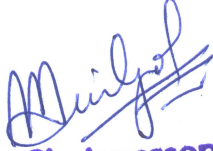
20. Evaluate $\int_C [xydx + yzdy + zxdz]$ where C is $x = t, y = t^2, z = t^3$ and $-1 < t < 1$

21. Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \frac{dydx}{\sqrt{a^2-x^2-y^2}}$

22. Find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ by using double integral.

23. Evaluate $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x + y + z) dydx dz$

24. Find the volume of the tetrahedron formed by the planes $x = 0, y = 0, z = 0$ and $6x + 4y + 3z = 12$


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Mathematics -2

Model Paper-3

Time : $2\frac{1}{2}$ Hours

Part A

max. marks : 60

I Answer any five questions

(5x3=15)

1. Solve the equation $3x^3 - 23x^2 + 72x - 70 = 0$ given $3 + i\sqrt{5}$ is one of its root.
2. State Remainder Theorem.
3. If α and β are the roots of $2x^2 - 3x + 5 = 0$ then find (i) $\sum \frac{1}{\alpha}$ (ii) $\sum \alpha^2$
4. If $U = x^2 + y^2$ find U_x , U_y and U_{xy}
5. Find $\frac{du}{dt}$, if $u = x^2y^3$ where $x = 2t^3$ and $y = 3t^2$ by using partial differentiation.
6. If $z = f(x, y)$ where $x = u + v$ and $y = u - v$ Prove that $\frac{\partial z}{\partial u} + \frac{\partial z}{\partial v} = 2 \frac{\partial z}{\partial x}$
7. Evaluate $\int_{(0,0)}^{(1,1)} x ds$ along $y = x$
8. Evaluate $\int_1^2 \int_3^4 (xy + e^y) dy dx$
9. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2 yz dx dy dz$

Part B

Unit-1

II Answer any three questions

(3X5=15)

10. Solve the equation $3x^3 - 26x^2 + 52x - 24 = 0$ given that the roots are in G.P.
11. Solve the equation $x^3 - 4x^2 + x + 6 = 0$ two of the roots being in the ratio 2:3
12. Solve the reciprocal equation $x^4 + 3x^3 - 3x - 1 = 0$



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13. Solve the equation $x^4 - 2x^3 - 10x^2 + 6x + 45 = 0$ given that $-2 + i$ is a root.

14. Find the multiple roots of $3x^4 + 16x^3 + 24x^2 - 16 = 0$

Unit-II

III Answer any three questions

(3x5=15)

15. If $u = \sqrt{(x^2 + y^2)}$ prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = u$

16. If $u = 2xy$, $v = x^2 - y^2$ and $x = r \cos \theta$, $y = r \sin \theta$ prove that $\frac{\partial(u,v)}{\partial(r,\theta)} = -4r^3$

17. Obtain Taylor's series expansion of $f(x, y) = x^2y + 3y - 4$ in powers of $(x - 1)$ and $(y + 2)$

18. Expand $\sin(x + y)$ in powers of x and y upto 3rd degree terms using Maclaurin's series expansion.

19. Find the extreme values of $f(x, y) = 2x^2 - xy + y^2 + 7x$

Unit-III

IV Answer any three questions

(3x5=15)


20. Evaluate $\int_c [(2x + y)dx + (3y + x)dy]$ along the line joining the points $(0,1)$ and $(2,5)$

21. Evaluate $\int_0^a \int_0^{\sqrt{a^2 - y^2}} \sqrt{a^2 - x^2 - y^2} dx dy$

22. Find the area of the circle $x^2 + y^2 = a^2$ by using double integration.

23. Evaluate $\int_0^1 \int_0^{x^2} \int_0^{x+y} (x - 2y + z) dz dy dx$

24. Find the volume of the sphere $x^2 + y^2 + z^2 = a^2$ by using triple integral.


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