

QUESTION BANK

MODULE :1

PART : A(MCQ) (ALL 1 MARKS)

- If $Z(x, y)$ is a homogeneous function of degree 'n' then what is the value of $x^2 \frac{\partial^2 Z}{\partial x^2} + 2xy \frac{\partial^2 Z}{\partial x \partial y} + y^2 \frac{\partial^2 Z}{\partial y^2} = \dots$
a) $n(n-1)z$ b) $(n-1)z$ c) nz d) 0 [C01/P01]
- The Stationary point at which the function $f(x, y)$ has neither maximum nor minimum is called as.....
a) Stationary point b) saddle point c) maximum d) none of these [C01/P01]
- If $U = \sin^{-1} \frac{1}{y} + \tan^{-1} y$ then what is the value of $\frac{\partial U}{\partial x} = \dots$
a) 2 b) 1 c) -1 d) 0 [C01/P01]
- The degree of $z = ax^2 + 2hxy + by^2$ is _____.
a) 2 b) 1 c) -1 d) 0 [C01/P02]
- If $U = \tan^{-1} \frac{y}{x}$ then $\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} = \dots$
a) n b) n-1 c) n+1 d) 0 [C01/P01]
- The degree of $f(x, y) = x \sin \frac{y}{x}$ is _____.
a) 2 b) 1 c) -1 d) 0 [C01/P02]
- The value of z_x is ____, where $z = y \sin 2y$
a) 2 b) 1 c) -1 d) 0 [C01/P02]
- _____ is the degree of $x u_x + y u_y = n u$
a) n-1 b) n+1 c) 1 d) none of these [C01/P02]
- _____ is the derivative of $\sin^2 x$.
a) $\cos 2x$ b) $\sin 2x$ c) $\tan 2x$ d) none of these [C01/P02]
- The value of z_{xy} is ____, where $z = 3x \sin 2x$
a) 2 b) 1 c) -1 d) 0 [C01/P02]

PART : B(Short Question) (ALL 2 MARKS)

- If $U = e^x \sin y$ then find dU . [C01/P01]
- Integrate $\int x^2 e^x dx$ [C01/P02]
- Find $\frac{dz}{dt}$ when $z = xy^2 + x^2 y$, $x = at^2$, $y = 2at$ [C01/P02]
- Expand $\sin x$ in powers of $(x - \frac{\pi}{2})$ by Taylor's Series. [C01/P02]

15. Define Euler's theorem for homogeneous functions. [C01/P01]
16. If $z = \cos xy$ then $z_x =$ _____ [C01/P01]
17. Find the total derivative of $u = y \cos x$ [C01/P02]
18. Define Taylor's theorem of two variable. [C01/P01]
19. Define stationary point. [C01/P01]
20. Find the total derivative of $u = e^x y$ [C01/P02]
21. Define Saddle point. [C01/P01]
22. Verify $f_{yx} = f_{xy}$ where $f = \sin(2x^2 + y^2)$ [C01/P02]
23. Find df , if $f = \log \frac{x^2 + y^2}{x + y}$ [C01/P02]
24. Integrate $\int 2x \cos 2x \sin x \, dx$ [C01/P02]
25. Integrate $\int 2x^3 \sin x \, dx$ [C01/P02]
26. Integrate $\int 2x^3 \cos 2x \, dx$ [C01/P02]

PART : C(Long Question)

27. If $U = \log \frac{x^4 + y^4}{x + y}$ then show that $x \frac{\partial U}{\partial x} + y \frac{\partial U}{\partial y} = 3$ [C01/P02] [8 MARKS]
28. if $U = \tan^{-1} \frac{x^3 + y^3}{x - y}$, $x \neq y$ then show that $x \frac{\partial U}{\partial x} + y \frac{\partial U}{\partial y} = \sin 2U$ [C01/P02] [8 MARKS]
29. Expand $f(x, y) = x^2 + xy + y^2$ in powers of $(x-2)$ and $(y-3)$. [C01/P02] [7 MARKS]
30. Expand $f(x, y) = e^x \cos y$ by Taylor's series in powers of x and y such that it includes all terms up to third degree. [C01/P02] [7 MARKS]
31. Discuss the maxima or minima value of $U = x^3 + y^3 - 3axy$ [C01/P02] [8 MARKS]
32. If $U = x^2 \tan^{-1} \frac{y}{x} - y^2 \tan^{-1} \frac{x}{y}$; $xy \neq 0$ then prove that $\frac{\partial^2 U}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$ [C01/P02] [8 MARKS]
33. If $Z = f(x + ay) + \phi(x - ay)$ then prove that $\frac{\partial^2 Z}{\partial y^2} = a^2 \frac{\partial^2 Z}{\partial x^2}$ [C01/P02] [7 MARKS]
34. Integrate $\int x^2 \sin 2x \cos 3x \, dx$ [C01/P02] [7 MARKS]
35. Verify $f_{xy} = f_{yx}$ where $f = e^{2x} \cos 3y$ [C01/P02] [7 MARKS]
36. Discuss the maxima and minima of the function $u = x^3 y^2 (1 - x - y)$ [C01/P02] [8 MARKS]
37. If u is homogeneous function of degree n , prove that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = n(n-1)u$ [C01/P02] [8 MARKS]
38. If $u = \sin^{-1} \left(\frac{x^2 + y^2}{x + y} \right)$, prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \tan u$. [C01/P02] [8 MARKS]

MODULE :2

PART : A(MCQ) (ALL 1 MARKS)

1. The number of arbitrary constants in the general solution of second order differential equation is _____ [C02/P01]
 - a) 2 b) 1 c) -1 d) 0
2. What is the Order and degree of the differential equation $\sqrt[3]{\frac{d^2 y}{dx^2}} + y = \sin \sqrt{x}$ [C02/P01]
 - a) 2,1 b) 1,1 c) 2,1/3 d) 0,-1

3. The integrating factor of $y' + 4y = 20$ is _____. [CO2/PO1]
a) $\text{Exp}(4x)$, b) $\text{Exp}(x)$ c) $\exp(4y)$, d) none of these
4. The function $Y = Ax + Bx^2$ is the solution of _____ order differential equation. [CO2/PO1]
a) Second b) first c) third d) none of these.
5. What is the order of differential equation $y'^2 + y = 0$. [CO2/PO1]
a) Second b) first c) third d) none of these.
6. Write the general solution of the Differential equation $y'' + 2y' + y = 0$ having equal roots is _____
a) $(a + bx)e^{-x}$, b) bxe^{-x} c) $x(a + bx)e^{-x}$ d) none of these [CO2/PO1]
7. The integrating factor of $y' + 4y = 20$ is _____. [CO2/PO1]
a) e^{2x} b) e^{-2x} c) e^{-4x} d) e^{4x}
- 8) The solutions y_1, y_2 are said to be independent if their Wronskian is not equal to _____. [CO2/PO1]
a) 0 b) 1 c) -1 d) none of these
- 9) The differential equation $y'' + 2xy' + y = 0$ is _____. [CO2/PO1]
a) Homogeneous b) Non- Homogeneous c) Exact d) none of these.
- 10) what is the general solution of $(D - 2)y = 0$ [CO2/PO1]
a) $y = k e^{2x}$ b) $y = k x e^{2x}$ c) $y = k x^2 e^{2x}$ d) none of these

PART : B(Short Question) (ALL 2 MARKS)

11. Write the general solution of the Differential equation $y'' + 2y' + y = 0$. [CO2/PO1]
12. What is the integrating factor of the equation $y' + 2xy = x^2$ [CO2/PO1]
13. Write the formula for particular solution of variation of parameter. [CO2/PO1]
14. Write the Bernoulli's equation. [CO2/PO1]
15. Test the exactness of the differential equation $x \sin(y^2) dx + y x^2 \cos(y^2) dy = 0$. [CO2/PO1]
16. Solve $(x^2 D^2 + 3x D + 1)y = 0$ [CO2/PO2]
17. What is the order and degree of the differential equation $y'' + e^x y = 0$ [CO2/PO1]
18. Under what condition the equation $(Ax + By)dx + (Cx + Dy)dy = 0$ is exact. [CO2/PO1]
19. Solve $(y'' - y' - 2y) = 0$. [CO2/PO2]
20. Solve $x^2 y'' - 3x y' + 4y = 0$ [CO2/PO2]
21. Solve $(2x - e^y) dx + x e^y dy = 0$ [CO2/PO2]
22. Solve $Y' + Y = e^{-x} \tan x$ [CO2/PO2]
23. Solve $y' + y = e^{-x} \tan x$ [CO2/PO2]
24. Solve the initial value problem $y' - e^x y = 0$ with $y(0) = 1$ [CO2/PO2]
25. Define Wronskian and find the Wronskian of $y_1 = \sin x$ and $y_2 = \cos x$ [CO2/PO1]
26. Define integrating factor and how it is useful for differential equation. [CO2/PO1]
27. Define general and particular solution of a differential equation. [CO2/PO1]
28. Solve $x y'' + 2y' = 0$ [CO2/PO2]
29. Find the particular solution of $y'' + 2y = \sin 3x$ [CO2/PO2]
30. Find the particular solution of $y'' + 3y = x^2$ [CO2/PO2]
31. Write the formula for particular solution of $y'' + 4y = \cos 2x$ by undetermined coefficient. [CO2/PO2]

PART : C(Long Question)

32. Solve $\cos(x+y) \frac{dy}{dx} = 1$. [C02/P02] [8MARKS]
33. solve $xy' = (y-x)^2 + y$. [C02/P02] [8MARKS]
34. $\frac{dy}{dx} - (1 + \frac{3}{x})y = x + 2$ [C02/P02] [7MARKS]
35. solve $x^2 y'' - xy' + y = 0$ [C02/P02] [7MARKS]
36. Solve $y'' - 4y' + 4y = \frac{e^{2x}}{x}$ by using variation of parameter. [C02/P02] [8MARKS]
37. Solve $xy \frac{dy}{dx} = 1 + xy + x + y$ [C02/P02] [7MARKS]
38. Solve $x^2 y'' - 4xy' + 6y = 0$ [C02/P02] [7MARKS]
39. Solve $y' + y = \sin 3x$. [C02/P02] [7MARKS]
40. Solve $(x+1) \frac{dy}{dx} - y = e^{3x}(x+1)^2$ [C02/P02] [7MARKS]
41. Solve $y'' + 3y' - 18y = 9 \sin x$ by using undetermined coefficient method. [C02/P02] [8MARKS]
42. Solve the differential equation $y'' + y = \operatorname{Cosec} x$ by using variation of parameter [C02/P02] [8MARKS]
43. Solve $3y'' + 10y' + 3y = 9x + 5 \cos x$ [C02/P02] [8MARKS]
44. Solve $y'' + y = \sec x$ by using variation of parameter. [C02/P02] [8MARKS]
45. Using Operator method Solve the differential equation $y'' + 9y = \cos 3x$ [C02/P02] [7MARKS]
46. Using Operator method Solve the differential equation $y'' - 4y' + 4y = e^{3x} + x + 1$ [C02/P02] [8MARKS]

MODULE : 3

PART : A(MCQ) (ALL 1 MARKS)

1. If $f(x)$ is an odd function then $\int_{-a}^a f(x) dx =$ _____. [C03/P01]
a) 0, b) 1, c) -1, d) none of these
2. The value of $\sin n\pi =$ _____. [C03/P01]
a) 0, b) 1, c) -1, d) none of these
3. The fundamental period of $\sin 2x$ is _____. [C03/P01]
a) π , b) 1, c) 2π , d) none of these
4. The function $f(x) = x^2$ is an _____ function in the range $(-c, c)$. [C03/P01]
a) odd, b) even, c) neither odd nor even, d) none of these
5. The value of $\cos n\pi$ is _____. [C03/P01]
a) 0, b) 1, c) -1, d) none of these
6. The function $\sin(n\pi x/L)$ is an _____ Function. [C03/P01]
a) odd, b) even, c) neither odd nor even, d) trigonometric function
7. If $f(x)$ is an even function then the value of $\int_{-a}^a f(x) dx$ is _____. [C03/P01]
a) 0, b) 1, c) -1, d) none of these
8. The fundamental Period of $\tan x$ is _____. [C03/P01]
a) π , b) 1, c) 2π , d) none of these
9. The fundamental period of $\sin 2x + \cos 3x$ is _____. [C03/P01]
a) π , b) 1, c) 2π , d) none of these
10. The function $f(x) = x^3$ is an _____ function in the range $(0, 3)$. [C03/P01]
a) odd, b) even, c) neither odd nor even, d) not defined

PART : B(Short Question) (ALL 2 MARKS)

9. Define periodic function. [C03/P01]
10. Check the function $f(x) = x \sin x$ for even or odd. [C03/P02]
11. Define half range cosine series. [C03/P01]
12. Define even and odd function. [C03/P01]
13. Draw the graph of $|x|$, $0 < x < 2$ [C03/P02]
14. Define half range sine series. [C03/P01]
15. Express the function $f(x) = 3x^2$, $-1 < x < 1$ in Fourier series [C03/P01]
16. Check for even and odd function for $f(x) = x + x^2$ [C03/P02]
17. Write the necessary condition for a function to have fourier series. [C03/P02]
18. Define Fourier series in the period 2π . [C03/P02]
19. Determine whether the function is even or odd. $f(x) = \log(x + \sqrt{x^2 + 1})$ [C03/P02]
20. Determine whether the function is even or odd. $f(x) = x \left(\frac{a^x - 1}{a^x + 1} \right)$ [C03/P02]
21. Determine whether the function is even or odd. $f(x) = \sin^2 x + \cos x$ [C03/P02]
22. Find the odd extension of the function $f(x) = x$, $0 < x < 2$ [C03/P02]

PART : C(Long Question)

23. Find the Fourier series of $f(x) = \begin{cases} 0, & \text{if } -\pi < x < 0 \\ x, & \text{if } 0 < x < \pi \end{cases}$ [C03/P02] [7MARKS]
24. Find the Fourier series of $f(x) = \begin{cases} 1, & \text{if } -\pi < x < 0 \\ -1, & \text{if } 0 < x < \pi \end{cases}$ [C03/P02] [7MARKS]
25. Find the Fourier series of $f(x) = x^3$, $-\pi < x < \pi$. [C03/P02] [8MARKS]
26. Find the Fourier series of $f(x) = x^2$, $0 < x < 2\pi$. [C03/P02] [7MARKS]
27. Find the Fourier series of $f(x) = x|x|$, $-\pi < x < \pi$. [C03/P02] [8MARKS]
28. Find the Fourier series of $f(x) = \begin{cases} x, & -\frac{\pi}{2} < x < \frac{\pi}{2} \\ 0, & \frac{\pi}{2} < x < \frac{3\pi}{2} \end{cases}$ [C03/P02] [8MARKS]
29. Find the Fourier series of $f(x) = \begin{cases} 1, & \text{if } -1 < x < 0 \\ -1, & \text{if } 0 < x < 1 \end{cases}$ [C03/P02] [7MARKS]
30. Find the Fourier series of $f(x) = |x|$, $-2 < x < 2$. [C03/P02] [7MARKS]
31. Find the Fourier series of $f(x) = 3x^2$, $-1 < x < 1$. [C03/P02] [8MARKS]
32. Find the Fourier series of $f(x) = \begin{cases} k, & -\frac{\pi}{2} < x < \frac{\pi}{2} \\ 0, & \frac{\pi}{2} < x < \frac{3\pi}{2} \end{cases}$ [C03/P02] [7MARKS]
33. Find the Half range sine Series of $f(x) = x^2$, in $0 < x < \pi$ [C03/P02] [7MARKS]
34. Find the Fourier series of $f(x) = (\pi - x)$, $0 < x < 2\pi$. [C03/P02] [8MARKS]
35. Find the Half range cosine series of $f(x) = x^2$ in $0 < x < 1$. [C03/P02] [7MARKS]
36. Find the Fourier series $f(x) = \frac{x^2}{2}$ in $-\pi < x < \pi$ [C03/P02] [8MARKS]
37. Find the Half-range sine series of $f(x) = \pi - x$ in $0 < x < \pi$ [C03/P02] [7MARKS]

MODULE : 4

PART : A(MCQ) (ALL 1 MARKS)

1. The Eigen Values of a symmetric matrix are _____. [C04/P01]
a) Zero b) one c) equal d) non of these
2. The absolute value of an orthogonal matrix is _____. [C04/P01]
a) 0 b) 1 c) ∞ d) none of these
3. The eigen values of a skew Hermitian matrix are _____. [C04/P01]
a) 0 b) 1 c) ∞ d) none of these
4. The diagonal elements of a skew symmetric matrix is _____. [C04/P01]
a) 1 b) -1 c) 0 d) none of these
5. The eigen values of the matrix $\begin{pmatrix} 7 & 1 \\ 0 & 2 \end{pmatrix}$ is _____. [C04/P01]
a) 1,0 b) 7,2 c) 0,0 d) none of these
6. The spectral radius of the matrix is $\begin{pmatrix} 5 & 0 \\ 9 & 2 \end{pmatrix}$ is _____. [C04/P01]

- a) 7 b) 9 c) 0 d) 2
7. The determinate of an orthogonal matrix is _____. [CO4/PO1]
a) 1 or -1 b) 1 or 0 c) -1 or 0 d) none of these
8. Set of eigen value of a matrix is called _____. [CO4/PO1]
a) Eigen set b) eigen vector c) Spectrum d) none of these
9. The determinant of a singular matrix is _____. [CO4/PO1]
a) 1 b) -1 c) 0 d) none of these
10. The Inverse of a _____ matrix is exist. [CO4/PO1]
a) Zero matrix b) non singular matrix c) singular matrix d) none of these

PART : B(Short Question) (ALL 2 MARKS)

11. Define algebraic and geometric multiplicity of an Eigen value. [CO4/PO1]
12. Find the eigen values of the matrix $\begin{bmatrix} 0 & 3i \\ -3i & 0 \end{bmatrix}$ [CO4/PO1]
13. Prove that the diagonal elements of a skew-symmetric matrix are zero. [CO4/PO2]
14. Find the symmetric coefficient matrix of the quadratic form $Q = (x - y)^2 + 4xy$ [CO4/PO2]
15. Define symmetric and skew-symmetric matrix. [CO4/PO1]
16. Define linear dependence and independence of vectors. [CO4/PO1]
17. Check the matrix $\begin{pmatrix} i & 1+i \\ -1+i & -2i \end{pmatrix}$ is skew-hermitian matrix or not. [CO4/PO2]
18. Find the symmetric coefficient matrix of the quadratic form $Q = 4x^2 - 8xy + 5y^2$ [CO4/PO2]
19. Define rank of matrix. What is its basic importance. [CO4/PO1]
20. Find the spectrum and spectral radius of the matrix $\begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix}$ [CO4/PO2]
21. Define hermitian and skew-hermitian matrix. [CO4/PO1]
22. Find the symmetric coefficient matrix of quadratic form for $Q = x_1^3 - 2x_1x_2 + 4x_2x_3 - 9x_3^2$ [CO4/PO2]
23. Check for Linear Dependent or linear independent of $[3,0,2,2]$, $[-6,4,2,24,54]$, $[21,-21,0,-15]$ [CO4/PO2]
24. Prove that any matrix A can be expressed as the sum of symmetric and skew-symmetric matrix. [CO4/PO2]
25. Define unitary matrix. [CO4/PO1]
26. Define Consistent and inconsistent of a system of Linear equation. [CO4/PO1]

PART : C(Long Question)

27. Find the rank of the matrix $\begin{bmatrix} 3 & -1 & 3 \\ 2 & -4 & 6 \\ 10 & 0 & 14 \end{bmatrix}$ [CO4/PO2] [7MARKS]
28. Solve $7x - 4y - 2z = -6$, $16x + 2y + z = 3$, $14x - 8y - 4z = -12$. [CO4/PO2] [8MARKS]
29. Prove that the absolute value of determinant of an unitary matrix is 1. [CO4/PO2] [7MARKS]
30. Find the rank of the matrix $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$ [CO4/PO2] [7MARKS]
31. Solve the system of linear equation by Gauss Elimination method [CO4/PO2] [8MARKS]
 $-3x + 2y + z = 3$, $2x + y + z = 0$, $6x + 2y + 4z = 6$
32. Find the rank of a matrix [CO4/PO2] [7MARKS]
 $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 5 & 8 \\ -3 & 4 & 4 \\ 1 & 2 & 4 \end{pmatrix}$
33. Find the eigen value and eigen vector of the matrix $\begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{pmatrix}$ [CO4/PO2] [8MARKS]
34. Find the Eigen value and Eigen vector of [CO4/PO2] [8MARKS]

$$\begin{pmatrix} -19 & 7 \\ -42 & 16 \end{pmatrix}$$

35. Find out which type of conic section is represented by Quadratic function [CO4/PO2] [7MARKS]

$$11x^2 + 84xy + 24y^2 = 156$$

36. Diagonalize $\begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$ [CO4/PO2] [8MARKS]

37. Solve the following system of equations by Gauss Elimination Method [CO4/PO2] [8MARKS]

$$x + y - z = 9, \quad 8y + 6z = -6, \quad -2x + 4y - 6z = 40$$

38. Find out which type of conic section is represented by Quadratic function [CO4/PO2] [7MARKS]

$$41x^2 + 24xy + 34y^2 = 0$$

39. Find the basis of Eigen vector that form a unitary system $\begin{bmatrix} i & 1 \\ -1 & i \end{bmatrix}$ [CO4/PO2] [7MARKS]

40. Diagonalize $\begin{bmatrix} 2 & 1 \\ 2 & 1 \end{bmatrix}$ [CO4/PO2] [8MARKS]

41. Prove that the eigen values of a Hermitian matrix are Real. [CO4/PO2] [7MARKS]

42. Prove that the eigen values of a Unitary matrix have absolute value 1. [CO4/PO2] [7MARKS]