

I B. Tech I Semester Regular Examinations, January-2024

LINEAR ALGEBRA AND CALCULUS

(Common to all Branches)

Time: 3 hours

Max. Marks: 70

Note: 1. Question paper consists of two parts (**Part-A** and **Part-B**)

2. All the questions in **Part-A** is Compulsory

3. Answer **ONE** Question from **Each Unit** in **Part-B**

PART –A (20 Marks)

1. a) Define linear system of equations. [2M]
- b) What is the normal form? [2M]
- c) Find the matrix corresponding to quadratic form $x^2 + 4xy + 2y^2$. [2M]
- d) Find the sum of the Eigen values of matrix $\begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$ [2M]
- e) State Cauchy's mean value theorem. [2M]
- f) Write the geometrical interpretation for Lagrange's mean value theorem. [2M]
- g) Find $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ for $f(x, y) = xy + x^2 + 2y$ [2M]
- h) Find $\frac{\partial u}{\partial x}$ if $u = f(x + y, x - y)$ [2M]
- i) Let $f(x, y)$ be a continuous function in R^2 where $R = \{(x, y) | a \leq x \leq b; c \leq y \leq d\}$ then $\iint_R f(x, y) dx dy = ?$ [2M]
- j) Evaluate $\int_0^1 \int_0^2 xy dx dy$ [2M]

PART – B (50 MARKS)**UNIT-I**

2. a) Find the rank of the matrix using echelon form $\begin{bmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{bmatrix}$ [5M]
- b) Solve the system of equations using Gauss elimination method [5M]
 $10x + y + z = 12, 2x + 10y + z = 13, x + y + 5z = 7.$

(OR)

3. a) Find the inverse using Gauss-Jordan method $\begin{bmatrix} 2 & -1 & 3 \\ 1 & 1 & 1 \\ 1 & -1 & 1 \end{bmatrix}$ [5M]
- b) Find the values of 'a' and 'b' for which the system of equations [5M]
 $x + y + z = 3, x + 2y + 2z = 6, x + ay + 3z = b$ has a unique solution.

UNIT-II

4. a) Determine the eigen values of $adjA$ where $A = \begin{bmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}$ [5M]
- b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ [5M]

(OR)

5. Diagonalize the matrix $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ and find A^4 using model matrix 'P' [10M]

UNIT-III

6. a) Verify Rolle's mean value theorem $f(x) = \frac{\sin x}{e^x}$ in $[0, \pi]$ [5M]
 b) Write the Taylor's series expansion for $f(x) = \log(1 + x)$ about $x = 0$ [5M]

(OR)

7. Prove that $\frac{\pi}{6} + \frac{1}{5\sqrt{3}} < \sin^{-1}\left(\frac{3}{5}\right) < \frac{\pi}{6} + \frac{1}{8}$ [10M]

UNIT-IV

8. a) If $x = r \cos \theta, y = r \sin \theta$ then prove that $\frac{\partial^2 \theta}{\partial x^2} + \frac{\partial^2 \theta}{\partial y^2} = 0$ [5M]
 b) Determine whether the following functions are functionally dependent if so find the relation between if $u = x\sqrt{1-y^2} + y\sqrt{1-x^2}, v = \sin^{-1}(x) + \sin^{-1}(y)$. [5M]

(OR)

9. a) Find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ if $u = \log\left(\frac{x^2+y^2}{xy}\right)$ [5M]
 b) Find extreme values $f(x, y) = 1 - x^2 - y^2$ [5M]

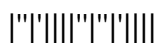
UNIT-V

10. By change of Integration Evaluate [10M]

$$\int_0^1 \int_{x^2}^x xy \, dx \, dy$$

(OR)

11. Find the volume of the sphere $x^2 + y^2 + z^2 = a^2$ using triple integration. [10M]



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2. All the questions in **Part-A** is Compulsory

3. Answer **ONE** Question from **Each Unit** in **Part-B**

PART -A (20 Marks)

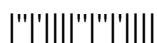
1. a) Define the rank of the matrix [2M]
- b) If the matrix of order $(m \times n)$, then that would be the rank of the matrix [2M]
- c) Find the product of the Eigen values of $\begin{bmatrix} 2 & 2 \\ 2 & 6 \end{bmatrix}$ [2M]
- d) Find the Eigen vector corresponding to $\lambda = 5$ for the matrix $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 4 \\ 0 & 0 & 5 \end{bmatrix}$ [2M]
- e) Write the geometrical interpretation for Rolle's mean value theorem. [2M]
- f) Find the value of 'c' using Lagrange's mean value theorem for $f(x) = x^2$ in $[1,5]$ [2M]
- g) Find $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ for $f(x, y) = e^{xy} + 2x^2$ [2M]
- h) Find $\frac{\partial u}{\partial y}$ if $u = f(x + y, x - y)$ [2M]
- i) If $f(x, y)$ be a continuous function defined over region R , where $R = \{(x, y) / a \leq x \leq b \text{ and } y_1 \leq y \leq y_2\}$ then $\iint_R f(x, y) dx dy = ?$ [2M]
- j) Evaluate $\int_0^1 \int_0^1 e^{xy} dx dy$ [2M]

PART - B (50 MARKS)**UNIT-I**

2. a) Solve the system of equations using Gauss elimination method [5M]
 $3x + y + 2z = 3, 2x - 3y - z = -3, x + 2y + z = 4$
 - b) Find the inverse using Gauss-Jordan method $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$ [5M]
- (OR)
3. a) Find the rank of the matrix using Normal form $\begin{bmatrix} 1 & 3 & 6 & -1 \\ 1 & 4 & 5 & 1 \\ 1 & 5 & 4 & 3 \end{bmatrix}$ [5M]
 - b) Test the consistency, if so, solve the system of equations [5M]
 $x + y + z = 6, x + 2y + 3z = 10, x + 2y + 3z = 5$

UNIT-II

4. a) Determine the Eigen values of A^{-1} where $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ [5M]
- b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 2 & 4 & 7 \\ 0 & 1 & 8 \\ 0 & 0 & 3 \end{bmatrix}$ [5M]



(OR)

5. Diagonalize the matrix $A = \begin{bmatrix} 2 & 2 & -7 \\ 2 & 1 & 2 \\ 0 & 1 & -3 \end{bmatrix}$ and find A^4 using model matrix 'P' [10M]

UNIT-III

6. a) Write the Taylor's series expansion for $f(x) = \log(1-x)$ about $x = 0$ [5M]
 b) Verify Rolle's mean value theorem $f(x) = |x|$ in $[-1,1]$ [5M]

(OR)

7. If $a < b$ prove that $\frac{b-a}{1+b^2} < \tan^{-1}b - \tan^{-1}a < \frac{b-a}{1+a^2}$ [10M]

UNIT-IV

8. a) Expand $f(x,y) = xy^2 + \cos(xy)$ in powers of $(x-1)$ and $(y-\frac{\pi}{2})$ using Taylor's series. [5M]
 b) If $u = \frac{y}{z} + \frac{z}{x}$ then find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$ [5M]

(OR)

9. a) Find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ if $u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y}{x}\right)$ [5M]
 b) Show that $u = \frac{x}{y-z}, v = \frac{y}{z-x}, w = \frac{z}{x-y}$ are functionally dependent. [5M]

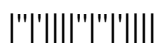
UNIT-V

10. Evaluate by change of order of Integration [10M]

$$\int_0^{2a} \int_{y^2/4a}^{3a-y} dx dy$$

(OR)

11. Evaluate $\iiint_R z(x^2 + y^2) dx dy dz$ where R is the Region bounded by the cylinder $x^2 + y^2 = 1$ and the planes $z = 2$ and $z = 3$ by changing it to cylindrical coordinates. [10M]



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2. All the questions in **Part-A** is Compulsory

3. Answer **ONE** Question from **Each Unit** in **Part-B**

PART – A (20 Marks)

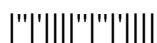
1. a) Find the rank of the singular matrix of order 4×4 [2M]
- b) What type of the solutions exists for $2x + 3y = 5$, $4x + 6y = 10$ system? [2M]
- c) If 5 is an Eigen value of A the find the Eigen value of $4A + 5I$ [2M]
- d) Write the quadratic form associated with $\begin{bmatrix} 4 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$ [2M]
- e) Find the value of 'c' using Rolle's's mean value theorem for $f(x) = x^2$ in $[-1,1]$ [2M]
- f) State Lagrange's mean value theorem. [2M]
- g) Find $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ for $f(x, y) = \log \sqrt{x^2 + y^2}$ [2M]
- h) Find $\frac{\partial u}{\partial x}$ if $u = f(x + 2y, x - 2y)$ [2M]
- i) If $f(x, y)$ be a continuous defined over a Region R, were $R = \{(x, y) / x_1 \leq x \leq x_2 \text{ and } c \leq y \leq d\}$ then $\iint_R f(x, y) dx dy = ?$ [2M]
- j) Evaluate $\int_0^2 \int_0^1 xy dx dy$ [2M]

PART – B (50 MARKS)**UNIT-I**

2. a) Find the rank of the matrix using echelon form $\begin{bmatrix} 2 & 1 & -3 & -6 \\ 2 & -3 & 1 & 2 \\ 1 & 1 & 1 & 2 \end{bmatrix}$. [5M]
 - b) Solve the system of equations $x + 2y + 3z = 0, 3x + 4y + 4z = 0, 7x + 10y + 12z = 0$. [5M]
- (OR)**
3. a) Test the consistency, if so, solve the system of equations $5x + 3y + 7z = 4, 3x + 26y + 2z = 9, 7x + 2y + 10z = 5$. [5M]
 - b) Solve the system of equations using Gauss Seidel iteration method $10x + y + z = 12, x + 10y - z = 10, x - 2y + 10z = 9$ [5M]

UNIT-II

4. Reduce the quadratic form $2x^2 + 2y^2 + 2z^2 - 2yz - 2zx - 2xy$ to the canonical form by orthogonal reduction. Hence find nature, rank, index, and signature. [10M]

(OR)

5. a) Find the Eigen values A^2 if $A = \begin{bmatrix} -1 & 0 & 2 \\ -1 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$ [5M]
- b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$ [5M]

UNIT-III

6. Show that for any $0 < x < 1$, $x < \sin^{-1}x < \frac{x}{\sqrt{1-x^2}}$ [10M]
- (OR)
7. a) Verify Cauchy's mean value theorem $f(x) = \sin x$ and $g(x) = \cos x$ in $\left[0, \frac{\pi}{2}\right]$ [5M]
- b) Write the Taylor's series expansion for $f(x) = \cos x$ about $x = \frac{\pi}{4}$ [5M]

UNIT-IV

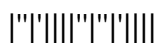
8. a) Find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ if $u = \frac{x^2+y^2}{\sqrt{x}+\sqrt{y}}$ [5M]
- b) Expand $f(x, y) = \tan^{-1}\left(\frac{y}{x}\right)$ in powers of $(x-1)$ and $(y-1)$ using Taylor's series. [5M]

(OR)

9. a) Find extreme values of $f(x, y) = x^2 - xy + y^2 + 3x - 2y + 1$ [5M]
- b) Prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$ if $u = z \tan^{-1}\left(\frac{x}{y}\right)$ [5M]

UNIT-V

10. By change into polar co-ordinates Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} (x^2y + y^2) dx dy$ [10M]
- (OR)
11. Evaluate $\iiint_R (x^2 + y^2 + z^2) dx dy dz$, where R is the Region bounded by $x = 0$, $y = 0$, $z = 0$ and the sphere $x^2 + y^2 + z^2 = 1$ in the first octant. [10M]



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2. All the questions in **Part-A** is Compulsory

3. Answer **ONE** Question from **Each Unit** in **Part-B**

PART –A (20 Marks)

1. a) The rank of 2×2 matrix with all elements are 3. [2M]
- b) Write the condition for the homogeneous system of equations possess trivial solutions. [2M]
- c) Find the nature of the quadratic form $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ [2M]
- d) Find the Eigen values of A^T If 1 and 2 are the Eigen values of A. [2M]
- e) Find the value of 'c' using Lagrange's mean value theorem for $f(x) = 2x$ in $[0,1]$ [2M]
- f) Write the Maclaurin's series. [2M]
- g) Find $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ for $f(x, y) = e^x \cos 2y$ [2M]
- h) Find $\frac{\partial u}{\partial y}$ if $u = f(2x + y, x - 2y)$ [2M]
- i) If the region 'R' is divided into two sub regions, R_1, R_2 then $\iint_R f(x, y) dx dy = ?$ [2M]
- j) Evaluate $\int_0^1 \int_0^1 dx dy$ [2M]

PART – B (50 MARKS)**UNIT-I**

2. a) Solve the system of equations [5M]
 $x + 3y - 2z = 0, \quad 2x - y + 4z = 0, \quad x - 11y + 14z = 0$
- b) Solve the system of equations using Gauss Jacobi iteration method [5M]
 $10x + y + z = 12, \quad x + 10y - z = 10, \quad x - 2y + 10z = 9$

(OR)

3. a) Find the rank of the matrix using Normal form $\begin{bmatrix} 3 & 2 & -1 & 5 \\ 5 & 1 & 4 & 2 \\ 1 & -4 & 11 & -19 \end{bmatrix}$ [5M]
- b) Test the consistency, if so, solve the system of equations [5M]
 $x + y + z + t = 4, \quad x - z + 2t = 2, \quad y + z - 3t = -1, \quad x + 2y - z + t = 3.$



UNIT-II

4. Reduce the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to the canonical form by orthogonal reduction. Hence find nature, rank, index, and signature. [10M]

(OR)

5. a) Find the Eigen values A^3 if $A = \begin{bmatrix} 3 & -2 & 2 \\ 6 & -4 & 6 \\ 2 & -1 & 3 \end{bmatrix}$ [5M]

- b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 2 & -1 & 1 \end{bmatrix}$ [5M]

UNIT-III

6. Show that for any $x > 0$, $1 + x < e^x < 1 + xe^x$ [10M]

(OR)

7. a) Verify Cauchy's mean value theorem $f(x) = x^2$ and $g(x) = x^3$ in $[1,2]$ [5M]

- b) Write the Taylor's series expansion for $f(x) = \sin x$ about $x = \frac{\pi}{4}$ [5M]

UNIT-IV

8. a) Prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$ if $u = (x^2 + y^2 + z^2)^{-\frac{1}{2}}$ [5M]

- b) Find the maximum and minimum distance of the point $(3,4,12)$ from the sphere $x^2 + y^2 + z^2 = 1$ using Lagrange's multiplier method [5M]

(OR)

9. a) Find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ if $u = \log \left(\frac{x^2 + y^2}{xy} \right)$ [5M]

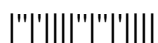
- b) Find extreme values of the following functions $f(x, y) = xy(a - x - y)$ [5M]

UNIT-V

10. Evaluate $\iint_R (\sqrt{xy} - y^2) dx dy$ where R is a triangle with vertices $(0,0)$, $(1, 0)$, $(1, 1)$ [10M]

(OR)

11. Find the volume under the parabolic $x^2 + y^2 + z = 16$ over rectangle $x = \pm a$, $y = \pm b$ [10M]



I B. Tech I Semester Supplementary Examinations, Jan/Feb-2024

MATHEMATICS-I

(Common to All Branches)

Time: 3 hours

Max. Marks: 70

*Answer any five Questions one Question from Each Unit**All Questions Carry Equal Marks*

UNIT - I

1. a) Test the Convergence of the series $\sum_{i=1}^{\infty} \sin\left(\frac{1}{n}\right)$. [7M]
 b) Test the Convergence of the series $\sum_{i=1}^{\infty} (-1)^n \frac{n}{5n+1}$. [7M]

(OR)

2. a) Verify Rolle's mean value theorem for $f(x) = |x|$ on $[-1,1]$ [7M]
 b) Verify Cauchy's Mean value theorem for $f(x) = \sin x$ and $g(x) = \cos x$ on $[0, \pi/2]$ [7M]

UNIT - II

3. a) A body kept in air with temperature 25°C cools from 140°C to 80°C in 20 minutes. Find when the body cools down to 35°C . [7M]
 b) Solve the Differential Equation $(x^2 + y^2 + 2x)dx + 2ydy = 0$ [7M]

(OR)

4. a) Find the orthogonal trajectory of the curve $r^2 = a^2 \sin 2\theta$ [7M]
 b) Solve the Differential Equation $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$ [7M]

UNIT - III

5. a) Solve the Differential Equation $(D + 2)^2 y = x^2$ [7M]
 b) Solve the Differential Equation $(x^2D^2 - 4xD + 6)y = (\log x)^2$ [7M]

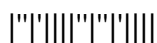
(OR)

6. a) Solve the Differential Equation $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 6y = e^{2x}(1+x)$ [7M]
 b) Solve the Differential Equation $y^{11} - 2y^1 + y = e^x \log x$ using method of variation of parameters [7M]

UNIT - IV

7. a) Find $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y}$ if $u = f(x+y, x-y)$ [7M]
 b) Find the extreme values of $x^2 + y^2 + z^2$ given that $xyz = a^3$ [7M]

(OR)



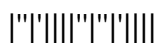
8. a) Verify Euler's theorem for the following function $u = \sin^{-1}\left(\frac{x^2 + y^2}{x + y}\right)$ [7M]
- b) Expand the function using Taylor's series $(1 + x + y^2)^{\frac{1}{2}}$ about (1,0) [7M]

UNIT - V

9. a) Evaluate $\iiint_V dx dy dz$ where v is the volume bounded by the planes $x = 0, y = 0, z = 0, z = 1$ and the cylinder $x^2 + y^2 = 1$ by changing it to cylindrical polar Coordinates. [7M]
- b) By change of order of integration evaluate $\int_0^3 \int_1^{\sqrt{4-y}} (x + y) dx dy$ [7M]

(OR)

- 10 a) Evaluate $\iint xy dx dy$ taken over the region bounded by the line $x+2y = 2$ in the first quadrant. [7M]
- b) Find the volume of solid enclosed by the surface $z = 0; x^2 + y^2 = cz$, and $x^2 + y^2 = 2ax$. [7M]



I B. Tech I Semester Supplementary Examinations, Jan/Feb-2024
MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, Chem E, EIE, IT, Auto E, Min E, Pet E, Agri E)

Time: 3 hours

Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

UNIT-I

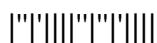
1. a) Test the Convergence of the series $\sum_{n=1}^{\infty} \frac{1.3.5..(2n-1)}{2.4.6...2n} x^n (x > 0)$ [7M]
 - b) Test the Convergence of the series $\sum_{n=1}^{\infty} (-1)^n \frac{1}{2n}$ [8M]
- (OR)**
2. a) Verify Rolle's Mean value theorem for $f(x) = \tan x$ on $[0, \pi]$ [8M]
 - b) Test the convergence of $1 - \frac{1}{3!} + \frac{1}{5!} - \frac{1}{7!} + \dots$ [7M]

UNIT-II

3. a) Solve the Differential Equation $\frac{dy}{dx} + \frac{x \sin x + \cos x}{x \cos x} \cdot y = \frac{1}{x \cos x}$ [7M]
 - b) Find the orthogonal trajectories of the family of curves $x^2 + (y-c)^2 = c^2$ [8M]
- (OR)**
4. a) Solve the Differential Equation $y dx - x dy = 3x^2 e^{x^3} y^2 dx$ [8M]
 - b) The initial value problem governing the current 'i' flowing in series R- L circuit when voltage $v(t) = t$ is applied is given by $Ri + L \frac{di}{dt} = t, t \geq 0$. Find the current i (t) at time 't'. [7M]

UNIT-III

5. a) Determine the charge on the capacitor at any time $t > 0$ in circuit in series having an emf $E(t) = 100 \sin 60 t$, a resistor of 2 ohms, an inductor of 0.1 Henries and capacitor of $\frac{1}{260}$ farads, if the initial current and charge on the capacitor are both zero. [7M]
 - b) Solve the Differential Equation $(D^2 - 3D + 2)y = \sin(e^{-x})$ [8M]
- (OR)**
6. a) Solve the Differential Equation $(D^3 - 5D^2 + 7D - 3)y = e^{2x} \cos hx$ [8M]
 - b) Solve the Differential Equation $(D^2 + 3D + 2)y = xe^x \sin x$ [7M]



UNIT-IV

7. a) Find $\frac{du}{dt}$ if $u = x^2 + y^2, x = at^2, y = 2at$ [7M]

b) Find the extreme values of $f(x, y) = xy + \frac{a^3}{x} + \frac{a^3}{y}$ [8M]

(OR)

8. a) Find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$ using Euler's theorem $u = \log \left(\frac{x^5 + y^5 + z^5}{x^2 + y^2 + z^2} \right)$ [8M]

b) Expand $f(x, y) = e^x \cos y$ about $(1, \frac{\pi}{4})$ [7M]

UNIT-V

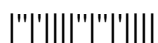
9. a) Evaluate $\int \int_R y^2 dx dy$ where R is a triangle with vertices $(0,0), (1,0), (1,1)$ [7M]

b) Evaluate $\iiint_V xyz dx dy dz$ taken over the volume bounded by the sphere $x^2 + y^2 + z^2 = 4$ in the first octant using spherical polar coordinates. [8M]

(OR)

10 a) By change of order of integration evaluate $\int_2^3 \int_0^x xy dx dy$ [8M]

b) Evaluate $\int_0^a \int_0^x \int_0^{x+y} xyz dx dy dz$. [7M]



I B. Tech I Semester Supplementary Examinations, Jan/Feb-2024**MATHEMATICS-I**

Time: 3 hours

Max. Marks: 70

*Note: 1. Question paper consists of two parts (Part-A and Part-B)**2. All the questions in Part-A is Compulsory**3. Answer any FOUR Questions from Part-B***PART -A (14 Marks)**

1. a) Solve the differential equation $3x^2ydx + (x^3 - y^3)dy = 0$ [2M]
- b) Determine orthogonal trajectories of the family of curves $xy = c$, where 'c' is the parameter. [2M]
- c) Find Laplace transform of $e^{2t} - 2 \cos 3t - 4t$ [2M]
- d) Show that $L\{u(t - a)\} = \frac{e^{-as}}{s}$ [2M]
- e) Verify whether the functions $u = e^x \sin y, v = e^x \cos y$ are functionally dependent or not. [2M]
- f) Form the partial differential equation by eliminating arbitrary function from. [2M]
 $z = f(x^2 + y^2)$
- g) Classify the Partial differential equation $\frac{\partial^2 u}{\partial x^2} - c^2 \frac{\partial^2 u}{\partial y^2} = 0$ [2M]

PART -B (56 Marks)

2. a) Is the differential equation $(xy \sin xy + \cos xy) y dx + (xy \sin xy - \cos xy) x dy = 0$ exact? If so find the solution. [7M]
- b) An R - L circuit has an emf given (in volts) by $4 \sin t$, a resistance of 100 ohms, an inductance of 4 henries with no initial current. Find the current at any time 't'. [7M]
3. a) Solve the equation $(D^3 - 3D^2 + 4D - 2)y = e^x + \cos x + x$ where $D = \frac{d}{dx}$ [7M]
- b) Use method of variation of Parameters and find solution of $\frac{d^2y}{dx^2} + 4y = \sec 2x$ [7M]
4. a) Determine inverse Laplace transform of $\frac{s^2 + 2s - 3}{s(s-3)(s+2)}$ [7M]
- b) By using Laplace transform method find solution of the differential equation $y'' + y = t, y(0) = 1, y'(0) = 0$ where $y'' = \frac{d^2y}{dt^2}$ [7M]
5. a) Examine the function $f(x, y) = x^3 + y^3 + 3xy$ for extreme values [7M]
- b) Expand $f(x, y) = e^x \sin y$ about the origin up to second degree terms using Taylor's theorem. [7M]
6. a) Solve the partial differential equation $xq - yp = zx$ [7M]
- b) Solve the partial differential equation $x^2p^2 - y^2q^2 = 0$ [7M]
7. a) Find the solution of the partial differential equation $(D^2 + DD' - 6D'^2)z = \cos(3x + y)$ [7M]
Where $D = \frac{\partial}{\partial x}$ and $D' = \frac{\partial}{\partial y}$
- b) Find the solution of the partial differential equation $(D^2 + 2DD' + D'^2)z = x^2 + xy + y^2$ [7M]
Where $D = \frac{\partial}{\partial x}$ and $D' = \frac{\partial}{\partial y}$.

