Course Code: 23HS0830 **R23**

SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583
QUESTION BANK (DESCRIPTIVE)

Subject with Code: Linear Algebra and Calculus (23HS0830) **Course & Branch**: B.Tech - Common to all

Year & Sem: I-B.Tech & I-Sem **Regulation:** R23

UNIT –I
MATRICES

1	a) Define rank of the matrix.	[L1][CO1]	**[2M]**
	b) Reduce the matrix A= $\begin{bmatrix}1 & 2 & 1\\ -1 & 0 & 2\\ 2 & 1 & -3\end{bmatrix}$ into Echelon form and find its rank?	[L3][CO1]	**[2M]**
	c) State Cauchy–Binet formulae.	[L1][CO1]	**[2M]**
	d) What is the Consistency and Inconsistency of system of linear equations?	[L1][CO1]	**[2M]**
	e) Solve by Gauss-Seidel method $x-2y=-3\,;2x+25y=15.$ [Only two iterations]	[L3][CO1]	**[2M]**
2	a) Reduce the matrix A= $\begin{bmatrix}1 & 2 & 3 & 2\\ 2 & 3 & 5 & 1\\ 1 & 3 & 4 & 5\end{bmatrix}$ into Echelon form and find its rank?	[L3][CO1]	**[5M]**
	b) Reduce the matrix A to normal form and hence find its rank A= $\begin{bmatrix}2 & 1 & 3 & 4\\ 0 & 3 & 4 & 1\\ 2 & 3 & 7 & 5\\ 2 & 5 & 11 & 6\end{bmatrix}$	[L3][CO1]	**[5M]**
3	a) If A= $\begin{bmatrix}2 & 3 & 1\\ 1 & 4 & 2\\ 0 & 1 & 1\end{bmatrix}$ and B= $\begin{bmatrix}1 & 6 & 0\\ 3 & 2 & 1\\ 1 & 2 & 3\end{bmatrix}$ Verify that $\lvert AB\rvert=\lvert A\rvert.\lvert B\rvert$	[L2][CO1]	**[5M]**
	b) Find whether the following equations are consistent if so solve them $x+y+2z=4\,;2x-y+3z=9\,;3x-y-z=2.$	[L3][CO1]	**[5M]**
4	a) Reduce the matrix A= $\begin{bmatrix}-2 & -1 & -3 & -1\\ 1 & 2 & 3 & -1\\ 1 & 0 & 1 & 1\\ 0 & 1 & 1 & -1\end{bmatrix}$ into Echelon form and find its rank?	[L3][CO1]	**[5M]**
	b) Solve completely the system of equations $4x+2y+z+3w=0\,;6x+3y+4z+7w=0\,;2x+y+w=0.$	[L3][CO1]	**[5M]**
5	Find the inverse of the matrix A= $\begin{bmatrix}-1 & -3 & 3 & -1\\ 1 & 1 & -1 & 0\\ 2 & -5 & 2 & -3\\ -1 & 1 & 0 & 1\end{bmatrix}$ using Gauss-Jordan method.	[L3][CO1]	**[10M]**
6	a) Solve completely the system of equations x+2y+3z=0, 3x+4y+4z=0, 7x+10y+12z=0.	[L3][CO1]	**[5M]**
	b) Show that the equations $x+y+z=4\,;2x+5y-2z=3\,;x+7y-7z=5$ are not consistent.	[L2][CO1]	**[5M]**
7	Show that the only real number λ for which the system $x+2y+3z=\lambda x\,;3x+y+2z=\lambda y\,;2x+3y+z=\lambda z$ has non-zero solution is 6. and solve them when λ=6.	[L2][CO1]	**[10M]**
8	Solve the equations $3x+y+2z=3\,;2x-3y-z=-3\,;x+2y+z=4$ Using Gauss elimination method.	[L3][CO1]	**[10M]**

9	Express the following system in matrix form and solve by Gauss elimination method. $2x_1 + x_2 + 2x_3 + x_4 = 6$; $6x_1 - 6x_2 + 6x_3 + 12x_4 = 36$; $4x_1 + 3x_2 + 3x_3 - 3x_4 = -1$; $2x_1 + 2x_2 - x_3 + x_4 = 10$.	[L2][CO1]	**[10M]**
10	Solve the following system of equations by Gauss-Jacobi Iteration method $27x + 6y - z = 85$; $x + y + 54z = 110$; $6x + 15y + 2z = 72$.	[L3][CO1]	**[10M]**
11	Solve the following system of equations by Gauss-Siedel Iteration method $4x + 2y + z = 14$; $x + 5y - z = 10$; $x + y + 8z = 20$.	[L3][CO1]	**[10M]**

UNIT –II

EIGEN VALUES, EIGEN VECTORS AND ORTHOGONAL TRANSFORMATION

1	a) Define Eigen values and Eigen vectors of a matrix.	[L1][CO2]	**[2M]**
	b) Find the Eigne values of the matrix $A = \begin{bmatrix} 1 & 3 & 4 \\ 0 & 2 & 5 \\ 0 & 0 & 3 \end{bmatrix}$	[L3][CO2]	**[2M]**
	c) State Cayley Hamilton theorem	[L1][CO2]	**[2M]**
	d) Convert the symmetric matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \\ 3 & 3 & 1 \end{bmatrix}$ into the quadratic form.	[L2][CO2]	**[2M]**
	e) Find the symmetric matrix corresponding to the quadratic form $ax^2 + 2hxy + by^2$.	[L3][CO2]	**[2M]**
2	a) For the matrix A=$\begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$ find the Eigen values of $3A^3 + 5A^2 - 6A + 2I$.	[L3][CO2]	**[5M]**
	b) Determine the Eigen values of A^{-1} *where* $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$	[L3][CO2]	**[5M]**
3	Find the Eigen values and corresponding Eigen vectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.	[L3][CO2]	**[10M]**
4	Find the Eigen values and corresponding Eigen vectors of the matrix A and also find the eigen values of A^{-1} where $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.	[L3][CO2]	**[10M]**
5	Determine the modal matrix P of $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.Verify that $P^{-1}AP$ is a diagonal matrix.	[L2][CO2]	**[10M]**
6	a) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{bmatrix}$.	[L2][CO2]	**[5M]**
	b) Show that the matrix $A = \begin{bmatrix} 8 & -8 & 2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ satisfies its characteristic equation.	[L2][CO2]	**[5M]**
7	Verify Cayley Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ and find A^{-1} *and* A^4 using Cayley Hamiltion theorem.	[L3][CO2]	**[10M]**
8	Show that the matrix $A = \begin{bmatrix} 1 & -2 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & 2 \end{bmatrix}$ satisfies its characteristic equation. Hence find A^{-1} .	[L2][CO2]	**[10M]**
9	a) State the nature of the Quadratic form $2x_1x_2 + 2x_1x_3 + 2x_2x_3$.	[L1][CO2]	**[5M]**

	b) Identify the nature of the Quadratic form $-3{x_1}^2-3{x_2}^2-3{x_3}^2-2x_1x_2-2x_1x_3+2x_2x_3$.	[L2][CO2]	**[5M]**
10	Reduce the Quadratic form $3{x_1}^2+3{x_2}^2+3{x_3}^2+2x_1x_2+2x_1x_3-2x_2x_3$ into canonical form by Orthogonal transformation and Find the Rank, Index and Signature of the canonical form.	[L3][CO2]	**[10M]**
11	Reduce the Quadratic form $2x^2+2y^2+2z^2-2xy-2xz-2yz$ into the canonical form by Orthogonal transformation and discuss its nature.	[L3][CO2]	**[10M]**

UNIT –III
CALCULUS

1	a) State Rolle's theorem.	[L1][CO3]	**[2M]**
	b) Verify the Rolle's Theorem can be applied to the function f(x) = tan x in [0,π]	[L2][CO3]	**[2M]**
	c) State Lagrange's mean value theorem.	[L1][CO3]	**[2M]**
	d) State Cauchy's mean value theorem.	[L1][CO3]	**[2M]**
	e) Expand Taylor's series of the function f(x) in powers of (x-a).	[L2][CO4]	**[2M]**
2	a) Verify Rolle's Theorem for the function f(x) = $\frac{\sin x}{e^x}$ in $[0,\pi]$	[L2][CO3]	**[5M]**
	b) Verify Lagrange's mean value theorem for f(x) = $\log_e x$ in $[1,e]$.	[L2][CO3]	**[5M]**
3	a) Verify Rolle's Theorem for the function f(x) =log$\left[\frac{x^2+ab}{x(a+b)}\right]$ in $[a,b]$; a,b>0	[L2][CO3]	**[5M]**
	b) Test whether the Lagrange's Mean value theorem holds f(x)=x^3-x^2-5x+3 in $[0,4]$ and if so find approximate value of c.	[L4][CO3]	**[5M]**
4	a) Verify Rolle's theorem for the function f(x) = x(x+3)$e^{-\frac{x}{2}}$ in [-3,0]	[L2][CO3]	**[5M]**
	b) Verify Cauchy's mean value theorem for f(x) = e^x and g(x) = e^{-x} in [a, b].	[L2][CO3]	**[5M]**
5	a) Show that for any x > 0, $1+x<e^x<1+xe^x$ using Lagrange's mean value theorem.		
	b) Verify Cauchy's Mean value theorem for $f(x)=x^3$ and $g(x)=x^2$ in [1,2]	[L2][CO3]	**[5M]**
6	a) Prove that $\frac{\pi}{3}-\frac{1}{5\sqrt{3}}>\cos^{-1}\left(\frac{3}{5}\right)>\frac{\pi}{3}-\frac{1}{8}$ using Lagrange's mean value theorem.	[L2][CO3]	**[5M]**
	b) Verify Cauchy's mean value theorem for $f(x)=sinx$; $g(x)=cosx$ in $\left[0,\frac{\pi}{2}\right]$.	[L2][CO3]	**[5M]**
7	a) Express the polynomial $2x^3+7x^2+x$-6 in power of $(x-2)$ by Taylor's series.	[L3][CO4]	**[5M]**
	b) Expand $\sin x$ in powers of $\left(x-\frac{\pi}{2}\right)$ up to the term containing $\left(x-\frac{\pi}{2}\right)^4$ assigning Taylor's series.	[L2][CO4]	**[5M]**
8	a) Expand $\log_e x$ in powers of (x-1) and hence evaluate $\log 1.1$ correct to 4 decimal places using Taylor's theorem.	[L2][CO4]	**[5M]**
	b) Obtain the Maclaurin's series expression of the following functions: i) e^x ii) $\cos x$ iii) $\sin x$	[L2][CO4]	**[5M]**
9	Verify Taylor's theorem for $f(x)=(1-x)^{\frac{5}{2}}$ with Lagrange's form of remainder up to 2 terms in the interval [0,1].	[L2][CO4]	**[10M]**
10	a) Calculate the approximate value of $\sqrt{10}$ correct to 4 decimal places using Taylor's theorem.	[L3][CO4]	**[5M]**
	b) Show that $\log(1+x)=x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\cdots$ by Maclaurin's theorem.	[L2][CO4]	**[5M]**
11	Using Maclaurin's series expand $\tan x$ up to the fifth power of x and hence find the series for log (sec x).	[L3][CO4]	**[10M]**

Course Code: 23HS0830 **R23**

UNIT –IV
PARTIAL DIFFERENTIATION AND APPLICATIONS
(MULTI VARIABLE CALCULUS)

1	a) Define Continuity of a function of two variables at a point.	[L1][CO5]	**[2M]**
	b) Evaluate $\lim_{\substack{x\to 1\\ y\to 2}} \frac{2x^2y}{x^2+y^2+1}$.	[L5][CO5]	**[2M]**
	c) If $x = u(1-v); y = uv$ $then\ prove\ that$ $J\left(\frac{x,y}{u,v}\right) = u$	[L2][CO5]	**[2M]**
	d) State Functional Dependence.	[L1][CO5]	**[2M]**
	e) Define Extreme value of a function of two variables.	[L1][CO5]	**[2M]**
2	a) If $U = log(x^3+y^3+z^3-3xyz)$, $prove\ that$ $\left(\frac{\partial}{\partial x}+\frac{\partial}{\partial y}+\frac{\partial}{\partial z}\right)^2 U = \frac{-9}{(X+Y+Z)^2}$	[L5][CO5]	**[5M]**
	b) If $u = tan^{-1}\left[\frac{2xy}{x^2-y^2}\right]$ then Prove that $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2} = 0$.	[L5][CO5]	**[5M]**
3	a) $u = sin^{-1}(x-y), where\ x = 3t, y = 4t^3$, $then\ \ show\ that$ $$\frac{du}{dt} = \frac{3}{\sqrt{1-t^2}}\ by\ total\ derivative.$$	[L2][CO5]	**[5M]**
	b) If $u = f(y-z, z-x, x-y)$ prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z} = 0$ by using Chain rule .	[L3][CO5]	**[5M]**
5	Expand $x^2y+3y-2$ in powers of $(x-2)$ and $(y+2)$ up to the term of 3rd degree.	[L2][CO5]	**[10M]**
6	a) Expand $e^x siny$ in powers of $x\ and\ y$ by Maclaurin series.	[L2][CO5]	**[5M]**
	b) If $u = x^2-2y;\ v = x+y+z,\ w = x-2y+3z$,then find Jacobian $J\left(\frac{u,v,w}{x,y,z}\right)$.	[L1][CO5]	**[5M]**
7	a) If $u = \frac{x+y}{1-xy}$ $and\ v = tan^{-1}x+tan^{-1}y$, $find$ $\frac{\partial(u,v)}{\partial(x,y)}$?	[L1][CO5]	**[5M]**
	b) Verify if $u = 2x-y+3z$, $v = 2x-y-z$, $w = 2x-y+z$ are functionally dependent and if so, find the relation between them.	[L5][CO5]	**[5M]**
8	Examine the maxima and minima, if any, of the function $$f(x) = x^3y^2(1-x-y).$$	[L4][CO5]	**[10M]**
9	a) Examine the function for extreme value $f(x,y) = x^4+y^4-2x^2+4xy-2y^2$; (x>0,y>0).	[L4][CO5]	**[5M]**
	b) Find the minimum value of $x^2+y^2+z^2$ $given\ x+y+z = 3a$.	[L1][CO5]	**[5M]**
10	a) Find the stationary points of $u(x,y) = sinx.siny.sin(x+y)$ $where$ $0 < x < \pi, 0 < y < \pi$ and find the maximum of u.	[L1][CO5]	**[5M]**
	b) Find the shortest distance from origin to the surface $xyz^2 = 2$.	[L1][CO5]	**[5M]**
11	a) Find a point on the plane $3x+2y+z-12 = 0$, which is nearest to the origin.	[L1][CO5]	**[5M]**
	b) Find the shortest and longest distance from the point $(3,1,-1)$ $to\ the\ sphere$ $x^2+y^2+z^2 = 4$	[L1][CO5]	**[5M]**

Course Code: 23HS0830

R23

UNIT –V
MULTIPLE INTEGRALS
(MULTI VARIABLE CALCULUS)

1	a) Evaluate $\int_0^2 \int_0^x y\,dy\,dx$	[L5][CO6]	**[2M]**
	b) Evaluate $\int_0^{\pi} \int_0^{a\sin\theta} r\,dr\,d\theta$	[L5][CO6]	**[2M]**
	c) Transform the integral into polar coordinates, $\int_0^a \int_0^{\sqrt{a^2-x^2}} (x^2+y^2)\,dy\,dx$.	[L2][CO6]	**[2M]**
	d) Find the area enclosed by the parabolas $x^2 = y$ and $y^2 = x$.	[L1][CO6]	**[2M]**
	e) Evaluate $I = \int_0^1 \int_1^2 \int_2^3 xyz\,dx\,dy\,dz$.	[L5][CO6]	**[2M]**
2	a) Evaluate $\int_0^5 \int_0^{x^2} x(x^2+y^2)dxdy$	[L5][CO6]	**[5M]**
	b) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$	[L5][CO6]	**[5M]**
3	a) Evaluate $\iint (x^2+y^2)dxdy$ in the positive quadrant for which $x+y \le 1$.	[L5][CO6]	**[5M]**
	b) Evaluate $\int_0^{\log 2} \int_0^x \int_0^{x+y} e^{x+y+z}\,dzdydx$.	[L5][CO6]	**[5M]**
4	a) Evaluate $\int_0^a \int_0^{\sqrt{a^2-y^2}} (x^2+y^2)dydx$	[L5][CO6]	**[5M]**
	b) Evaluate $\int_0^{\infty} \int_0^{\infty} e^{-(x^2+y^2)}dxdy$ by converting to polar coordinates.	[L5][CO6]	**[5M]**
5	a) Show that the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16}{3}a^2$.	[L2][CO6]	**[5M]**
	b) Evaluate the integral by transforming into polar coordinates $\int_0^a \int_0^{\sqrt{a^2-x^2}} y\sqrt{x^2+y^2}\,dxdy$.	[L3][CO6]	**[5M]**
6	a) Evaluate $\int_0^1 \int_x^{\sqrt{x}} (x^2+y^2)dxdy$.	[L5][CO6]	**[5M]**
	b) Evaluate the integral by changing the order of integration $\int_0^{\infty} \int_x^{\infty} \frac{e^{-y}}{y}dydx$.	[L5][CO6]	**[5M]**
7	Change the order of integration in $I = \int_0^1 \int_{x^2}^{2-x} (xy)dydx$ and hence evaluate the same.	[L1][CO6]	**[10M]**
8	a) By changing order of integration, evaluate $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dydx$.	[L3][CO6]	**[5M]**
	b) Evaluate $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x+y+z)dxdydz$	[L5][CO6]	**[5M]**
9	a) Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	[L1][CO6]	**[5M]**
	b) Evaluate $\int_1^e \int_1^{\log y} \int_1^{e^x} \log z\,dzdxdy$.	[L5][CO6]	**[5M]**
10	a) Find the volume common to the cylinders $x^2+y^2 = a^2$ and $x^2+z^2 = a^2$.	[L1][CO6]	**[5M]**
	b) Evaluate $\int\int\int (x^2+y^2+z^2)\,dx\,dy\,dz$ taken over the volume enclosed by the sphere $x^2+y^2+z^2 = 1$, by transforming into spherical polar coordinates.	[L5][CO6]	**[5M]**
11	a) Evaluate the triple integral $\iiint xy^2zdxdydz$ taken through the positive octant of the sphere $x^2+y^2+z^2 = a^2$.	[L5][CO6]	**[5M]**
	b) Calculate the volume of the solid bounded by the planes $x = 0, y = 0, x+y+z = a$ and $z = 0$	[L1][CO6]	**[5M]**

Prepared by: Dept. of Mathematics

SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (OBJECTIVE)

Subject with Code : Linear Algebra & Calculus (23HS0830)

Course &Branch: B.Tech – Common toAll

Year &Sem: I-B.Tech & I-Sem **Regulation:** R23

UNIT – I
(MATRICES)

1) If A=$\begin{bmatrix} 2 & 1 \\ 3 & 1 \end{bmatrix}$ is a square matrix of order 2, then det A=______ [ ]

A) 0 B) 1 C)-1 D) 2

2) The adjoint of $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ is __________ [ ]

A)$\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ B)$\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$ C)$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ D) None

3) If A is a non-singular matrix then_________ [ ]

A)$|A| = 0$ B)$|A| \neq 0$ C)$|A| > 0$ D)$|A| < 0$

4) If A and B are skew-symmetric matrices, then A+B is ________ [ ]

A)Orthogonal B)Skew-symmetric C)Symmetric D)Unitary

5) A square matrix A is Skew-symmetric if __________ [ ]

A) $A^T = -A$ B) $AA^{-1} = I$ C)$A^T = A$ D) none

6) The matrix A=$\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ is _______ [ ]

A) Symmetric B) Skew-symmetric C) Orthogonal D) unitary

7) The determinant of an orthogonal matrix is ________ [ ]

A) 1 B) 0 C) 2 D)± 1

8) If A is symmetric, then A^{-1} is ________ [ ]

A) Symmetric B) Skew-symmetric C)Hermitian D) None

9)The rank of a singular matrix of order 3 is _____________ [ ]

A)3 B)≤ 3 C)≤ 2 D)2

10) If A&B is 3×4 matrices, then the rank of (A+B) is _____ [ ]

A) 4 B)≤ 3 C) 0 D) none

11) The rank of the matrix is $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$------- [ ]

A) 3 B) 2 C) 1 D) none

12)The rank of the matrix is $\begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 4 & 5 & 6 \end{bmatrix}$ -------- [ ]

A) 0 B) 1 C) 2 D) 3

13) The rank of the matrix A =$\begin{bmatrix} -1 & 0 & 6 \\ 3 & 6 & 1 \\ -5 & 1 & 3 \end{bmatrix}$ is ___________ [ ]

A)3 B)2 C)1 D) None

14) If the rank of the product of two matrices each of order 3 is___________ [ ]

A)3 B) ≤ 2 C) ≤ 3 D)2

15) The rank of unit matrix of order 4 is ______ [ ]
A) 0 B) 2 C) 1 D) 4

16) If the rank of A is 2, then rank of A^T is ________ [ ]
A) 0 B) 1 C) 2 D)4

17) The rank of 3× 3 matrix whose elements are all 2 is__________ [ ]
A) 1 B) 2 C) 3 D) 0

18) If A is an orthogonal matrix, then A^{-1} is ________________ [ ]
A) Symmetric B) Skew-symmetric C) Orthogonal D)none

19) If A is skew-symmetric, then A^3 is ____________ [ ]
A) Symmetric B) Skew-symmetric C) Hermitian D)none

20) A square matrix A is said to be unitary if ____________ [ ]
A)$AA^T = I$ B) $AA^\theta = 1$ C) $AA^{-1} = I$ D)none

21) The homogeneous system of equations have only trivial solution if _________ [ ]
A) r<n B)r>n C)r$\neq n$ D)r=n

22) Which of the following is a symmetric matrix_______ [ ]
A)$\begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -3 \\ 4 & -3 & 1 \end{bmatrix}$ B) $\begin{bmatrix} 1 & 2 & 4 \\ 3 & 5 & 7 \\ 6 & 7 & 8 \end{bmatrix}$ C)$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ D) none

23) The system of equations have infinite number of solutions if_______ [ ]
A) r<n B)r>n C)r$\neq n$ D)r=n

24) If A= $\begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ then A(adj A) = [ ]
A) $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$ B) $\begin{bmatrix} 10 & 0 \\ 0 & 0 \end{bmatrix}$ C) $\begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ D) $\begin{bmatrix} -3 & 2 \\ 1 & 4 \end{bmatrix}$

25) If I is a unit matrix of order n then |I| [ ]
A) 0 B)1 C) -1 D) 2

26) The diagonal elements of a skew-symmetric matrix are all ______ [ ]
A) Real B) 0 C) 1 D) imaginary

27) If A is a symmetric matrix, then adj A is ________ [ ]
A) Symmetric B) skew- symmetric C) Orthogonal D) None

28) The transpose of an orthogonal matrix is __________ [ ]
A) Symmetric B) skew- symmetric C) Unitary D) None

29) If A and B are matrices and if AB is defined then the rank of AB is ________ [ ]
A) Rank of A B) rank of B
C) $\leq \{rank\ A, rank\ B\}$ D)$\leq max\{rank\ A, rank\ B\}$

30) Let A be a skew-symmetric matrix of order n, then ____________ [ ]
A) $|A|$=0, if n is even B) $|A|$=0, if n is odd
C) $|A|$=0, for all nϵN D) $|A| \neq 0\ always$

31) If A is a symmetric matrix, then A^n is ____________ [ ]
A) Symmetric B) skew- symmetric C) Unit matrix D) Orthogonal

32) If A=$\begin{bmatrix} 1+i & 3 \\ 2-i & 4+2i \end{bmatrix}$ then $\bar{A}$ = []
A) $\begin{bmatrix} 1+i & 2-i \\ 3 & 4+2i \end{bmatrix}$ B) $\begin{bmatrix} 1+i & -3 \\ -2+i & 4+2i \end{bmatrix}$ C) $\begin{bmatrix} 1-i & 3 \\ 2+i & 4-2i \end{bmatrix}$ D) None

33) The maximum value of the rank of a 4x5 matrix is _______ [ ]
A)3 B)4 C) 5 D) None

34) A square matrix A = $[a_{ij}]$ is called a symmetric matrix if_______ [ ]
A) $a_{ij} = a_{ij}, \forall i, j$ B) $a_{ij} = a_{ji}, \forall i, j$ C) $a_{ij} = 0, , \forall i < j$ D) $a_{ij} = 0, \forall i > j$

35) By applying elementary transformation to a matrix , its rank [ ]

A) Does not change B) decreases C) increases D) None

36) Let A and B be two real symmetric matrices of order n. Then which of the following is true? [ ]

A) AA^T =I B) A=A^{-1} C) AB=BA D) $(AB)^T$=AB

37) Inverse of a unitary matrix is [ ]

A) Hermitian B) skew-Hermitian C) unitary D) orthogonal

38) The matrix A=$\begin{bmatrix} 0 & i \\ -i & 0 \end{bmatrix}$is [ ]

A) Hermitian B) skew-Hermitian C) unitary D) None of the above

39) The matrix u = $\frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1 & 1 \\ 1 & \omega & \omega^2 \\ 1 & \omega^2 & \omega \end{bmatrix}$ where ω is a complex cube root of unity is[ ]

A) Idempotent B) orthogonal C) unitary D) Hermitian

40) The matrix A= $\begin{bmatrix} a+ic & -b+id \\ b+id & a-ic \end{bmatrix}$ is unitary if, and only if $a^2 + b^2 + c^2 + d^2 =$ [ ]

A) 0 B) 1 C) -1 D) i

UNIT – II

(EIGEN VALUES AND EIGEN VECTORS AND ORTHOGONALIZATION)

1) The Eigen values of the matrix $\begin{bmatrix} 1 & 3 & 4 \\ 0 & 2 & 5 \\ 0 & 0 & 3 \end{bmatrix}$---- [ ]

A) -1, 2, 3 B) 1, 2, 3 C) 1,-2, 3 D) 3, 4,5

2) If the eigen value of A is λ, then eigen value of A^T is _________ [ ]

A) λ B) $\frac{1}{\lambda}$ C) λ^T D) λ^{-1}

3) Sum of characteristic roots of a matrix A is equal to the [ ]

A) A^T B) Trace of A C) A^{-1} D) None

4) If A=$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ then eigen values of 2A are _______ [ ]

A) 0,0 B) -1, 2 C) -2,2 D) -1, 1

5) If 2,3,4 be the eigen values of A, then the trace of A is [ ]

A) 3 B) 9 C) 24 D)-3

6)If the eigen values of A are 2,3,-2, then eigen values of A-3I are _____ [ ]

A) 2, 3,-2 B) 1, 2, 2 C)-2,-3, 2 D)-1, 0,-5

7) The nature of the quadratic form 2x^2+2y^2+2z^2 is ________ [ ]

A) Positive definite B) Positive semidefinite C) indefinite D) Negative definite

8) If λ is an eigen value of A, then the matrix A-λI is ___________ [ ]

A) Skew-Symmetric B) Rectangular C) Nonsingular D) Singular

9) If 1,2,3 are the eigen values of the matrix A, then the eigen values of A^{-1} are __________ [ ]

A) 1, 2, 3 B) $1, \frac{1}{2}, \frac{1}{3}$ C) 1, 4, 9 D) $1, \frac{-1}{2}, \frac{-1}{3}$

10) If A= $\begin{bmatrix} -1 & 0 & 0 \\ 2 & -3 & 0 \\ 1 & 4 & 2 \end{bmatrix}$ then eigen values of A^{-1} are ______________ [ ]

A) 1, 3,-2 B) $-1, \frac{-1}{3}, \frac{1}{2}$ C) -1, 3, 2 D) $1, \frac{-1}{2}, \frac{-1}{3}$

11) If all the eigen values of square matrix A are non zero, then A is [ ]

A) Singular B) Non singular C) Symmetric D) Skew symmetric

12) Cayley-Hamilton theorem states that every square matrix satisfies its own [ ]

A) Characteristic polynomial B) Characteristic equation

C) Characteristic root D) Characteristic vector

13) If $\lambda^2 - 5\lambda - 2 = 0$ is the characteristic equation of A, then A^{-1} =____________ [ ]

A) A+5I B)A-3I C) $\frac{1}{2}(A - 2I)$ D) $\frac{1}{2}(A - 5I)$

14) If A= $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ then A^3=_____________ [ ]

A) $2A^2 + 5A$ B) 2A C) A D) $5A^2 + 2$A

15) The symmetric matrix associated with the Quadratic form $x^2 + 3y^2 - 8xy$ is _________ [ ]

A) $\begin{bmatrix} 1 & 4 \\ 4 & -3 \end{bmatrix}$ B) $\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ C) $\begin{bmatrix} 1 & -4 \\ -4 & 3 \end{bmatrix}$ D) None

16) The Quadratic form corresponding to the symmetric matrix $\begin{bmatrix} 1 & 2 \\ 2 & -4 \end{bmatrix}$ is ______ [ ]

A) $x^2 + 4xy - 4y^2$ B) $x^2 + 4xy + 4y^2$ C) $x^2 - 4xy - 4y^2$ D) None

17) If one of the eigen values of a square matrix A is zero, then A is _____ [ ]

A) Symmetric B) Skew-symmetric C) Non-singular D) Singular

18) If A is a nilpotent matrix, then the eigen value of A is __________ [ ]

A) 1 B) 0 C) order of A D) Degree of nilpotent

19) The characteristic equation of $\begin{bmatrix} 1 & 1 \\ 2 & 5 \end{bmatrix}$ is ____________ [ ]

A) $\lambda^2 - 6\lambda + 3 = 0$ B) $\lambda^2 + 6\lambda + 3 = 0$ C) $\lambda^2 - 3\lambda + 6 = 0$ D) None

20) If 1,-2,3 are the eigen values of the matrix A, then the eigen values of $A^2 - 2A + 3I$ are _____[ ]

A) 2,3,6 B) 2,11,6 C)3,11,8 D) 3,6,11

21) The latent roots of $\begin{bmatrix} a & h & g \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$ are ______ [ ]

A) a, b, c B)$\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ C) h, g, 0 D)b,g,0

22) If A is a singular matrix, then the product of the eigen values of A is _____ [ ]

A)0 B)1 C)-1 D)2

23) If D=$P^{-1}AP$ then A^2=__________ [ ]

A) PDP^{-1} B) $P^2D^2(P^{-1})^2$ C) PD^2P^{-1} D) PDA

24) If A=$\begin{bmatrix} 4 & 2 \\ -3 & 0 \end{bmatrix}$ then A^{-1} is ___________ [ ]

A)$\frac{1}{6}(A-4I)$ B)$\frac{1}{4}(5I-A)$ C)$\frac{1}{18}(7I-A)$ D)$\frac{-1}{6}(A+4I)$

25) The eigen values of $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ are _______ [ ]

A) i, i B) i,-i C) 1,-1 D) -1,-1

26) The symmetric matrix associated with the Quadratic form $x^2-2xy+2y^2$ is _________ [ ]

A) $\begin{bmatrix} 1 & -1 \\ -1 & 2 \end{bmatrix}$ B) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ C) $\begin{bmatrix} 1 & -1 \\ -1 & 0 \end{bmatrix}$ D) None

27) If the eigen values of A are -1,-4,-4, then the nature of the Quardratic form is ______ [ ]

A) Positive definite B) Negative definite C) Indefinite D) None

28) If 2, 3, 4, be the eigen values of A, then |A| is __________ [ ]

A) 9 B) 24 C) 1/24 D) 2

29) If A =$\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, which of the following is a characteristic root of A _____________ [ ]

A) 0 B)1 C) -1 D) 3

30) If λ is an eigen value of A and f(A) is any polynomial in A, then eigen values of f(A)is______[ ]

A) f(λ) B) f(-λ) C) -f(λ) D)None

31) If A and B are two invertible square matrices, then the eigen values of AB and BA are _____[ ]

A) Same B) Different C) Not determined D) Not equal

32) The eigen vectors of a square matrix A constitute the ___________ [ ]

A) Spectral matrix B) Modal matrix C) Unit matrix D) Null matrix

33) The symmetric matrix associated with the quadratic form $ax^2 - 2hxy$+by^2 is ___________ [ ]

A) $\begin{bmatrix} a & 2h \\ 2h & b \end{bmatrix}$ B) $\begin{bmatrix} a & -h \\ -h & b \end{bmatrix}$ C) $\begin{bmatrix} a & h \\ h & b \end{bmatrix}$ D) $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$

34) The quadratic form corresponding to the symmetric matrix $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ is ___________ [ ]

A)$x^2 + 4xy + y^2$ B) $x^2 - 4xy - y^2$ C) $x^2 - 4xy + y^2$ D) $x^2 + y^2$

35) If the eigen values of A are 1,2,-3, then the nature of the quadratic form is ______________ [ ]

A) Positive definite B) Negative definite C) Indefinite D) Positive semi definite

36) A quadratic form is +ve definite when [ ]

A) All the eigen values are ≥ 0and atleast one eigen value is zero

B) All the eigen values are +ve

C) All the eigen values are +ve

D) All the eigen values are ≤ 0

37) If A is a symmetric singular matrix and two of the eigen values are positive then the nature of the quadratic form $X^T AX$is [ ]

A) Positive definite B) Positive semi definite C) Negative definite D) Indefinite

38) If A=$\begin{bmatrix} 1 & 0 & 1 \\ 0 & -2 & 5 \\ 0 & 0 & -3 \end{bmatrix}$then the nature of the quadratic form $X^T AX$is [ ]

A) Positive definite B) Positive semi definite C) Negative definite D) Indefinite

39) The matrix of the quadratic form $2xy + 2yz + 2zx$ is [ ]

A) $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ B) $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ C) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ D) $\begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

40) The eigen values of the identiy matrix of order 3 are [ ]

A) 1,1,1 B) 2,2,2 C) 3,3,3 D) 0,0,0

UNIT – III
(Calculus)
(Mean Value Theorems)

1) By Rolle's theorem, f(x) is continuous and differential on [a,b] then their exits at least one value of c∈(a,b) such that $f^1(c)$= [ ]

A) 0 B) 2 C) 1 D) None

2) The Rolle's theorem satisfies if [ ]

A) f(a)=f(b) B) f(a)≠ f(b) C) f(a) = -f(b) D) None

3) If f(x)= $tanx$ in[0,π] is [ ]

A) Continuous B) Discontinuous

C) Continuous and derivable D) Neither continuous nor derivable

4) The value of c of Roll's theorem for f(x)=$\frac{\sin x}{e^x}$ in (0,π) is------ [ ]

A)2 B)1 C)$\frac{\pi}{4}$ D)$\frac{\pi}{2}$

5) Is Roll's theorem applicable to f(x) =x^2 in [1,2] ---- [ ]

A) applicable B) not applicable C) can't say D) None

6) The value of 'c' of Roll's theorem for f(x) =(x-a)(x-b) in [a, b] is ------ [ ]

A)$\frac{-a+b}{2}$ B)$\sqrt{ab}$ C) a+b D)$\frac{a+b}{2}$

7) Is Roll's theorem applicable for f(x) = $\frac{1}{1-x}$ in [0, 4]---- ------ [ ]

A) Yes B) no C) can't say D) None

8) Is Roll's theorem applicable for f(x) = sinx in (0, π) is ----- [ ]

A) Yes B)no C) can't say D) None

9) The value of 'c' in Roll's Theorem for f(x) = sin x in (0, π) is--- [ ]

A) 0 B)$\frac{\pi}{4}$ C) $\frac{\pi}{2}$ D) $\frac{\pi}{6}$

10)The value of 'c' in Roll's theorem for f(x) = x^2 –2x in (-1, 1) is------ [ ]

A) 1 B) ½ C) ¼ D) – ½

11) For which value of c∈(a,b), the Roll's theorem is verified for the function

$f(x) = \log\left[\frac{x^2+ab}{x(a+b)}\right]$ defined on? [ ]

A)$\frac{a+b}{2}$ B) $\sqrt{ab}$ C)$a + b$ D) None

12) For which value of c∈(1,5) the Rolle's theorem is verified for the function

$f(x)=x^2-6x+5$ *in* [1, 5] ? [ ]

A) 1 B) 2 C) 3 D) 4

13) Is Lagrange's mean value theorem applicable for f(x)=$\cos x$ in [0,$\frac{\pi}{2}$] ? [ ]

A) Yes B) No C) Can't say D) None

14) The Lagrange's form of remainder in Taylor's series is-------. [ ]

A) $\frac{(b-a)^n f^{(n)}(c)}{n!}$ B) log e C) $\frac{(b+a)^n f^{(n)}(c)}{n!}$ D) None

15) The value of c in Lagrange's mean value theorem for f(x) = $\log_e x$ in [1,e] is-----------. [ ]

A) 3 B) log e C) (e-1) D) 1.5

16) By Lagrange's theorem, f(x) is continuous and differential on [a,b] then their exits at least one value of c∈(a,b) such that $f^1(c)$= [ ]

A)0 B) $\frac{f(b)-f(a)}{b-a}$ C) $\frac{f(b)+f(a)}{b-a}$ D) None

17) For which value of c∈ (-2, 3) .the Lagranges Mean Value Theorem is verified for the function

$f(x)=x^2+3x+2$ $in[-2, 3]$? [ ]

A) 1 B) $\frac{1}{2}$ C) $\frac{-1}{2}$ D) 0

18) Is Lagrange's mean value theorem applicable for f(x) = $x^{\frac{1}{3}}$ in [-1, 1]----- [ ]

A) Yes B) No C) can't say D) None

19) By Cauchy's Mean value theorem, f(x) is continuous and differential on [a,b] then their exits at least one value of c∈(a,b) such that $f^1(c)$=---- [ ]

A) $\frac{f(b)+f(a)}{g(b)+g(a)}$ B) $\frac{f(b)-f(a)}{b-a}$ C) $\frac{f(b)+f(a)}{b-a}$ D) $\frac{f(b)-f(a)}{g(b)-g(a)}$

20) The value of 'c' in Cauchy's Mean value theorem for f(x) = x^3 and g(x)=x^2 in (1, 2) is--- [ ]

A) ¼ B) ½ C) $\frac{14}{9}$ D) – ½

21) For which value of c∈(a,b), the Cauchy's Mean value theorem is verified for the functions $f(x) = \sqrt{x}, g(x) = \frac{1}{\sqrt{x}}$ defined on? [ ]

A) $\frac{a+b}{2}$ B) $\sqrt{a}$ C) $a + b$ D) $\sqrt{ab}$

22) If f(x)=e^x and g(x)=e^{-x} in (a,b) then by Cauchy's Mean value theorem find the value of c=? [ ]

A) $\frac{a+b}{2}$ B) $\frac{a-b}{2}$ C) $\frac{ab}{2}$ D) None

23) The value of 'c' in Cauchy's Mean value theorem for f(x) = sinx and g(x)=cosx in $[0,\pi]$is-- [ ]

A) $-\pi$ B) ½ C) $\frac{\pi}{4}$ D) π

24) If f(x)= x^3 and g(x)=2-x in (0,9) then by Cauchy's Mean value theorem find the value of c=? [ ]

A) $\sqrt{3}$ B) $3\sqrt{3}$ C) $\sqrt{-3}$ D) None

25) In Taylor's series expansion, third term is ___________ [ ]

A) f(a) B) $(x$-a) $f^1(a)$ C) $\frac{(x-a)^2}{2!}$ $f^{11}(a)$ D) $\frac{(x-a)^3}{3!}$ $f^{111}(a)$

26) The function f(x) = $x\sin\frac{1}{x}$ for x≠0 is-------------. [ ]

A) Continuous and derivable B) Not continuous but derivable

C) Continuous but not derivable D) Neither continuous nor derivable

27) The first term of Taylor's series of Sin$x$ about $x = \pi/4$ is----------. [ ]

A) $\frac{1}{\sqrt{2}}$ B) $\left(x-\frac{\pi}{4}\right)\left(\frac{1}{\sqrt{2}}\right)$ C) $\frac{(x-\pi/4)^2}{2!}\left(\frac{1}{\sqrt{2}}\right)$ D) $\frac{(x-\pi/4)^3}{3!}\left(\frac{1}{\sqrt{2}}\right)$

28) Taylors's series expansion of f(x)=sinx at x=0 [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots..$ B)$x-\frac{x^3}{3!}+\frac{x^5}{5!}-\ldots..$ C)$1+x+x^2+x^3+\ldots$ D)$1-x+x^2-x^3+\ldots\ldots$

29) Taylors's series expansion of f(x)=log(1+x) at x=0 --------. [ ]

A)$x-\frac{x^2}{2}+\frac{x^3}{3}-\ldots..$ B)$x+\frac{x^3}{3}+\frac{x^5}{5}+\ldots..$ C)$1+x+x^2+x^3+\ldots\ldots$ D) None

30) If f(x)=f(a)+(x-a) $f^1(a)$+ $\frac{(x-a)^2}{2!}$ $f^{11}(a)$+-------------- then the series is called [ ]

A) Maclaurin's series B) Jacobi C) Taylor's series D) None

31) If f(x)=f(0)+ $f^1(0)x$+ $f^{11}(0)\frac{x^2}{2!}$+-------------- then the series is called ……… [ ]

A) Maclaurin's series B) LMVT C) Taylor's series D) None

32) The first term of Maclaurin's series of Cos x about $x = 0$ is ___________. [ ]

A) 1 B) 0 C) ∞ D) none

33) Maclaurin's series expansion of f(x)=e^x [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ B)$1-\frac{x}{1!}+\frac{x^2}{2!}-\frac{x^3}{3!}+\ldots$ C)$1+x+x^2+x^3+\ldots$ D) $1-x+x^2-x^3+\ldots$

34) The second term of Maclaurin's series of Cos x about $x=0$ is ____ [ ]

A) 1 B) 0 C) ∞ D) none

35) Maclaurin's series expansion of f(x)=cosx-----------. [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ B)$1-\frac{x^2}{2!}+\frac{x^4}{4!}-\ldots$ C)$1+x+x^2+x^3+\ldots$ D)$1-x+x^2-x^3+\ldots$

36) Maclaurin's series expansion of f(x)=e^{-x} ---------. [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ B)$1-\frac{x}{1!}+\frac{x^2}{2!}-\frac{x^3}{3!}+\ldots$ C)$1+x+x^2+x^3+\ldots$ D)None

37) The second term of Taylor's series of Sin$x$ about $x=\pi/4$ is ___________. [ ]

A) $\frac{1}{\sqrt{2}}$ B) $\left(x-\frac{\pi}{4}\right)\left(\frac{1}{\sqrt{2}}\right)$ C) $\frac{(x-\pi/4)^2}{2!}\left(\frac{1}{\sqrt{2}}\right)$ D) $\frac{(x-\pi/4)^3}{3!}\left(\frac{1}{\sqrt{2}}\right)$

38) In Taylor's series expansion, third term is ___________ [ ]

A) f(a) B) (x-a) f^1(a) C) $\frac{(x-a)^2}{2!}f^{11}(a)$ D) $\frac{(x-a)^3}{3!}f^{111}(a)$

39) Expansion of $\tan^{-1}x$ in power of x by Maclaurin's theorem… [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ B)$x-\frac{x^3}{3}+\frac{x^5}{5}\ldots$ C)$1+x+x^2+x^3+\ldots$ D) $1-x+x^2-x^3+\ldots$

40) The first term of Maclaurin's series of $f(x)=\frac{e^x}{e^x+1}$ is----------. [ ]

A) $\frac{1}{\sqrt{2}}$ B) $\frac{1}{2}$ C) $-\frac{1}{2}$ D) None.

UNIT – IV
Partial differentiation and Applications (Multi variable calculus)

1. Maclaurin's series expansion of f(x)=e^x [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ B)$1-\frac{x}{1!}+\frac{x^2}{2!}-\frac{x^3}{3!}+\ldots$ C)$1+x+x^2+x^3+\ldots$ D) $1-x+x^2-x^3+\ldots$

2. The function f(x)= $x\sin\frac{1}{x}$ for x≠0 is_________ [ ]

A) Continuous and derivable B) Not continuous but derivable
C) Continuous but not derivable D) Neither continuous nor derivable

3. If f(x)=*tanx* in[0,π] is [ ]

A)Continuous B) Discontinuous
C) Continuous andderivable D) Neither continuousnorderivable

4. The first term of Taylor's series of Sin$x$ about $x=\pi/4$ is_________ [ ]

A) $\frac{1}{\sqrt{2}}$ B) $\left(x-\frac{\pi}{4}\right)\left(\frac{1}{\sqrt{2}}\right)$ C) $\frac{(x-\pi/4)^2}{2!}\left(\frac{1}{\sqrt{2}}\right)$ D) 0

5.The non-zero second term of Maclaurin's series of Cos $x$is ___ [ ]

A) 1 B) $\frac{x^3}{3!}$ C) $\frac{x^2}{2!}$ D) $-\frac{x^2}{2!}$

6. Maclaurin's series expansion of f(x)=cosx_______. [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ B)$1-\frac{x^2}{2!}+\frac{x^4}{4!}-\ldots$ C)$1+x+x^2+x^3+\ldots$ D)$1-x+x^2-x^3+\ldots$

7. Maclaurin's series expansion of f(x)=e^{-x} [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ B)$1-\frac{x}{1!}+\frac{x^2}{2!}-\frac{x^3}{3!}+\ldots$ C)$1+x+x^2+x^3+\ldots$ D)None

8. Taylors's series expansion of f(x)=sinx at x=0 [ ]

A)$1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots..$ B)$x-\frac{x^3}{3!}+\frac{x^5}{5!}-\ldots..$ C)$1+x+x^2+x^3+\ldots$ D)$1-x+x^2-x^3+\ldots\ldots$

9. The infinite series $f(x)=x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+\ldots..$ converges to [ ]

A)cos x B) sin hx C) sin x D) coshx

10. If $f(x)=f(a)+(x-a)\, f^{1}(a)+\frac{(x-a)^2}{2!}\, f^{11}(a)+$-------------- then the series is called [ ]

A) Maclaurin's series B) LMVT C) Taylor's series D) None

11.Taylors's series expansion of f(x)=log(1+x) at x=0 _______ [ ]

A)$x-\frac{x^2}{2}+\frac{x^3}{3}-\ldots..$ B)$x+\frac{x^3}{3}+\frac{x^5}{5}+\ldots..$ C)$1+x+x^2+x^3+\ldots\ldots$ D) None

12. If $u=e^x \sin y$,$v=e^x \cos y$,then $J\left(\frac{u,v}{x,y}\right)=$ [ ]

A)e^{-x} B)$-e^{x}$ C) $-e^{2x}$ D)e^{-2x}

13. If u = 3x+5y, v= 4x-3y then $J\left(\frac{u,v}{x,y}\right)=$ [ ]

A) 29 B) -29 C) 20 D) 19

14. If $J=\frac{\partial(u,v)}{\partial(x,y)}$, $J^*=\frac{\partial(x,y)}{\partial(u,v)}$ then $JJ^*=$ _______ [ ]

A) 0 B) 1 C) 2 D) 3

15. Jacobian is a ___________ [ ]

A) Rank B) Constant C) Function D) Determinant value

16. If l=2, m=3, n=5, then the f(x, y) has ___________ [ ]

A) Max (or) min B) Min C) Max D) None

17. If l=2, m=4, n=10, then the function has ___________ [ ]

A) Either max (or) min B) Max C) Min D) None

18. The function f(x, y) has a maximum value for________ [ ]

A) ln-$m^2>0; l<0$ B) ln-$m^2>0; l>0$ C) ln-$m^2=0$ D) None

19. The function f(x, y) has a minimum value for________ [ ]

A) ln-$m^2>0; l<0$ B) ln-$m^2>0; l>0$ C) ln-$m^2=0$ D) None

20. The function f(x, y) is not an extreme for_____________ [ ]

A) ln-$m^2>0; l<0$ B) ln-$m^2>0; l>0$ C) ln-$m^2<0$ D) None

21. The necessary conditions for f(x, y) to have a maxima or minima at (a, b) are [ ]

A)$f_x(a,b)=0$;$f_y(a,b)$=0 B)$f_x(a,b)\neq 0$ C)$f_y(a,b)$=0 D) None

22. f (a, b) is said to be an extreme value of f(x, y) if it is a_____________ [ ]

A) Only maxi value B) Only mini value C) Maxior Mini value D) None

23. The stationary point of f(x, y) = x^3+y^3-3axy is ________ [ ]

A) (a, a) B) (a,-a) C) (-a, a) D) none

24. The maximum value of f(x, y) = sin x + sin y +sin(x+y) at (π/3, π/3)) is ____ [ ]

A) ($\sqrt{3}$/2 B) 3$\sqrt{3}$/2 C) $\sqrt{3}$ D) None

25. The maximum value of f(x, y) = sin x.sin y.sin (x+y) at (π/3, π/3) is __ [ ]

A) $\sqrt{3}/2$ B) $3\sqrt{3}/2$ C) $3\sqrt{3}/8$ D) None

26. The minimum value of $x^2+y^2+z^2$ given that xyz = a^3 at (a, a, a) is [ ]

A) 3a B) $4a^2$ C) $2a^2$ D) $3a^2$

27. The stationary point of $x^3y^2(1-x-y)$ is [ ]

A) (0,1) B) (-1,-1) C) (12,13) D) (1,1)

28. If f(x, y, z) = x +y +z and ϕ(x, y, z) = xyz then Lagrangian function is ____ [ ]

A) L=(x +y +z) +λ (xyz) B) L= (xyz)+λ(x +y +z) C) L=x +y + z D) L = xyz

29. The distance between (0, 0, 0) to (x, y, z) is __________ [ ]

A) $\sqrt{x+y+z}$ B) $\sqrt{x^2+y^2+z^2}$ C) x +y +z D) $x^2+y^2+z^2$

30. If $y=e^{x+y}$ then $\frac{\partial^2 y}{\partial y\,\partial x}=$ __________ [ ]

A) y B) e^{yx} C) e^{x-y} D) e^{-x-y}

31. If $u=cos^{-1}\left(\frac{x}{y}\right)$ then $\frac{\partial u}{\partial x}=$ ________ [ ]

A) $\frac{-x}{\sqrt{x^2-y^2}}$ B) $\frac{y}{\sqrt{x^2-y^2}}$ C) $\frac{1}{\sqrt{y^2-x^2}}$ D) $-\frac{1}{\sqrt{y^2-x^2}}$

32. If $u=cos\,x\,y$ then $\frac{\partial u}{\partial y}=$ ________ [ ]

A) $-x\,sin\,x\,y$ B) $x\,sin\,x\,y$ C) $-sin\,x\,y$ D) $y\,sin\,x\,y$

33. If $u=e^{\frac{x}{y}}$ then $\left(\frac{\partial u}{\partial x}\right)^2=$ ________ [ ]

A) $\frac{e^{\frac{2x}{y}}}{y^2}$ B) $-\frac{e^{\frac{2y}{x}}}{x^2}$ C) $-\frac{1}{x^2}$ D) $\frac{1}{xy}$

34. If $u=log\,x\,y$ then $\frac{\partial^2 u}{\partial x^2}=$ ________ [ ]

A) $\frac{1}{x}$ B) $-\frac{1}{x}$ C) $-\frac{1}{x^2}$ D) $\frac{1}{xy}$

35. If $f(x,y)=\frac{x-y}{2x+y}$ *then* [ ]

A) $\lim_{x\to 0}\left\{\lim_{y\to 0} f(x,y)\right\} \neq \lim_{y\to 0}\left\{\lim_{x\to 0} f(x,y)\right\}$ B) $\lim_{x\to 0}\left\{\lim_{y\to 0} f(x,y)\right\} = \lim_{y\to 0}\left\{\lim_{x\to 0} f(x,y)\right\}$

C) $\lim_{x\to 0}\left\{\lim_{y\to 0} f(x,y)\right\} \neq 2\lim_{y\to 0}\left\{\lim_{x\to 0} f(x,y)\right\}$ D) $2\lim_{x\to 0}\left\{\lim_{y\to 0} f(x,y)\right\} \neq \lim_{y\to 0}\left\{\lim_{x\to 0} f(x,y)\right\}$

36. If u=sin (xy^2), we have x=logt, y=e^t, then $\frac{du}{dt}$= [ ]

A) 0 B) 1 C) 2 D) $y^2\left(\frac{1}{t}+2x\right)\cos x\,y^2$

37. If f(x,y)=c, where c is a constant then $\frac{dy}{dx}$ = [ ]

A) $-\frac{f_x}{f_y}$ B) $\frac{f_x}{f_y}$ C) 0 D) 1

38. If u=xy, then $\frac{\partial u}{\partial y}=$ [ ]

A) xy logx B) xy C) y^x logy D) x^2y

39. The stationary point of x^3y^2(1-x-y) are [ ]

A) (0,1) B) (-1,-1) C) (12,13) D) (1,1)

40. If λ is the lagrange multiplier in maximizing 8xyz when x^2a^2+ y^2 b^2+ z^2 c^2=1

then λ^4= [ ]

A) b^2y B) -a^2yzx C) 2^{2x} D) a^2xy

UNIT-V
(Integral Calculus)

1. $\int_0^2 \int_0^y xdxdy$ [ ]
A)$\frac{4}{3}$ B) $\frac{8}{3}$ C) 4 D) 1
2. $\int_0^a \int_0^{\sqrt{ay}} xydydx =$ [ ]
A)$\frac{a^4}{6}$ B) $\frac{a^4}{5}$ C)$\frac{a^4}{4}$ D) $\frac{a^4}{3}$
3. The value of the triple integral $\int_0^1 \int_0^1 \int_0^1 e^{x+y+z}dx\ dy\ dz$ is [ ]
A)$(e-1)^2$ B) $(e-1)$ C)$(e-1)^3$ D) None
4. $\int_0^1 \int_1^2 xydydx =$ [ ]

A)$\frac{4}{3}$ B) $\frac{3}{4}$ C)$\frac{5}{3}$ D) $\frac{5}{4}$

5. $\int_0^2 \int_0^x (x+y)dydx =$ [ ]

A) 2 B) 5 C) 4 D) None

6. $\int_0^1 \int_0^1 \int_0^1 xyzdxdydz =$ [ ]

A) $\frac{1}{3}$ B) $\frac{1}{5}$ C) $\frac{1}{8}$ D) None

7. $\int_0^\pi \int_0^{a\cos\theta} r\sin\theta drd\theta =$ [ ]
A) $\frac{a^2}{3}$ B) $\frac{\pi a^2}{4}$ C)$\frac{a^3}{3}$ D) None
8. $\int_{-1}^2 \int_{x^2}^{x+2} dydx =$ [ ]
A) $\frac{1}{3}$ B) $\frac{9}{2}$ C) $\frac{1}{8}$ D) None
9. $\int_1^0 \int_0^1 (x+y)dxdy =$ [ ]
A) 2 B) -2 C) -1 D) 1
10. $\int_0^1 dx \int_0^x e^{\frac{y}{x}}dy =$ [ ]
A) e-1 B) $\frac{1}{2}(e-1)$ C) $\frac{1}{3}(e-1)$ D) None

11. $\int_0^1 \int_0^x e^x dydx =$ [ ]
A) 2 B) -2 C) -1 D) 1

12. $\int_0^1 \int_x^{\sqrt{x}} xydydx =$ [ ]
A) $\frac{1}{8}$ B) $\frac{1}{16}$ C) $\frac{1}{24}$ D) None

13. $\int_0^2 \int_0^{x^2} x(x^2+y^2)dxdy =$ [ ]
A) $\frac{32}{3}$ B) $\frac{64}{3}$ C) $\frac{84}{3}$ D) None

14. $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dxdy =$ [ ]
A) $\frac{\pi}{4}$ B) $\frac{\pi}{3}$ C) $\frac{\pi}{6}$ D) 0

15. The area of a region R bounded by the given curves is [ ]
A) $\iint_R$ dxdy B) $\iint_R xdxdy$ C) $\iint_R x^2dxdy$ D) None

16. If the region is represented in polar coordinates then the area is given by [ ]
A) $\iint_R$ rdrdθ B) $\iint_R r^2drd\theta$ C) $\iint_R drd\theta$ D) None

17. $\int_0^3 \int_{-x}^x xy\, dydx =$ [ ]
A) 1 B) 0 C) -1 D) 3

18. $\int_0^3 \int_1^2 xy(x+y)\, dxdy =$ [ ]
A) 21 B) 22 C) 24 D) 23

19. By change of variables method, $dx\ dy =$ [ ]
A) $dr\ d\theta$ **B) r dr dθ** C) $2dr\ d\theta$ D) None

20. $\int_1^e \int_1^e \int_1^e (xyz)^{-1}dxdydz =$ [ ]
A) 1 B) -1 C) e D) -e

21. $\int_{-1}^1 \int_{-2}^2 \int_{-3}^3 dxdydz =$ [ ]
A) 12 B) 24 C) 48 D) 36

22. $\int_0^1 \int_0^{1-x} \int_0^{1-x^2-y^2} dzdydx =$ [ ]
A) $\frac{\pi}{4}$ B) $\frac{\pi a^2}{4}$ C) $\frac{\pi}{6}$ D) 0

23. $\int_0^2 \int_1^3 \int_1^2 xy^2zdzdydx =$ [ ]
A) 12 B) 24 C) 48 D) 26

24. $\int_0^1 \int_0^2 \int_1^2 x^2\, yzdzdydx =$ [ ]
A) $\frac{1}{3}$ B) $\frac{9}{2}$ C) 1 D) None

25. $\int_0^2 \int_{y/2}^1 e^{x^2}\, dxdy =$ [ ]
A) e-1 B) $\frac{1}{2}(e-1)$ C) $\frac{1}{3}(e-1)$ D) None

26. The value of double integral $\int_0^{\pi/2} \int_0^1 drd\theta$ [ ]
A) π B) π/2 C) 2π D) None

27. The value of the triple integral $\int_0^1 \int_0^2 \int_0^3 dx\ dy\ dz$ is [ ]
A) 3 B) 5 C) 8 D) 6

28. The value of double integral $\int_0^2 \int_0^1 dydx\ = ---------$ [ ]
A) 2 B) 1 C) 4 D) 3

29. The value of double integral $\int_0^2 \int_0^x dydx = - - - - - - - -$ [ ]
    A) x B) 4 C) 1 D) 2

30. The area enclosed by the parabolas $x^2 = y$ and $y^2 = x$ is … [ ]
    A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\frac{1}{4}$ D) $\frac{\sqrt{2}}{3}$

31. Evaluate I $= \int_0^1 \int_1^2 \int_2^3 xyzdxdydz$ [ ]
    A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\mathbf{\frac{15}{8}}$ D) $\frac{\sqrt{2}}{3}$

32. Find $\int_0^{\pi} \int_0^{asin\Theta} rdrd\Theta =$ [ ]
    A) $\frac{a^2\pi}{4}$ B) $\frac{\pi}{4}$ C) π D) 4

33. Evaluate $\int_0^{\infty} \int_0^{\pi/2} e^{-r^2} rdrd\Theta =$ [ ]
    A) $\frac{a^2\pi}{4}$ B) $\frac{\pi}{4}$ C) π D) 4

34. Find $r^3 drd\theta$over the region included between the circles$r = 2\sin\theta$, $r = 4\sin\theta$is [ ]
    A) $\int_0^{\pi} \int_{2\sin\theta}^{4\sin\theta} r^3 drd\theta$ B) $\int_0^{\pi/2} \int_{2\sin\theta}^{4\sin\theta} r^3 drd\theta$ C) $\int_{-\pi}^{\pi} \int_{2\sin\theta}^{4\sin\theta} r^3 drd\theta$ D) None

35. Evaluate I = $\int_0^1 dx \int_0^2 dy \int_1^2 x^2 yzdz$ [ ]
    A) 1 B) 4 C) 0 D) 5

36. Suppose the region of integration is $x = 0, x = a, y = 0, y = \sqrt{a^2 - x^2}$then the region lies in [ ]
    A) 2nd quadrant B) 3rd quadrant C) 4nd quadrant D) 1st quadrant

37. If the region R is bounded by $x = 0, y = 0, x + y = 1$and if vertical strip is consider first then the limits of x are [ ]
    A) (1,1) B) (0,1) C) (0,1-y) D) (0,1-x)

38. Find the volume of the sphere $x^2 + y^2 + z^2 = 9$ by double integration [ ]
    A) $\left(3\pi - \frac{4}{\pi}\right) cu.u$ B) $\left(3\pi + \frac{4}{\pi}\right) cu.u$ C) $\left(3\pi - \frac{2}{\pi}\right) cu.u$ D) $\left(3\pi + \frac{2}{\pi}\right) cu.u$

39. Find the volume bounded by the paraboloid $x^2 + y^2 = az$, the cylinder $x^2 + y^2 = 2ay$ and the plane $z = 0$ [ ]
    A) $\frac{3\pi a^2}{2} cu.u.$ B) $\frac{\pi a^3}{2} cu.u.$ C) $\frac{3\pi a^3}{2} cu.u.$ D) $\frac{3\pi a^3}{4} cu.u.$

40. Find the volume of the region bounded by paraboloid $az = x^2 + y^2$ and the cylinder $x^2 + y^2 = b^2$ by triple integration [ ]
    A) $\frac{\pi b^4}{2} cu.u$ B) $\frac{\pi b^4}{2a} cu.u$ C) $\frac{\pi b^4}{a} cu.u$ D) $\frac{\pi b^2}{2a} cu.u$

Prepared by: **Dep.of Mathematics**