INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad-500043

MECHANICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**LINEAR ALGEBRA AND CALCULUS**				
Course Code	**AHSB02**				
Programme	**B.Tech**				
Semester	I	AE | CSE | IT | ECE | EEE | ME | CE			
Course Type	**Foundation**				
Regulation	**IARE - R18**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	Ms. P Rajani, Assistant Professor				
Course Faculty	Dr. M Anita, Professor Dr. S Jagadha, Professor Dr. J Suresh Goud, Assistant Professor Ms. L Indira, Assistant Professor Mr. Ch Somashekar, Assistant Professor Ms. P Srilatha, Assistant Professor Ms. C Rachana, Assistant Professor Ms. V Subba Laxmi, Assistant Professor Ms. B Praveena, Assistant Professor				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Determine rank of a matrix and solve linear differential equations of second order.
II	Determine the characteristic roots and apply double integrals to evaluate area.
III	Apply mean value theorems and apply triple integrals to evaluate volume.
IV	Determine the functional dependence and extremum value of a function
V	Analyze gradient, divergence, curl and evaluate line, surface, volume integrals over a vector field.

COURSE OUTCOMES (COs):

CO 1	Determine rank by reducing the matrix to Echelon and Normal forms. Determine inverse of the matrix by Gauss Jordon Method and Solving Second and higher order differential equations with constant coefficients.
CO 2	Determine a modal matrix, and reducing a matrix to diagonal form. Evaluate inverse and powers of matrices by using Cayley-Hamilton theorem. Evaluate double integral. Utilize the concept of change order of integration and change of variables to evaluate double integrals. Determine the area.
CO 3	Apply the Mean value theorems for the single variable functions. Apply triple integrals to evaluate volume.

CO 4	Determine the maxima and minima for a function of several variable with and without constraints.
CO 5	Analyze scalar and vector fields and compute the gradient, divergence and curl. Evaluate line, surface and volume integral of vectors. Use Vector integral theorems to facilitate vector integration.

COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

AHSB02.01	Demonstrate knowledge of matrix calculation as an elegant and powerful mathematical language in connection with rank of a matrix.
AHSB02.02	Determine rank by reducing the matrix to Echelon and Normal forms.
AHSB02.03	Determine inverse of the matrix by Gauss Jordon Method.
AHSB02.04	Find the complete solution of a non-homogeneous differential equation as a linear combination of the complementary function and a particular solution.
AHSB02.05	Solving Second and higher order differential equations with constant coefficients.
AHSB02.06	Interpret the Eigen values and Eigen vectors of matrix for a linear transformation and use properties of Eigen values
AHSB02.07	Understand the concept of Eigen values in real-world problems of control field where they are pole of closed loop system.
AHSB02.08	Apply the concept of Eigen values in real-world problems of mechanical systems where Eigen values are natural frequency and mode shape.
AHSB02.09	Use the system of linear equations and matrix to determine the dependency and independency.
AHSB02.10	Determine a modal matrix, and reducing a matrix to diagonal form.
AHSB02.11	Evaluate inverse and powers of matrices by using Cayley-Hamilton theorem.
AHSB02.12	Apply double integrals to evaluate area of a given function.
AHSB02.13	Utilize the concept of change order of integration and change of variables to evaluate double integrals.
AHSB02.14	Apply the Mean value theorems for the single variable functions.
AHSB02.15	Apply triple integrals to evaluate volume of a given function.
AHSB02.16	Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies.
AHSB02.17	Understand the techniques of multidimensional change of variables to transform the coordinates by utilizing the Jacobian. Determine Jacobian for the coordinate transformation.
AHSB02.18	Apply maxima and minima for functions of several variable's and Lagrange's method of multipliers.
AHSB02.19	Analyze scalar and vector fields and compute the gradient, divergence and curl.
AHSB02.20	Understand integration of vector function with given initial conditions.
AHSB02.21	Evaluate line, surface and volume integral of vectors.
AHSB02.22	Use Vector integral theorems to facilitate vector integration.

TUTORIAL QUESTION BANK

MODULE - I				
THEORY OF MATRICES AND LINEAR TRANSFORMATIONS				
Part - A (Short Answer Questions)				
S No	Questions	Blooms Taxonomy Level	Course Outcomes	Course Learning Outcomes (CLOs)
1	Define Orthogonal matrix.	Remember	CO 1	AHSB02.01
2	Find the value of k such that the rank of $\begin{bmatrix} 1 & 1 & -1 & 1 \\ 1 & -1 & k & -1 \\ 3 & 1 & 0 & 1 \end{bmatrix}$ is 2.	Remember	CO 1	AHSB02.01
3	Prove that $\frac{1}{2}\begin{bmatrix} 1+i & -1+i \\ 1+i & 1-i \end{bmatrix}$ is a unitary matrix.	Understand	CO 1	AHSB02.01
4	Find the value of k such that rank of $\begin{bmatrix} 1 & 2 & 3 \\ 2 & k & 7 \\ 3 & 6 & 10 \end{bmatrix}$ $is\ 2$	Understand	CO 1	AHSB02.01
5	Find the Skew-symmetric part of the matrix $\begin{bmatrix} 1 & 1 & 2 \\ -1 & 1 & 1 \\ 3 & -1 & 2 \end{bmatrix}$.	Understand	CO 1	AHSB02.01
6	Define Rank of a matrix and Skew-Hermitian matrix., Unitary matrix.	Remember	CO 1	AHSB02.01
7	If $A = \begin{bmatrix} 3 & a & b \\ -2 & 2 & 4 \\ 7 & 4 & 5 \end{bmatrix}$ is symmetric, then find the values of a and b.	Understand	CO 1	AHSB02.01
8	Define orthogonal matrix .Prove that A = $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ is orthogonal.	Understand	CO 1	AHSB02.01
9	Determine the values of a, b, c when the matrix $\begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is orthogonal.	Remember	CO 1	AHSB02.01
10	Express the matrix A as sum of symmetric and Skew-symmetric matrices. where A = $\begin{bmatrix} 3 & -2 & 6 \\ 2 & 7 & -1 \\ 5 & 4 & 0 \end{bmatrix}$	Understand	CO 1	AHSB02.01
11	Write the solution of the $\frac{d^3y}{dx^3} - 3\frac{dy}{dx} + 2y = 0$	Understand	CO 1	AHSB02.04
12	Write the solution of the $(4D^2-4D+1)y=100$	Understand	CO 1	AHSB02.04

13	Find the particular integral of $\frac{1}{(D^2-1)}x$	Understand	CO 1	AHSB02.04
14	Solve the differential equation $\frac{d^3y}{dx^3}+y=0$	Remember	CO 1	AHSB02.04
15	Solve the differential equation $(D^2+a^2)y=0$	Understand	CO 1	AHSB02.04
16	Find the particular value of $\frac{1}{(D-3)}x$	Understand	CO 1	AHSB02.04
17	Find the particular integral of $(D^3-D^2+4D-4)y=e^x$	Understand	CO 1	AHSB02.04
18	Solve the differential equation $\frac{1}{(D+1)(D-1)}e^{-x}$	Understand	CO 1	AHSB02.04
19	Solve the differential equation $(D^3+D)y=0$	Understand	CO 1	AHSB02.04
20	Solve the differential equation $(D^6-64)y=0$	Remember	CO 1	AHSB02.04
Part - B (Long Answer Questions)				
1	By reducing the matrix $\begin{bmatrix}-1 & 2 & 0\\ 3 & 7 & 1\\ 5 & 9 & 3\end{bmatrix}$ into normal form, find its rank.	Understand	CO 1	AHSB02.02
2	Find the values of a and b such that rank of the matrix $\begin{bmatrix}1 & -2 & 3 & 1\\ 2 & 1 & -1 & 2\\ 6 & -2 & a & b\end{bmatrix}$ is 3.	Understand	CO 1	AHSB02.02
3	Find the rank of the matrix A= $\begin{bmatrix}2 & 1 & 3 & 5\\ 4 & 2 & 1 & 3\\ 8 & 4 & 7 & 13\\ 8 & 4 & -3 & -1\end{bmatrix}$ by reducing to echelon form.	Understand	CO 1	AHSB02.02
4	Reduce the matrix to its normal form where A= $\begin{bmatrix}-1 & -3 & 3 & 1\\ 1 & 1 & -1 & 0\\ 2 & -5 & 2 & -3\\ -1 & 1 & 0 & 1\end{bmatrix}$	Understand	CO 1	AHSB02.03
5	Find the Inverse of a matrix by using Gauss-Jordan method $A=\begin{bmatrix}1 & -2 & 0 & 1\\ 2 & -1 & 1 & 0\\ 3 & -3 & 1 & 1\\ -1 & -1 & -1 & 1\end{bmatrix}$.	Understand	CO 1	AHSB02.02

6	Reduce the matrix A to its normal form where $A=\begin{bmatrix}0 & 1 & 2 & -2\\ 4 & 0 & 2 & 6\\ 2 & 1 & 3 & 1\end{bmatrix}$ and hence find the rank	Understand	CO 1	AHSB02.02
7	Find value of K such that the matrix $\begin{pmatrix}4 & 4 & -3 & 1\\ 1 & 1 & -1 & 0\\ k & 2 & 2 & 2\\ 9 & 9 & k & 3\end{pmatrix}$ has rank 3	Understand	CO 1	AHSB02.02
8	Find the rank of the matrix $\begin{bmatrix}1 & 2 & 3 & 0\\ 2 & 4 & 3 & 2\\ 3 & 2 & 1 & 3\\ 6 & 8 & 7 & 5\end{bmatrix}$ by reducing to normal form	Understand	CO 1	AHSB02.02
9	Find the rank of the matrix, by reducing it to the echelon form $\begin{bmatrix}2 & -4 & 3 & -1 & 0\\ 1 & -2 & -1 & -4 & 2\\ 0 & 1 & -1 & 3 & 1\\ 4 & -7 & 4 & -4 & 5\end{bmatrix}$	Understand	CO 1	AHSB02.02
10	Find the rank of the A^T matrix if A= $\begin{bmatrix}4 & 0 & 2 & 1\\ 2 & 1 & 3 & 4\\ 2 & 3 & 4 & 7\\ 2 & 3 & 1 & 4\end{bmatrix}$ by Echelon form.	Understand	CO 1	AHSB02.02
11	Solve the differential equation $(D^2+1)y = cosecx$ using variation of parameter.	Understand	CO 1	AHSB02.04
12	Solve the differential equation $D^2(D^2+4)y = 96x^2+\sin 2x-k$	Understand	CO 1	AHSB02.04
13	Solve the differential equation $(D^2+6D+9)y = sin3x$	Understand	CO 1	AHSB02.04
14	Solve the differential equation $(D^2+2D+1)y = x^2$	Understand	CO 1	AHSB02.04
15	Solve the differential equation $(D^3-6D^2+11D-6)y=e^{-2x}+e^{-3x}$	Understand	CO 1	AHSB02.04
16	Solve the differential equation $(D^2+1)y=\sin x\sin 2x+e^x x^2$	Understand	CO 1	AHSB02.04
17	Solve the differential equation $(D^3+1)y=3+5e^x$	Understand	CO 1	AHSB02.04
18	Solve the differential equation $\left(D^2-3D+2\right)y=\cos hx$	Understand	CO 1	AHSB02.04
19	Solve the differential equation $(D^2+4)y = x\ cosx$	Understand	CO 1	AHSB02.04
20	Solve the differential equation $\left(D^2+9\right)y=\cos 3x+\sin 2x$	Understand	CO 1	AHSB02.04

Part - C (Problem Solving and Critical Thinking Questions)				
1	Find the Inverse of a matrix by using Gauss-Jordan method $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$.	Understand	CO 1	AHSB02.03
2	Find the Inverse of a matrix by using Gauss-Jordan method $\begin{pmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{pmatrix}$	Understand	CO 1	AHSB02.03
3	Find the rank of the matrix $\begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$ by Normal form.	Understand	CO 1	AHSB02.02
4	Find the rank of the matrix A= $\begin{bmatrix} 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \\ 1 & 1 & 1 & 2 \end{bmatrix}$. by canonical form	Understand	CO 1	AHSB02.03
5	Find the inverse of A if $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ by elementary row operation.	Understand	CO 1	AHSB02.03
6	By using method of variation of parameters solve $y'' + y = x\cos x$.	Understand	CO 1	AHSB02.05
7	Solve the differential equation $\left(D^3 - 4D^2 - D + 4\right) y = e^{3x} cos2x$	Understand	CO 1	AHSB02.04
8	Solve the differential equation $\left(D^2 + 3D + 2\right)y = e^{e^x}$, By using method of variation of parameters	Understand	CO 1	AHSB02.05
9	Solve the differential equation $(D^3 - 5D^2 + 8D - 4)Y = e^x + 3e^{-x}$+x$e^x$	Understand	CO 1	AHSB02.04
10	Apply the method of variation parameters to solve $\left(D^2 + a^2\right)y = \tan ax$	Understand	CO 1	AHSB02.05
MODULE-II				
LINEAR TRANSFORMATIONS AND DOUBLE INTEGRALS				
Part – A (Short Answer Questions)				
1	State Cayley- Hamilton theorem.	Understand	CO 2	AHSB02.06
2	Find the sum of Eigen values of the matrix $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$	Understand	CO 2	AHSB02.06
3	Show that the vectors X_1=(1,1,2), X_2=(1,2,5) and X_3=(5,3,4) are linearly dependent.	Understand	CO 2	AHSB02.09
4	Find the characteristic equation of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$	Remember	CO 2	AHSB02.06

5	Find the Eigen values of the matrix $\begin{pmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{pmatrix}$	Understand	CO 2	AHSB02.06
6	Show that the vectors X_1=(1,1,1) X_2=(3,1,2) and X_3=(2,1,4) are linearly independent.	Understand	CO 2	AHSB02.09
7	Define Modal and Spectral matrices.	Understand	CO 2	AHSB02.10
8	Define diaganalisation of a matrix.	Understand	CO 2	AHSB02.10
9	Find the Eigen values of the matrix A^{-1} , A= $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$	Understand	CO 2	AHSB02.06
10	Find the eigen values A^3 of the matrix A= $\begin{pmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{pmatrix}$	Understand	CO 2	AHSB02.06
11	Evaluate the double integral $\int_0^2 \int_0^x ydydx$.	Remember	CO 2	AHSB02.12
12	Evaluate the double integral $\int_0^{\pi} \int_0^{a\sin\theta} rdrd\theta$.	Understand	CO 2	AHSB02.12
13	Evaluate the double integral $\int_0^3 \int_0^1 xy(x + y)dxdy$.	Understand	CO 2	AHSB02.12
14	Find the value of double integral $\int_1^2 \int_1^3 xy^2 dx\, dy$.	Understand	CO 2	AHSB02.12
15	Evaluate the double integral $\int_0^1 \int_x^{x^2}$ xy$dxdy$	Understand	CO 2	AHSB02.12
16	Evaluate the double integral $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \sin(x+y)\, dxdy$	Remember	CO 2	AHSB02.12
17	Evaluate the double integral 1 $\int_0^1 \int_1^2$ xy$dxdy$	Understand	CO 2	AHSB02.12
18	Evaluate the double integral $\int_0^{\infty} \int_0^{\pi/2} e^{-r^2} r\, d\theta\, dr$.	Understand	CO 2	AHSB02.12
19	Evaluate the double integral $\int_0^{\pi} \int_0^{a(1+\cos\theta)} r\ dr\, d\theta$.	Understand	CO 2	AHSB02.12
20	State the formula to find area of the region using double integration in Cartesian form.	Remember	CO 2	AHSB02.12
Part - B (Long Answer Questions)				
1	Find the characteristic vectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$	Understand	CO 2	AHSB02.06
2	Diagonalisation of matrixA= $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$	Understand	CO 2	AHSB02.11
3	Show that matrix $\begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ satisfying Cayley-Hamilton theorem and hence find its inverse,if its exists.	Understand	CO 2	AHSB02.11
4	Use Cayley-Hamilton theorem to find A^3 ,if A = $\begin{bmatrix} 2 & 4 \\ 1 & 1 \end{bmatrix}$	Understand	CO 2	AHSB02.11

5	Find the Eigen values and Eigen vectors of the matrix A and its inverse, where A = $\begin{bmatrix}1 & 3 & 4\\0 & 2 & 5\\0 & 0 & 3\end{bmatrix}$	Understand	CO 2	AHSB02.06
6	Find a matrix P such that $P^{-1}AP$ is a diagonal matrix, where A= $\begin{bmatrix}-2 & 2 & -3\\2 & 1 & -6\\-1 & -2 & 0\end{bmatrix}$	Understand	CO 2	AHSB02.10
7	Find the characteristic roots of the matrix $\begin{bmatrix}1 & 1 & 1\\1 & 1 & 1\\1 & 1 & 1\end{bmatrix}$ and the corresponding characteristic vectors.	Understand	CO 2	AHSB02.06
8	Express $A^5-4A^4-7A^3+11A^2-A-10I$ as a linear polynomial in A, where $A=\begin{bmatrix}1 & 4\\2 & 3\end{bmatrix}$	Understand	CO 2	AHSB02.06
9	Verify Cayley-Hamilton theorem for A= $\begin{pmatrix}1 & 2 & -1\\2 & 1 & -2\\2 & -2 & 1\end{pmatrix}$ and find A^{-1}& A^4.	Understand	CO 2	AHSB02.11
10	Diagonalize the matrix A= $\begin{pmatrix}1 & 1 & 1\\0 & 2 & 1\\-4 & 4 & 3\end{pmatrix}$ by linear transformation and hence find A^4.	Understand	CO 2	AHSB02.10
11	Evaluate the double integral $\int_0^{\pi}\int_0^{a(1+\cos\theta)} r^2\cos\theta\, dr\, d\theta.$	Understand	CO 2	AHSB02.12
12	Evaluate the double integral $\int_0^1\int_x^{\sqrt{x}}(x^2+y^2)dxdy.$	Understand	CO 2	AHSB02.12
13	Evaluate the double integral $\int_0^5\int_0^{x^2} x\left(x^2+y^2\right)dx\,dy.$	Understand	CO 2	AHSB02.12
14	Evaluate the double integral $\int_0^1\int_0^{\pi/2} r\sin\theta\, d\theta\, dr.$	Understand	CO 2	AHSB02.12
15	By changing the order of integration evaluate the double integral $\int_0^1\int_{x^2}^{2-x} xy\ dx\ dy.$	Understand	CO 2	AHSB02.13
16	By changing the order of integration Evaluate the double integral $\int_0^{4a}\int_{\frac{x^2}{4a}}^{2\sqrt{ax}} xydydx$	Understand	CO 2	AHSB02.13

17	Find the value of $\iint xy\,dxdy$ taken over the positive quadrant of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$.	Understand	CO 2	AHSB02.12
18	Evaluate the double integral using change of variables $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dxdy$.	Understand	CO 2	AHSB02.13
19	By transforming into polar coordinates Evaluate $\iint \frac{x^2y^2}{x^2+y^2}dxdy$ over the annular region between the circles $x^2+y^2=a^2$ and $x^2+y^2=b^2$ with $b>a$.	Understand	CO 2	AHSB02.12
20	Find the area of the region bounded by the parabola $y^2 = 4ax$ and $x^2 = 4ay$.	Understand	CO 2	AHSB02.12
Part - C (Problem Solving and Critical Thinking Questions)				
1	Find Eigen values and Eigen vectors of $A=\begin{bmatrix} i & 0 & 0 \\ 0 & 0 & i \\ 0 & i & 0 \end{bmatrix}$	Understand	CO 2	AHSB02.06
2	Examine whether the vectors [2,-1,3,2], [1,3,4,2], [3,5,2,2] is linearly independent or dependent?	Understand	CO 2	AHSB02.07
3	Find Eigen values and corresponding Eigen vectors of the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$	Understand	CO 2	AHSB02.06
4	Verify Cayley-Hamilton theorem for If $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$,	Understand	CO 2	AHSB02.11
5	Verify Cayley-Hamilton theorem for $A=\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and find A^{-1}.	Understand	CO 2	AHSB02.11
6	Evaluate $\iint r^3 dr d\theta$ over the area included between the circles $r=2\sin\theta$ and $r=4\sin\theta$.	Understand	CO 2	AHSB02.12
7	Find the area of the cardioid r = a(1+cosθ).	Understand	CO 2	AHSB02.12
8	Find the area of the region bounded by the curves $y = x^3$ and y = x.	Understand	CO 2	AHSB02.12
9	Evaluate $\iint xy\,dxdy$ taken over the positive quadrant of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$.	Understand	CO 2	AHSB02.12
10	By changing the order of integration Evaluate the double integral $\int_0^\infty\int_x^\infty \frac{e^{-y}}{y}dydx$	Understand	CO 2	AHSB02.13

MODULE-III				
FUNCTIONS OF SINGLE VARIABLES AND TRIPLE INTEGRALS				
Part - A (Short Answer Questions)				
1	Discuss the applicability of Rolle's theorem for any function f(x) in interval [a,b].	Understand	CO 3	AHSB02.14
2	Discuss the applicability of Lagrange's mean value theorem for any function f(x) in interval [a,b].	Understand	CO 3	AHSB02.14
3	Discuss the applicability of Cauchy's mean value theorem for any function f(x) in interval [a,b].	Understand	CO 3	AHSB02.14
4	Interpret Rolle's theorem geometrically.	Understand	CO 3	AHSB02.14
5	Interpret Lagrange's mean value theorem geometrically.	Remember	CO 3	AHSB02.14
6	Given an example of function that is continuous on [-1, 1] and for which mean value theorem does not hold.	Understand	CO 3	AHSB02.14
7	Using Lagrange's mean value theorem, find the value of c for f(x) = log x in (1, e).	Understand	CO 3	AHSB02.14
8	Explain why mean value theorem does not hold for $f(x)=x^{2/3}$ in [-1,1]	Understand	CO 3	AHSB02.14
9	Find the region in which $f(x)=1-4x-x^2$ is increasing using mean value theorem.	Understand	CO 3	AHSB02.14
10	If $f'(x)=0$ throughout an interval [a, b], using mean value theorem show that f(x) is constant.	Understand	CO 3	AHSB02.14
11	Find the value of triple integral $\int_{-1}^{1}\int_{-2}^{2}\int_{-3}^{3} dxdydz$.	Understand	CO 3	AHSB02.15
12	Find the volume of the tetrahedron bounded by the coordinate planes and the plane x+y+z=1.	Understand	CO 3	AHSB02.15
13	State the formula to find volume of the region using triple integration in Cartesian form.	Understand	CO 3	AHSB02.15
14	Evaluate the triple integral $\int_0^2\int_1^3\int_1^2 xy^2z\ dz\ dy\ dx$	Understand	CO 3	AHSB02.15
15	Evaluate the triple integral $\int_0^a\int_0^x\int_0^y xyz\ dz\ dy\ dx$	Understand	CO 3	AHSB02.15
16	Evaluate the triple integral $\int_0^1\int_0^2\int_0^3 (x+y+z)\ dz\ dy\ dx$	Understand	CO 3	AHSB02.15
17	Evaluate the triple integral $\int_0^1\int_0^1\int_0^1 xz\ dz\ dy\ dx$	Understand	CO 3	AHSB02.15
18	Evaluate the triple integral $\int_{-2}^2\int_{-3}^3\int_{-1}^1 e^{x+y+z}\ dz\ dy\ dx$	Understand	CO 3	AHSB02.15
19	Evaluate the triple integral $\int_0^2\int_0^3\int_0^1 dz\ dy\ dx$	Understand	CO 3	AHSB02.15
20	Evaluate the triple integral $\int_0^1\int_{-1}^1\int_{-1}^1 (x^2+y^2+z^2) dz\ dy\ dx$	Understand	CO 3	AHSB02.15
Part – B (Long Answer Questions)				
1	Verify Rolle's theorem for the function $f(x)=e^{-x}\sin x$ in the interval $[0,\pi]$.	Understand	CO 3	AHSB02.14
2	Show that for any $x>0, 1+x<e^x<1+xe^x$	Understand	CO 3	AHSB02.14
3	Verify Lagrange's mean value theorem for $f(x)=x^3-x^2-5x+3$ in the interval $[0,4]$.	Understand	CO 3	AHSB02.14
4	If a<b, prove that $\frac{b-a}{1+b^2}<Tan^{-1}b-Tan^{-1}a<\frac{b-a}{1+a^2}$ using Lagrange's Mean value theorem and hence deduce the following. (i) $\frac{\pi}{4}+\frac{3}{25}<Tan^{-1}\frac{4}{3}<\frac{\pi}{4}+\frac{1}{6}$	Understand	CO 3	AHSB02.14

	(ii) $\frac{5\pi+4}{20} < Tan^{-1}2 < \frac{\pi+2}{4}$			
5	Analyze the value of c in the interval [3, 7] for the function $f(x)=e^{x}, g(x)=e^{-x}$	Understand	CO 3	AHSB02.14
6	Find value of the C using Cauchy's mean value theorem for $f(x)=\sqrt{x}$ & $g(x)=\frac{1}{\sqrt{x}}$ in $[a,b]$ where $0 < a < b$	Understand	CO 3	AHSB02.14
7	Verify Cauchy's mean value theorem for f(x) $=x^2$ & g(x) = x^3 in [1,2] and find the value of c.	Understand	CO 3	AHSB02.14
8	Verify Rolle's theorem for the function $f(x) = (x-a)^m(x-b)^n$ where m, n are positive integers in [a, b].	Understand	CO 3	AHSB02.14
9	Using mean value theorem, for 0 < a < b, prove that $1-\frac{a}{b} < \log\frac{b}{a} < \frac{b}{a}-1$ and hence show that $\frac{1}{6} < \log\frac{6}{5} < \frac{1}{5}$.	Understand	CO 3	AHSB02.14
10	Find all numbers c between a and b b which satisfies lagranges mean value theorem ,for the following function(x)= (x-1)(x-2)(x-3) in [0 4]	Understand	CO 3	AHSB02.14
11	Evaluate the triple integral $\int_0^1\int_0^{1-z}\int_0^{1-y-z} xyzdxdydz.$	Understand	CO 3	AHSB02.15
12	Evaluate the triple integral $\int_0^{\log 2}\int_0^{x}\int_0^{x+\log y} e^{x+y+z}dxdydz.$	Understand	CO 3	AHSB02.15
13	Evaluate $\int_0^1\int_0^{\sqrt{1-x^2}}\int_0^{\sqrt{1-x^2-y^2}}\frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$.	Understand	CO 3	AHSB02.15
14	Find the volume of the tetrahedron bounded by the plane x=0,y=0,z=0;and $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ and the coordinate planes by triple integration.	Understand	CO 3	AHSB02.15
15	Using triple integration find the volume of the sphere $x^2+y^2+z^2=a^2$.	Understand	CO 3	AHSB02.15
16	Evaluate $\iiint_v dxdydz$ where v is the finite region of space formed by the planes x=0,y=0,z=0 and 2x+3y+4z=12.	Understand	CO 3	AHSB02.15
17	Evaluate $\iiint_R (x+y+z)dzdydx$ where R is the region bounded by the plane $x=0, x=1, y=0, y=1, z=0, z=1.$	Understand	CO 3	AHSB02.15
18	Find the volume of the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{x^2}{c^2}=1$	Understand	CO 3	AHSB02.15
19	If R is the region bounded by the planes x=0,y=0,z=1 and the cylinder $x^2+y^2=1$,evaluate $\iiint_R xyzdxdydz.$	Understand	CO 3	AHSB02.15
20	Evaluate $\int_0^1\int_0^1\int_{\sqrt{x^2+y^2}}^2 xyz\ dz\ dy\ dx$	Understand	CO 3	AHSB02.15
Part - C (Problem Solving and Critical Thinking Questions)				
1	Verify the hypothesis and conclusion of rolles thorem for the function defined below f(x)=$x^3-6x^2+11x-6$ in [1 3]	Understand	CO 3	AHSB02.14
2	Verify the hypothesis and conclusion of rolles thorem for the function defined below f(x)= $\frac{\log(x^2+ab)}{(a+b)x}$ in $[a\ b]$	Understand	CO 3	AHSB02.14
3	Use lagranges mean value theorem to establish the following	Understand	CO 3	AHSB02.14

	inequalities $x \leq sin^{-1}x \leq \frac{x}{\sqrt{1-x^2}} for\ 0 \leq x \leq 1$			
4	Calculate approximately $\sqrt[5]{245}$ by using L.M.V.T.	Understand	CO 3	AHSB02.14
5	Verify Cauchy's mean value theorem for f(x) = x^3 & g(x) = 2-x in [0,9] and find the value of c.	Understand	CO 3	AHSB02.14
06	Evaluate $\int_0^a \int_0^b \int_0^c (x+y+z)dxdydz$.	Understand	CO 3	AHSB02.15
07	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dx\,dy\,dz$	Understand	CO 3	AHSB02.15
08	Evaluate $\int_{-1}^{1} \int_0^{z} \int_{x-z}^{x+z} (x+y+z)dx\,dy\,dz$	Understand	CO 3	AHSB02.15
09	Evaluate $\iiint \frac{dxdydz}{(x+y+z+1)^3}$.where D is the region bounded by the planes x=0,y=0,z=0,x+y+z=1	Understand	CO 3	AHSB02.15
10	Evaluate $\iiint xyz\ dxdydz$ where D is the region bounded by the positive octant of the sphere $x^2+y^2+z^2=a^2$.	Understand	CO 3	AHSB02.15
MODULE-IV				
FUNCTIONS OF SEVERAL VARIABLES AND EXTREMA OF A FUNCTION				
Part - A (Short Answer Questions)				
1	If $x=\frac{u^2}{v}, y=\frac{v^2}{v}$, find the value of $\frac{\partial(u,v)}{\partial(x,y)}$	Understand	CO 4	AHSB02.17
2	The stationary point of the function $f(x,y) = x^2 + y^2 + xy + x - 4y + 5$	Understand	CO 4	AHSB02.18
3	If $x=u(1-v), y=uv$, find the value of J'.	Understand	CO 4	AHSB02.17
4	Calculate $\frac{\partial(x,y,z)}{\partial(u,v,w)}$ $if\ u=\frac{2yz}{x}, v=\frac{3zx}{y} w=\frac{4xy}{z}$	Understand	CO 4	AHSB02.17
5	If $x=u(1+v), y=v(1+u)$ then find the value of $\frac{\partial(x,y)}{\partial(u,v)}$	Understand	CO 4	AHSB02.17
6	Write the condition for the function f(x,y) to be functionally dependent.	Understand	CO 4	AHSB02.17
7	Define jacobian of a function.	Understand	CO 4	AHSB02.17
8	Define a saddle point for the function of f(x, y).	Understand	CO 4	AHSB02.17
9	Write the condition for the function f(x,y) to be functionally independent.	Understand	CO 4	AHSB02.17
10	Define a extreme point for the function of f(x, y).	Understand	CO 4	AHSB02.18
11	Define Stationary points	Understand	CO 4	AHSB02.18
12	Define maxium function ?	Understand	CO 4	AHSB02.18
13	Define a minimum function?	Understand	CO 4	AHSB02.18
14	If u and v are functions of x and y then prove that J J'=1	Understand	CO 4	AHSB02.18
15	X= rcos$\theta, Y = rsin\theta$ find J	Understand	CO 4	AHSB02.17
16	If X=log(xtan^{-1}y)then f_{xy} is equal to zero	Understand	CO 4	AHSB02.16
17	If f(x,y,z)=0 then the values $\frac{\partial x}{\partial y}\frac{\partial y}{\partial z}\frac{\delta z}{\delta x}$=-1	Understand	CO 4	AHSB02.16
18	Prove that if the function u,v,w of three independent variables x,y,z	Understand	CO 4	AHSB02.17

	are not independent ,then the Jacobian of u,v,w w.r.t x,y,z is always equals to zero.			
19	If z=cos$(\frac{x}{y})$ + sin$(\frac{x}{y})$,then Show that $x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial x}=0$	Understand	CO 4	AHSB02.20
20	Write the properties of maxima and minima under the various conditions .	Understand	CO 4	AHSB02.20
Part – B (Long Answer Questions)				
1	i) If x = u(1 - v), y = uv then prove that JJ'=1. ii) If $x+y^2=u, y+z^2=v, z+x^2=w$ find the value of $\frac{\partial(x,y,z)}{\partial(u,v,w)}$.	Understand	CO 4	AHSB02.18
2	If $u=x^2-y^2, v=2xy$ where $x=r\cos\theta, y=r\sin\theta$ then show that $\frac{\partial(u,v)}{\partial(r,\theta)}=4r^3$	Understand	CO 4	AHSB02.18
3	If $x=e^r\sec\theta,\ y=e^r\tan\theta$ Prove that $\frac{\partial(x,y)}{\partial(r,\theta)}\frac{\partial(r,\theta)}{\partial(x,y)}$ =1.	Understand	CO 4	AHSB02.18
4	If $ux=yz, vy=zx, wz=xy$ find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$	Understand	CO 4	AHSB02.18
5	If x= $\frac{u^2}{v}$, y= $\frac{v^2}{u}$ then find the Jacobian of the function u and v with respect to x and y	Understand	CO 4	AHSB02.18
6	Show that the functions $u=x+y+z, v=x^2+y^2+z^2-2xy-2yz-2xz$ and $w=x^3+y^3+z^3-3xyz$ are functionally related.	Understand	CO 4	AHSB02.19
7	If x = u, y = tanv, z = w then prove that $\frac{\partial(x,y,z)}{\partial(u,v,w)}=u\sec^2 v$	Understand	CO 4	AHSB02.18
8	Show that the functions $u=e^x\sin y, v=e^x\cos y$ are not functionally related.	Understand	CO 4	AHSB02.18
9	Prove that $u=x+y+z, v=xy+yz+zx, w=x^2+y^2+z^2$ are functionally dependent.	Understand	CO 4	AHSB02.18
10	If $u=x+y+z, uv=y+z, z=uvw$ Prove that $\frac{\partial(x,y,z)}{\partial(u,v,w)}=u^2v$	Understand	CO 4	AHSB02.18
11	Find the maximum value of the function xyz when x + y + z = a.	Understand	CO 4	AHSB02.19
12	Find the maxima and minima of the function f(x, y) = x^3y^2 (1-x-y).	Understand	CO 4	AHSB02.20
13	Find the maximum and minimum of the function $f(x,y)=\sin x+\sin y+\sin(x+y)$	Understand	CO 4	AHSB02.20
14	Find the maximum and minimum values of $f(x,y)=x^3+3xy^2-3x^2-3y^2+4$	Understand	CO 4	AHSB02.20
15	Find the shortest distance from the origin to the surface $xyz^2=2$	Understand	CO 4	AHSB02.18
16	Find the minimum value of x^2+y^2 ,subjects to the condition ax+by=c using lagranges multipliers method.	Understand	CO 4	AHSB02.18
17	Find the points on the surface $z^2=xy+1$ nearest to the origin.	Understand	CO 4	AHSB02.20
18	Show that the rectangular solid of maximum volume that can be inscribed in a given sphere is a cube using lagranges multipliers method	Understand	CO 4	AHSB02.20
19	Find the value of the largest rectangular parallelepiped that can be	Understand	CO 4	AHSB02.20

	inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1.$			
20	Find the stationary points of $U(x,y)=\sin x\sin y\sin(x+y)$ where $0<x<\pi, 0<y<\pi$ and find the maximum value of the function U.	Understand	CO 4	AHSB02.20
Part – C (Problem Solving and Critical Thinking)				
1	If $u=x+3y^2+z^3, v=4x^2yz,\ w=2z^2-xy$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1,-1,0).	Understand	CO 4	AHSB02.17
2	If $u=e^{xyz}, show\ that\ \frac{\partial^3 u}{\partial x\partial y\partial z}=(1+3xyz+x^2y^2z^2)e^{xyz}$	Understand	CO 4	AHSB02.16
3	If $u=\log(x^2+y^2+z^2), prove\ that$ $(x^2+y^2+z^2)\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial x^2}\right)=2$	Understand	CO 4	AHSB02.16
4	Determine whether the following functions are functionally dependent or not .If functionally dependent , find the relation between them . $u=\frac{x-y}{x+z}, v=\frac{x+z}{y+z}$	Understand	CO 4	AHSB02.17
5	Determine whether the following functions are functionally dependent or not .If functionally dependent , find the relation between them . $u=\frac{x+y}{1-xy}, v=tan^{-1}x+tan^{-1}y$	Understand	CO 4	AHSB02.18
6	Find the maxima value of $u=x^2y^3z^4$ with the constrain condition $2x+3y+4z=a$	Understand	CO 4	AHSB02.18
7	Find the point of the plane $x+2y+3z=4$ that is closed to the origin.	Understand	CO 4	AHSB02.20
8	Divide 24 into three parts such that the continued product of the first, square of the second and cube of the third is maximum.	Understand	CO 4	AHSB02.18
9	Find three positive numbers whose sum is 100 and whose product is maximum.	Understand	CO 4	AHSB02.18
10	A rectangular box open at the top is to have volume of 32 cubic ft . Find the dimensions of the box requiring least material for its construction.	Understand	CO 4	AHSB02.18
MODULE-V				
VECTOR CALCULUS				
Part - A (Short Answer Questions)				
1	Define gradient of scalar point function.	Remember	CO 5	AHSB02.19
2	Define divergence of vector point function.	Remember	CO 5	AHSB02.19
3	Define curl of vector point function.	Remember	CO 5	AHSB02.19
4	State Laplacian operator.	Understand	CO 5	AHSB02.19
5	Find curl $\bar{f}$ where $\bar{f}$ = grad $(x^3+y^3+z^3-3xyz)$.	Understand	CO 5	AHSB02.19
6	Find the angle between the normal to the surface xy= z^2 at the points (4, 1, 2) and (3,3,-3).	Understand	CO 5	AHSB02.19
7	Find a unit normal vector to the given surface $x^2y+2xz = 4$ at the point(2,-2,3).	Understand	CO 5	AHSB02.19
8	If $\bar{a}$ is a vector then prove that grad $(\bar{a}.\bar{r})=\bar{a}$.	Understand	CO 5	AHSB02.19
9	Define irrotational vector and solenoidal vector of vector point function.	Remember	CO 5	AHSB02.19

10	Show that $\nabla\left(f(r)\right)=\frac{\overline{r}}{r}f'(r).$	Understand	CO 5	AHSB02.19
11	Prove that f= $yzi+zxj+xyk$ is irrotational vector.	Understand	CO 5	AHSB02.19
12	Show that (x+3y)i+(y-2z)j+(x-2z)k is solenoidal.	Understand	CO 5	AHSB02.20
13	Define work done by a force,circulation.	Understand	CO 5	AHSB02.20
14	State Stokes theorem of transformation between line integral and surface integral.	Understand	CO 5	AHSB02.22
15	Prove that div curl$\bar{f}$=0 where $\overline{f}=f_1\bar{i}+f_2\bar{j}+f_3\bar{k}$.	Understand	CO 5	AHSB02.20
16	Define line integral on vector point function.	Remember	CO 5	AHSB02.21
17	Define surface integral of vector point function $\overline{F}$.	Remember	CO 5	AHSB02.21
18	Define volume integral on closed surface S of volume V.	Remember	CO 5	AHSB02.21
19	State Green's theorem of transformation between line integral and double integral.	Understand	CO 5	AHSB02.22
20	State Gauss divergence theorem of transformation between surface integral and volume integral.	Understand	CO 5	AHSB02.22
Part - B (Long Answer Questions)				
1	Evaluate $\int_C \bar{f}.d\bar{r}$ where $\bar{f}=3xyi-y^2j$ and C is the parabola y=2x^2 from points (0, 0) to (1, 2).	Understand	CO 5	AHSB02.21
2	Evaluate $\iint_S \bar{F}.d\bar{s}$ if $\overline{F}=yzi+2y^2j+xz^2k$ and S is the Surface of the cylinder x^2+y^2=9 contained in the first octant between the planes z = 0 and z = 2.	Understand	CO 5	AHSB02.21
3	Find the work done in moving a particle in the force field $\overline{F}=(3x^2)i+(2zx-y)j+zk$ along the straight line from(0,0,0) to (2,1,3).	Understand	CO 5	AHSB02.21
4	Find the circulation of $\overline{F}=(2x-y+2z)\bar{i}+(x+y-z)\bar{j}+(3x-2y-5z)\bar{k}$ along the circle $x^2+y^2=4$ in the xy plane.	Understand	CO 5	AHSB02.21
5	Verify Gauss divergence theorem for the vector point function F = (x^3-yz)i - 2yxj+ 2zk over the cube bounded by x = y =z =0 and x = y= z = a.	Understand	CO 5	AHSB02.22
6	Verify Gauss divergence theorem for $2x^2yi-y^2j+4xz^2k$ taken over the region of first octant of the cylinder $y^2+z^2=9$ and $x=2.$	Understand	CO 5	AHSB02.22
7	Verify Green's theorem in the plane for $\int_C (x^2-xy^3)dx+(y^2-2xy)dy$ where C is a square with vertices (0,0),(2,0),(2,2),(0,2).	Understand	CO 5	AHSB02.22
8	Applying Green's theorem evaluate $\oint_c (y-\sin x)dx+\cos x\,dy$ where C is the plane triangle enclosed by $y=0,\ y=\frac{2x}{\pi},\ and\ x=\frac{\pi}{2}.$	Understand	CO 5	AHSB02.22
9	Apply Green's Theorem in the plane for $\int_c (2x^2-y^2)dx+(x^2+y^2)dy$ where C is a is the boundary of the area enclosed by the x-axis and upper half of the circle $x^2+y^2=a^2$.	Understand	CO 5	AHSB02.22

10	Verify Stokes theorem for $f = (2x-y)i - yz^2 j - y^2 zk$ where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ bounded by the projection of the xy plane.	Understand	CO 5	AHSB02.22
11	Verify Stokes theorem for $\bar{f} = (x^2 - y^2)\bar{i} + 2xy\bar{j}$ over the box bounded by the planes x=0, x=a, y=0,y=b.	Understand	CO 5	AHSB02.24
12	Find the directional derivative of the function $\phi = xy^2 + yz^3$ at the point P(1,-2,-1) in the direction to the surface $x\ logz - y^2 = -4\ at\ (-1,2,1)$.	Understand	CO 5	AHSB02.21
13	If $\bar{F} = 4xz\bar{i} - y^2\bar{j} + yz\bar{k}$ evaluate $\int_s \bar{F}.\bar{n}ds$ where S is the surface of the cube x = 0 , x = a , y = 0, y = a, z = 0 , z = a.	Understand	CO 5	AHSB02.20
14	If $\bar{f} = (5xy - 6x^2)\bar{i} + (2y - 4x)\bar{j}$ evaluate $\int_C \bar{f}.d\bar{r}$ along the curve C in xy-plane $y = x^3$ from (1,1) to (2,8).	Understand	CO 5	AHSB02.21
15	Evaluate the line integral $\int_c (x^2 + xy)dx + (x^2 + y^{2)}dy$ where C is the square formed by lines $x = \pm 1,\ y = \pm 1$.	Understand	CO 5	AHSB02.21
16	If $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$ show that $\nabla r^n = nr^{n-2}\bar{r}$.	Understand	CO 5	AHSB02.19
17	Evaluate by Stokes theorem $\int_c (e^x dx + 2ydy - dz)$ where c is the curve $x^2+y^2=9$ and z=2.	Understand	CO 5	AHSB02.22
18	Verify Stokes theorem for the function $x^2\bar{i} + xy\bar{j}$ integrated round the square in the plane z=0 whose sides are along the line x=0,y=0,x=a, y=a.	Understand	CO 5	AHSB02.22
19	Evaluate by Stokes theorem $\int_c (x+y)dx + (2x-z)dy + (y+z)dz$ where C is the boundary of the triangle with vertices (0,0,0),(1,0,0),(1,1,0).	Understand	CO 5	AHSB02.22
20	Verify Green's theorem in the plane for $\int_C (3x^2 - 8y^2)dx + (4y\ \ -6xy)dy$ where C is a region bounded by $y= \sqrt{x}$ and $y = x^2$.	Understand	CO 5	AHSB02.22

Part – C (Problem Solving and Critical Thinking)

1	Verify Gauss divergence theorem for $\bar{f} = x^2\bar{i} + y^2\bar{j} + z^2\bar{k}$ taken over the cube bounded by x=0,x=a, y=0,y=b, z=0,z=c.	Understand	CO 5	AHSB02.22
2	Find the work done in moving a particle in the force field $\bar{F} = (3x^2)i + (2zx - y)j + zk$ along the curve defined by $x^2 = 4y,\ 3x^3 = 8z$ from x=0 and x=2.	Understand	CO 5	AHSB02.21
3	Show that the force field given by $\bar{F} = 2xyz^3 i + x^2 z^3 j + 3x^2 yz^2 k$ is conservative. Find the work done in moving a particle from (1,-1,2) to (3,2,-1) in this force field.	Understand	CO 5	AHSB02.20
4	Show that the vector $(x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational and find its scalar potential function.	Understand	CO 5	AHSB02.21

5	Using Gauss divergence theorem evaluate $\iint_S \bar{F}.d\bar{s}$,for the $\overline{F} = y\vec{i} + x\vec{j} + z^2\vec{k}$ for the cylinder region S given by $x^2 + y^2 = a^2$, z = 0 and z = b.	Understand	CO 5	AHSB02.22
6	Find the directional derivative of $\phi(x, y, z) = x^2yz + 4xz^2$ at the point(1,-2,-1) in the direction of the normal to the surface f(x, y, z) = x logz – y^2at (-1,2,1).	Understand	CO 5	AHSB02.20
7	Using Green's theorem in the plane evaluate $\int_C (2xy - x^2)dx + (x^2 + y^2)dy$ where C is the region bounded by $y = x^2$ and $y^2 = x$.	Understand	CO 5	AHSB02.22
8	Applying Green's theorem evaluate $\int_c (xy + y^2)dx + x^2\, dy$ where C is the region bounded by $y = \sqrt{x}$ and $y = x^2$.	Understand	CO 5	AHSB02.22
9	Verify Green's Theorem in the plane for $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the region bounded by x=0, y=0 and x + y=1.	Understand	CO 5	AHSB02.22
10	Verify Stokes theorem for $\overline{F} = (y - z + 2)i + (yz + 4)j - xzk$ where S is the surface of the cube x=0, y=0, z=0 and x=2,y=2,z=2 above the xy-plane.	Understand	CO 5	AHSB02.22

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