INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
QUESTION BANK

Course Title	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**				
Course Code	AHSD08				
Program	B.Tech				
Semester	II	COMMON TO ALL BRANCHES			
Course Type	Foundation				
Regulation	IARE - BT23				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Dr.P.Raja Kumari, Assistant Professor				

COURSE OBJECTIVES:
The students will try to learn:

I	The analytical methods for solving first and higher order differential equations with constant coefficients.
II	The analytical methods for formation and solving partial differential equations .
III	The physical quantities of vector valued functions involved in engineering field..
IV	The logic of vector theorems for finding line, surface and volume integrals..

COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1	**Utilize** the methods of differential equations for solving the orthogonal trajectories and Newton's law of cooling.	Apply
CO 2	**Solve** the higher order linear differential equations with constant coefficients by using method of variation of parameters.	Apply
CO 3	**Make use of** analytical methods for PDE formation to solve boundary value problems.	Apply
CO 4	**Identify** various techniques of Lagrange's method for solving linear partial differential equations which occur in Science and engineering..	Apply
CO 5	**Interpret** the vector differential operators and their relationships for solving engineering problems.	Understand

CO 6	**Apply** the integral transformations to surface, volume and line of different geometrical models.	Apply

QUESTION BANK:

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	MODULE I			
	FIRST ORDER AND FIRST DEGREE ORDINARY DIFFERENTIAL EQUATIONS			
	PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS			
1	Find the general solution of the following differential equation $x^2ydx - (x^3 + y^3)dy = 0$	Apply	Learner to recall the homogeneous differential equations, understand the exactness ,integrating factor and apply them to compute solution	CO 1
2	Solve the given differential equation $2xydy - (x^2 + y^2 + 1)dx = 0$ to get the general solution	Apply	Learner to recall the homogeneous differential equations, understand the exactness ,integrating factor and apply them to compute solution	CO 1
3	Determine the general solution of the differential equation $(1 + x^2)\frac{dy}{dx} + 2xy = 4x^2$.	Apply	Learner to recall the homogeneous differential equations, understand the exactness ,integrating factor and apply them to compute solution	CO 1
4	Find the general solution for the given linear differential equation $\frac{dy}{dx} + 2y = e^x + x$,	Apply	Learner to recall the homogeneous differential equations, understand the exactness ,integrating factor and apply them to compute solution	CO 1

5	Prove that the system of parabolas $y^2 = 4a(x + a)$ is self orthogonal	Apply	Learner to recall the differential equations, understand the orthogonal trajectories and apply them to compute solution	CO 1
6	The temperature of a cup of coffee is 92^oC,when freshly poured the room temperature being 24^o C.In one minute it was cooled to 80^o C. How long a period must elapse, before the temperature of the cup becomes 65^o C.	Apply	Learner to recall the differential equations, understand the variable seperable , rate of change of temperature and apply them to compute solution	CO 1
7	Find the orthogonal trajectories of the family of curves $x^2 + y^2 = a^2$	Apply	Learner to recall the differential equations, understand the orthogonal trajectories and apply them to compute solution	CO 1
8	Solve the given first order differential equation $(x^4e^x - 2mxy^2)dx + 2mx^2ydy = 0$	Apply	Learner to recall the homogeneous differential equations, understand the exactness ,integrating factor and apply them to compute solution	CO 1
9	Find the Orthogonal trajectories of the family of circles passing through origin and centre on x-axis	Apply	Learner to recall differential equations, understand the Orthogonal trajectories and apply them to compute solution	CO 1
10	The temperature of the body drops from 100^oC to 75^oC in ten minutes when the surrounding air is at 20^oC temperature. What will be its temperature after half an hour. When will the temperature be 25^oC	Apply	Learner to recall differential equations, understand the Newton's law of cooling and apply them to compute solution	CO 1

PART-B LONG ANSWER QUESTIONS				
1	Solve the differential equation $(1+e^{\frac{x}{y}})dx + e^{\frac{x}{y}}(1-\frac{x}{y})dy = 0$ to obtain the general solution	Apply	Learner to recall the differential equations, understand the exactness of the function and apply them to compute solution	CO 1
2	Find the required general solution for given differential equation $(xe^{xy}+2y)\frac{dy}{dx} + ye^{xy} = 0$	Apply	Learner to recall the differential equations, understand the exactness of the function and apply them to compute solution	CO 1
3	Check whether the given differential equation is exact or not and find the solution $x^3Sec^2y\frac{dy}{dx} + 3x^2tany = cosx$	Apply	Learner to recall the differential equations, understand the exactness of the function and apply them to compute solution	CO 1
4	Find the solution for given differential equation $(x^2-y^2)dx = 2xydy$ by checking its exactness	Apply	Learner to recall the differential equations, understand the exactness of the function and apply them to compute solution	CO 1
5	An object cools from 120^oF to 95^o F in half an hour surrounded by air whose temperature is 70^o F. Find its temperature at the end of another half an hour.	Apply	Learner to recall differential equations, understand the Newton's law of cooling and apply them to compute solution	CO 1
6	Show that the system of rectangular hyperbolas $x^2-y^2=a^2$ and $xy=c^2$ are mutually orthogonal trajectories	Apply	Learner to recall differential equations, understand the Orthogonal trajectories and apply them to compute solution	CO 1
7	Solve the ordinary differential equation $x(x-1)\frac{dy}{dx} - y = x^2(x-1)^2$	Apply	Learner to recall the differential equations, understand the exactness of the function and apply them to compute solution	CO 1

8	Solve the following differential equation $e^x \frac{dy}{dx} = 2xy^2 + ye^x$	Apply	Learner to recall the differential equations, understand the Bernoullis equation and apply them to compute solution	CO 1
9	A body kept in air with temperature 25^oC cools from 140^oC to 80^oC in 20 minutes. Find when the body cools down to 35^oC	Apply	Learner to recall differential equations, understand the Newton's law of cooling and apply them to compute solution	CO 1
10	Solve the given differential equation $x(1-x^2)\frac{dy}{dx} + (2x^2-1)y = x^3$	Apply	Learner to recall the differential equations, understand the linear DE ,integrating factorand apply them to compute solution	CO 1
11	Find the required general solution for given differential equation $\frac{dy}{dx}(x^2y^3 + xy) = 1$	Apply	Learner to recall the differential equations, understand the Bernoullis equation ,integrating factor and apply them to compute solution	CO 1
12	Solve the differential equation $2\frac{dy}{dx} - ysecx = y^3tanx$	Apply	Learner to recall the differential equations, understand the linear DE, integrating factor and apply them to compute solution	CO 1
13	Solve the differential equation $(1-x^2)\frac{dy}{dx} + xy = y^3sin^{-1}x$	Apply	Learner to recall the differential equations, understand the linear DE, integrating factor and apply them to compute solution	CO 1
14	Solve the differential equation $(xy^2 - x^2)dx + (3x^2y^2 + x^2y - 2x^3)dy = 0$	Apply	Learner to recall the differential equations, understand the exactness of the function and apply them to compute solution	CO 1

15	Find the required general solution for given differential equation $x^2\frac{dy}{dx} = e^y - x$	Apply	Learner to recall the differential equations, understand the linear DE,integrating factor apply them to compute solution	CO 1
16	Solve the following differential equation $\frac{dy}{dx} + \frac{ycosx+siny+y}{sinx+xcosy+x} = 0$	Apply	Learner to recall the differential equations, understand the exactness, and apply them to compute solution	CO 1
17	Find the orthogonal trajectories of the family of circles $x^2 + y^2 + 2gx + c = 0$ Where g is the parameter.	Apply	Learner to recall differential equations, understand the Orthogonal trajectories and apply them to compute solution	CO 1
18	Solve the first order differential equation $(x + 1)\frac{dy}{dx} - y = e^{3x}(x + 1)^2$	Apply	Learner to recall differential equations, understand the linear DE,integrating factor and apply them to compute solution	CO 1
19	Find the required general solution for given differential equation $(x^2 - ay)dx = (ax - y^2)dy$.	Apply	Learner to recall differential equations, understand the exactness,integraing factor and apply them to compute solution	CO 1
20	Determine solution fot the following differential equation $y(x^2y^2 + 2)dx + x(2 - 2x^2y^2)dy = 0$	Apply	Learner to recall the differential equations, understand the exactness , integraing factor and apply them to compute solution	CO 1
PART-C SHORT ANSWER QUESTIONS				
1	Define differential equation	Remember	—	CO 1
2	write the types of differential equations	Remember	—	CO 1
3	Define ordinary differential equation	Remember	—	CO 1
4	Define partial differential equation	Remember	—	CO 1
5	Define the order and degree of a differential equation	Remember	—	CO 1
6	what is integral of the differential equation	Remember	—	CO 1

7	Define the complete primitive of the equation	Remember	—	CO 1
8	Defne the particular solution of a differential equation	Remember	—-	CO 1
9	Obtain the differential equation by eliminating A and B from $Ax^2 + By^2 = 1$	Apply		CO 1
10	Obtain the differential equation $y = Ae^{-2t} + Be^{3x}$ by eliminating the arbitrary Constants	Apply		CO 1
11	Writ e the differential equation of the family of straight lines	Remember	—	CO 1
12	Form a differential equation by eliminating 'a' from $r = 2a(sint - cost)$	Apply	Learner to recall the differential equations of first order, understand formation and apply them to compute solution.	CO 1
13	Solve the differential equation $dy/dx = e^{x-y} + x^2e^{-y}$	Apply	—	CO 1
14	Define the Homogenous differential equation	Remember	—-	CO 1
15	What is the condition for exactness	Remember		CO 1
16	Define a linear differential equation of first order	Remember	—-	CO 1
17	write the form of Bernoulli's equation	Remember	—	CO 1
18	Define an orthogonal trajectory of the family of curves	Remember	—-	CO 1
19	Find the orthognal trajectory of the family of y=ax	Apply	Learner to recall the differential equations of first order, understand the orthogonal trajectoriesl and apply them to compute solution	CO 1
20	State the Newton's law of cooling	Remember	—-	CO 1

MODULE II				
ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Solve the differential equation $(D^2+4)y{=}sin2x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
2	Apply the method of variation of parameters to solve $(D^2-2D)y{=}e^x sinx$	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
3	Using the of method of variation of Parameters, solve $\frac{d^2y}{dx^2}+y=Cosecx$.	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
4	Find the general solution of $y^{1111}+8y^{11}+16y=0$.	Apply	Learner to recall the homogeneous differential equations, understand the complementary function and apply them to compute solution.	CO 2
5	Solve the differential equation $y^{1111}+18y^{11}+81y=64Cosx+108Cos3x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

6	Using the method of variation of Parameters, solve $(D^2 + 4)y= Sec2x$.	Apply	Learner to recall the concept of homogeneous differential equatios , understand the procedure and apply complementary function, particular integral to find solution of non-homogeneous differential equations.	CO 2
7	Using the method of variation of Parameters, solve $(D^2 + 1)y = Tanx$	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
8	Using the method of variation of Parameters, solve $(D^2 - 2D + 2)y = e^x Tanx$	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
9	Using the method of variation of Parameters, solve $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
10	Using the of method of variation of Parameters, solve $(D^2 - 2D + 1)y = e^x logx$.	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
PART-B LONG ANSWER QUESTIONS				

1	Solve the differential equation $(D^2+3D+2)y = 2cos(2x+3)+2e^x+x^2$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
2	Solve the differential equation $(D^2+4)y = 96x^2+sin2x-k$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
3	Solve the differential equation $(D^2-2D+1)y = x^2e^{3x}$-sin2x+3	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
4	Solve the differential equation $(D^3-6D^2+11D-6)y = e^{-2x}+e^{-3x}$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
5	Solve the differential equation $(D^2+1)y = sinxsin2x+e^xx^2$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

6	Solve the differential equation $(D^3+1)y{=}3+5e^x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
7	Solve the differential equation $(D^2-4)y=2cos^2x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
8	Solve the differential equation $(D^2+1)y{=}SinxSin2x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
9	Solve the differential equation $(D^2+9)y{=}cos3x+sin2x$.	Apply	Learner to recall the non homogeneous differential equations understand the complementary function and particular integral and apply them to compute solution.	CO 2
10	Solve the differential equation $(D^2+5D-6)y{=}Sin4xSinx$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

11	Solve the differential equation .$(D^2+D+1)y$=$sin2x$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
12	By using method of variation of parameters solve $(D^2+4)y$= $tan2x$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
13	Solve the differential equation $(D^3-4D^2-D+4)y$=$e^{3x}cos2x$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
14	Evaluate the differential equation $(D^2+9)y=Cos3x$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
15	Find the differential equation $(D^3-7D^2+14D-8)y=e^x\ Cos2x.$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

16	Solve the differential equation $(D^3 - 4D^2 - D + 4)y = e^{3x}$..	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
17	Solve the differential equation $(D^3 + 4D)y = sin2x$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution	CO 2
18	Solve the differential equation $(D^2 + 4D + 4)y = 3Sinx + 4Cosx$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO2
19	By using method of variation of parameters solve $(D^2 + 1)y{=}sinx$.	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2
20	Solve the differential equation $(D^3 - 1)y = e^x + Sin3x + 2$.	Apply	Learner to recall the non-homogeneous differential equations, understand the method of variation of parameters and apply them to compute solution.	CO 2

PART-C SHORT ANSWER QUESTIONS				
1	Write the solution of the $\frac{d^2y}{dx^2}$ - 3 $\frac{dy}{dx}$ + 2y = 0	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution	CO 2
2	Write the solution of the $(4D^2 - 4D + 1)y = 100$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution	CO 2
3	Define wronskian of the functions.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution. and define wronskian function	CO 2
4	Find the particular value of $\frac{1}{D-3}$ x	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
5	Find the particular value of $\frac{1}{(D-2)(D-3)}$ e^{2x}.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

6	Solve the differential equation $(D^4-2D^3-3D^2+4D+4)y{=}0$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
7	Solve the differential equation $(D^4-1)y{=}0$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
8	Write the particular values of $\frac{1}{(D^2+a^2)}cosax$ and $\frac{1}{(D^2+a^2)}sinax$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
9	Find the particular integral of $(D^2-3D+2)y{=}cos3x$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
10	Write the particular values of $\frac{1}{(D^2+4)}sin2x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

11	Solve the differential equation $\frac{d^3y}{dx^3} + y = 0$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
12	Fine the particular integral of $\frac{1}{(D^2-1)}$ x.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
13	Solve the differential equation $(D^2 + a^2)y = 0$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
14	Find the particular integral of $(D^2 + 2D)y = 24x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
15	Find the general solution of the differential equation $y^{11} + y^1 - 2y = 0$	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

16	What is general solution of higher order differential equation.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution and define general solution of higher order differential equation	CO 2
17	Write the solution of the $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
18	Write the particular values of $\frac{1}{(D^2+9)} cos3x$ and $\frac{1}{(D^2+16)} sin4x$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
19	Solve the differential equation $(D^2 + D)y = 0$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2
20	Solve the differential equation $(D^4 - 16)y = 0$.	Apply	Learner to recall the non-homogeneous differential equations, understand the complementary function and particular integral and apply them to compute solution.	CO 2

MODULE III				
PARTIAL DIFFERENTIAL EQUATIONS				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Form the partial differential equation by eliminating arbitrary function $lx + my + nz = \phi(x^2 + y^2 + z^2)$	Apply	Recall dependent and independent variables, explain partial derivatives, and applyit to form PDE by eliminating arbitrary function..	CO 3
2	Form the partial differential equation by eliminating arbitrary function $xy + yz + zx = f(\frac{z}{(x+y)})$.	Apply	Recall dependent and independent variables, explain partial derivatives, and applyit to form PDE by eliminating arbitrary function.	CO 3
3	Form the partial differential equation by eliminating arbitrary function from$f(x^2 - y^2, x^2 - z^2) = 0$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 3
4	Form the partial differential equation by eliminating the arbitrary function from $z = f(x + ct) + g(x - ct)$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
5	Form the partial differential equation by eliminating the arbitrary function from $z = f(x + iy) + g(x - iy)$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4

CIE-II				
6	Solve the partial differential equation.$(z^2 - 2yz - y^2)p + (xy + xz)q = xy - zx$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
7	Solve $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$	Apply	Recall dependent and independent variables, explain partial derivatives, and apply standard forms to solve nonlinear partial differential equations..	CO 4
8	Solve $\frac{p}{x^2} + \frac{q}{y^2} = z$.	Apply	Recall dependent and independent variables, explain partial derivatives, and apply standard forms to solve nonlinear partial differential equations.	CO 4
9	Solve $xp + yq = 1$.	Apply	Recall dependent and independent variables, explain partial derivatives, and apply standard forms to solve nonlinear partial differential equations	CO 4
10	Solve $y^2zp + zx^2q = xy^2$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
PART-B LONG ANSWER QUESTIONS				
1	Form the partial differential equation by eliminating arbitray function from $f(x^2 + y^2 + z^2, z^2 - 2xy) = 0$.	Apply	Recall dependent and independent variables, explain partial derivatives, and applyit to form PDE by eliminating arbitrary function..	CO 3

2	Form a partial differential equation by eliminating a, b, c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	Apply	Recall dependent and independent variables, explain partial derivatives, and apply it to form PDE by eliminating arbitrary constants.	CO 3
3	Form the partial differential equation by eliminating arbitrary constants $z = ax^3 + by^3$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
4	Form the partial differential equation by eliminating the constants from $(x-a)^2 + (y-b)^2 = z^2 cot^2 \alpha$ where α is a parameter	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
5	Form the partial differential equation by eliminating arbitrary function $z = f(x) + e^y g(x)$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
6	Find the differential equation of all spheres whose centres lie on z-axis with a given radius r. .	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
7	Form the partial differential equation by eliminating arbitrary function f from $z = xy + f(x^2 + y^2)$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4

8	Form the partial differential equation by eliminating arbitrary constants from $2z = \sqrt{(x+a)} + \sqrt{(y-a)}$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
9	Form the partial differential equation by eliminating a and b from $log(az-1) = x + ay + b$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
10	Form the partial differential equation by eliminating arbitrary function f from $xyz = f(x^2 + y^2 + z^2)$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
		CIE-II		
11	Solve the partial differential equation $px^2 + qy^2 = z(x+y)$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
12	Solve $p - x^2 = y^2 + q$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
13	Solve the partial differential equation $y^2p + x^2q = x^2y^2z^2$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4

14	Solve the partial differential equation $ptanx + qtany = tanz$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order. .	CO 4
15	Solve the partial differential equation $(x-a)p + (y-b)q + (c-z) = 0$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
16	Solve $px^2 + qy^2 = z(x+y)$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order.	CO 4
17	Solve the partial differential equation $pz - qz = z^2 + (x+y)^2$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order..	CO 4
18	Solve the partial differential equation $\frac{y^2z}{x}p + xzq = y^2$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order..	CO 4
19	Solve $x(y^2 - z^2)p - y(z^2 + x^2)q = z(x^2 + y^2)$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4

20	Solve $(x-y)p+(y-x-z)q=z$..	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
PART-C SHORT ANSWER QUESTIONS				
1	Define order and degree with reference to partial differential equation.	Remember	-	CO 3
2	Form the partial differential equation by eliminate the arbitrary function from $z=yf(y/x)$.	Apply	Recall dependent and independent variables, explain partial derivatives, and apply it to form PDE by eliminating arbitrary constants.	CO 3
3	Form the partial differential equation by eliminating arbitrary function $z=f(x^2+y^2)$	Apply	Recall dependent and independent variables, explain partial derivatives, and apply it to form PDE by eliminating arbitrary functions.	CO 3
4	Form the partial differential equation by eliminating arbitrary constants $z^2=(x-a)^2+(y-b)^2$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
5	Form the partial differential equation by eliminating arbitrary constants from $z=ax+by$	Apply	Recall dependent and independent variables, explain partial derivatives, and apply it to form PDE by eliminating arbitrary constants.	CO 4

6	Form the partial differential equation by eliminating arbitrary constants h,k from $(x-h)^2+(y-k)^2+z^2=a^2$	Apply	Recall dependent and independent variables, explain partial derivatives, and apply it to form PDE by eliminating arbitrary constants.	CO 4
7	Eliminate the arbitrary constants from $z=(x^2+a)(y^2+b)$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
8	Eliminate the arbitrary function from $z=f(sinx+cosy)$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
9	Eliminate the arbitrary function from $f(x^2-y^2,x-z)=0$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
10	Eliminate the arbitrary function from $z=yf(x)+xg(y)$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
CIE-II				
11	Solve $xp+yq=3z$.	Remember		CO 4
12	Solve $xp+yq=1$..	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4

13	Solve $px + qy = z$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
14	Solve, $p + 3q = 5z + tan(y - 3x)$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
15	Solve. $2p + 3q = 1$	Remember	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
16	Solve. $(x + y)p - (x + y)q = z$	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
17	Solve. $p - q = log(x + y)$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
18	Solve. $y^2p - xyq = x(z - 2y)$.	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method to solve linear partial differential equations of first order	CO 4
19	Explain linear partial differential equation. .	Remembe	-	CO 4

20	write the general solution of first order linear differential equation.	Remember	-	CO 4
MODULE IV				
VECTOR DIFFERENTIATION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point(2,-1,2)	Understand	Learner to recall vector and scalar functions, explain gradient and obtain the transformation between surface and volume of a bounded region of cube.	CO 5
2	Find the angle between the normals to the surfaces $x^2 = yz$ at the points (1,1,1)and (2,4,1).	Understand	Learner to recall vector and scalar functions, explain gradient and apply to the surfaces.	CO 5
3	Prove that $div(gradr^m) = m(m+1)r^{m-2}$ where $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$	Understand	Learner to recall vector and scalar functions, explain gradient and apply line integral to obtain the work done by the force.	CO 5
4	Show that the vector $(x^2 - yz)\bar{i} + (y^2 - zx)\bar{j} + (z^2 - xy)\bar{k}$ is irrotational and find its scalar potential function.	Understand	Learner to recall vector and scalar functions, explain curl of the gradient, and apply it to obtain irrotational and scalar potential function	CO 5
5	Determine a unit vector normal to the surface $xy^3z^2 = 4$ at the point (-1,-1,2)	Understand	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cylinder	CO 5
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 $f(x, y, z) = x \log z – y^2$ at (-1,2,1).	Understand	Learner to recall vector and scalar functions, explain the gradient, and apply it to obtain the direction derivative of the function.	CO 5

7	Prove that $\nabla r^n = nr^{n-2}\bar{r}$	Understand	Learner to recall vector and scalar functions, explain gradient and of a bounded region of parabolas.	CO 5
8	Show that $\nabla f(r) = \frac{\bar{f}(r)}{r} where r = xi + yj + zk$	Understand	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation of a bounded region of parabolas.	CO 5
9	Find the directional derivative of the function $xy^2 + yz^2 + zx^2$ along the tangent to the curve $x = t, y = t^2, z = t^3$ at the point (11,1)	Understand	Learner to recall vector and scalar functions, explain gradient and to obtain the transformation between bounded region of a plane.	CO 5
10	If the temperature at any point in space is given by $t = xy + yz + zx$, find the direction in which temperature changes most rapidly with distance from the point (1,1,1) and determine the maximum rate of change	Understand	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to obtain the transformation between line and surface of a bounded region of a plane.	CO 5
PART-B LONG ANSWER QUESTIONS				
1	If the vector field F is irrotational find the constants a,b,c where $\bar{f} = (x+2y+az)\bar{i}+(bx-3y-z)\bar{j}+(4x+cy+2z)\bar{k}$ and also find its scalar potential.	Understand	Learner to recall vector and scalar functions, explain gradient and apply it to obtain solution of line integral.	CO 5
2	Find the constants a and b so that the surface $ax^2 - byz = (a + 2)x$ will be orthogonal to the surface $4xx^2y + z^3 = 4$ at the point (1,-1,2)	Understand	Learner to recall vector and scalar functions, explain gradient and normal forces, and apply it to compute solution .	CO 5

3	Show that $\bar{A} = 3y^4z^2i + 4x^3z^2j - 3x^2y^2k$ is solenoidal	Understand	Learner to recall vector and scalar functions, explain gradient and normal forces, and apply it to compute solution .	CO 5
4	Prove that $\bar{A} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ is irrotational and find the scalar function .	Understand	Learner to recall vector and scalar functions, explain gradient and normal forces, and apply it to compute solution .	CO 5
5	If $\triangledown f = (y^2 - 2xyz^3)i + (3 + 2xy - x^2z^3)j + (6z^3 - 3x^2yz^2)k$, find f if f(1,0,1)=8.	Understand	Learner to recall vector and scalar functions, explain gradient and normal forces, and apply it to compute solution .	CO 5
6	Find the curl of $\bar{V} = e^{xyz}(\bar{i} + \bar{j} + \bar{k})$ at the point (1,2,3)	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution .	CO 5
7	If f(r) is differentiable and $r = (x^2 + y^2 + z^2)^1/2$, show that$f(r)\bar{r}$ is irrotational	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution .	CO 5
8	If $f = x^2yz$ and $g = xy - 3z^2$, calculate $\triangledown(\triangledown f.\triangledown g)$	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
9	Find the angle of intersection of the spheres $x^2 + y^2 + z^2 = 29$ and $x^2 + y^2 + z^2 + 4x - 6y - 8z = 47$ at (4,-3,2)	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5

10	Determine the angle between the normals to the surface $xy = z^2$ at the points (4,1,2) and (3,3,-3) .	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution .	CO 5
11	Calculate the angle between the normals to the surface $2x^2 + 3y^2 = 5z$ at the points (2,-2,4) and (-1,-1,1)	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
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	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
13	Determine the constants a,b,c so that$\bar{A} = (2x + 3y + az)i + (bx + 2y + 3z)j + (2x + cy + 3z)k$ is irrotational.Find the scalar function	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution .	CO 5
14	Determine curl of $xyz^2i + yzx^2j + zxy^2k$ at the point (1,2,3)	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
15	Find the value of constant b such that $\bar{A} = (bxy - z^3)i + (b - 2)x^2j + (1 - b)xz^2k$ has its curl identically equal to zero.	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
16	Determine $div\bar{f}$ where $\bar{f} = r^n\bar{r}$ and calculate n if it is solenoid ?	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5

17	If $a = x + y + z$,$b = x^2 + y^2 + z^2$,$c = xy + yz + zx$,prove that [grada,gradb,gradc]=0 .	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution e	CO 5
18	Prove that $(y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)$ is both solenoidal and irrotational .	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
19	Find the directional derivative of $\nabla.(\nabla f)$ at the point (1,-2,1) in the direction of the normal to the surface $xy^2z = 3x + z^2$ where $f = 2x^3y^2z^4$.	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
20	Calculate $\nabla^2 f$ when $f = 3x^2z - y^2z^3 + 4x^3y + 2x - 3y - 5$ at the point (1,1,0)	Understand	Learner to recall vector and scalar functions, explain gradient ,divergence and curl and apply it to compute solution	CO 5
PART-C SHORT ANSWER QUESTIONS				
1	Define gradient of scalar point function.	Remember	—	CO 5
2	Define divergence of vector point function.	Remember	—	CO 5
3	Define curl of vector point function.	Remember	—	CO 5
4	State Laplacian operator.	Remember	—	CO 5
5	Find$curl\bar{f}$where $\bar{f} = grad(x^3 + y^3 + z^3 - 3xyz)$	Remember	—	CO 5
6	Find the angle between the normal to the surface $xy = z^2$ at the points $(4, 1, 2) and (3, 3, -3)$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply it to obtain the angle between the normal surfaces	CO 5
7	Find a unit normal vector to the given surface $x^2y + 2xz = 4$ at the point (2,-2,3).	Apply	Learner to recall vector and scalar functions, explain gradient and apply it to obtain the unit vector of normal surfaces.	CO 5

8	If is a vector then prove that $\vec{\nabla}(\bar{a}, \bar{r}) = \bar{a}$	Apply	Learner to recall vector and scalar functions, explain gradient and apply it to obtain the required solution of normal surfaces	CO 5
9	Define ir rotational vector and solenoidal vector of vector point function.	Remember	—	CO 5
10	Show that $\vec{\nabla}(f(r)) = \frac{(r)}{r} f'(r)$	Apply	Learner to recall vector and scalar functions, explain gradient and apply it to obtain the required solution of normal surfaces	CO 5
11	Prove that $f = yz\bar{i} + zx\bar{j} + xy\bar{k}$ is irrotational vector.	Apply	Learner to recall vector and scalar functions, explain gradient and apply it to obtain the irrotational vector	CO 5
12	Show that $(x+3y)\bar{i} + (y-2z)\bar{j} + (x-2z)\bar{k}$ is solenoidal.	Apply	Learner to recall vector and scalar functions, explain gradient and apply it to obtain conservation of mass	CO 5
13	Show that $\vec{\nabla} \times (\vec{\nabla}(\phi)) = 0$ where ϕ is scalar point function.	Apply	Learner to recall vector and scalar functions, explain gradient and apply it to obtain solution of scalar point function	CO 5
14	Define the derivative of vector function	Remember	—	CO 5
15	Prove that $[div \vec{\nabla} \times = 0]$ where . $$\overline{f} = f_1\bar{i} + f_2\bar{j} + f_3\overline{k}$$	Remember	—	CO 5
16	what is unit tangent vector	Remember	—	CO 5
17	If$\bar{A} = 5t^2 i + tj - t^3 k$ and $\bar{B} = sinti - costj$ find $\frac{d}{dt}(\bar{A}.\bar{B})$	Remember	—	CO 5
18	Define the operator del	Remember	—	CO 5
19	Define the divergence of a vector	Remember	—	CO 5
20	Define the curlof a vector	Remember	—	CO 5

MODULE V				
VECTOR INTEGRATION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
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. .	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cube	CO 6
2	Using Gauss divergence theorem evaluate $\int\int_s \bar{F}.ds$,for the $\bar{F} = y\bar{i} + x\bar{j} + z^2\bar{k}$ for the cylinder region S given by $x^2 + y^2 = a^2$, z = 0 and z = b.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cylinder	CO 6
3	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 $y^2 = x$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between line and double integral of a bounded region of parabolas.	CO 6
4	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 $y = x^2$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between line and double integral of a bounded region of parabolas.	CO 6

5	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.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to obtain the transformation between line and surface of a bounded region of a plane.	CO 6
6	Verify Stokes theorem for $\bar{F} = (y - z + 2)\bar{i} + (yz + 4)\bar{j} - xz\bar{k}$ 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.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to obtain the transformation between line and surface of a bounded region of a plane.	CO 6
7	Verify Gauss divergence theorem for the vector point function $\bar{F} = (x^3 - yz)\bar{i} - 2xy\bar{j} + 2z\bar{k}$ over the cube bounded by $x = y = z = 0$ and$x = y = z = a$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cube .	CO 6
8	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 $y = x^2$	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between surface and volume of a bounded region of cube ..	CO 6
9	If $\bar{F} = (x^2 + y^2)\bar{i} - 2xy\bar{j}$ evaluate $\int \bar{F}.\bar{d}r$ where curve c is the rectangle in xy-plane bounded by $y = 0, y = b, x = 0, x = a$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cube .	CO 6

10	If $\bar{F} = (2x + y^2)i + (3y - 4x)j$evaluate $\int_c \bar{F}.\bar{d}r$ around a triangle ABC in the xy-plane with A(0,0), B(2,0),C(2,1) in the counter clock wise direction and opposite direction	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cube .	CO 6
PART-B LONG ANSWER QUESTIONS				
1	Evaluate $\iint_s \bar{F}.ds$ if $\bar{F} = yz\bar{i} + 2y^2\bar{j} + xz^2\bar{k}$ 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.	Apply	Learner to recall vector and scalar functions, explain gradient and normal forces, and apply it to value the area of the cylinder .	CO 6
2	Find the work done in moving a particle in the force field $\bar{F} = 3x^2\bar{i} + (2zx - y)\bar{j} + z\bar{k}$ along the straight line from (0,0,0) to (2,1,3) .	Apply	Learner to recall vector and scalar functions, explain gradient and apply line integral to value the work done by the force.	CO 6
3	Find the circulation of $\bar{F} = (2x-y+2z)\bar{i}+(x+y-z)\bar{j}+(3x-2y-5z)\bar{k}$ along the circle $x^2 + y^2 = 4$ in the xy plane.	Apply	Learner to recall vector and scalar functions, explain gradient and apply line integral to value the work done by the force.	CO 6
4	Verify Gauss divergence theorem for the vector point function $\bar{F} = (x^3 - yz)\bar{i} - 2xy\bar{j} + 2z\bar{k}$ over the cube bounded by $x = y = z = 0$ and$x = y = z = a$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cylinder	CO 6
5	Verify Gauss divergence theorem for $2x^2y\bar{i} - y^2\bar{j} + 4xz^2\bar{k}$ taken over the region of first octant of the cylinder $y^2 + z^2 = 9$ and x=2.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cylinder	CO 6

6	Verify Green's theorem in the plane for $\int_c (x^2 - xy)dx + (y^2 - 2xy)dy$ where C is a square with vertices (0,0) ,(2,0) ,(2,2),(0,2).	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between line and double integral of a square bounded region .	CO 6
7	Applying Green's theorem evaluate $\int_c (y - sinx)dx + cosydy$ where C is the plane triangle enclosed by y= 0 .y $= \frac{2x}{\pi}$,and $x = \frac{\pi}{2}$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between line and double integral of a square bounded region .	CO 6
8	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$x^2 + y^2 = a^2$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between line and double integral of a triangle bounded region	CO 6
9	Verify Stokes theorem for $\bar{f} = (2x - y)\bar{i} - yz^2\bar{j} - y^2z\bar{k}$ 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.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to the transformation between line and surface of a bounded region of sphere.	CO 6
10	Verify Stokes theorem for $\bar{f} = -y^3\bar{i} + x^3\bar{j}$ where S is the circular disc $x^2 + y^2 \leq 1$, z=0.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to the transformation between line and surface of a bounded region of sphere	CO 6

11	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	Apply	Learner to recall vector and scalar functions, explain gradient and apply Gauss divergence theorem to obtain the transformation between surface and volume of a bounded region of cube.	CO 6
12	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 $y = x^3$ plane from (1,1) to (2,8)	Apply	Learner to recall vector and scalar functions, explain gradient and apply line integral to obtain the work done by the force.	CO 6
13	Evaluate the line integral r $\int_c (x^2 + xy)dx + (x^2 + y^2)dy$ where C is the square formed by lines $x = \pm 1, y = \pm 1$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply line integral to obtain the work done by the force	CO 6
14	Evaluate by Stokes theorem $\int_c (e^x dx + 2ydy - dz)$where c is the curve $x^2 + y^2 = 9$ and z=2	Apply	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to obtain the transformation between line and surface of a bounded region of a plane	CO 6
15	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	Apply	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to obtain the transformation between line and surface of a bounded region of a plane	CO 6

16	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),(1,1,1)	Apply	Learner to recall vector and scalar functions, explain gradient and apply Stoke's theorem to obtain the transformation between line and surface of a square bounded region	CO 6
17	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 $y=x^2$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between line and double integral of a bounded region of parabola	CO 6
18	Determine whether the force field $\bar{F} = 2xz\bar{i} + (x^2-y)\bar{j} + (2z-x^2)\bar{k}$ is conservative or not	Apply	Learner to recall vector and scalar functions, explain gradient and apply line integral to obtain the work done by the force.	CO 6
19	Evaluate $\int\int_s \bar{A}.\bar{n} ds where \bar{A} = z\bar{i} + x\bar{j} - 3y^2z\bar{k}$ and s is the surface of the cylinder $x^2+y^2=16$ included in the first octant between z=0 and z=5	Apply	Learner to recall vector and scalar functions, explain gradient and volume integral to obtain the transformation between line and surface of a square bounded region	CO 6
20	Evaluate by Green's theorem $\int (y - sinx)dx + cosxdy$ where 'C' is the triangle enclosed by the lines $y=0, x=\pi/2, \pi y = 2x.$.	Apply	Learner to recall vector and scalar functions, explain gradient and apply Green's theorem to obtain the transformation between line and double integral of a bounded region of parabola.	CO 6
	PART-C SHORT ANSWER QUESTIONS			
1	Define gradient of scalar point function.	Remember	—	CO 6
2	Define divergence of vector point function.	Remember	—-	CO 6
3	Define curl of vector point function.	Remember	—	CO 6

4	State Laplacian operator.	Remember	—-	CO 6
5	State Stokes theorem of transformation between line integral and surface integral.	Remember	—	CO 6
6	Define line integral on vector point function.	Remember	—	CO 6
7	State Green's theorem	Remember	—	CO 6
8	Define the line integral of vector point function	Remember	—	CO 6
9	Define surface integral of vector point function $\bar{F}$.	Remember	—	CO 6
10	Define volume integral on closed surface S of volume V.	Remember	—r	CO 6
11	State Green's theorem of transformation between line integral and double integral.	Remember	—	CO 6
12	State Gauss divergence theorem of transformation between surface integral and volume integral.	Remember	—	CO 6
13	What is the surface area of the surface S whose equation is F(x,y,z)=0?	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method	CO 6
14	Find the surface area of the plane$x + 2y + 2z = 12$ cut off by x=0,y=0,x=1,y=1	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method	CO 6
15	Find the surface area of $z = x^2 + y^2$ included between z=0 z=1	Apply	Recall dependent and independent variables, explain Lagrange's Linear equation, apply suitable method	CO 6
16	Evaluate $\int y^2 dx - 2x^2 dy$ along the parabola $y = x^2 from (0, 0) to (2, 4)$	Apply	Recall dependent and independent variables, apply suitable method	CO 6
17	Compute the area of the ellipse $x = acos^3 t$ $y = bsint$	Apply	Recall dependent and independent variables, apply suitable method t	CO 6
18	What is the surface area of a curved surface	Apply	Remember	CO 6
19	what are the applications of line integral	Remember	—	CO 6
20	Define volume integral on closed surface S of volume V.	Remember	—	CO 6

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