VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203.

VALLIAMMAI ENGEINEERING COLLEGE

DEPARTMENT OF MATHEMATICS

QUESTION BANK

I SEMESTER

MA8151- ENGINEERING MATHEMATICS-I

Regulation – 2017

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QUESTION BANK

SUBJECT : MA8151 – Engineering Mathematics - I

YEAR /SEMESTER/:I Year / I Semester B.E. B.Tech.

(Common to all Branches)

UNIT I DIFFERENTIAL CALCULUS

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

Q.No.	Question	Bloom's Taxonomy Level	Domain
	PART – A		
1.	Show that $\lim_{x\to 0} x^2 \sin\left(\frac{1}{X}\right) = 0$.	**BTL -1**	Remembering
2.	Sketch the graph of the function f(x) $=\begin{cases} 1+x; x<-1 \\ x^2; -1\le x\le 1 \\ 2-x; x\ge 1 \end{cases}$ And use it to determine the value of "a" for which $\lim_{x\to a} f(x)$ exists?	**BTL -1**	Remembering
3.	Evaluate $\lim_{x\to\frac{\pi}{2}} \frac{1+\cos 2x}{(\pi-2x)^2}$.	**BTL -5**	Evaluating
4.	Find $\lim_{x\to 0} \frac{\tan x - x}{x^3}$.	**BTL -2**	Understanding
5.	Use the squeeze theorem to show that $\lim_{x\to 0}\sqrt{x^3+x^2}\ \sin\frac{\pi}{x}=0$	**BTL -3**	Applying
6.	Find $\lim_{x\to\infty} \frac{\ln x}{\sqrt{x}}$.	**BTL -2**	Understanding
7.	Calculate $\lim_{x\to\infty} \frac{e^x}{x^2}$.	**BTL -3**	Applying
8.	Evaluate the limit for $\lim_{x\to -2} \frac{x+2}{x^3+8}$.	**BTL -5**	Evaluating
9.	Find the limits if it exists for $\lim_{t\to 0} \frac{(1+t)^{\frac{1}{2}}-(1-t)^{\frac{1}{2}}}{t}$.	**BTL -2**	Understanding
10.	Point out $\frac{dy}{dx}$, $if\ y = \ln\lvert\cos(\ln x)\rvert$.	**BTL -4**	Analysing
11.	Does the curve $y = x^4 - 2x^2 + 2$ have any horizontal tangents? If so there?	**BTL -3**	Applying

12.	Predict the values of a and b so that the function f given by $f(x)=\begin{cases}1 & if\ x\le 3\\ ax+b & if\ 3<x<5\\ 7 & if\ x\ge 5\end{cases}$ is continuous at x=3 and x=5.	**BTL -2**	Understanding
13.	If the function $f(x)=\begin{cases}\frac{x^2-16}{x-4} & if\ x\neq 4\\ c & if\ x=4\end{cases}$ is continuous, what is the value of c?	**BTL -6**	Creating
14.	Where the function is $f(x)=\|x\|$is differentiable?	**BTL -2**	Understanding
15.	Estimate $\frac{d}{dx}((sinx)^{cosx})$	**BTL -2**	Understanding
16.	Calculate$\frac{d}{dx}\left((x)^{\sqrt{x}}\right)$	**BTL -3**	Applying
17.	Compute$\frac{d}{dx}\left((x)^{sinx}\right)$	**BTL -3**	Applying
18.	Evaluate$\frac{d}{dx}\left((sinx)^{\ln x}\right)$	**BTL -5**	Evaluating
19.	Estimate y' if $x^3+y^3=6xy$	**BTL -2**	Understanding
20.	Find the critical numbers of the function $f(x)=2x^3-3x^2-36x$	**BTL -3**	Applying

PART – B

1.(a)	Point out the domain where the function f is continuous Also find the number at which the function f is discontinuous when $f(x)=\begin{cases}1+x^2 & if\ x\le 0\\ 2-x & if\ 0<x\le 2\\ (x-2)^2 & if\ x>2\end{cases}$	**BTL -4**	Analyzing
1. (b)	Find the local maximum and minimum values of $f(x)=\sqrt{x}-\sqrt[4]{x}$ Using both the first and second derivative tests.	**BTL -3**	Applying
2. (a)	Show that the function $f(x)=1-\sqrt{1-x^2}$ is continuous in the interval [-1, 1].	**BTL -1**	Remembering
2.(b)	Estimate the absolute maximum and minimum of the function $f(x)=x-2sinx\quad 0\le x\le 2\pi$	**BTL -2**	Understanding
3. (a)	For what value of the constant "c" is the function "f" continuous on $(-\infty,\infty), f(x)=\begin{cases}cx^2+2x; x<2\\ x^3-cx; x\ge 2\end{cases}$	**BTL -4**	Analyzing
3.(b)	Calculate the absolute maximum and minimum of the function $f(x)=3x^4-4x^3-12x^2+1\ \ in\ [-2,3]$	**BTL -3**	Applying

4. (a)	Prove that the equation $x^3 - 15x + 1 = 0$ has at most one real root in the interval [-2,2].	**BTL -1**	Remembering
4.(b)	Find the absolute maximum and minimum of f(x)= $x - 2\tan^{-1} x \quad in\ [0,4]$	**BTL -3**	Applying
5. (a)	Show that there is a root of the equation $4x^3 - 6x^2 + 3x - 2 = 0$ between 1 and 2.	**BTL -1**	Remembering
5.(b)	Calculate the local maximum and local minimum of $f(x) = 4x^3 + 3x^2 - 6x + 1$	**BTL -3**	Applying
6. (a)	Show that the function $sinx = x^2 - x$ has a root in the interval (1,2).	**BTL -1**	Remembering
6.(b)	Point out the local maximum and minimum of $f(x) = x^4 - 2x^2 + 3$ by first derivative test.	**BTL -4**	Analyzing
7. (a)	Find $y''\ if\ x^4 + y^4 = 16$	**BTL -3**	Applying
7. (b)	Predict the local maximum and minimum of the function $f(x) = cos^2x - 2sinx \quad 0 \le x \le 2\pi$	**BTL -2**	Understanding
8. (a)	Find the tangent line to the equation $x^3 + y^3 = 6xy$ at the point (3, 3) and at what point the tangent line horizontal in the first quadrant.	**BTL -1**	Remembering
8.(b)	Find where the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is increasing and where it is decreasing. Also find the local maximum and local minimum of f(x).	**BTL -3**	Applying
9. (a)	Find an equation of the tangent line to the hyperbola $y = \frac{3}{x}$ at (3,1)	**BTL -3**	Applying
9.(b)	Show that there is a root of $x^4 + x - 3 = 0$ in the interval (1,2)	**BTL -1**	Remembering
10.(a)	Find the equation of tangent to the curve $y = 4x - 3x^2$ at the point (2,-4)	**BTL -3**	Applying
10.(b)	Use second derivative test to examine the relative maxima for $f(x) = x(12 - 2x)^2$	**BTL -3**	Applying
11.(a)	Find an equation of the tangent to the curve $y = x^3 - 3x + 1$ at the point (2,3).	**BTL -3**	Applying
11.(b)	Point out the local maximum and minimum of $f(x) = \frac{x^2}{x-1}$ using second derivative test.	**BTL -4**	Analyzing
12.(a)	Find the equation of tangent to the curve $y = \sqrt{x}$ at (1,1)	**BTL -3**	Applying
12.(b)	Examine the local extreme of $f(x) = x^4 + 2x^3 - 3x^2 - 4x + 4$. Also discuss the concavity and find the inflection points.	**BTL -2**	Understanding
13.(a)	Find the equation of tangent to the curve $y = \frac{2x+1}{x+2}$ at (1,1)	**BTL -3**	Applying
13.(b)	Discuss the curve $y = x^4 - 4x^3$ with respect to cancavity , points of inflection and local maxima and minima	**BTL -3**	Applying
14.(a)	Find the equation of the tangent to the curve $y = \frac{1}{\sqrt{x}}$ at (i) (1,1) (ii) (4,1/2)	**BTL -3**	Applying
14.(b)	Evaluate local maximum and minimum values for the function $f(x) = x + 2sinx \quad 0 \le x \le 2\pi$	**BTL -5**	Evaluating

UNIT-II FUNCTIONS OF SEVERAL VARIABLES Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers			
Q.No.	**Question**	**Bloom's Taxonomy Level**	**Domain**
	PART - A		
1.	If $u = \frac{y}{z}+\frac{z}{x}+\frac{x}{y}$, *then find* $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}$.	**BTL -1**	Remembering
2.	If $u = f(x-y, y-z, z-x)$, *then find* $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}$.	**BTL -1**	Remembering
3.	If $x^y + y^x = 1$, then find $\frac{dy}{dx}$.	**BTL -1**	Remembering
4.	Statement of Euler's Theorem.		
5.	Find the value of $\frac{du}{dt}$, given $u = x^2 + y^2$, $x = at^2, y = 2at$.	**BTL -1**	Remembering
6.	If $u = x^3y^2 + x^2y^3$ *where* $x = at^2$ *and* $y = 2at$, *then find* $\frac{du}{dt}$.	**BTL -3**	Applying
7.	Find $\frac{du}{dt}$ *if* $u = \sin\left(\frac{x}{y}\right)$, *where* $x = e^t, y = t^2$.	**BTL -3**	Applying
8.	Find $\frac{du}{dt}$ *if* $u = \frac{x}{y}$, *where* $x = e^t, y = \log t$.	**BTL -2**	Understanding
9.	Find $\frac{\partial r}{\partial x}$, *if* $x = r\cos\theta$ & $y = r\sin\theta$.	**BTL -3**	Applying
10.	Find the Jacobian $\frac{\partial(u,v)}{\partial(r,\theta)}$, *if* $x = r\cos\theta$ & $y = r\sin\theta, u = 2xy, v = x^2 - y^2$, without actual substitution.	**BTL -4**	Analyzing
11.	If $u = \frac{y^2}{2x}$ *and* $v = \frac{x^2+y^2}{2x}$, *find* $\frac{\partial(u,v)}{\partial(x,y)}$.	**BTL -3**	Applying
12.	If $x = uv$, $y = \frac{u}{v}$. *Find* $\frac{\partial(x,y)}{\partial(u,v)}$.	**BTL -1**	Remembering
13.	If $u = x^y$ show that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$	**BTL -2**	Understanding
14.	If u = $\frac{x+y}{1-xy}$ *and* $v = \tan^{-1}x + \tan^{-1}y$, *find* $\frac{\partial(u,v)}{\partial(x,y)}$	**BTL -3**	Applying
15.	Find the Taylor series expansion of x^y near the point $(1, 1)$ up to first term	**BTL -2**	Understanding
16.	Expand $xy + 2x - 3y + 2$ *in powers of* $(x-1)$ & $(y+2)$, using Taylor's theorem up to first degree form	**BTL -3**	Applying

17.	Find the Stationary points of $f(x,y)=x^3+3xy^2-15x^2-15y^2+72x.$	**BTL -4**	Analyzing
18.	Find the Stationary points of $x^2-xy+y^2-2x+y.$	**BTL -4**	Analyzing
19.	State the Sufficient condition for $f(x,y)$to be extremum at a point	**BTL -4**	Analyzing
20.	Find the minimum point of $f(x,y)=x^2+y^2+6x+12.$	**BTL -4**	Analyzing
	PART – B		
1.(a)	If u = log ($x^2 + y^2$) + $\tan^{-1}\left(\frac{y}{x}\right)$, prove that $u_{xx} + u_{yy} = 0$		
1.(b)	If $u=\frac{yz}{x}, v=\frac{zx}{y}$ and $w=\frac{xy}{z}$, find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.	**BTL -3**	Analyzing
2. (a)	If $u=\tan^{-1}\frac{x^3+y^3}{x-y}$, Prove that $(i)x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$ (ii)$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=\sin 4u-\sin 2u.$.	**BTL -2**	Understanding
2.(b)	Find the Jacobian of $\frac{\partial(x,y,z)}{\partial(r,\theta,\varphi)}$of the transformation $x=r\sin\theta\cos\varphi, y=r\sin\theta\sin\varphi, z=r\cos\theta$	**BTL -2**	Understanding
3.(a)	If $u=(x^2+y^2+z^2)^{-1/2}$, then find the $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}$	**BTL -4**	Analyzing
3.(b)	*If* $x+y+z=u, y+z=uv, z=uvw,$ *prove that* $\frac{\partial(x,y,z)}{\partial(u,v,w)}=u^2v$	**BTL -2**	Understanding
4. (a)	*If* $u=f(x,y)$ *where* $x=r\cos\theta, y=r\sin\theta$ *prove that* $\left(\frac{\partial u}{\partial x}\right)^2+\left(\frac{\partial u}{\partial y}\right)^2=\left(\frac{\partial u}{\partial r}\right)^2+\frac{1}{r^2}\left(\frac{\partial u}{\partial\theta}\right)^2$	**BTL -4**	Applying
4.(b)	Verify Euler's theorem$u=\sin^{-1}\frac{x}{y}+\tan^{-1}\frac{y}{x}$.	**BTL -3**	Analyzing
5. (a)	*If* $z=f(x,y)$ *where* $x=u^2-v^2$ $y=2uv$ *provethat* $\frac{\partial^2 z}{\partial u^2}+\frac{\partial^2 z}{\partial v^2}=4(u^2+v^2)\left(\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial y^2}\right)$	**BTL -4**	Applying
5.(b)	If $u=xyz, v=x^2+y^2+z^2$ *and* $w=x+y+z$ then find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$	**BTL -3**	Analyzing
6. (a)	If $u=x+y+z, u^2v=y+z$ *and* $u^3w=z$ Show that $\frac{\partial(u,v,w)}{\partial(x,y,z)}=u^5$	**BTL -3**	Analyzing
6.(b)	If $u=\log_e\left[\frac{x^4+y^4}{x+y}\right]$, *show that* $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=3.$	**BTL -3**	Analyzing
7. (a)	If $u=\log(x^3+y^3+z^3-3xyz)$, show that $\left[\frac{\partial}{\partial x}+\frac{\partial}{\partial y}+\frac{\partial}{\partial z}\right]^2 u=-\frac{9}{(x+y+z)^2}$	**BTL -3**	Analyzing
7. (b)	If $u=\sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$, Prove that	**BTL -2**	Understanding

	$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=-\frac{sinu\ cos2u}{4cos^3u}$.		
8. (a)	Expand $e^x \log(1+y)$ in powers of x & y up to terms of third degree terms using Taylor's series	**BTL -1**	Remembering
8.(b)	Discuss the maxima and minima of $f(x,y) = x^3y^2(1-x-y)$.	**BTL -5**	Evaluating
9. (a)	Expand $\tan^{-1}\frac{y}{x}$ in the neighborhood of (1, 1)	**BTL -3**	Applying
9.(b)	Find the Maximum value of $x^m y^n z^p$ *when* $x+y+z=a$.	**BTL -3**	Applying
10.(a)	Find the Taylors series expansion of $e^x\ siny$ at the point (-1, $\frac{\pi}{4}$) up to the third degree terms	**BTL -4**	Applying
10.(b)	Find the extreme value of $x^2+y^2+z^2$ subject to the condition $x+y+z=3a$.	**BTL -2**	Understanding
11.(a)	Expand e^{xy} in powers of $(x-1)$ and $(y-1)$ upto third degree terms by Taylor's series	**BTL -4**	Applying
11.(b)	Find the maximum and minimum value of f(x, y) = $3x^2 - y^2 + x^3$	**BTL -2**	Understanding
12.(a)	Expand Taylor's series of $x^3+y^3+xy^2$ in powers of $(x-1)$ and $(y-2)$ upto the third degree terms.	**BTL -5**	Evaluating
12.(b)	Find the volume of the greatest rectangular parallelepiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$.	**BTL -3**	Applying
13.(a)	Find the extreme values of $f(x,y)=x^3+y^3-3x-12y+20$.	**BTL -3**	Applying
13.(b)	Find the shortest and longest distances from the point (1,2,-1) to the sphere $x^2+y^2+z^2=24$	**BTL -4**	Analyzing
14.(a)	Find the dimension of the rectangular box without a top of maximum capacity, whose surface area is 108 sq.cm.	**BTL -3**	Applying
14.(b)	Find the maximum and minimum distances of the point (3,4,12) from the sphere $x^2+y^2+z^2=1$.	**BTL -4**	Applying

UNIT III INTEGRAL CALCULUS

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

Q.No.	Question	Bloom's Taxonomy Level	Domain
	PART - A		
1.	Prove that the following integral by interpreting each in terms of areas $\int_a^b x dx = \frac{b^2-a^2}{2}$	**BTL -1**	Remembering
2.	Show that $\int_a^b dx = b-a$	**BTL -1**	Remembering

3.	Evaluate $\int_0^1 \sqrt{1-x^2}dx$ interms of areas.	**BTL -5**	Evaluating
4.	Evaluate $\int_0^3 (x-1)dx$ interms of areas.	**BTL -5**	Evaluating
5.	Evaluate the integral $\int_a^b xdx$ by using Riemann sum method	**BTL -5**	Evaluating
6.	Calculate $\int \frac{x^3}{\sqrt{4+x^2}}$ dx	**BTL -3**	Applying
7.	Calculate $\int \sqrt{1+x^2}x^5dx$	**BTL -3**	Applying
8.	Find $\int \sqrt{2x+1}\,dx$	**BTL -3**	Applying
9.	Find $\int \frac{x}{\sqrt{1-4x^2}}$ dx	**BTL -3**	Applying
10.	Evaluate $\int_0^1 \tan^{-1} x\ dx$	**BTL -5**	Evaluating
11.	Calculate $\int \frac{(lnx)^2}{x}dx$	**BTL -3**	Applying
12.	Calculate $\int (\log x)^2\,dx$	**BTL -3**	Applying
13.	Evaluate $\int_0^1 \frac{dx}{(1+\sqrt{x})^4}$	**BTL -2**	Understanding
14.	What is wrong with the equation $\int_{-1}^2 \frac{4}{x^3}dx = \left[\frac{-2}{x^3}\right]_{-1}^2 = \frac{3}{2}$?	**BTL -5**	Evaluating
15.	Evaluate $\int_4^\infty \frac{1}{\sqrt{x}}\,dx$ and determine whether it is convergent or divergent.	**BTL -5**	Evaluating
16.	Evaluate $\int_0^1 e^{-x^2}\,dx$	**BTL -5**	Evaluating
17.	Estimate $\int_1^3 \sqrt{x^2+3}dx$	**BTL -5**	Evaluating
18.	Evaluate the improper integral $\int_2^3 \frac{dx}{\sqrt{3-x}}$, if possible.	**BTL -5**	Evaluating
19.	Find $\int_2^5 \frac{dx}{\sqrt{x-2}}$	**BTL -3**	Analyzing
20.	Prove that $\int_1^\infty \frac{1}{x}$ dx is divergent.	**BTL -1**	Remembering
	PART -B		
1.(a)	Evaluate the integral using Riemann sum method and verify the answer by fundamental theorem of calculus $\int_0^2 (2x-x^3)dx$	**BTL -5**	Evaluating
1. (b)	Calculate $\int \frac{1}{\sqrt{a^2-x^2}}dx$, by using trigonometric substitution.Hence use it to evaluate $\int \frac{x}{\sqrt{3-2x-x^2}}dx$,	**BTL -3**	Applying
2. (a)	Evaluate $\int_0^1 (x^2-2x)dx$ by using Riemann sum by taking the right end points as sample points . Hence verify it by using fundamental theorem of calculus.	**BTL -5**	Evaluating
2.(b)	Find $\int x^3\sqrt{9-x^2}dx$ by trigonometric substitution.	**BTL -3**	Applying
3. (a)	Evaluate $\int_0^3 (x^3-6x)dx$ by using Riemann sum by taking the right end points as sample points. Hence verify it by using fundamental theorem of calculus.	**BTL -5**	Evaluating
3.(b)	Using trigonometric substitution evaluate $\int (5+4x-x^2)dx$	**BTL -3**	Applying

4. (a)	Evaluate $\int_0^1 (x^3 - 3x^2)dx$ by using Riemann sum by taking the right end points as sample points .	**BTL -5**	Evaluating
4.(b)	Evaluate $\int e^{ax} \cos bx \, dx$ using integration by parts.	**BTL -3**	Applying
5. (a)	Evaluate the following integrals by interpreting interms of areas $\int_0^9 \left(\frac{1}{3}x - 2\right) dx$.	**BTL -5**	Evaluating
5.(b)	Calculate using partial fraction $\int \frac{10}{(x-1)(x^2+9)} dx$	**BTL -3**	Applying
6. (a)	Evaluate $\int_{-1}^{2} \|x\| \, dx$ by interpreting interms of areas.	**BTL -5**	Evaluating
6.(b)	Find $\int \frac{sec^2 x}{tan^2 x + 3tanx + 2} \, dx$	**BTL -3**	Applying
7. (a)	Evaluate $\int_0^{10} \|x - 5\| \, dx$ by interpreting interms of areas.	**BTL -5**	Evaluating
7. (b)	Use the substitution t = $\tan\frac{x}{2}$, to transform the integral as a rational function of t and then evaluate $\int_{\pi/3}^{\pi/2} \frac{1}{1+sinx-cosx} dx$	**BTL -3**	Applying
8. (a)	Evaluate $\int_{-5}^{5} (x - \sqrt{25 - x^2}) \, dx$ by interpreting interms of areas.	**BTL -5**	Evaluating
8.(b)	Calculate by partial fraction $\int \frac{x^4 - 2x^3 + 4x + 1}{x^3 - x^2 - x + 1}$dx.	**BTL -3**	Applying
9. (a)	Evaluate$\int \frac{xe^{2x}}{(1+2x)^2} dx$	**BTL -5**	Evaluating
9.(b)	Compute$\int \frac{x^3 + x^2 2x + 1}{(x^2+1)(x^2+2)} dx$ partial faction.	**BTL -3**	Applying
10.(a)	Evaluate $\int sin^6 x cos^3 x \, dx$.	**BTL -5**	Evaluating
10.(b)	Estimate $\int e^{tan^{-1}x} \left(\frac{1+x+x^2}{1+x^2}\right) dx$ by using an appropriate substitution.	**BTL -2**	Understanding
11.(a)	Evaluate $\int_0^{\pi/2} sin^7 x cos^5 x \, dx$	**BTL -5**	Evaluating
11.(b)	Evaluate $\int \frac{x}{\sqrt{x^2 + x + 1}} \, dx$	**BTL -6**	Creating
12.(a)	Prove the reduction formula $\int_0^{\pi/2} sin^n x \, dx = \frac{n-1}{n} \int_0^{\pi/2} sin^{n-2} x \, dx$. Hence by using it evaluate $\int_0^{\pi/2} sin^7 x dx$ and $\int_0^{\pi/2} sin^8 x \, dx$	**BTL -1**	Remembering
12.(b)	Evaluate $\int_0^{\frac{\pi}{2}} cos^5 x \, dx$	**BTL -6**	Creating
13.(a)	Prove the reduction formula $\int cos^n x dx = \frac{1}{n} cos^{n-1} x sinx + \frac{n-1}{n} \int_0^{\pi/2} cosx dx$ and use it to evaluate $\int cos^2 x dx$, $\int cos^4 x dx$,$\int_0^{\pi/2} cos^2 x dx$ and	**BTL -1**	Remembering

	$\int_0^{\pi/2} cos^4 x\, dx$		
13.(b)	Evaluate $\int \frac{\tan x}{\sec x+\cos x}\, dx$	**BTL -6**	Creating
14.(a)	Prove that $\int sec^n x dx = \frac{tanxsec^{n-2}x}{n-1} - \frac{n-2}{n-1}\int sec^{n-1}xdx$ (n≠1)	**BTL -1**	Remembering
14.(b)	Evaluate the integral (i)$\int_0^3 \frac{dx}{x^2+6x+5}$ (ii) Show that $\int_0^\infty e^{-x^2}dx$ is convergent.	**BTL -5**	Evaluating

UNIT IV MULTIPLE INTEGRALS

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals

Q.No.	Question	Bloom's Taxonomy Level	Domain
	PART - A		
1.	Evaluate $\int_2^3 \int_1^2 \frac{dxdy}{xy}$	**BTL -5**	Evaluating
2.	Evaluate $\int_0^\pi \int_0^{sin\theta} rdrd\theta$	**BTL -2**	Understanding
3.	Find the area bounded by the lines $x = 0, y = 1\ and y = x$	**BTL -2**	Understanding
4.	Evaluate $\int_0^\pi \int_0^a rdrd\theta$	**BTL -2**	Understanding
5.	Evaluate $\int_0^5 \int_0^2 (x^2 + y^2)dxdy$	**BTL -2**	Understanding
6.	Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} dydx$	**BTL -2**	Understanding
7.	Find the value of $\int_0^1 \int_1^2 \left(\frac{e^{-y}}{y}\right) dxdy$	**BTL -2**	Understanding
8.	Evaluate $\int_0^\pi \int_0^5 r^4 sin\theta drd\theta$	**BTL -2**	Understanding
9.	Evaluate $\int_0^2 \int_0^x \frac{dxdy}{x^2+y^2}$	**BTL -2**	Understanding
10.	Evaluate $\int\int dxdy$ over the region bounded by $x = 0, x = 2$, $y = 0\ and y = 2$	**BTL -2**	Understanding
11.	Change the order of integration $\int_0^1 \int_0^y f(x,y)\, dxdy$	**BTL -2**	Understanding
12.	Change the order of integration $\int_0^\infty \int_x^\infty f(x,y)\, dxdy$	**BTL -2**	Understanding
13.	Find the limits of integration in the double integral $\iint_R f(x,y)dxdy$ where R is in the first quadrant and bounded x=1, y=0, $y^2 = 4x$	**BTL -4**	Applying
14.	Evaluate $\int\int\int (x + y + z)\, dxdydz$ over the region bounded by $x = 0, x = 1, y = 0\ and y = 1, z = 0, z = 1$	**BTL -4**	Applying
15.	Write down the double integral to find the area of the circles $r = 2sin\theta, r = 4sin\theta$	**BTL -4**	Applying
16.	Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy\ (x + y)dydx$	**BTL -3**	Analyzing
17.	Evaluate $\int_0^1 \int_0^{x^2} (x^2 + y^2)dydx$	**BTL -2**	Understanding
18.	Evaluate $\int_1^3 \int_3^4 \int_1^4 \int xyz\, dzdydx$	**BTL -2**	Understanding

19.	Evaluate $\int_0^1 dx \int_0^2 dy \int_0^3 (x+y+z)dz$	**BTL -1**	Remembering
20.	Evaluate $\int_a^b \int_c^d \int_f^g e^{x+y+z} dzdydx$	**BTL -2**	Understanding
	PART B		
1.(a)	Evaluate $\iint xydxdy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$	**BTL -4**	Applying
1. (b)	Change the order of integration $\int_0^2 \int_0^{\sqrt{4-y^2}} xy\, dxdy$ and hence evaluate it	**BTL -2**	Understanding
2. (a)	Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \sqrt{(a^2-x^2-y^2)}dxdy$.	**BTL -4**	Applying
2.(b)	By change the order of integration and evaluate $\int_0^2 \int_{x^2}^{2-x} xy\, dydx$	**BTL -2**	Understanding
3. (a)	Using double integral find the area of the Ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$.	**BTL -4**	Applying
3.(b)	Change the order of integration $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} xydxdy$ and hence evaluate it	**BTL -2**	Understanding
4. (a)	By changing in to polar Co – ordinates , evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dxdy$. Hence find the value of $\int_0^\infty e^{-x^2}\, dx$.	**BTL -4**	Applying
4.(b)	Change the order of integration $\int_0^a \int_0^{2\sqrt{ax}} x^2 dxdy$ and hence evaluate it	**BTL -3**	Analyzing
5. (a)	Evaluate $\int_0^2 \int_0^{\sqrt{2x-x^2}} (x^2+y^2)dydx$ by changing into polar co – ordinates	**BTL -3**	Analyzing
5.(b)	Change the order of integration $\int_0^a \int_y^a \frac{x}{\sqrt{x^2+y^2}} dydx$ and hence evaluate it	**BTL -4**	Applying
6. (a)	Using the transformation $x+y=u, y=uv$, Prove that $\iint [xy(1-x-y)]^{\frac{1}{2}}\, dxdy = \frac{25}{105}$ taken over the area of triangle bounded by the lines x=0, y=0, x+y =1.	**BTL -4**	Applying
6.(b)	Find the area of the cardioids $r = a(1 + \cos\theta)$	**BTL -3**	Analyzing
7. (a)	Evaluate the following integrals after transforming into spherical polar coordinates $\iiint \frac{dxdydz}{x^2+y^2+z^2}$ taken throughout the sphere $x^2+y^2+z^2 = a^2$.	**BTL -3**	Analyzing
7. (b)	Find the volume of the tetrahedron bounded by the coordinate planes and $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$.	**BTL -1**	Remembering
8. (a)	Evaluate the integral $\iint_R e^{\frac{x+y}{x-y}} dxdy$ where Ris the trapezoidal region with vertices (1,0) (2,0) (0,-2) (0,-1).	**BTL -2**	Understanding
8.(b)	Evaluate $\iiint_v \frac{dzdydx}{(x+y+z+1)^3}$ where V is the region bounded by $x=0, y=0, z=0$ and $x+y+z=1$.	**BTL -2**	Understanding

9. (a)	Find the area included between the curves $y^2 = 4x$ and $x^2 = 4y$	**BTL -3**	Analyzing
9.(b)	Evaluate $\int_1^e \int_1^{logy} \int_1^{e^x} logz\, dzdydx$	**BTL -2**	Understanding
10.(a)	Change the integral into polar coordinates $\int_0^a \int_0^x \frac{x^3}{\sqrt{x^2+y^2}} dxdy$ and hence evaluate it	**BTL -2**	Understanding
10.(b)	Find the volume of the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$	**BTL -2**	Understanding
11.(a)	Find the area which is inside the circle $r = 3a\cos\theta$ and outside the cardioids $r = a(1+\cos\theta)$.	**BTL -3**	Analyzing
11.(b)	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$	**BTL -2**	Understanding
12.(a)	Find the area that lies inside the cardioids $r = a(1+\cos\theta)$ and outside the circle $r = a$ by double integral	**BTL -3**	Analyzing
12.(b)	Find the value of $\iiint xyz\, dxdydz$ through the positive spherical octant for which $x^2+y^2+z^2 \le a^2$.	**BTL -2**	Understanding
13.(a)	Evaluate $\iint_R \frac{xy}{\sqrt{x^2+y^2}} dxdy$ by converting into polar coordinates where R is the first quadrant part of the region bounded by two circles $x^2+y^2=a^2 and\ x^2+y^2=4a^2$	**BTL -2**	Understanding
13.(b)	Find the volume bounded by the cylinder $x^2+y^2=1$ and the planes $x+y+z=3, z=0$	**BTL -5**	Evaluating
14.(a)	Evaluate $\int_0^a \int_0^b \int_0^c (x^2+y^2+z^2)dxdydz$	**BTL -6**	Creating
14.(b)	Find the area enclosed by the curves $y^2 = 4ax$ and $x^2 = 4ay$	**BTL -2**	Understanding

UNIT VDIFFERENTIAL EQUATIONS

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

Q.No.	Question	Bloom's Taxonomy Level	Domain
	PART – A		
1.	Find the P.I of $(D-1)^2 y = \sinh 2x$.	**BTL -5**	Evaluating
2.	Find the P.I of $(D^2+1)y = \cos 2x$.	**BTL -5**	Evaluating
3.	Find the P.I of $(D^2+1)y = sinx$.	**BTL -2**	Understanding
4.	Find the particular Integral for $(D^2+2D-1)y = x$.	**BTL -5**	Evaluating
5.	Find the P.I of $(D^2+2)y = x^2$.	**BTL -5**	Evaluating
6.	Find the P.I of $(D^2+4D+5)y = e^{-2x}$	**BTL -5**	Evaluating
7.	Estimate the P.I of $(D^2+5D+4)y = sin2x$.	**BTL -5**	Evaluating
8.	Estimate the P.I of $(D^2-4D+4)y = e^{2x}$.	**BTL -5**	Evaluating
9.	Estimate the P.I of $(D^3+3D^2+3D+1)y = e^{-x}$.	**BTL -5**	Evaluating
10.	Find the complementary function of $(D^2+4)y = sin2x$.	**BTL -5**	Evaluating

11.	Solve $(D^4-1)y=0.$	**BTL -4**	Applying
12.	Solve $Dx = -wy\,; Dy = wx$	**BTL -4**	Applying
13.	Solve Dx + y = e^t, $x - Dy = t.$	**BTL -4**	Applying
14.	Find the complementary function of $y'' - 4y' + 4y = 0$	**BTL -5**	Evaluating
15.	Solve (D^2+a^2)y=0	**BTL -1**	Remembering
16.	Convert $(x^2D^2 - 2xD + 4)y = 0$in to differential equations with constant coefficients	**BTL -5**	Evaluating
17.	Find the particular integral $(D-1)^2y = e^x sinx$	**BTL -5**	Evaluating
18.	Solve $(D^4 + D^3 + D^2)y = 0$	**BTL -5**	Evaluating
19.	Rewrite the equation$(2x+5)^2D^2 - 6(2x+5)D + 8y = 6x$ into the linear equation with constant coefficients.	**BTL -5**	Evaluating
20.	Rewrite the equation$(2x-1)^2D^2 - 4(2x-1)D + 8y = 8x$ into the linear equation with constant coefficients	**BTL -5**	Evaluating
	PART-B		
1.(a)	Identify the solution of $(D^2 - 2D + 1)y = coshx.$	**BTL -5**	Evaluating
1. (b)	Using the method of variation of parameter to Evaluate $(D^2 + 1)\, y = x\, sinx.$	**BTL -4**	Applying
2. (a)	Identify the solution of $(D^2 - 4D + 13)y = e^{2x}\sin 3x + (x^2 + x + 9).$	**BTL -5**	Evaluating
2.(b)	Using the method of variation of parameter to Evaluate (D^2 + 25) y = sec5x.	**BTL -4**	Applying
3. (a)	Identify the solution of $(D^3 - 7D - 6)y = (1+x)e^{2x}$	**BTL -5**	Evaluating
3.(b)	Solve $y''-2y'+y = e^x \log x$, Using the method of variation of parameters.	**BTL -4**	Applying
4. (a)	Give the complimentary function and particular integral of $(D^2 - 3D + 2)y = x\cos x.$	**BTL -4**	Applying
4.(b)	Using the method of variation of parameters find the solution of$(D^2 + 2D + 1) = \frac{e^{-x}}{x^2}$	**BTL -4**	Applying
5. (a)	Solve $(x^2D^2 - xD + 1)\, y = x\sin(\log x) + \frac{1}{x}.$	**BTL -5**	Evaluating
5.(b)	Evaluate the simultaneous equations $\frac{dx}{dt} + 2x - 3y = 5t, \frac{dy}{dt} - 3x + 2y = 2e^{2t}$ given that $x(0) = 0,\, y(0) = -1.$	**BTL -4**	Applying
6. (a)	Give the general solution of $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \sin(\log x^2).$	**BTL -4**	Applying
6.(b)	Solve: $\frac{dx}{dt} + 2y = \sin 2t, \frac{dy}{dt} - 2x = \cos\, 2t.$	**BTL -2**	Understanding
7. (a)	Find the solution of $(2x+3)^2\frac{d^2y}{dx^2} - (2x+3)\frac{dy}{dx} - 12y = 6x.$	**BTL -4**	Applying

7. (b)	Formulate the ODE and hence solve $(x^2D^2 + 4xD + 2)y = x^2 + \frac{1}{x^2}$	**BTL -2**	Understanding
8. (a)	Solve $y'' + y = cotx$ by method of variation of parameters	**BTL -2**	Understanding
8.(b)	Identify the solution of $D^2x - 5x + 3y = \sin t$, $D^2y + 5y - 3x = t$	**BTL -5**	Evaluating
9. (a)	Solve the differential equation $y'' + y = sec\, x$ by method of variation of parameters	**BTL -2**	Understanding
9.(b)	Evaluate the general solution of $(x^2D^2 - xD + 1)\, y = \left(\frac{logx}{x}\right)^2$	**BTL -5**	Evaluating
10.(a)	Solve the differential equation $y'' - 2y' + 2y = e^x tanx$ by method of variation of parameters	**BTL -2**	Understanding
10.(b)	Formulate the ODE and hence solve $(2x + 5)2\, y'' - 6(2x + 5)\, y' + 8y = 6x.$	**BTL -2**	Understanding
11.(a)	Solve the equation $(D^2 + 4D + 3)y = e^{-x} sinx$	**BTL -2**	Understanding
11.(b)	Using method of undetermined coefficients solve $(D^2 - 2D)y = 5e^x cosx$	**BTL -5**	Evaluating
12.(a)	Solve $\frac{dx}{dt} + y = e^t, x - \frac{dy}{dt} = t$	**BTL -2**	Understanding
12.(b)	Using method of undetermined coefficients solve $y'' + y = 2\, cosx.$	**BTL -2**	Understanding
13.(a)	Solve $(D^2 - 2D + 1)y = xe^x sinx$	**BTL -5**	Evaluating
13.(b)	Solve $((x + 1)^2D^2 + (x + 1)D + 1)y = 4Coslog(x+1)$	**BTL -2**	Understanding
14.(a)	Solve $\frac{dy}{dt} + x = e^{2t}, \frac{dx}{dt} + y = t$	**BTL -5**	Evaluating
14.(b)	Using method of undetermined coefficients solve $(D^2 - D - 2)y = 4x^2.$	**BTL -2**	Understanding