Subject Name: MATHEMATICS - 2
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Faculties

Mr. Pathik Mehta, Mr. Jaysan Shukla, Mr. Dattu Patel, Mr. Hitesh Manglani, Mr. Hardik Patel, Ms. Hena Shah, Ms. Purva Joshi, Mr. Dharmin Patel, Mr. Shailesh Bhanotar, Ms. Sakina Jadliwala

	CHAPTER 01:VECTOR CALCULUS	
	TOPIC: 1 SCALAR , VECTOR POINT FUNCTION, FIELD, NEBLA,GRADIEN AND CURVE ARC LENGTH	
	MCQ/ Short Questions	
1.	If $\vec{a} = 2\vec{i} - 3\vec{j} + \vec{k}$ then the $\|\vec{a}\|$= (a) $\sqrt{-4}$ (b)$\sqrt{4}$ (c)$\sqrt{13}$ (d)$\sqrt{14}$**(Jan'15 New)[LJIET]** **Ans:- (d) $\sqrt{14}$**	**01**
2.	f $\phi = xyz$, then the value of $\|grad\phi\|$ at $(1,2,-1)$ is (a) 0 (b) 1 (c) 2 (d) 3**(May'16 New)[LJIET]** **Ans:- (d) 3**	**01**
3.	$\bar{\imath} \times \bar{\jmath}$ is (a)$\bar{k}$ (b) - $\bar{k}$ (c) 0 (d) none of these**(Dec'17 New)[LJIET]** Ans:- **(a) $\bar{k}$**	**01**
4.	If $\bar{u}$ = 6$\bar{\imath}$ -3$\bar{\jmath}$ + 2$\bar{k}$ then $\|\|\bar{u}\|\|$ is (a)$\sqrt{49}$ (b) -$\sqrt{49}$ (c)49 (d) none of these**(Dec'17 New)[LJIET]Ans:- (a)$\sqrt{49}$**	**01**
5.	If $\bar{a}.\bar{b} = 0$ then angle between $\bar{a}$ and $\bar{b}$ is (a)0 b)2π (c) π(d)none of these**(Dec'17 New)[LJIET]Ans:- (d)none of these**	**01**
	Descriptive	
	Numericals	
6.	If $\bar{r} = x\bar{\imath} + y\bar{\jmath} + z\bar{k}$, Prove that $\nabla^2 r^n = n(n+1)r^{n-2}$.**(May'12 Old) (May'16 Old)[LJIET]**	**02** **03**
7.	Prove that $\nabla^2 f(r) = f''(r) + \frac{2}{r}f'(r)$ **(May'12 Old)[LJIET]**	**03**
8.	*If* $\phi = 3x^2y - y^3z^2$, find gradϕ at the point (1,-2,-1). **(June'13 Old)(Jan'15 Old)[LJIET]**	**03** **02**
9.	Find grad(ϕ) if ϕ = log($x^2 + y^2 + z^2$) at the point(1,0, -2)**(Jan'15New)(LJIET)** **OR** (i) Find $grad(\emptyset), if\ \emptyset = log(x^2 + y^2 + z^2)$ at the point (1, 0, −2)**(Updated)** (ii) Find a unit vector normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point (1, 2, −1) **(May'18 Old)[LJIET]**	**03** **04**
10.	Find the length of the arc of the curve y = log sec x from x=0 to x=π/3. **(June'13 Old)[LJIET]**	**03**
11.	Find the arc length of the portion of the circular helix $\bar{r}(t) = \cos t\,\hat{\imath} + \sin t\,\hat{\jmath} + t\hat{k}$ from t=0 to t=π. **(June'15 New)(LJIET)**	**03**
12.	The shape of a cable from an antenna tower is given by the equation $y = \frac{4}{3}x^{\frac{3}{2}}$ from x=0 to x=20. Find the total length of the cable. **(Dec'16 Old) [LJIET]**	**03**

13.	If $\bar{r} = x\bar{\imath} + y\bar{\jmath} + z\bar{k}$, show that $\nabla log\ r = \frac{1}{r}\hat{r}$ .Where $\hat{r}$ is unit vector.**(Dec'17 New)[LJIET]**	**03**
	TOPIC: 2 DIRECTIONAL DERIVATIVES, DIVERGENCE, CURL, LINE INTEGRAL	
	MCQ/ Short Questions	
1.	$\bar{F}$ is solenoidal vector, If div($\bar{F}$) is (a) $\bar{F}$ (b) 1 (c) 0 (d) -1 **(Dec'15 New)[LJIET]** **Ans :- (c) 0** **OR** If F is solenoidal then (A) $\nabla F = 0$ (B) $\nabla \times F = 0$ (C) $\nabla \bullet F = 0$ (D) none of these **(May'18 New)[LJIET] Ans:- (C)** $\nabla \bullet F = 0$	**01** **01**
2.	If $r = xi + yj + zk$ then div (r) is (a) r (b) 0 (c) 1 (d) 3 **(Dec'15 New)[LJIET]Ans :- (d) 3**	**01**
3.	If the value of line integral does not depend on path C then **F** is (a) solenoidal (b) incompressible (c) irrotational (d) none of these **(Dec'15 New)[LJIET] Ans :- (c) Irrotational**	**01**
4.	div$\bar{r}$ is (a) 0 (b) 1 (c) 2 (d) 3**(June'14 New)[LJIET]Ans:- (d) 3**	**01**
5.	If the value of the line integral $\oint_c \bar{F}.\,d\bar{r}$ does not depend on path C then $\bar{F}$ is (a) Solenoidal (b) incompressible (c) irrotational (d) none of these**(June'14 New)[LJIET] Ans:- (c) irrotational**	**01**
6.	The divergence of $\bar{F} = xyz\hat{\imath} + 3x^2y\hat{\jmath} + (xz^2 - y^2z)\hat{k}$ at (2,-1,1) is (a) $yz + 3x + 2xz$ (b) $yz + xy$ (c) $yz + 3x^2 + (2xz - y^2)$ (d) $xy - yz$**(June'15 New)[LJIET]Ans:- (c)** $\mathbf{yz + 3x^2 + (2xz - y^2)}$	**01**
7.	If $\bar{F}$ is conservative field then curl$\bar{F}$ = ____________ (a) i (b) j (c) k (d) $\bar{0}$ **(June'15 New)[LJIET]Ans:- (d)** $\bar{0}$	**01**
8.	If $\vec{r} = x\vec{\imath} + y\vec{\jmath} + z\vec{k}$ then the divergence of $\vec{r}$ is (a) 2 (b) -2 (c) 3 (d) -3**(Jan'15 New)[LJIET] (Dec'15 New)[LJIET] Ans:- (c) 3**	**01** **01**
9.	If $\vec{F}$ is conservative then (a) $\nabla \times \vec{F} = 0$ (b)$\nabla \times \vec{F} \neq 0$ (c) $\nabla\vec{F} = 0$ (d)$\nabla \cdot \vec{F} = 0$**(Jan'15 New)[LJIET] Ans:- (a)** $\mathbf{\nabla \times \vec{F} = 0}$	**01**
10.	If $r = xi + yj - zk$ then $curl(r)$ is (a) 1 (b) 2 (c) 0 (d) *none of these* .**(May'16 New)[LJIET] Ans:- (c) 0**	**01**
11.	The value of curl (grad $\emptyset$) , where $\emptyset = 2x^2 - 3y^2 + 4z^2$ is (a) 4xi -6yj +8zk (b) 4x – 6y + 8z (c)6 (d) 0 **(Jan' 17 New)[LJIET] Ans:- (d) 0**	**01**
12.	The magnitude of the maximum directional derivative of the function 2x+y+2z at the point (1,0,0) is (a) 0 (b) 1 (c) 2 (d) 3 **(May'17 New) [LJIET] Ans:- (d) 3**	**01**
13.	For vector point function $\vec{F}$, divergence of $\vec{F}$ is obtained by (a) $\nabla.\vec{F}$ (b) $\nabla \times \vec{F}$ (c) $\nabla\vec{F}$ (d) $\nabla^2\vec{F}$**Ans:-(a)** $\mathbf{\nabla.\vec{F}}$**(May'17 New) [LJIET]**	**01**
14.	If $\bar{F}$ is irrotational then (a)$\nabla\bar{F} \neq \bar{0}$ (b)$\nabla \times \bar{F} = \bar{0}$ (c)$\nabla.\bar{F}$=0 (d)none of these**(Dec'17 New)Ans:- (b)** $\mathbf{\nabla \times \vec{F} = 0}$	**01**
15.	If $\bar{F} = x\bar{\imath} + y\bar{\jmath} + z\bar{k}$then $\nabla.\bar{F}$ at (1,1,1) is (a)0 (b)-1 (c)3 (d)none of these**(Dec'17 New)[LJIET]Ans:- (c)3**	**01**
16.	Find the value of 'a' if $\bar{F} = (x + 3y)i + (y - 2z)j + (az + x)k$ is solenodial (a) 2 (b) 1 (c) -2 (d) 0 .**(Jan'19 New)[LJIET] Ans:- (c) -2**	**01**
	Numerical	
1.	If $\bar{F} = 3xy\hat{i} - y^2\hat{j}$; evaluate $\int_c \bar{F}d\bar{r}$ Where c is the arc of the Parabola y = 2x^{2}from (0, 0) to	**04**

	(1, 2). **(June'13 Old)[LJIET]**	
2.	Show that $\bar{F} = (y^2 - z^2 + 3yz - 2x)\hat{i} + (3xz + 2xy)\hat{j} + (3xy - 2xz + 2z)\hat{k}$ is both solenoidal and irrotational.**(June'13 Old) (Jan'15 New) (Jan' 17 New) (May'17 Old)(May'17 New) (May'18 Old)[LJIET]**	**04** **03**
3.	Find the directional derivative of $f(x, y, z) = 2x^2 + 3y^2 + z^2$ at point $P(2,1,3)$ in the direction of $\vec{a} = [1,0,-2]$. **(Jan'13 Old)[LJIET]**	**02**
4.	Find divergence and curl of $\vec{v} = xyz[x, y, z]$. **(Jan'13 OldNew)[LJIET]**	**02**
5.	Find the derivative of $f(x, y) = x^2 \sin 2y$ at the point $\left(1, \frac{\pi}{2}\right)$ in the direction of $v = 3i - 4j$.**(May'12 Old)[LJIET]**	**02**
6.	Find the directional derivative of (x, y, z) = xyz at the pointp: (-1,1,3) in the direction of the vector $\bar{a} = \hat{i} - 2\hat{j} + 2\hat{k}$. **(Dec'13 Old)[LJIET]**	**02**
7.	The velocity vector $\bar{v} = \bar{r}'(t) = x^3\hat{k}$ of a fluid motion is given. Is the flow irrotational? Incompressible? Find the path of the particle. **(Dec'13 Old)[LJIET]**	**03**
8.	Find the angle between the surfaces $x^2+y^2+z^2=9$ and $x^2+y^2-z=3$at the point (2,-1,2)**(Jan'15 New) (LJIET).**	**04**
9.	A vector field is given by $\vec{F} = (x^2 + xy^2)\vec{i} + (y^2 + x^2y)\vec{j}$. Find the scalar potential. Show that $\vec{F}$ is irrotational. **(Jan'15 New) (June'15 New)(Jan.'18 old)[LJIET].**	**04** **07**
10.	Show that the differential form under the integral of $I = \int_{(0,-1,1)}^{(2,4,0)} e^{x-y+z^2}(dx - dy + 2zdz)$ is exact in space and evaluate the integral. **(Dec'13 Old)[LJIET]**	**05**
11.	Show that the vector field $\bar{F}$ = (y sinz– sinx)i+ (xsinz +2yz)j+(xycosz + y^2)k is conservative and find the corresponding scalar potential. **(June'15 New)[LJIET]**	**05**
12.	Find the directional derivative of $x^2y^2z^2$ at (1,1,-1) along a direction equally inclined with coordinate axes.**(June'14 New) [LJIET]**	**04**
13.	Find the work done when a force $\bar{F} = (x^2 - y^2 + x)i - (2xy + y)j$ moves a particle in the XY plane from (0,0) to (1,1) along the parabola $y^2 = x$. **(June'14 New) [LJIET]**	**04**
14.	Find the work done when a force $\bar{F} = (2x^2yi + 3xyj)$ moves a particle in the XY plane from (0,0) to (1,4) along the parabola y = 4 x^2 **(June-2014 Old) [LJIET]**	**02**
15.	Find the directional derivative of $\emptyset = 4xz^3 - 3x^2y^2z$ at the point (2,-1,2) in the direction (2,3,6).**(Jan'15 Old) [LJIET]** **OR** Find the directional derivative of $\emptyset = 4xz^3 - 3x^2yz^2$ at the point (2,-1,2) in the direction $2\bar{\imath} + 3\bar{\jmath} + 6\bar{k}$.**(Dec'17 New)[LJIET]**	**04** **04**
16.	Find the derivative of $f(x, y) = x e^y + \cos xy$ at the point (2,0) in the direction of A = 3i -4j. **(June'14 Old) [LJIET]**	**02**
17.	Find constants a,b,c so that V = (x +2y +az)i + (bx -3y-z)j+(4x + cy + 2z) is irrotational. **(June'14 Old) (Dec'17 New) [LJIET]**	**02** **03**
18.	If $\emptyset = xyz - 2y^2z + x^2z^2$, Find div(grad $\emptyset$) at the point (2,4,1).**(June'15 New) [LJIET].**	**03**
19.	Evaluate $\int_c ydx + xdy + zdz$, where C is given by $x = \cos t, y = \sin t, z = t^2$, $0 \le t \le 2\pi$. **(Dec'15 Old) [LJIET]**	**04**
20.	Find the value of the constant λ such that the vector field defined by $F = (2x^2y^2 +$	**03**

	$z^2)i + (3xy^3 - x^2z)j + (\lambda xy^2z + xy)k$ is solenoidal.**(Dec'15 Old) [LJIET]**	
21.	Determine whether the vector field $u = y^2\hat{i} + 2xy\hat{j} - z^2\hat{k}$ is solenoidal at a point (1,2,1). **(Dec'15 New)[LJIET]**	**03**
22.	Find the unit vector normal to surface $x^2y + 2xz = 4$ at the point (2,-2,3). **(Dec'15 New) [LJIET]**	**04**
23.	Find curl $\vec{F}$ at the point (2,0,3) , if $\vec{F} = z\,e^{2xy}\hat{i} + 2xy\cos y\,\hat{j} + (x + 2y)\hat{k}$. **(Dec'15 New) [LJIET]**	**03**
24.	Find the directional derivative of $\emptyset = x^2 - y^2 + 2z^2$ at the point P(1,2,3) in the direction of the line PQ where Q is the point (5,0,4). **(May'16 Old)[LJIET]**	**04**
25.	Show that $\bar{F} = 2xyz\bar{\imath} + (x^2z + 2y)\bar{\jmath} + x^2y\bar{k}$ is conservative. Find its scalar potential function $\emptyset$.**(May'16 Old)[LJIET]**	**04**
26.	Find curl F, if $F = (y^2\cos x + z^3)i + (2y\sin x - 4)j + 3xz^2k$. Whether F is irrotational? **(May'16 New)[LJIET]**	**03**
27.	Find the directional derivative of $f(x,y,z) = x^3 - xy^2 - z$ at (1,1,0) in the direction of $2i - 3j + 6k$ **(May'16 New)[LJIET]**	**04**
28.	Find the unit normal to the surface $z^2 = 4(x^2 + y^2)$ at a point (1,0,2). **(May'16 New)[LJIET]**	**03**
29.	If $F = (2xy + z^3)i + x^2j + 3xz^2k$ .Show that $\int_c F \cdot dr$ is independent of path of integration. Hence find the integral when C is any path joining (1,-2,1) and (3,1,4) **(May'16 New)[LJIET]**	**04**
30.	Find the directional derivative of the function $f(x,y,z) = xy^2 + yz^3$ at the point (2,-1,1) in the direction of the vector $\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$. **(Dec'16 Old) [LJIET]**	**04**
31.	Find div $\vec{F}$ and curl $\vec{F}$, where $\vec{F} = grad\left(x^3 + y^3 + z^3 - 3xyz\right)$**(Dec'16 Old) [LJIET]**	**07**
32.	find the workdone when a force F =$(x^2 - y^2 + 2x)i - (2xy + y)j$ moves a particle in the xy plane from (0,0) to (1,1) along the parabola $y^2 = x$. Is the workdone different when the path is straight line y=x? **(Jan' 17 New) [LJIET]**	**04**
33.	Find directional derivative of the function $f(x,y,z) = x^2 + 3y^2 + z^2$ at the point $P(2,1,3)$ in the direction of the vector $\hat{\imath} - 2\hat{k}$. **(May'17 Old) [LJIET]**	**03**
34.	Find unit normal vector to the surface $x^2 + 2y^2 + z^2 = 7$ at $(1,-1,2)$ **(May'17 Old) [LJIET]**	**03**
35.	If $F = 3xy\,\hat{\imath} - y^2\hat{\jmath}$,evaluate $\int_c F\,dr$ where C is the arc of parabola $y=2x^2$ from$(0,0)$ to $(1,2)$ **(May'17 Old) [LJIET]**	**04**
36.	Find the directional derivative of $xy^2 + yz^3$ at the point (2,-1,1). **(May'17 New) [LJIET]**	**03**
37.	Find directional derivative of function $\emptyset = zx^2 + 2xy^2 + yz^2$ at point (1,2,-1) in the direction of the vector $\bar{a} = 2i + 3j - 4k$. **(Jan.'18 old) [L.J.I.E.T]**	**04**
38.	Find directional derivative of thefunction $f(x,y,z) = ax + by$; a,b are constants, at the pointP(0,0) which makes anangle of 30^0 with positive x-axis.**(Dec'17 Old)[LJIET]**	**03**
39.	Find a potential function for the field $F=e^{y+2z}(i + xj + 2xk)$.**(Dec'17 Old)[LJIET]**	**04**
40.	Find the magnitude and the direction of the greatest change of $u=xyz^2$ at (1, 0,3)**(Dec'17 Old)[LJIET]**	**03**
41.	Find the workdone when a force $F=(x^2-y^2+x)i-(2xy+y)j$ moves a particle in the xy-plane from(0, 0)and(1, 1) along the parabola $y^2=x$. Is the work done different when the path is the straight-line y=x?**(Dec'17 Old)[LJIET]**	**04**

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42.	Find the directional derivative of the divergence of $\bar{F}(x, y, z) = xy\hat{\imath} + xy^2\hat{\jmath} + z^2\hat{k}$ at the point (2, 1, 2) in the direction of the outer normal to the sphere $x^2 + y^2 + z^2 = 9$. **(May'18 Old)[LJIET]**	**03**
43.	Find the unit vector normal to the surface $xy^3z^2 = 4$ at (-1,-1,2) **(May'18 New)[LJIET]**	**03**
44.	Find the work done by the force $\bar{F} = (3x^2 - 3x)i + 3zj + k$ along the straight line $ti + tj + tk, 0 \le t \le 1$. **(May'18 New)[LJIET]**	**03**
45.	Find the directional derivative of $4xz^2 + x^2yz$ at (1,-2,-1) in the direction of 2i – j – 2k. **(May'18 New)[LJIET]**	**03**
46.	Show that $\bar{F} = (e^x \cos y + yz)i + (xz - e^x \sin y)j + (xy + z)k$ is conservative and find the potential function. **(May'18 New)[LJIET]**	**04**
47.	What do you mean by an irrotational vector field? Show that $\bar{F} = (e^x cosy + yz, xz - e^x siny, xy + z)$ is conservative and find a potential function for it. **.(Jan'19 Old)[LJIET]**	**07**
48.	Find the work done in moving a particle in the force field $\bar{F} = 3x^2i + (2xz - y)j + zk$ along the straight line from (0,0,0) to (2,1,3). **(Jan'19 New)[LJIET]**	**04**
49.	Evaluate $\oint_C \vec{F}.\overrightarrow{dr}$ where $\vec{F} = (x^2 + y^2)i + (x^2 - y^2)j + z^2k$ along the boundary of the triangle with vertices (1,1,0), (0,1,0), (0,0,0) **.(Jan'19 Old)[LJIET]**	**04**
50.	Show that the $\vec{F} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ irrotational. Find the scalar $\emptyset$such that $\vec{F} = \nabla\emptyset$ **.(Jan'19 Old)[LJIET]**	**04**
	TOPIC: 3 SURFACE INTEGRAL	
	MCQ/ Short Questions	
	Descriptive	
	Numericals	
1.	Find the flux of $F = 4xzi - y^2j + yzk$ outward through the surface of the cube cut from the first octant by the planes x=1, y=1 and z=1.**(May'12 Old)[LJIET]**	**03**
2.	Prove that $\iint \bar{F} \cdot \hat{n} ds = 3v$, if $\bar{F} = xi + yj + zk$,where S is any closed surface enclosing volume V.**(June'13 Old)[LJIET]**	**03**
3.	Evaluate $\iint_s \vec{F}\,\hat{n}\,ds$where $\vec{F} = yz\vec{I} + xz\vec{j} + xy\vec{k}$ and S is the surface of the sphere $x^2 + y^2 + z^2 = 1$ in the first octant. **(Jan'15 New) [LJIET]**	**07**
4.	Evaluate $\iint_s 6xy\, ds$ where s is the portion of the plane x + y + z = 1 that lies in front of the YZ plane.**(Jan'15 Old) [LJIET]**	**04**
5.	Find the flux of F = yzj+ z^2koutward through the surface cut from the cylinder $y^2 + z^2 = 1$, z ≥0 by the planes x = 0 and x = 1.**(June'14 Old) [LJIET]**	**05**
6.	Evaluate $\iint_S \bar{F}.d\bar{s}$, where $\bar{F} = (2x + 3z)\hat{\imath} - (xz + y)\hat{\jmath} + (y^2 + 2z)\hat{k}$ and S is the surface of the sphere having center at $(3, -1, 2)$ and radius 3. **(May'18 Old)[LJIET]**	**03**
	TOPIC: 4GREEN'S THEOREM	
	MCQ/ Short Questions	
	Descriptive	
	Numericals	
1.	Verify Green's theorem for vector function $\vec{F} = (y^2 - 7y)\hat{\imath} + (2xy + 2x)\hat{\jmath}$ and curveC: $x^2 + y^2 = 1$. **(Jan'13 Old)[LJIET]**	**05**
2.	Verify Green's theorem for the field $f(x, y) = (x - y)i + xj$ and the region R bounded by	**04**

	the unit circle $C: r(t) = (\cos t)i + (\sin t)j$; $0 \le t \le 2\pi$ **(May'12 Old)[LJIET]**	
3.	Using Green's theorem, evaluate the line integral $\oint_c (\sin y\,dx + \cos x\,dy)$ counter clockwise, where C is the boundary of the triangle with vertices (0,0), (p ,0), (p ,1). **(Dec'13 Old)[LJIET]**	**04**
4.	Verify Green'sTheorem in the plane $\oint(3x^2 - 8y^2)dx + (4y - 6xy)dy$ and the path is bounded by the regions $y^2 = x$ and $x^2 = y$. **(Jan'15 New) (June'15 Old)[LJIET]**	**07** **04**
5.	Verify Green's theorem for $\oint(3x - 8y^2)dx + (4y - 6xy)dy$ and the path is boundary of the triangle with vertices (0,0), (1,0) and (0,1). **(June'14 New) (May'17 New) [LJIET]**	**05** **07**
6.	State Green's theorem and also evaluate the integral $\oint(6y + x)dx + (y + 2x)dy$ where C: the circle $(x - 2)^2 + (y - 3)^2 = 4$. **(June'14 Old) [LJIET]**	**05**
7.	Verify Green's theorem in the plane for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is boundary of the region defined by $x = 0, y = 0, x + y = 1$. **(June'15 Old) [LJIET]**	**07**
8.	Use Green's theorem to evaluate $\int_c [x^2y\,dx + y^3\,dy]$,where C is the closed path formed by $y = x$ and $y = x^3$ from $(0,0)$ to $(1,1)$. **(June'15 New) [LJIET]**	**04**
9.	Evaluate $\int_c F.dr$ where $F = \frac{yi - xj}{(x^2 + y^2)}$ and C is the circle $x^2 + y^2 = 1$ traversed counterclockwise. **(Dec'15 Old) [LJIET]**	**03**
10.	Using Green's theorem evaluate $\oint_c xydy - y^2dx$ where C is the square cut from the first quadrant by the lines $x = 1$ and $y = 1$. **(Dec'15 Old) [LJIET]**	**04**
11.	Verify Green's theorem for $\vec{F} = x^2\hat{i} + xy\hat{j}$ under the square bounded by $x = 0, x = 1$, $y = 0, y = 1$. **(Dec'15 New) [LJIET]**	**07**
12.	Verify the Green's theorem in the plane for $\oint_C (y^2\,dx + x^2 dy)$ where *C* is triangle bounded by x = 0, x + y = 1 and y = 0. **(May'16 Old)(Dec'17 New)[LJIET]**	**07** **07**
13.	Verify Green's theorem for the function $F = (x + y)i + 2xyj$ and C is the rectangle in the xy-plane bounded by x=0,y=0,x=a,y=b. **(May'16 New)[LJIET]**	**07**
14.	Use Green's theorem to evaluate $\int_c (3x^2 - 8y^2)dx + (4x - 6xy)dy$, where c is the boundary of the region defined by $y = x$ & $y = x^2$. **(Dec'16 Old) [LJIET]**	**07**
15.	state the Green's theorem and use it to evaluate the integral $\oint y^2dx + x^2dy$, where c is the triangle bounded by x = 0, x +y =1 , y = 0. **(Jan' 17 New) [LJIET]**	**07**
16.	Verify Green's theorem for $\oint_C [(y - \sin x)\,dx + \cos x\,dy]$: where C is the plane triangle enclosed by the lines $y = 0$, $x = \frac{\pi}{2}$, $y = \frac{2x}{\pi}$ **(May'17 Old)[LJIET]**	**07**
17.	Using Green's theorem evaluate $\oint_C [(xy - x^2)dx + (x^2y)dy]$ along the closed curve C formed by y=0 , x=1and y=x. **(Jan.'18 old) [L.J.I.E.T]**	**03**
18.	Verify green's theorem for the function $\vec{F} = (x + y)\hat{\imath} + 2xy\hat{\jmath}$ and C is the rectangle in the xy-planebounded by x=0, y=0, x= a, y=b. **(Dec'17 Old)[LJIET]**	**07.**
19.	Verify Green's theorem for the function $F = (x^2 + y^2)\hat{\imath} - 2xy\hat{\jmath}$, where C is the rectangle in the xy-plane bounded by $y = 0, y = b, x = 0$ and $x = a$. **(May'18 Old)[LJIET]**	**07**
20.	Verify Green's Theorem for $\overline{F} = (x - y)i + xj$ and C is $x^2 + y^2 = 1$ **(May'18 New)[LJIET]**	**07**
21.	State Stoke's theorem. Using Green's theorem, evaluate the integral $\oint_C xy^3dx + (x^2 - y^2)dy$ *, where C is the triangle bounded by* $x = 0$, $x + y = 1$, $y = 0$. **(Jan'19 Old)[LJIET]**	**07**
22.	Using Green's theorem evaluate $\int_C (x^2ydx + x^2dy)$ where C is the boundary of the	**07**

	triangle whose vertices are (0,0),(1,0),(1,1). **(Jan'19 New)[LJIET]**	
23.	Verify Green's theorem in the xy-plane for $\oint(xy+y^2)dx + x^2dy$ where C is the closed curve of the region bounded by $y = x \ and \ y = x^2$.**(Jan'19 Old)[LJIET]**	**07**
	Chapter No. 02: Laplace Transform and Its Application	
	TOPIC: 1 LAPLACE TRANSFORM	
	MCQ/ Short Questions	
	Descriptive	
	Numericals	
1.	By using First shifting theorem obtain the value of $L[(t+1)^2e^t]$**(Dec. 2009)[LJIET]**	**02**
2.	Find $L(\sin 2t \cos 2t)$**(Dec. 2009)[LJIET]**	**02**
3.	Find Laplace Transform of $\frac{\sin wt}{t}$**(H May 2011)[LJIET]**	**02**
4.	Find the Laplace Transform of $f(t) = \begin{cases} 0, 0 \le t \le 2 \\ 3, when \ t \ge 2 \end{cases}$**(Dec. 2011)[LJIET]**	**02**
5.	Define the term Laplace transform of f(t) and its inverse Transform **(Dec. 2011)[LJIET]**	**02**
6.	Find $L(cos^2 at), a$ is any constant **(Dec. 2011)[LJIET]**	**02**
7.	Find $L(t^2 \sinh at)$**(H May 2012)[LJIET]**	**02**
8.	Find the Laplace Transform of $f(t) = \begin{cases} 0, 0 < t < \pi \\ \sin t\,, \ t > \pi \end{cases}$**(H May 2012)[LJIET]**	**02**
9.	Find Laplace transform of $\frac{1-\cos t}{t}$**(H May 2012)[LJIET]**	**02**
10.	Find the Laplace transform of $t^2 \sin 2t$**(H June 2013old course)[LJIET]**	**02**
11.	Define Convolution and Unit Step function. **(H June 2013old course)[LJIET]**	**02**
12.	Find the Laplace Transforms of $2t^3 + e^{-2t} + t^{4/3}$.**(Dec. 2013old course) [LJIET]**	**02**
13.	Find Laplace Transform of $(t-1)^2u(t-1)$**(H June 2015) [LJIET]**	**02**
14.	If f(t) is a periodic function with Period t then $L[f(t)] =$ ________ Or For a periodic function f with fundamental period p, state the formula to find Laplace Transform of f. **(Dec. 2015, H June 2016)[LJIET]**	**01,01**
15.	Find $L(e^{-3t}f(t)) \ if \ L(f(t)) = \frac{s}{(s-3)^2}$ **(Dec. 2015)[LJIET]**	**01**
16.	Find $L[(2t-1)^2]$**(Dec. 2015)[LJIET]**	**01**
17.	Find $L(t^2 * \cos t)$**(Dec. 2015)[LJIET]**	**02**
18.	Laplace transform of f(t) is defined for +ve and –ve values of t. True or False ? **(H June 2016)[LJIET]**	**01**
19.	Define Pairwise continuous function.	**01**
20.	State the sufficient conditions for the existence of the Laplace Transform of $f(t)$.	**01**
21.	Define Laplace transform of f(t), t≥ 0 **(H Dec 2016)[LJIET]**	**01**
22.	Find Laplace transform of $t^{-\frac{1}{2}}$. **(H Dec 2016)[LJIET]**	**01**
23.	Find $L\left\{\frac{sinat}{t}\right\}$, given that $L\left\{\frac{sint}{t}\right\} = \tan^{-1}\left\{\frac{1}{s}\right\}$. **(H Dec 2016)[LJIET]**	**01**
24.	Find $L\{e^{3t+3}\}$ **(H May 2017)[LJIET]**	**01**
25.	Define: Dirac Delta function, Laplace Transform of a function. **(H Nov 2018)[LJIET]**	**2**

26.	Find the value of 1. $L(t\sin wt)$ 2. $1*1$ where * denote the convolution product **(Dec. 2009)[LJIET]**	**04**
27.	Find the Laplace transform of half wave rectification of $\sin wt$ defined by $f(t)=\begin{cases}\sin wt \ \ if\ 0<t<\frac{\pi}{w}\\ 0\ \ if\ \frac{\pi}{w}<t<\frac{2\pi}{w}\end{cases}$, $f(t)=f(t+\frac{2\pi}{w})$**(H March 2010, Jan. 2013old course)[LJIET]**	**03,04**
28.	Find the Laplace transform of 1. $t^2\sin\pi t$ 2. $e^t u(t-2)$ **(Dec. 2010)[LJIET]**	**04**
29.	Find Laplace Transform of $f(t)=\lvert\sin wt\rvert; t\geq 0$**(H May 2011)[LJIET]**	**03**
30.	Find Laplace Transform of $f(t)=\sinh wt, t\geq 0$**(Dec. 2011)[LJIET]**	**03**
31.	Find Laplace Transform of 1. $e^{-3t}u(t-2)$, 2. $\int_0^t e^{-u}\cos u\,du$**(H May 2012)[LJIET]**	**03**
32.	Solve the differential equation $\frac{d^2y}{dt^2}+4y=f(t), y(0)=0, y'(0)=1$ by Laplace transform where (i) $f(t)=1, 0<t<1$ $=0, t>1$ (ii) $f(t)=H(t-2)$. **(H May 2012) (H Nov 2017,OLD)[LJIET]**	**03,07**
33.	Prove that $L(1)=\frac{1}{s}$ & $L(\sinh at)=\frac{a}{(s^2-a^2)}$**(Jan. 2013)[LJIET]**	**07**
34.	If $L\{f(t)\}=\overline{f}(s)$ and if $L\left\{\frac{f(t)}{t}\right\}$ exists then prove that $L\left\{\frac{f(t)}{t}\right\}=\int_s^\infty \overline{f}(s)ds$ Also find $L\left\{\frac{\sin 2t}{t}\right\}$. **(Jan. 2013, H June 2014) [LJIET]**	**07,07**
35.	Find the Laplace Transform of 1. $cos^2 2t$ 2. $t^3\cosh 2t$**(Jan. 2013old course) [LJIET]**	**04**
36.	Prove that $L(e^{-at})=\frac{1}{s+a}, s>-a$. **(H June 2013) [LJIET]**	**03**
37.	Prove that $L(t^n)=\frac{n!}{s^{n+1}}, n$ being positive integer. **(H June 2013, Dec. 2013) [LJIET]**	**04,04**
38.	If $\overline{f(s)}$ is the Laplace transform of $f(t)$ and $a\geq 0$, then prove that $L[f(t-a)u(t-a)]=e^{-as}\overline{f(s)}$. **(H June 2013) [LJIET]**	**07**
39.	Find the Laplace Transform $L\left[\int_0^t e^{-x}\cos x dx\right]$. **(H June 2013) [LJIET]**	**03**
40.	Find the Laplace Transform $L\left[\int_0^t\int_0^t \sin au du du\right]$. **(H June 2013) [LJIET]**	**04**
41.	Define Laplace Transform and find Laplace Transform of 1. $t^3+e^{-3t}+t^{\frac{1}{2}}$ 2. $e^{-2t}sin^2 2t$**(H June 2013old course) [LJIET]**	**07**
42.	Prove that $\cosh at=\frac{s}{(s^2-a^2)}$**(Dec. 2013)[LJIET]**	**03**
43.	If $L\{f(t)\}=\overline{f}(s)$, then show that $L\{tf(t)\}=-\frac{d}{ds}\{\overline{f}(s)\}$. Use this result to obtain	**07**

	$L\left\{e^{at}t\sin at\right\}$. **(Dec. 2013) [LJIET]**	
44.	Given that $f(t)=t+1, 0\le t<2$ $=3, t\ge 2$ find $L\{f(t)\}$ and $L\{f'(t)\}$. **(Dec. 2013old course) [LJIET]**	**05**
45.	Find the Laplace Transform of $\frac{1-e^t}{t}$. **(Dec. 2013old course) [LJIET]**	**05**
46.	Prove that $L(\sinh at)=\frac{a}{s^2-a^2}$, $s>\lvert a\rvert$**(H June 2014, H Jan. 2015 for $a=k$)[LJIET]**	**03, 04**
47.	Find the Laplace Transforms of (i) $\sin 2t\sin 3t$ (ii) $e^{-3t}(2\cos 5t-3\sin 5t)$. **(H June 2014)[LJIET]**	**04**
48.	Find Laplace Transform of $t^5+\cos 5t+e^{-100t}$ **(H June 2014old course) [LJIET]**	**03**
49.	Find the Laplace Transforms of the function $f(t)=t\cosh t$. **(H June 2014old course) [LJIET]**	**03**
50.	Find the Laplace Transforms of following functions: (i) $\cos^3 t$ (ii) $\sin^2 t$. **(H June 2014old course) [LJIET]**	**07**
51.	$L\{f(t)\}=\overline{f}(s)$, then show that $L\{t^n f(t)\}=(-1)^n\frac{d^n}{ds^n}\{\overline{f}(s)\}$ where n=1,2,3,..... and use this result to find $L(t^2\sin wt)$**(H Jan. 2015)[LJIET]**	**07**
52.	Find the Laplace Transform of $f(t)=\begin{cases}0\ ; 0\le t\le 3\\ 4\quad ; t\ge 3\end{cases}$**(H Jan. 2015)[LJIET]**	**03**
53.	Find the Laplace Transform of the following functions 1. $\sin 2t\cos 2t$ 2. $cos^3\ 2t$ 3. Unit step function **(H Jan. 2015old course)[LJIET]**	**07**
54.	Prove that 1. $L(e^{at})=\frac{1}{s-a}; s>a$ 2. $L(\sinh at)=\frac{a}{s^2-a^2}$ **(H June 2015)[LJIET]**	**04**
55.	Find the Laplace Transform of $t\sin 2t$**(H June 2015) [LJIET]**	**03**
56.	Find the Laplace Transform of $f(t)=\begin{cases}0, 0<t<\pi\\ \sin t\ ,\ t\ge\pi\end{cases}$**(H June 2015) [LJIET]**	**04**
57.	Find Laplace Transform of $e^{4t}\sin 2t\cos t$**(H June 2015) [LJIET]**	**03**
58.	Find $L(t^2\cosh 3t)$**(H June 2015, H June 2016)[LJIET]**	**03,03**
59.	Find the Laplace Transform of $f(t)=100^t+2t^{10}+\sin 10t$**(H June 2015old course)[LJIET]**	**03**
60.	Find the Laplace Transform of function $t\sin t$**(H June 2015old course)[LJIET]**	**03**
61.	Find the Laplace Transform of $sin^3 2t\ and\ sin^2 2t$ **(H June 2015, old course)[LJIET]**	**07**
62.	Find $L\left\{\int_0^t e^u(u+\sin u)du\right\}$**(Dec. 2015)[LJIET]**	**03**
63.	Find $L\{t(\sin t-t\cos t)\}$**(Dec. 2015)[LJIET]**	**03**
64.	Find $L\{t^2\sin 4t\}$**(Dec. 2015)[LJIET]**	**03**
65.	Find the Laplace Transform of the Periodic Function defined by $f(t)=\frac{t}{2}, 0<t<3, f(t+3)=f(t)$.**(Dec. 2015)[LJIET]**	**04**

66.	Find $L(\frac{1-\cos 2t}{t})$**(Dec. 2015)[LJIET] (H Nov-2017)[LJIET]**	**03,02**
67.	1. Find $L(\frac{t-\sin 5t}{t})$ 2. Find $L(t^2 cos^2 2t)$**(H June 2016)[LJIET]**	**07**
68.	Find the Laplace Transform of 1. $\frac{\cos at-\cos bt}{t}$ 2. $t\sin at$**(H June 2016)[LJIET]**	**04**
69.	Find $L\{u(t-4)(t-4)^2\}$ **(H Dec 2016, old)[LJIET]**	**04**
70.	Find $L\{4te^{-t}\}$ **(H Dec 2016, old)[LJIET]**	**03**
71.	Obtain $L\{e^{2t}sin^2 t\}$**(H May 2017)[LJIET]**	**03**
72.	Find the Laplace transform $\{te^{4t}\ cos2t\}$**(H May 2017)[LJIET]**	**03**
73.	Find $L\left\{\int_0^t e^t \frac{sint}{t}dt\right\}$. **(H Dec 2016)[LJIET]**	**03**
74.	Find $L\{tsin3tcos2t\}$. **(H Dec 2016)[LJIET]**	**03**
75.	show that 2) $L\{t\sin at\}$ **(H May 2017,old)[LJIET]**	**02**
76.	show that $L\{\sin at\}=\dfrac{a}{s^2+a^2}$ **(H May 2017,old)[LJIET]**	**03**
77.	show that 1) $L\left\{\dfrac{1-\cos 2t}{t}\right\}$ **(H May 2017,old)[LJIET]**	**3.5**
78.	Prove that if $L\{f(t)\}=F(S) then\ L\left\{\frac{f(t)}{t}\right\}=\int_0^\infty F(S)dS$ **(H May 2017,old)[LJIET]**	**04**
79.	Find L[$\cos^2$t] **(MAY-2018)[LJIET]**	**03**
80.	Find L [e^{2t} sin3t] **(MAY-2018)[LJIET]**	**04**
81.	Prove that $L\{\cosh at\}=\dfrac{s}{s^2-a^2}$ **(H May 2018,old)[LJIET]**	**03**
82.	State first shifting theorem and using it compute $L\{e^{3t}(2\sin 4t-3\cos 4t)\}$ **(H May 2018,old)[LJIET]**	**04**
83.	Find the laplace transform of f(t)=e^t **(H NOV 2017,OLD)[LJIET]**	**03**
84.	Find the laplace transform function f(t)=tsint**(H May 2018,old)[LJIET]**	**03**
85.	Find the Laplace Transform of the function **f(t)=** $\dfrac{\sin t}{t}$**.(H May 2018,old)[LJIET]**	**04**
86.	Find the Laplace transform of $t\sin^2 3t$. **(H Nov-2017)[LJIET]**	**04**
87.	Find the Laplace transforms of : (i) $e^{-3t}u(t-2)$ **(H Nov-2017)[LJIET]**	**02**
88.	Find the Laplace transform of the periodic function of the waveform $f(t)=\dfrac{2t}{3}, 0\le t\le 3,\ f(t+3)=f(t)$ **(H Nov-2017)[LJIET]**	**03**
89.	State and prove First shifting theorem of Laplace Transform **(H Nov 2018)[LJIET]**	**03**
90.	Find $L[t\ Sint]$ **(H Nov 2018)[LJIET]**	**03**
91.	Define unit step function $u(t-a)$. Find $L[t^2u(t-2)]$. **(H Nov 2018)[LJIET]**	**03**
92.	Find Laplace transform of $\frac{(cosat-cosbt)}{t}$ **(H Nov 2018)[LJIET]**	**03**
93.	Define periodic function. Find Laplace transform $f(t)=t^2; 0\le t\le 2, f(t+2)=f(t)$ **(H Nov 2018)[LJIET]**	**04**

94.	Prove that $\int_0^\infty \frac{e^{-at}-e^{-bt}}{t}\,dt = \ln\left(\frac{b}{a}\right)$ **(H Nov 2018)[LJIET]**	**04**
95.	Find the Laplace transform of the function $f(t)=\sin\sqrt{t}$ **(H Nov 2018)[LJIET]**	**03**
96.	Find the Laplace transform of the function $f(t)=t\cos t$. **(H Nov 2018)[LJIET]**	**03**
	TOPIC: 2 INVERSE LAPLACE TRANSFORM	
	MCQ/ Short Questions	
	Descriptive	
1.	State and Prove Convolution Theorem **(H June 2013old course) [LJIET]**	**07**
	NUMERICAL	
1.	Find the convolution of t & e^t**(H Dec. 2010, H NOV 2017,old)[LJIET]**	**02,03**
2.	Obtain $L^{-1}(\log\frac{1}{s})$**(H May 2011)[LJIET]**	**02**
3.	Find the inverse Laplace Transform of $\frac{3(s^2-1)^2}{2s^5}$. **(H Dec. 2013old course) [LJIET]**	**02**
4.	Find the convolution of $1*1$**(H June 2015)[LJIET]**	**02**
5.	$L^{-1}\left(\frac{1}{(s+a)^2}\right) =$ ________________**(H June 2016)[LJIET]**	**01**
6.	Define Inverse Laplace Transform of the function $f(t)$	**01**
7.	Find$L^{-1}\left(\frac{4}{s^2}-\frac{1}{s^2+9}\right)$**(H May 2017)[LJIET]**	**01**
8.	Evaluate $L^{-1}(\frac{3}{s^2+6s+18})$**(H Dec. 2009)[LJIET]**	**02**
9.	Find $L^{-1}(\frac{1}{(s+\sqrt{2})(s-\sqrt{3})})$**(H Dec. 2009, H Dec. 2010, H June 2015old course, H June 2016)[LJIET]OR** Find the Inverse Laplace Transform of the function: $F(s)=\frac{1}{(s+\sqrt{2})(s-\sqrt{3})}$. **(H May 2018)[LJIET]**	**02,02,03,03,03**
10.	Evaluate $L^{-1}(\frac{se^{-2s}}{s^2+\pi^2})$**(H Dec. 2009, H Dec. 2010)[LJIET]**	**03,02**
11.	Using Convolution theorem obtain the value of $L^{-1}(\frac{1}{s(s^2+4)})$ or State convolution theorem on Laplace Transform and using it find $L^{-1}(\frac{1}{s(s^2+4)})$ Or Find $L^{-1}(\frac{1}{s(s^2+4)})$ **(H Dec. 2009, H Jan. 2013old course, H Jan. 2015, H June 2015)[LJIET]**	**03, 05, 03, 04**
12.	Find $L^{-1}(-\frac{s+10}{s^2-s-2})$**(H March 2010)[LJIET]**	**03**
13.	Find $L^{-1}(\frac{s^3+2s^2+2}{s^3(s^2+1)})$**(H March 2010)[LJIET]**	**03**
14.	State convolution theorem and use it to evaluate $L^{-1}(\frac{a}{s^2(s^2+a^2)})$**(H March 2010, H Dec 2016, old)[LJIET]**	**04,07**
15.	Find $L^{-1}(\frac{1}{s^4-81})$**(H March 2010, H June 2016)[LJIET]**	**03,04**
16.	Find Inverse transform of $\ln(1+\frac{w^2}{s^2})$**(H March 2010)[LJIET]**	**03**

17.	Find $L^{-1}(\log(\frac{s+a}{s+b}))$**(H Dec. 2010, H June 2013)[LJIET]**	**02,04**
18.	Using convolution theorem find $L^{-1}(\frac{1}{(s^2+a^2)^2})$ Or State convolution theorem and use it to evaluate $L^{-1}(\frac{1}{(s^2+a^2)^2})$ **(H Dec. 2010 (for $a = w$), H May 2011, H June 2016, H June 2016)[LJIET]**	**04,03,07,07**
19.	Using Laplace transform find the solution of IVP $x\frac{\partial u}{\partial x}+\frac{\partial u}{\partial t} = xt, u(x,0) = 0; if\ x \geq 0, u(0,t) = 0; if\ t \geq 0$**(H Dec. 2010)[LJIET]**	**06**
20.	Find the Inverse Laplace Transform of $\frac{5s^2+3s-16}{(s-1)(s-2)(s+3)}$**(H Dec. 2011)[LJIET]**	**04**
21.	Find the Inverse Laplace Transform of $\frac{6+s}{s^2+6s+13}$**(H Dec. 2011)[LJIET]**	**04**
22.	Find the Inverse Laplace Transform of $\frac{5s+3}{(s^2+2s+5)(s-1)}$**(H May 2012, H Jan. 2015old course)[LJIET]**	**03,04**
23.	Evaluate 1. $L^{-1}(\frac{6s}{s^2-16})$ 2. $L^{-1}(\frac{10}{(s-2)^4})$**(H Jan. 2013)[LJIET]**	**07**
24.	Find the Inverse Laplace Transform of 1. $\frac{5s^2+3s-16}{(s-1)(s-2)(s+3)}$ 2. $\frac{s^3}{s^4-81}$**(H Jan. 2013old course)[LJIET]**	**05**
25.	Find $L^{-1}\left\{\frac{s+2}{(s^2+4s+5)^2}\right\}$. **(H June 2013) [LJIET]**	**03**
26.	Find the Inverse Laplace Transform of 1. $\frac{3s^2+2}{(s+1)(s+2)(s+3)}$ 2. $\frac{s^3+2s^2+2}{s^3(s^2+1)}$**(H June 2013old course) [LJIET]**	**07**
27.	Find the Inverse Laplace Transform of 1. $\log(\frac{s+1}{s-1})$ 2. $\frac{e^{-4s}(s+2)}{s^2+4s+5}$**(H June 2013old course) [LJIET]**	**07**
28.	Find 1. $L^{-1}(\frac{s}{s^4+4a^4})$ 2. $L^{-1}(\frac{1}{s(s+a)^3})$**(H Dec. 2013)[LJIET]**	**07**
29.	Use Convolution theorem to evaluate $L^{-1}(\frac{1}{(s+1)(s+3)})$**(H Dec. 2013old course)[LJIET]**	**05**
30.	Evaluate 1. $L^{-1}(\frac{5s+3}{(s^2+2s+5)(s-1)})$ 2. $L^{-1}(\ln(1+\frac{w^2}{s^2}))$**(H June 2014)[LJIET]**	**07**
31.	State the convolution theorem Apply convolution theorem to evaluate $L^{-1}(\frac{s}{(s^2+a^2)^2})$**(H June 2014, H Jan. 2015old course, H Dec 2016)[LJIET]**	**03,04,07**
32.	Find the Inverse Laplace Transform of $\frac{s}{s^2-3s+2}$**(H June 2014old course)[LJIET]**	**03**
33.	State convolution theorem and using it find Inverse Laplace Transform of $f(t)=\frac{s^2}{(s^2+4)(s^2+9)}$ **(H June 2014old course) [LJIET]**	**07**
34.	Find $L^{-1}(\frac{3s^2+2}{(s+1)(s+2)(s+3)})$**(H Jan. 2015)[LJIET]**	**04**
35.	Find the Inverse Laplace Transform of $\frac{1}{s(s+1)}$ **(H Jan. 2015old course) [LJIET]**	**03**
36.	Find inverse Laplace transform of $\frac{1}{(s-2)(s+3)}$**(H June 2015)[LJIET]**	**03**
37.	Evaluate $t * e^t$**(H June 2015)[LJIET]**	**03**

38.	Find the inverse Laplace Transform of $\frac{4s+5}{(s-1)^2(s+2)}$**(H June 2015) [LJIET]**	**04**
39.	Find inverse Laplace Transform of $\frac{2-5s}{(s-6)(s^2+11)}$**(H June 2015) [LJIET]**	**04**
40.	State convolution theorem on Laplace Transform and using it find inverse Laplace Transform of $F(s)=\frac{s^2}{(s^2+a^2)(s^2+b^2)}$**(H June 2015old course) (H Nov-2017)[LJIET]**	**07,04**
41.	Find $L^{-1}(\frac{1}{s(s^2-3s+3)})$**(H Dec. 2015) [LJIET]**	**04**
42.	Find $L^{-1}\{\frac{e^{-2s}}{(s^2+2)(s^2-3)}\}$**(H Dec. 2015) [LJIET]**	**04**
43.	State the convolution theorem and verify it for $f(t)=t$ & $g(t)=e^{2t}$**(H Dec. 2015) [LJIET]**	**07**
44.	Find $L^{-1}(\log(\frac{s+4}{s+3}))$**(H Dec. 2015) [LJIET]**	**04**
45.	Find the Inverse Laplace Transform of $\frac{1}{s(s+a)^3}$**(H Dec. 2015)[LJIET]**	**03**
46.	Use Convolution theorem to $L^{-1}(\frac{1}{s(s^2+a^2)})$**(H Dec. 2015)[LJIET]**	**04**
47.	1. Find $L^{-1}(\frac{1-3s}{s^2+8s+21})$ 2. Find $L^{-1}(\log(\frac{s+a}{s+b}))$**(H June 2016)[LJIET]**	**07**
48.	Find $L^{-1}\left\{\frac{e^{-2s}}{s-3}\right\}$ **(H Dec 2016, old)[LJIET]**	**04**
49.	Find $L^{-1}\left\{\frac{s+2}{s^2-2s+5}\right\}$ **(H Dec 2016, old)[LJIET]**	**03**
50.	Using convolution theorem find $L^{-1}\left[\frac{1}{(s^2+4)^2}\right]$. **(H May 2017)[LJIET]**	**07**
51.	find $L^{-1}\left[\frac{S+7}{S^2+8S+25}\right]$. **(H May 2017)[LJIET]**	**04**
52.	Find $L^{-1}\left\{\frac{2s^2-1}{(s^2+1)(s^2+4)}\right\}$. **(H Dec 2016)[LJIET]**	**04**
53.	Find $L^{-1}\left\{\frac{e^{-3s}}{(s^2+8s+25)}\right\}$. **(H Dec 2016)[LJIET]**	**04**
54.	show that 2) $L^{-1}\left\{\frac{15}{s^2+4s+29}\right\}$**(H May 2017,old)[LJIET]**	**02**
55.	show that 1) $L^{-1}\left\{\frac{e^{-2\pi s}+e^{-8\pi s}}{(s^2+1)}\right\}$ **(H May 2017,old)[LJIET]**	**3.5**
56.	State convolution theorem and hence find $L^{-1}\left[\frac{1}{(s^2+4)^2}\right]$**(H MAY-2018)[LJIET]**	**07**
57.	Find $L^{-1}\left[\frac{1}{(s+1)(s+2)}\right]$**(H MAY-2018)[LJIET]**	**03**
58.	Find the inverse laplace transform $L^{-1}\left[\frac{1}{s^3(s^2+a^2)}\right]$(**H NOV 2017,OLD)[LJIET]**	**04**
59.	Find the Inverse Laplace Transform of the function: $F(s)=\frac{s^2}{(s^2+25)(s^2+49)}$. **(H MAY-2018,old)[LJIET]**	**04**

60.	find the inverse Laplace transform of 1)$\tan^{-1}(2/S)$ 2) $\frac{s^3}{s^4-a^4}$ **(H Nov-2017)[LJIET]**	**04**
61.	Find $L^{-1}\left[\frac{4s+5}{(s-1)^2(s+2)}\right]$ **(H Nov 2018)[LJIET]**	**04**
62.	State Convolution theorem and hence find $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$ **(H Nov 2018)[LJIET]**	**07**
63.	Find inverse Laplace transform of $\frac{3(s^2-1)^2}{s^5}$ **(H Nov 2018)[LJIET]**	**03**
64.	State Convolution theorem. Use it find Inverse Laplace transform of $\frac{s}{(s^2+a^2)(s^2+b^2)}$ **(H Nov 2018)[LJIET]**	**07**
65.	Find Inverse Laplace transform of $\frac{5s^2-2s-19}{(s+3)(s-1)^2}$ **(H Nov 2018)[LJIET]**	**03**
66.	Find the inverse Laplace transform of the function $F(s)=\frac{6s-4}{s^2-4s+20}$ **(H Nov 2018)[LJIET]**	**04**
67.	Find the inverse Laplace transform of the function $F(s)=\log\left(1+\frac{1}{s^2}\right)$. **(H Nov 2018)[LJIET]**	**04**
68.	Define Convolution theorem for Laplace transform. Using convolution theorem to find Laplace inverse of the function $F(s)=\frac{s^2}{(s^2+a^2)(s^2+b^2)}$ **(H Nov 2018)[LJIET]**	**07**
	TOPIC: 3 Application to Differential Equations	
	MCQ/ Short Questions	
	Descriptive	
	NUMERICAL	
1.	Using the Method of Laplace Transform solve the IVP $y''+2y'+y=e^{-t}, y(0)=-1 \text{ and } y'(0)=1$**(H Dec. 2009, H Dec. 2013old course) (H MAY-2018,old)[LJIET]**	**07,05,07**
2.	By Laplace transform solve $y''+a^2y=k\sin at$**(H March 2010, H June 2014)[LJIET]**	**04,04**
3.	Using Laplace Transform solve the IVP $y''+y=\sin 2t,\ y(0)=2, y'(0)=1$ **(H Dec. 2010, H Jan. 2015)[LJIET]**	**05,07**
4.	Solve the simultaneous equations using Laplace transform $\frac{dx}{dt}-y=e^t, \frac{dy}{dt}+x=\sin t,\ x(0)=1, y(0)=0$**(H May 2011)[LJIET]**	**06**
5.	Solve the IVP using Laplace Transform : $y''+4y=0, y(0)=1, y'(0)=6$**(H Dec. 2011)[LJIET]**	**03**
6.	Using Laplace Transform solve the Differential equation $\frac{d^2x}{dt^2}+2\frac{dx}{dt}+5x=e^{-t}\sin t,\quad where\ x(0)=0, x'(0)=1$ **(H May 2012, H June 2016)[LJIET]**	**03,07**
7.	Solve by Laplace transform $y''+6y=1, y(0)=2, y'(0)=0$**(H Jan. 2013, H June 2015)[LJIET]**	**07,05**
8.	Solve the differential equation by Laplace Transform method $y''+4y'+3y=e^{-t}, y(0)=y'(0)=1$**(H Dec. 2013)[LJIET]**	**07**

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9.	Using Laplace Transform solve the Differential equation $y'' + 5y' + 6y = e^{-t}$, $y(0) = 0, y'(0) = -1$**(H June 2014old course) [LJIET]**	**07**
10.	Solve using Laplace Transform, $y''' + 2y'' - y' - 2y = 0, y(0) = 1, y'(0) - 2, y''(0) = 2$**(H Jan. 2015old course) [LJIET]**	**03**
11.	Solve the IVP using Laplace Transform: $y'' + 3y' + 2y = e^t, y(0) = 1, y'(0) = 0$**(H June 2015)[LJIET]**	**07**
12.	Solve by Laplace transform $y' - 4y = 2e^{2t} + e^{4t}$ given that $t = 0, y = 0$.**(H June 2015)[LJIET]**	**05**
13.	Using Laplace Transform solve the differential equation $y'' - 4y' + 3y = 6t - 8, y(0) = 0, y'(0) = 0$**(H June 2015, old course)[LJIET]**	**07**
14.	Solve IVP: $y'' - 2y' = e^t \sin t, y(0) = y'(0) = 0$ using Laplace Transform. **(H Dec. 2015)[LJIET]**	**07**
15.	Solve by Laplace Transform :$\frac{dy}{dt} - 2y = 4, given\ that\ t = 0, y = 1$.**(H Dec. 2015)[LJIET]**	**05**
16.	Solve the equation $y'' - 3y' + 2y = 4t + e^{3t}, when\ y(0) = 1, y'(0) = -1$ **(H June 2016, H Dec 2016)[LJIET]**	**07,07**
17.	Solve $\frac{d^2y}{dt^2} - 4y = 24cos2t$, given that at $t = 0, y = 3\ and\ \frac{dy}{dt} = 4$ **(H Dec 2016, old)[LJIET]**	**07**
18.	Use Laplace transform to solve following equation $'' - 3y' + 2y = 12\ e^{-2t}, y(0) = 2, y'(0) = 6$. **(H May 2017)[LJIET]**	**07**
19.	Solve $y'' - y = t\ y(0) = 1, y'(0) = 1$ by Laplace transform**(H May 2017,old)[LJIET]**	**07**
20.	Solve $y'' + y = \sin 2t$ with y(0)=2, y'(0)=1 by using Laplace transform. **(H MAY-2018)[LJIET]**	**07**
21.	Solve the following initial value problem using the method of Laplace transforms $y''' + 2y'' - y' - 2y = 0, given\ that\ y(0) = 1, y'(0) = 2, y''(0) = 2$**(H Nov-2017)[LJIET]**	**07**
22.	Solve differential equation using Laplace transform. $y'' + 2y' + y = e^{-t}$; $y(0) = -1, y'(0) = 1$ **(H Nov 2018)[LJIET]**	**07**
23.	Solve the differential equation using Laplace Transformation method $\frac{d^2y}{dt^2} + y = t\cos t$, Given that, $y(0) = 0,\ y'(0) = 0,\ t > 0$. **(H Nov 2018)[LJIET]**	**07**
	CHAPTER : 03 Fourier Integral	
	MCQ/ Short Questions	
1.	Can we represent non periodic functions in terms of Fourier series? **[LJIET]**	**01**
2.	What is the basic difference between Fourier series and Fourier integrals? **[LJIET]**	**01**
3.	State Fourier Integral theorem. **[LJIET]**	**01**
	Descriptive	
	NUMERICALS	
4.	Prove that,	**03**

	$\int_0^\infty \frac{1-\cos(\pi w)}{w}\sin(xw)dw = \begin{cases}\frac{\pi}{2}; 0<x<\pi \\ 0;\ x>\pi\end{cases}$ **(H March 2010)[LJIET]**	
5.	Find the Fourier cosine integral of $f(x)=e^{-kx}; x>0, k>0$. **(March 2010, H Dec 2016)(H NOV 2017,old)[LJIET]**	**03,03,03**
6.	Show that, $\int_0^\infty \frac{\omega\sin(\omega x)+\cos(\omega x)}{1+\omega^2}d\omega = \begin{cases}0; x<0 \\ \frac{\pi}{2};\ x=0 \\ \pi e^{-x}; x>0\end{cases}$ **(H Dec 2010, H Jan 2015, H June 2015, new)[LJIET]**	**05,07,07**
7.	Find Fourier integral representation of $f(x)=\begin{cases}2 & ;\lvert x\rvert<2 \\ 0 & ;\lvert x\rvert>2\end{cases}$. **(H Jan 2013, H June 2014, H June 2016, H Dec 2016, old ,H May 2017)[LJIET]**	**07,07,03,07,04**
8.	Find Fourier cosine integral of $f(x)=\begin{cases}x & ;0<x<a \\ 0 & ;x>a\end{cases}$. **(H June 2013)[LJIET]**	**07**
9.	Find Fourier integral representation of $f(x)=\begin{cases}1 & ;\lvert x\rvert<1 \\ 0 & ;\lvert x\rvert>1\end{cases}$ and hence evaluate $\int_0^\infty \frac{\sin(x)\cos(\lambda x)}{\lambda}d\lambda$ **(H Dec 2013, H June 2015)[LJIET]** **or** Find Fourier integral representation of $f(x)=\begin{cases}1 & ;\lvert x\rvert<1 \\ 0 & ;\lvert x\rvert>1\end{cases}$ **(H May 2017,old)[LJIET]** Express the function $f(x)=\begin{cases}1, & \lvert x\rvert<1 \\ 0; & otherwise\end{cases}$ as fourier integral. **(H Nov 2018)[LJIET]**	**07,07,07,05**
10.	Express the function $f(x)=\begin{Bmatrix}\sin x, 0\le x\le\pi \\ 0, x>\pi\end{Bmatrix}$ as a fourier sine integral and evaluate $\int_0^\infty \frac{\sin\lambda x\sin\pi\lambda}{1-\lambda^2}d\lambda$ **(H Dec 2013)[LJIET]**	**04**
11.	Prove that, $\int_0^\infty \frac{1-\cos(\pi\lambda)}{\lambda}\sin(x\lambda)d\lambda = \begin{cases}\frac{\pi}{2}; 0<x<\pi \\ 0;\ x>\pi\end{cases}$ **(H Dec 2015)[LJIET]**	**07**
12.	Find the Fourier cosine integral of $f(x)=\frac{\pi}{2}e^{-x}, x\ge 0$. **(H Dec 2015, new)[LJIET]**	**03**
13.	Show that $\int_0^\infty \frac{\lambda^3}{\lambda^4+4}\sin\lambda x d\lambda = \frac{\pi}{2}e^{-x}\cos x$, x>0.**(H Dec 2015, new)[LJIET]**	**04**
14.	Find the Fourier transform of $(x)=\frac{1}{x}$. **(H June 2016, old)[LJIET]**	**07**
15.	Find the Fourier transform of the function $f(x)=e^{-ax^2}$ **(H June 2016)[LJIET]**	**03**
16.	Show that $\int_0^\infty \frac{\sin\lambda\cos\lambda}{\lambda}d\lambda$ =0, if x>1. **(H Dec 2016)[LJIET]**	**04**
17.	Express $f(x)=\begin{cases}1, & for\ 0\le x\le\pi \\ 0, & for\ x>\pi\end{cases}$ As a Fourier sine integral and hence evaluate $\int_0^\infty \frac{1-\cos(\pi\lambda)}{\lambda}\sin(x\lambda)\,d\lambda$ **(H Nov-2017)[LJIET]**	**03**
18.	Express $f(x)=\begin{cases}\sin x, & 0\le x\le\pi \\ 0, & x>\pi\end{cases}$ as Fourier Sine integral and evaluate $\int_0^\infty \frac{\sin\lambda x\sin\pi\lambda\ d\lambda}{1-\lambda^2}$ **(H Nov 2018)[LJIET]**	**04**

	Chapter No. 04 : First Ordered Ordinary Differential Equations	**Marks**
	TOPIC: 1 Linear Differential Equations and Bernoulli's Equation of 1st order	
	MCQ/ Short Questions	
1.	Find the order and degree of the differential equation $[\frac{dy}{dx}+y]^{\frac{1}{2}}=\sin x$ **.(H May 2011)[LJIET]**	**01**
2.	Give the differential equation of the orthogonal trajectory to the equation $y=cx^2$.**(H Dec 2015 new)[LJIET]**	**01**
3.	Integrating factor of the differential equation $\frac{dx}{dy}+\frac{3x}{y}=\frac{1}{y^2}$ is ______________________ **(H June 2016)[LJIET]**	**01**
4.	The general solution of the differential equation $\frac{dy}{dx}+\frac{y}{x}=tan2x$ is ______ **(H June 2016)[LJIET]**	**01**
5.	The orthogonal trajectory of the family of the curve $x^2+y^2=c^2$ is _____ **(H June 2016)[LJIET]**	**01**
6.	State the type, order and degree of differential equation $(\frac{dx}{dy})^2+5y^{\frac{1}{3}}=x$ is _______________ **(H June 2016)[LJIET]**	**01**
7.	Define order and degree of the differential equation. **[LJIET]**	**01**
8.	The solution of $\frac{dy}{dx}+e^{x+y}$ is ____________.**[LJIET]**	**01**
9.	The Integrating factor of $\frac{dy}{dx}-cotx.y=x^2$ is ___________.**[LJIET]**	**01**
10.	Write the general form of First order Linear Differential equation and its solution. **[LJIET]**	**01**
11.	What is the difference between general solution and particular solution? Give one example. **[LJIET]**	**01**
12.	Give the differential equation of the orthogonal trajectory of the family of circles $x^2+y^2=a^2$**(H Dec 2016)[LJIET]**	**01**
13.	What are the order and the degree of the differential equation $y''+3y^2=3cosx$ **(H May 2017)[LJIET]**	**01**
14.	What is the integrating factor of the linear differential equation $y'-\frac{1}{x}y=x^2$**(H May 2017)[LJIET]**	**01**
	Descriptive	
	NUMERICALS	
1.	Find the orthogonal trajectories of the curve $y=x^2+c$.**(H Dec 2010)[LJIET]**	**03**
2.	Solve the IVP : $xy'+y=0, y(2)=-2$.**(H Dec 2011)[LJIET]**	**02**
3.	Find the orthogonal trajectory of the family of the curve $ay^2=x^3$**(H Dec. 2013)[LJIET]**	**03**
4.	Find the differential equation of family of circles of radius r whose centre lies on the x axis. **(H Jan 2015)[LJIET]**	**04**
5.	Define order and degree of a differential equation. Find order and degree of a differential equation $\sqrt{x^2\frac{d^2y}{dx^2}+2y}=\frac{d^3y}{dx^3}$**(H Jan 2015 old)[LJIET]**	**04**
6.	Obtain the differential equations of all parabolas whose axes are parallel to the axis of y.**(H NOV 2017,old)[LJIET]**	**03**
7.	Find the orthogonal trajectory of the cardioids r=a(1-cosθ)**(H Nov-2017)[LJIET]**	**03**
8.	Solve: $\frac{dy}{dx}+y=x$ **(H Dec 2009)[LJIET]**	**02**

9.	Solve $\frac{dy}{dx} - y = e^{2x}$ **(H Dec 2009)[LJIET]**	**02**
10.	Solve $\frac{dy}{dx} - y = -\frac{x}{y}$ **(H Dec 2009)[LJIET]**	**03**
11.	Solve $y' + 6x^2 y = \frac{e^{-2x^3}}{x^2}$ **(H March 2010,old)[LJIET]**	**03**
12.	Solve the differential equation y' + y sinx = $e^{\cos x}$. **(H March10,old)[LJIET]**	**03**
13.	Solve: $\frac{dy}{dx} + \frac{1}{3}y = \frac{1}{3}(1-2x)x^4$ **(Dec.2010)[LJIET]**	**03**
14.	Solve the initial value problem y' – (1 + 3x^{-1})y = x + 2, y(1) = e – 1 **(H Dec 2010)[LJIET]**	**03**
15.	Solve the differential equation $\frac{dy}{dx} + \frac{1}{x} = \frac{e^y}{x^2}$**(H May 2011, H June 2015 new,H June 2016 old)[LJIET]**	**03,04,3.5**
16.	Solve the Bernoulli equation $y' + y\sin x = e^{\cos x}$ **(H Dec 2011)[LJIET]**	**03**
17.	Solve : $(x+y)^2[x\frac{dy}{dx} + y] = xy[1 + \frac{dy}{dx}]$**(H May 2012)[LJIET]**	**02**
18.	Solve $\frac{dy}{dx} + \frac{1}{x^2}y = 6e^{1/x}$**(H Jan 2013)[LJIET]**	**03**
19.	Solve $x\frac{dy}{dx} + (1+x)y = x^3$ **(H June 2013,old)[LJIET]**	**03**
20.	Solve: $\frac{dy}{dx} + \frac{4x}{x^2+1}y = \frac{1}{(x^2+1)^3}$ **(H Dec 2013)[LJIET]**	**03**
21.	Solve $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$ **(H June 2014, H Dec 2016)[LJIET]**	**03,03**
22.	Solve $(1+y^2)\frac{dx}{dy} = \tan^{-1} y - x$.**(H June 2013)[LJIET]**	**03**
23.	Solve $\frac{dy}{dx} + y\tan x = \sin 2x$ **(H Jan 2013 old, H Dec 2016, old)[LJIET]**	**02,03**
24.	Solve the differential equation $x\frac{dx}{dy} + y = x^3y^6$ **(H Dec 2013 old)[LJIET]**	**04**
25.	Solve $\frac{dy}{dx} + 2y\tan x = \sin x$**(H Jan 2015)[LJIET]**	**03**
26.	Solve $\frac{dy}{dx} + y\tan x = \cos x, y(0) = 2$**(H Jan 2015, old)[LJIET]**	**04**
27.	Solve $\frac{dy}{dx} + x\sin 2y = x^3 cos^2 y$**(H Jan 2015, old)[LJIET]**	**07**
28.	Solve $\frac{dy}{dx} + \frac{1}{x^2}y = 6e^{1/x}$ **(H June 2015)[LJIET]**	**03**
29.	Solve $\frac{dy}{dx} + 2ytanx = sinx$**(H Dec 2015, old)[LJIET]**	**04**
30.	Solve $\frac{dy}{dx} + \frac{1}{x}y = x^3y^3$.**(H Dec 2015, new)[LJIET]**	**04**
31.	Solve$\frac{dy}{dx} + ycotx = 2cosx$. **(H June 2016)[LJIET]**	**04**
32.	Solve $\frac{dy}{dx} + (tanx)y = sin2x, y(0) = 0$**(H May 2017) [LJIET]**	**04**
33.	Solve $y' + (x+1)y = e^{x^2}y^3, y(0) = 0.5$ **(H May 2017,old)[LJIET]**	**04**

34.	Solve $\frac{dy}{dx}+y\sin x=e^{\cos x}$ **(H MAY-2018)[LJIET]**	**04**
35.	Solve the following Bernoulli's equation: $\frac{dy}{dx}+\frac{y}{x}=\frac{y^2}{x^2}$ **(H Nov-2017)[LJIET]**	**03**
36.	Show that current in a circuit containing Resistance R, Inductance L and Constant emf E is given by $i=\frac{E}{R}[1-e^{\frac{-Rt}{L}}]$. **(H Nov 2018)[LJIET]**	**07**
37.	Solve: $\frac{dy}{dx}+\frac{x}{(1-x^2)}y=x\sqrt{y}$ **(H Nov 2018)[LJIET]**	**04**
38.	Solve: $(x^2-1)\frac{dy}{dx}+2xy=1$ **(H Nov 2018)[LJIET]**	**03**
	TOPIC: 2 Variable Seperable Differential Equation	
	MCQ/ Short Questions	
1.	Solve $\frac{dy}{dx}=e^{3x-2y}+x^2e^{-2y}$. **(H Dec 2016)[LJIET]**	**01**
2.	Is the differential equation $ye^{x}dx+(2y+e^{x})dy=0$ is the exact ?justify**(H May 2017) [LJIET]**	**01**
	Descriptive	
	NUMERICALS	
1.	Solve $2xydx+x^2dy=0$ **(H Dec 2009)(H MAY-2018)[LJIET]**	**02,03**
2.	Solve $xy'=y^2+y$ **(H Dec 2010)[LJIET]**	**02**
3.	Solve : $9yy'+4x=0$ **(H Dec 2011, H June 2016)[LJIET]**	**02,03**
4.	Solve the different equation $xy\frac{dy}{dx}=1+x+y+xy$ **(H May 2012,H June 2016 old)[LJIET]**	**01,3.5**
5.	Solve e^x tany dx + (1+e^x) $\sec^2$y dy = 0 **(June 13,old)[LJIET]**	**02**
6.	Solve the differential equation $(1+x^2)dy=xydx$. **(H Dec 2013,old)[LJIET]**	**02**
7.	Find out general solution of differential equation $e^x dx-e^y dy=0$ **(H Jan 2015,old)[LJIET]**	**03**
8.	Find the general solution of the differential equation $y'=e^{x-y}+xe^{-y}$**(H June 2015, old)[LJIET]**	**02**
9.	Solve$(x-y^2x)dx=(y-x^2y)dy$**(H Dec 2016, old)[LJIET]**	**04**
10.	Solve $\frac{dy}{dx}=e^{x-y}+x^2e^{-y}$ by variable separable method. **(H MAY-2018)[LJIET]**	**03**
11.	Solve the following differential equation using variable separable method $3e^x\tan y\,dx+(1+e^x)\sec^2 y\,dy=0$ **(H Nov-2017)[LJIET]**	**03**
12.	Solve $\sinh x\cos y\,dx=\cosh x\sin y\,dy$ **(H Nov 2018)[LJIET]**	**04**
	TOPIC: 3 Exact and Non Exact Differential Eqaution	
	MCQ/ Short Questions	
1.	Is the differential equation $\frac{dy}{dx}=\frac{y}{x}$ exact? Give reason.**(H Dec 2015 new)[LJIET]**	**01**
2.	Write the sufficient condition for the equation to be exact? **[LJIET]**	**01**
3.	Write all the formulaes of different cases of Non exact differential equation. **[LJIET]**	**01**
	Descriptive	

	NUMERICALS	
1.	Find the solution of differential equation $ye^x dx+(2y+e^x)dy=0$ where y(0) =-1 **(H March 2010,old)[LJIET]**	**02**
2.	Test for exactness and solve : $[(x+1)e^x-e^y]dx-xe^y dy=0, y(1)=0$ **(Dec.2011)[LJIET]**	**03**
3.	Solve the differential equation : $(x^2y^2+2)ydx+(2-x^2y^2)xdy=0$ **(H May 2012)[LJIET]**	**03**
4.	Solve $\frac{dy}{dx}=\cos x\cos y-\sin x\sin y$ **(H Jan 2013 old)[LJIET]**	**02**
5.	Solve $x^2y\,dx-(x^3+xy^2)dy=0$ **(H Jan 2013)[LJIET]**	**04**
6.	Solve $\frac{dy}{dx}+\frac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0$. **(H June 2013, H Dec 2016)[LJIET]**	**04,04**
7.	Solve $(xy-2y^2)\,dx-(x^2+3xy)dy=0$ **(H Dec 2013)[LJIET]**	**04**
8.	State the necessary and sufficient conditions to be exact differential equation. Using it, solve $x^3ydx-(x^3+y^3)dy=0$. **(H Jan 2013,old)[LJIET]**	**05**
9.	Solve the differential equation $xdy-ydx=\sqrt{(x^2+y^2)}$. **(H June 2014 old)[LJIET]**	**03**
10.	Solve $[(x+1)e^x-e^y]dx-xe^y dy=0, y(1)=0$. **(H June 2014)(H NOV 2017,OLD)[LJIET]**	**04,04**
11.	Solve $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$**(H Jan. 2015, old) (H NOV 2017,OLD)[LJIET]**	**03,07**
12.	Solve the differential Equation $ye^x dx+(2y+e^x)dy=0$ **(H June 2015, new)[LJIET]**	**03**
13.	Solve the differential equation $(x+y)dx+(y-x)dy=0$**(H June 2015, old)[LJIET]**	**03**
14.	Solve $(e^y+1)cosxdx+e^y sinxdy=0$**(H Dec 2015, old)[LJIET]**	**03**
15.	Solve $\left[1+e^{\frac{x}{y}}\right]dx+e^{\frac{x}{y}}\left[1-\frac{x}{y}\right]=0$**(H June 2015)[LJIET]**	**02**
16.	Solve $\frac{dy}{dx}=\frac{x^2-x-y^2}{2xy}$.**(H Dec 2015, new)[LJIET]**	**03**
17.	Solve : $((x^2+y^2+3)dx-2xydy=0$**(H May 2017)) [LJIET]**	**03**
18.	Solve $(e^y-ye^x)dx+(xe^y-e^x)dy=0$ **(H May 2017,old)[LJIET]**	**03**
19.	Solve $(x^4+y^4)dx-xy^3dy=0$ **(H MAY-2018)[LJIET]**	**03**
20.	Find the General Solution ofthe differential equation $(1+y^2)dx=\left(e^{-\tan^{-1}y}-x\right)dy$. **(H MAY-2018,old)[LJIET]**	**04**
21.	Find the General Solutionofthe differential equation $(x^2-y^2)dy=2xydx$. **(H MAY-2018,old)[LJIET]**	**03**
22.	Check whether the given differential equations is exact or not $\left(x^4-2xy^2+y^4\right)dx-\left(2x^2y-4xy^3+\sin y\right)dy=0$ Hence find the general solution. **(H Nov-2017)[LJIET]**	**04**
23.	Solve:$\left(xtan\frac{y}{x}-ysec^2\frac{y}{x}\right)dx+xsec^2\frac{y}{x}dy=0$ **(H Nov 2018)[LJIET]**	**03**
24.	Solve $x(x-1)\frac{dy}{dx}-(x-2)=x^3(2x-1)$. **(H Nov 2018)[LJIET]**	**03**
25.	Solve $\left(x^2y^2+2\right)ydx+\left(2-x^2y^2\right)xdy=0$. **(H Nov 2018)[LJIET]**	**04**
26.	Solve $(2xy+y-tany)dx+(x^2-xtan^2y+sec^2y)dy=0$ **(H Nov 2018)[LJIET]**	**03**
27.	Solve $\left(x^2+y^2+1\right)dx-2xydy=0$ **(H Nov 2018)[LJIET]**	**03**
	Chapter No. 05 : Higher Order Ordinary Differential	

	# Equations	
	TOPIC: 1 Solution by [1/f(D)] R(x) method for finding Particular Solution:	
	MCQ/ Short Questions	
1.	Solve $(D^2+D+1)y=0$; where $D=\frac{d}{dt}$..**(H Dec 2015 new)[LJIET]**	**01**
2.	Particular Integral of $(D^2+4)y=cos2x$ is _______.**(H June 2016)[LJIET]**	**01**
3.	The C.F of the differential equation $(D^3+2D^2+D)y=x^2$ is ___________.**[LJIET]**	**01**
4.	The general solution of $(D^3-3D^2+4)y$=0 is ___________.**[LJIET]**	**01**
5.	Solve to find PI: $(\frac{1}{D^2}+5)sin2x$**[LJIET]**	**01**
6.	Find the general solution of $(D^2+1)y$=0. **[LJIET]**	**01**
7.	Solve :$y"+11y'+10y=0$**(H May 2017) [LJIET]**	**01**
8.	Find particular integral of :$y"'+y'=e^{2x}$**(H May 2017) [LJIET]**	**01**
9.	Solve $(D^2+6D+9)x=0; D=\frac{d}{dt}$. **(H Dec 2016)[LJIET]**	**01**
	Descriptive	
1.	Write the different cases to find complementary function for different values of R(x). **[LJIET]**	**02**
	NUMERICALS	
2.	Find the general solution of the differential equation $y'=e^{2x+3y}$. **(H June 2014)[LJIET]**	**02**
3.	Find the particular solution of the differential equation $y''+4y=2sin3x$. **(H June 2014)[LJIET]**	**02**
4.	Solve :$(D^4-1)y=0$.**(H June 2014)[LJIET]**	**02**
5.	Solve :$(D^2-25)y=cos5x$.**(H June 2014)[LJIET]**	**04**
6.	Solve: $(D^2+5D+6)y=e^x$.**(H June 2014)[LJIET]**	**03**
7.	Solve $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=e^{4x}$.**(H Dec 2013)[LJIET]**	**03**
8.	Solve $(D^2-4D+3)y=sin3xcos2x$. **(H Dec 2013)(H NOV 2017,OLD))[LJIET]**	**04,o 7**
9.	Solve the differential equation$(D^3+D^2-D-1)y=cos2x$ **.(Dec2013 old)[LJIET]**	**04**
10.	Solve the differential equation $(D^2+4)y=x^2+sin2x$. **(H Dec 2013 old)[LJIET]**	**04**
11.	Find general solution of $y'''-y=0$.**(H June 2013, H June 2015, old)[LJIET]**	**02,0 2**
12.	Solve:(D^2+D-6)y=$e^{2x}sin3x$.**(H June 2013)[LJIET]**	**03**
13.	Solve:$(D^3-D^2-6D)y=x^2+1$ **(H June 2013)[LJIET]**	**07**
14.	Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+y=\frac{e^x}{x^2}$..**(H Jan 2013)[LJIET]**	**04**
15.	Solve$y'''-y''+100y'-100y=0$.**(H Jan 2013)[LJIET]**	**2.5**
16.	Solve $\frac{d^2y}{dx^2}+\frac{dy}{dx}-12y=e^{6x}$. **(H Jan 2013)[LJIET]**	**03**
17.	Show that$y=be^{2x}+ce^{2x}$is the solution of$\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=0$ **(H Dec 2013 old)[LJIET]**	**02**
18.	Find the general solution of $\frac{d^4y}{dx^4}-18\frac{d^2y}{dx^2}+81y=0$**(H May 2012)(H NOV 2017,OLD)[LJIET]**	**02,0 3**
19.	Find particular solution of $y=\frac{1}{(D+1)^2}$ coshx,where D = $\frac{d}{dx}$.**(H May 2012)[LJIET]**	**02**
20.	Solve $\frac{d^4y}{dx^4}-\frac{d^2y}{dx^2}+y=cost+e^{2t}+e^t$.**(H May 2012)[LJIET]**	**03**
21.	Solve:$\frac{d^2y}{dx^2}-4\frac{dy}{dx}+4y=\frac{e^{2x}}{x^5}$. **(H May 2012)[LJIET]**	**03**

22.	Solve:$\frac{d^3y}{dx^3}-\frac{d^2y}{dx^2}+3\frac{dy}{dx}+5y=e^x cos3x$.**(H May 2012)[LJIET]**	**03**
23.	Solve the differential equation$\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=2e^x\cos\left({}^{x}/_{2}\right)$. **(H May 2012)[LJIET]**	**03**
24.	Find the general solution of $(D^2+1)=0$**(H Dec 2011)[LJIET]**	**02**
25.	Solve$16y''-8y'+5y=0$ **(H Dec 2011)[LJIET]**	**02**
26.	Solve the non homogeneous equation 1. $y''-3y'+2y=e^x$ 2. $y''+y'=secx$**(H Dec 2011)[LJIET]**	**07**
27.	Find the general solution :$y'''-3y''-y=4e^t$.**(H Dec 2011)[LJIET]**	**04**
28.	Solve $(D^2+a^2)y=cosecax$. **(H May 2011)[LJIET]**	**04**
29.	Solve $(D^4+2a^2D^2+a^4)y=cosax$ **(H May 2011)[LJIET]**	**04**
30.	Find the particular solution of $y''-2y'+5y=5x^3-6x^2$+6x. **(H March 2010)[LJIET]**	**02**
31.	Solve: $(D^2+4D+4)y=\frac{e^{-2x}}{x^2}$. **(H March 2010)[LJIET]**	**03**
32.	Solve $(D^2+16)y=x^4+e^{3x}+\cos 3x$**(H Jan. 2015)[LJIET]**	**04**
33.	Solve the differential equations: $\frac{d^2y}{dx^2}+7\frac{dy}{dx}-18y=0$ 2. $y''+y'-2y=0, y(0)=4, y'(0)=-5$**(H Jan. 2015 old)[LJIET]**	**07**
34.	Solve the differential equation $(D^2-2D+1)y=10e^x$**(H June 2015 new)[LJIET]**	**03**
35.	Solve $(D^3-7D+6)y=e^{2x}$**(H June 2015)[LJIET]**	**04**
36.	Solve $(D^2+9)y=\cos 2x+\sin 2x$**(H June 2015)[LJIET]**	**04**
37.	Solve $(D^2-49)y=\sinh 3x$**(H June 2015 old)[LJIET]**	**04**
38.	Solve $(\mathrm{D}^2-5\mathrm{D}+6)\mathrm{y}=\mathrm{x}+\mathrm{e}^{4\mathrm{x}}$.**(H Dec 2015)[LJIET]**	**04**
39.	Solve $(D^2-8D+9)y=40\sin 5x$. **(H Dec 2015)[LJIET]**	**04**
40.	Find the complete solution of$\frac{d^3y}{dx^3}+8y=\cosh(2x)$.**(H Dec 2015, new)[LJIET]**	**03**
41.	Solve completely , the differential equation $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=\cos(2x)\,sinx$.**(H Dec 2015, new course)[LJIET]**	**03**
42.	Solve $(D^3+4D)y=sin2x$. **(H June 2016, old)[LJIET]**	**3.5**
43.	Solve $(D^2+D)y=\frac{1}{1+e^x}$. **(H June 2016, old)[LJIET]**	**3.5**
44.	Solve $(D^2-6D+9)y=x^2e^{3x}$.**(H June 2016, old)[LJIET]**	**3.5**
45.	Solve $(D^2-4)y=x^2$. **(H June 2016, old)[LJIET]**	**3.5**
46.	Solve $(D^2+9)y=2sin3x+cos3x$. **(H June 2016)[LJIET]**	**03**
47.	Solve $(D^2+D-6)y=e^{2x}$ **(H Dec 2016, old)[LJIET]**	**04**
48.	Solve $(D^3+D)y=cosx$ **(H Dec 2016, old)[LJIET]**	**03**
49.	Solve $(D^2-5D+6)y=xe^{4x}$**(H Dec 2016, old)[LJIET]**	**04**
50.	Solve $(D^3+8)y=x^4+2x+1$ **(H Dec 2016, old)[LJIET]**	**03**
51.	Solve: $(D^3-3D^2+9D-27)y=\cos 3x$.**(H Dec 2016)[LJIET]**	**03**
52.	Solve: $(D^3-D)y=x^3$. **(H Dec 2016)[LJIET]**	**03**
53.	Solve $(D^2-1)y=xe^x$ where D=$\frac{d}{dx}$**(H May 2017)[LJIET]**	**03**
54.	Solve $(D^4-16)y=e^{2x}+x^4$ where D=$\frac{d}{dx}$ **(H May 2017)) [LJIET]**	**07**
55.	Solve y”+y’=0**(H May 2017,old)[LJIET]**	**03**
56.	Solve $y''-3y'+2y=e^{3x}$ **(H MAY-2018)[LJIET]**	**03**
57.	Solve $(D^2+9)y=\cos 4x$ **(H MAY-2018)[LJIET]**	**04**
58.	Solve $y'''-6y''+11y'-6y=0$ **(H MAY-2018)[LJIET]**	**03**

59.	Find the general solution of $y'''-3y''+3y'-y=4e^{t}$ **(H NOV 2017,old)[LJIET]**	**04**
60.	Find the general solution of the following differential equation : $\frac{d^3y}{dx^3}-2\frac{dy}{dx}+4y=e^x\cos x$ **(H Nov-2017)[LJIET]**	**04**
61.	Solve $(D^2-4)y=1+e^x$; where $D=d/dx$. **(H Nov 2018)[LJIET]**	**04**
62.	Solve $\frac{d^4y}{dx^4}-2\frac{d^2y}{dx^2}+y=0$ **(H Nov 2018)[LJIET]**	**03**
63.	Solve the differential equation. $(D^3-2D^2+4D-8)y=0$; where $D=d/dx$ **(H Nov 2018)[LJIET]**	**04**
64.	Solve: $\frac{d^4x}{dy^4}+4x=0$ **(H Nov 2018)[LJIET]**	**04**
65.	Solve: $\frac{d^3y}{dt^3}-6\frac{d^2y}{dt^2}+11\frac{dy}{dt}-6y=0$ **(H Nov 2018)[LJIET]**	**04**
66.	Solve $(D^2-4)y=e^x+\sin 2x$. **(H Nov 2018)[LJIET]**	**03**
	TOPIC: 2 Cauchy-Euler and Legendre's Equation	
	MCQ/ Short Questions	
1.	Write the steps to solve Cauchy Euler's differential equation. **[LJIET]**	**01**
2.	The solution of $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}=0$ is __________.**[LJIET]**	**01**
	Descriptive	
	NUMERICALS	
1.	Solve the Euler-Cauchy equation $x^2y''-2.5xy'-2.0y=0$. **(H May 2011)[LJIET]**	**02**
2.	Solve $x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10(x+\frac{1}{x})$. **(H May 2011,H June 2014, H Jan 2013, H Jan 2015, old)[LJIET]**	**04,04,05,07**
3.	Solve:$(2x+5)^2\frac{d^2y}{dx^2}-6(2x+5)\frac{dy}{dx}+8y=6x$.**(H JUNE 2014 old)[LJIET]**	**04**
4.	Solve the differential equation $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}-3y=x^2logx$.**(H Dec 2013 old)[LJIET]**	**04**
5.	Solve $x^2y''+4xy'-4y=sin(lnx)$ **(H June 2013)[LJIET]**	**04**
6.	Solve:$(1+x^2)\frac{d^2y}{dx^2}+(1+x)\frac{dy}{dx}+y=4\cos(\log(1+x))$ **.(H May 2012,H Dec 2015)[LJIET]**	**03,05**
7.	Solve the differential equation$(X^2D^2-3XD+4)y=x^2$ given that y (1)=1 and y'(1)=0. **(H May 2012)[LJIET]**	**03**
8.	Solve: $(x^2D^2-3xD+4)y=0, y(1)=0, y'(1)=3$.**(H Dec 2011)[LJIET]**	**02**
9.	Solve: $\mathrm{x^2y''-4xy'+6y=21x^{-4}}$**(H May 2011)(H NOV 2017,OLD)[LJIET]**	**04,07**
10.	Find the general solution of the equation $(x^2D^2-2xD+2)y=x^3cosx$. **(H Dec 2010)[LJIET]**	**04**
11.	Solve $(x^2D^2-3xD+3)y=3lnx-4$. **(H March 2010)[LJIET]**	**03**
12.	Solve $x^2D^2y-3xDy+5y=x^2\sin(\log x)$**(H June 2015)[LJIET]**	**05**
13.	Solve $x^2\frac{d^2y}{dx^2}-2y=x^2+\frac{1}{x}$**(H June 2015, old)[LJIET]**	**04**
14.	Solve:$(3x+2)^2\frac{d^2y}{dx^2}+3(3x+2)\frac{dy}{dx}-36y=3x^2+4x+1$.**(H June 2015, old)[LJIET]**	**04**

15.	Solve completely the differential equation $x^2\frac{d^2y}{dx^2}-6x\frac{dy}{dx}+6y= x^{-3}logx$.**(H Dec 2015, new)[LJIET]**	**04**
16.	Solve $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=x^2\sin(lnx)$. **(H Dec 2016)[LJIET]**	**04**
17.	Solve $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+y=\sin(\ln x)$**(H May 2017)[LJIET]**	**04**
18.	Solve the following Cauchy-Euler equation $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=logxsin(logx)$. **(H Nov-2017)[LJIET]**	**07**
19.	Solve $x^2y''+xy'+y=0$ **(H Nov 2018)[LJIET]**	**03**
20.	Solve: $(x^2D^2+4xD+2)y=x+logx$ **(H Nov 2018)[LJIET]**	**05**
21.	Solve $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=e^x$.**(H Nov 2018)[LJIET]**	**07**
	TOPIC: 3 Method of Variation of Parameters	
	MCQ/ Short Questions	
1.	Find the Wronskian of the two function sin2x and cos2x. **(H Dec 2016)[LJIET]**	**01**
	Descriptive	
	NUMERICALS	
1.	Solve:$\frac{d^2y}{dx^2}+4y=tan2x$by method of variation parameter.**(H June 2014 old,new)[LJIET]**	**04,04**
2.	Using method of variation parameter solve $y''-2y'+y=e^xx^{\frac{3}{2}}$**(H June 2013)[LJIET]**	**04**
3.	Solve the differential equation by the method of variation of parameter .$\frac{d^2y}{dx^2}+y=secx$ **(H Dec 2013)[LJIET]**	**07**
4.	Solve $(D^2-4D+4)y=\frac{e^{2x}}{1+x^2}$ where D=$\frac{d}{dx}$. **(H May 2012)[LJIET]**	**03**
5.	Using the method of variation of parameters $\frac{d^3y}{dx^3}+\frac{dy}{dx}=cosecx$.**(H May 2012, H Jan 2013)[LJIET]**	**03,05**
6.	Solve $(D^2-3D+2)y=\frac{e^x}{1+e^x}$by method of variation parameter.**(H Jan 2013)[LJIET]**	**04**
7.	Using the method of variation of parameters find the general solution of the differential equation $(D^2-2D+1)y=3x^{\frac{3}{2}}e^x$.**(H Dec 2010)[LJIET]**	**05**
8.	Solve the non-homogeneous Euler-Cauchy equation $x^3y'''-3x^2y''+6xy'-6y=x^4logx$by Variation of parameters method. **(H May 2011)[LJIET]**	**04**
9.	Find the general solution of y''+9y=sec3x by method of variation parameter . **(H March 2010)[LJIET]**	**03**
10.	Using the method of variation of parameter solve the differential equation: $y''+y=secx$.**(H Dec 2009)[LJIET]**	**05**
11.	Find general solution of $y''+9y=\sec 3x$ using method of variation of parameters. **(H Jan 2015 old, H June 2015 new) (H MAY-2018,old)[LJIET]**	**04,04,04**
12.	Use Method of variation of Parameters solve the differential equation $y''+y=\cot x$. **(H June 2015, old)[LJIET]**	**04**
13.	Find solution of $\frac{d^2y}{dx^2}+9y=tan3x$, using the method of variation of parameters. **(H Dec 2015, new)[LJIET]**	**04**
14.	Find the solution of $y''+a^2y=tan\ ax$,by the method of variation of parameters.**(H**	**04**

	June 2016)[LJIET]	
15.	Find the solution of $y'' - 3y' + 2y = e^x$, using the method of variation of parameters.**(H Dec 2016)[LJIET]**	**04**
16.	Use Method of variation of Parameters to find the general solution $y'' - 4y' + 4y = \frac{e^{2x}}{x}$.**(H May 2017)[LJIET]**	**07**
17.	Solve $y''+4y = 4\tan 2x$ by method of variation parameter**(H MAY-2018)[LJIET]**	**07**
18.	Find solution of $\frac{d^2y}{dx^2} + y = \sin x$, using the method of variation of parameters**(H Nov-2017)[LJIET]**	**04**
19.	Solve using method of variation of parameters. $y'' + 2y' + y = e^{-x}\cos x$ **(H Nov 2018)[LJIET]**	**07**
20.	Find the solution of $y'' - 2y' + 2y = e^x \tan x$ using method of variation of parameter. **(H Nov 2018)[LJIET]**	**07**
21.	Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{e^x}{1+e^x}$, by using method of variation of parameter. **(H Nov 2018)[LJIET]**	**04**
	TOPIC: 4 Initial Value Problem and Find Second solution	
	MCQ/ Short Questions	
1.	If $y = c_1y_1 + c_2y_2 = e^x\,(c_1\cos x + c_2\sin x)$ is a complementary function of a second order differential equation, find the Wronskian $W(y_1, y_2)$.**(H Dec 2015 new course)[LJIET]**	**01**
2.	If $y = (c_1 + c_2 x)e^x$ is a complementary function of a second order differential equation, find the Wronskian $W(y_1, y_2)$.**(H May 2017) [LJIET]**	**01**
	Descriptive	
	NUMERICALS	
	Solve the IVP $y'' - 9y = 0, y(0) = 2, y'(0) = -1$**(H Jan 2015)[LJIET]**	**03**
1.	Solve the initial value problem : $y'' + y' - 2y = 0, y(0) = 4\ and\ y'(0) = -5$. **(H Dec 2013 old, H Jan 2015 old)[LJIET]**	**02,04**
2.	Find the solution of differential equation y''-5y'+6y=0 with initial condition y(1)=e^2 and y'(1)=$3e^2$.**(H May 2012)[LJIET]**	**02**
3.	Verify that y=e^x(acosx+bsinx) is a solution of $y'' + 2y' + 2y = 0$, where a and b are constants.**(H Dec 2011)[LJIET]**	**02**
4.	Solve the IVP $L\frac{dI}{dt} + RI = 0, I(0) = I_0,$ where R,L and I_0 being constant.**(H Dec 2010)[LJIET]**	**03**
5.	Verify that function $x^{-1/2}\ and\ x^{3/2}$ form a basis of solutions of $4x^2y'' - 3y = 0;\ and\ solve\ it\ when\ y(1)3, y'(1) = 2.5$**(Dec2011)[LJIET]**	**03**
6.	Solve : $y'' + 4y' + 4y = 0, y(0) = 1, y'(0) = 1$**(H Dec 2011,H June 2016)[LJIET]**	**02,03**
7.	Solve: $y''' - y'' + 100y' - 100y = 0,\ y(0) = 1, y'(0) = 11,\ y''(0) = -299$. **(H Dec 2011)[LJIET]**	**03**
8.	Obtain the second linearly independent solution of $xy'' + 2y' + xy = 0\ given\ that\ y_1(x) = \frac{\sin x}{x}$. **(H May 2011)[LJIET]**	**03**
9.	Write Abel-Liouville formula use it to check that the set{x,x^2, $x\log\lvert x\rvert$}.**(H May**	**02**

	2011)[LJIET]	
10.	Find a second order homogeneous linear differential equation for which the Functions $x^2, x^2 \log x$ are solutions. **(H Dec 2010)[LJIET]**	**02**
11.	Solve $y'' + 2y' + 2y = 0, y(0) = 1,\ y\left(\frac{\pi}{2}\right) = 0$.**(H Dec 2010)[LJIET]**	**02**
12.	Find a basis of solution for the differential equation $x^2y'' - xy' + y = 0$,if one of its solutions is $y_1 = x$. **(H Dec 2010)[LJIET]**	**03**
13.	Solve the initial value problem $y'' + 4y = 8e^{-2x} + 4x^2$+2, y(0)=2, y'(0)=2. **(H Dec 2010)[LJIET]**	**05**
14.	Solve the initial value problem : $y'' + y' - 2y = 0, y(0) = 4$ and $y'(0) = -5$.**(H Dec 2009)[LJIET]**	**05**
15.	Given the functions e^x and e^{-x} on any interval [a,b]. Are these functions linearly independent or dependent?.**(H Dec 2009)[LJIET]**	**04**
16.	If one of the solutions of $x^2y'' - 4xy' + 6y = 0$ is $y_1 = x^2, x > 0$, then determine its second solution.**(H Jan 2013 old)[LJIET]**	**05**
17.	If $y_1 = x$ is one of the solution of $x^2y'' + xy' - y = 0$ then find the second solution. **(H June 2014)[LJIET]**	**03**
18.	If $y_1 = e^{-2x}$ is one solution of $y'' + 4y' + 4y = 0$ then find the second solution. **(H June 2015, old)[LJIET]**	**03**
19.	Find indicial roots of the given differential equation $4x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ **(H NOV 2017,old)[LJIET]**	**04**
	TOPIC:5 Free Oscillations	
	MCQ/ Short Questions	
	Descriptive	
	NUMERICALS	
1.	The differential equation for a circuit in which self-inductance and capacitance neutralize each other is $L\frac{d^2i}{dt^2} + \frac{i}{C} = O$.Find the current i as a Function of time t given that I as the maximum current and i=0 when t=0. **(H Dec 2013)[LJIET]**	**03**
2.	Find the steady state oscillation of the mass-spring system governed by the equation: $y'' + 3y' + 2y = 20\cos 2t$.**(H Dec 2009)[LJIET]**	**05**
	TOPIC:6 Method of Undetermined Coefficients	
	MCQ/ Short Questions	
	Descriptive	
	NUMERICALS	
3.	Using method of undetermined coefficients solve $y'' - 2y' + y = e^x + x$. **(H June 2013)[LJIET]**	**03**
4.	Using the method of undetermined coefficients , solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 6x + 3x^2 - 6x^3$ **(H Jan 2013)[LJIET]**	**05**
5.	Solve the initial value problem by method of undeterminedcoefficients $y''' + 3y'' + 3y' + y = 30e^{-x}, y(0) = 3, y'(0) = -3, y''(0) = -47$**(H May**	**04**

	2011)[LJIET]	
6.	Using the method of undetermined coefficient, find the general solution of the differential equation$y'' + 2y' + 10y = 25x^2 + 3$. **(H Dec 2010)[LJIET]**	**04**
7.	Find the solution of differential equation $y'' + 4y = 2sin3x$ by method of undetermined coefficient . **(H March 2010,H June 2014 old)[LJIET]**	**02,02**
8.	Using the method of undetermined coefficients, solve the differential equation: $y'' + 4y = 8x^2$.**(H Dec 2009, H June 2016)[LJIET]**	**05,04**
9.	Solve differential equation using method of undetermined coefficient $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 3e^{-2x}$ **(H Jan 2015, old)[LJIET]**	**03**
10.	Find the Particular Solution of the Differential Equation $y'' + 9y = \cos 5x$ by method of undetermined coefficient. **(H June 2015, old course)[LJIET]**	**02**
11.	Use the method of undetermined coefficients to solve the different equation $y'' + 9y = 2x^2$.**(H May 2017)[LJIET]**	**04**
12.	solve y'''+3y''+3y'+y=30 e^{-x} by the method of undetermined coefficients. **(H May 2017,old)[LJIET]**	**04**
13.	Solve $y''-2y'+5y = 5x^3 - 6x^2 + 6x$ by method of undetermined coefficients. **(MAY-2018)[LJIET]**	**07**
14.	Find the Particular Solution of the Differential Equation $y''+25y = \cos 7x$ by method of undetermined coefficient **(MAY-2018,old)[LJIET]**	**03**
15.	Obtain the general solution $(D-2)^3 Y = 17e^{2x}$ using method of undetermined coefficient **(H Nov 2017,OLD)[LJIET]**	**07**
16.	Solve the following differential equation using the method of undetermined coefficient :· $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = 2x^2 + 3e^{-x}$ **(H Nov-2017)[LJIET]**	**07**
	Solve by the method of undetermined coefficients. $y'' + 10y' + 25y = e^{-5x}$ **(H Nov 2018)[LJIET]**	**04**
17.	Find solution of $(D^2 + D)y = x^2 + 2x + 4$ using method of undetermined coefficient **(H Nov 2018)[LJIET]**	**07**
18.	Solve $(D^3 + 3D^2 + 2D)y = x^2 + 4x + 8$, by using method of undetermined coefficients. **(H Nov 2018)[LJIET]**	**04**
	Chapter No. 05 :Series Solution of Ordinary Differential Equations and Special Functions	
	TOPIC:1 INTRODUCTION AND EXISTENCE OF POWER SERIES SOLUTION	
	MCQ/ Short Questions	
1.	For the equation $y'' + xy' + y = 0$ if both the terms $(x-0)P(x)$& $(x-0)^2Q(x)$ are analytic at $x = 0$ then the point $x = 0$ is called_______________**[LJIET]**	**01**
2.	For the differential equation $x^2y'' + xy' + y = 0$, the point $x = 1$ is called _______________**[LJIET]**	**01**
3.	Define Irregular singular Point for the differential equation. **[LJIET]**	**01**
4.	Define Singular Point for the differential equation. **[LJIET]**	**01**
5.	What is analytic function? **[LJIET]**	**01**
6.	Find the singular point of the differential equation	**01**

	$(1-x^2)y''-2xy'+n(n+1)y=0$**(H May 2017) [LJIET]**	
	Descriptive	
1.	Define ordinary point of the equation $y''+P(x)y'+Q(x)y=0$**(H June 2014old course, H June 2015old course)[LJIET]**	**02 02**
2.	Define Ordinary Point of the differential equation $y''+P(x)y'+Q(x)y=0$. Give an example of it. (**H MAY-2018,old)[LJIET]**	**03**
3.	**NUMERICAL**	
4.	$x=0$is a regular singular point of $2x^2y''+3xy'+(x^2-4)y=0$ true or false ? **(H June 2016)[LJIET]**	**02**
5.	Determine if $x=1$ is regular singular point of $(1-x^2)y''-2xy'+n(n+1)y=0$ where n is a constant. **(H Dec. 2011) [LJIET]**	**02**
6.	Determine the singular points of the differential equation $2x(x-2)^2y''+3xy'+(x-2)y=0$ and classify them as regular or irregular. **(H May 2012) [LJIET]**	**02**
7.	Classify the singularities for the following differential equations 1. $2x^2y''+6xy'+(x+3)y=0$ 2. $x(x+1)^2y''+(2x-1)y'+x^2y=0$**(H Jan 2013old course) [LJIET]**	**04**
8.	Discuss the singularities of $x^3(x-1)y''-3(x-1)y'+xy=0$**(H June 2013old course) [LJIET] or** Discuss about ordinary point ,singular point, regular singular point, and irregular singular point for the differential equation $x^3(x-1)y''-3(x-1)y'+xy=0$**(H May 2017)[LJIET]**	**02,0 3**
9.	Find the ordinary points, regular singular points and irregular singular points of the differential equation $x^3y''+5xy'+3y=0$**(H Jan. 2015old course) [LJIET]**	**04**
10.	Find the ordinary and singular points of $2x^2y''+6xy'+(x+3)y=0$**(H June 2015)[LJIET]**	**03**
11.	Find ordinary and singular points for $2x(x-2)^2y''+3xy'+(x-2)y=0$ **(H Dec. 2015)[LJIET]**	**03**
12.	Discuss the nature of point -1 and 0 for xy’’+(sinx)y-0.**(H NOV 2017,old)[LJIET]**	**03**
13.	Solve in series the equation $y'=3x^2y$. **(H Nov 2018)[LJIET]**	**07**
14.	Find Radius of convergence of the power series. $\sum_0^\infty \frac{x^n}{n!}$ **(H Nov 2018)[LJIET]**	**03**
15.	Find series solution of $(1+x^2)y''+xy'-y=0$ **(H Nov 2018)[LJIET]**	**07**
16.	Find series solution of $\frac{d^2y}{dx^2}+x^2\frac{dy}{dx}=0$ **(H Nov 2018)[LJIET]**	**07**
	TOPIC:2 Power Series Method	
	MCQ/ Short Questions	
	Descriptive	
	NUMERICAL	
1.	Using Method of series solution solve the differential equation: $y''+y=0$ (near x=0/about x=0)**(H Dec. 2009, H Dec. 2011, H Jan. 2013old course, H Dec. 2013old course, H June 2014, H June 2015old course)[LJIET]** Find the series solution of $y''+y=0$ **(H May 2017,old)** (**H MAY-2018,old)** .**(H NOV 2017,old)[LJIET]**	**04,0 4,05, 05,0 7,03, 07,0 4,07**

2.	If possible find the series solution of $y'' = y'$**(H March 2010) [LJIET]**	**03**
3.	Solve the Legendre's equation $(1-x^2)y'' - 2xy' + n(n+1)y = 0$**(H March 2010) [LJIET]**	**04**
4.	Solve $y' = 2xy$ by Power series Method. **(H May 2011, H Jan. 2015, H Dec 2016,old) [LJIET]**	**02,07,07**
5.	Find the power series solution of the equation $(1-x^2)y'' - xy' + py = 0$, p is an arbitrary constant. **(H May 2011) [LJIET]**	**04**
6.	Find the power series solution of the equation $(x^2+1)y'' + xy' - xy = 0$ about an ordinary point. (Near x=0, about x=0)) **(H May 2011, H Jan. 2013, H June 2013,H May 2017) [LJIET]**	**03,07,07,07**
7.	Find the Power series solution in powers of x of $y' + 2xy = 0$**(H Dec. 2011)[LJIET]**	**04**
8.	Find the series solution of $(x^2+1)y'' + xy' - 9y = 0$**(H May 2012, H June 2015, H June 2015)[LJIET]**	**04,07,07**
9.	Find the series solution of $y'' = 2y'$ in powers of x **(H Jan. 2013, H June 2016)[LJIET]**	**07, 07**
10.	Find power series solution of the equation $\frac{d^2y}{dx^2} + xy = 0$ in powers of x. (about x=0) **(H June 2013, H June 2014, H June 2014old course, H June 2016, H Dec 2016)[LJIET]**	**07,07,03 07,07**
11.	By power series method solve $(1-x^2)y'' - 2xy' + 2y = 0$**(H March 2010, H June 2013old course, H Dec. 2013, H Jan. 2015old course)(H Nov-2017)[LJIET]**	**04,07,07, 07,07**
12.	Solve in series the equation $\frac{d^2y}{dx^2} + x^2y = 0$**(H Dec. 2013, H Jan. 2015old course)[LJIET]**	**07,04**
13.	Find the series solution of $(x-2)\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + 9y = 0$ about $x_0 = 0$**(H Dec. 2015)[LJIET]**	**07**
14.	Find the power series solution about $x = 0$ of $y'' + xy' + x^2y = 0$**(H Dec. 2015)[LJIET]**	**07**
15.	Find the series solution of $y'' + x^2y = 0$ about an ordinary point x=0. **(H MAY-2018)[LJIET]**	**07**
16.	Find the series solution of the differential equation $(1+x^2)y'' + xy' - y = 0$. **(H Nov 2018)[LJIET]**	**07**
	TOPIC:3 Frobenius Method	
	MCQ/ Short Questions	
1.	In Frobenius method for solving D.E , the equation formed by equating to zero the coefficient of the lowest power term is called ________________**[LJIET]**	**01**
2.	In the series solution of a D.E. by Frobenius method logarithmic term always present in the answer when the root of an indicial equation are______________**[LJIET]**	**01**
3.	In the Frobenius method , the series solution of any D.E. around $x = 0; x \neq 0$, Assumes the form_______________**[LJIET]**	**01**
	Descriptive	
	NUMERICAL	
1.	Find the series solution of differential equation $xy'' + 2y' + xy = 0$.**(H March 2010, H**	**04,0**

	Dec. 2013old course) [LJIET]	**5**
2.	Find the series solution of differential equation $(x^2-x)y''-xy'+y=0$ **(H March 2010) [LJIET]**	**04**
3.	Find the series solution of differential equation $x^2y''+x^3y'+(x^2-2)y=0$ by Frobenious Method. **(H Dec. 2010) [LJIET]**	**06**
4.	Find the series solution of $xy''+y'+xy=0$**(H May 2011) [LJIET]**	**07**
5.	Solve by Frobenious Method at $x=0$:$x(x-1)y''+(3x-1)y'+y=0$ **(H Dec. 2011) [LJIET]**	**04**
6.	Find the series solution by using Frobenious Method: $xy''+y'-y=0$**(H May 2012) [LJIET]**	**04**
7.	Using Frobenious Method solve: $2x(1-x)y''+(1-x)y'+3y=0$**(H June 2013old course) [LJIET]**	**07**
8.	Solve in series the differential equation $4x\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=0$**(H Jan. 2015)[LJIET]**	**07**
9.	Find the series solution of $2x(x-1)y''-(x+1)y'+y=0;\ x_0=0$**(H June 2015)[LJIET]**	**07**
10.	Use Frobenius method to solve $2x^2y''-xy'+(1-x^2)y=0$**(H June 2015)[LJIET]**	**07**
11.	Explain the regular-singular point of a second order differential equation and find the roots of the indicial equation to $x^2y''+xy'-(2-x)y=0$**(H Dec. 2015)[LJIET]**	**07**
12.	Find the general solution of $2x^2y''+xy'+(x^2-1)y=0$ by using frobenius method. **(H Dec 2016)[LJIET]**	**07**
13.	Find the series solution of the differential equation $3xy''+2y'+y=0$**(H May 2017,old)[LJIET]**	**07**
14.	Find the series solution of $8x^2y''+10xy'-(1+x)y=0$ **(H MAY-2018)[LJIET]**	**07**
15.	Find the Series Solution of the Differential Equation $2x^2y''+(2x^2-x)y'+y=0$. **(MAY-2018,old)[LJIET]**	**07**
16.	Using the method of frobenius obtain the two linearly independent solutions about x=0 for the equation $x^2y''+x(x-1)y'+(1-x)y=0$ **(H NOV 2017,old)[LJIET]**	**07**
17.	Find the power series solution $3x\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=0$ about the point x=0, using Frobenius method**(H Nov-2017)[LJIET]**	**07**
18.	Find the power series solution of the equation, $4x\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=0$, about $x=0$. **(H Nov 2018)[LJIET]**	**07**
	TOPIC:4 Special functions	
	MCQ/ Short Questions	
	Descriptive	
1.	State the generating function and integral representation for the Bessel function $J_n(x)$.**(H Dec 2009) [LJIET]**	**02**
2.	Write the Bessel's function of the first kind.Also derive $J_0(x)$and $J_1(x)$ from it.**(H March 2010, H Dec 2011,H H Jan 2015 old) [LJIET]**	**03,0 1,03**
	NUMERICAL	
1.	Prove that: $J_{\frac{3}{2}}(x)=\sqrt{\frac{2}{\pi x}}\left(\frac{sinx}{x}-cosx\right)$.**(H Dec 2009, H May 2011,H Jan 2013,H June 2014 old) [LJIET]**	**02,0 3,2.5 ,03**

2.	Prove that: $J_{\frac{1}{2}}(x) = \sqrt{(2/\pi x)} \sin x$ **(H Jan 2013, H June 2015) [LJIET]**	**2.5,03**
3.	Prove that $J_0{}'(x) = -J_1(x)$.**(H March 2010, H Dec 2011) [LJIET]**	**04,02**
4.	Show that (i)$J_{n-1}(x) - J'_n(x) = \frac{n}{x} J_n(x)$ (ii) $J_0(0) = 1$.**(H Jan 2013) [LJIET]**	**04**
5.	Prove that $\frac{d}{dx}[x^n J_n(x)] = x^n J_{n-1}(x)$. **(H June 2013 old) [LJIET]**	**04**
6.	Determine the value of (a) $J_{\frac{1}{2}}(x)$ $(b))$ $J_{\frac{3}{2}}(x)$.**(H June 2016)[LJIET]**	**07**
7.	Prove that $\frac{d}{dx}\left(x^n J_n(x)\right) = x^n J_{n-1}(x)$. **(H Nov 2018)[LJIET]**	**04**

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