Subject Code: R13102/R13 **Set No - 1**

I B. Tech I Semester Regular Examinations Feb./Mar. - 2014

MATHEMATICS-I

(Common to All Branches)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

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PART-A

1.(i) Find the orthogonal trajectories of the curve $r = a(1+\cos\theta)$.

(ii) If $x = r sin\theta cos\varphi, y = r sin\theta sin\varphi, z = r\, cos\theta$, find $\frac{\partial(r,\theta,\varphi)}{\partial(x,y,z)}$, given that $\frac{\partial(x,y,z)}{\partial(r,\theta,\varphi)} = r^2 sin\theta$.

(iii) Find the Laplace transform of $f(t) = \begin{cases} t, & 0 < t < 1 \\ 0, & t > 1 \end{cases}$ using Heaviside function.

(iv) Let the heat conduction in a thin metallic bar of length L is governed by the equation $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$, t > 0. If both ends of the bar are held at constant temperature zero and the bar is initially has temperature f(x), find the temperature u(x,t).

(v) Solve $p^2 + pq = z^2$.

(vi) Find $\frac{1}{D^2-4D+4} x^2 sinx$. [4+4+4+4+3+3]

PART- B

2.(a) Solve $y(2x^2 - xy + 1)dx + (x - y)dy = 0$

(b) Find the complete solution of $y'' + 2y = x^2 e^{3x} + e^x \cos 2x$ [8+8]

3.(a) Solve $\frac{dy}{dx} + x sin2y = x^3 cos^2 y$

(b) Find the solution of $\frac{d^2y}{dx^2} + 4y = Sin\, 3x + \cos 2x$. [8+8]

4.(a) Find the Laplace transform of $f(t) = \frac{\cos at - \cos bt}{t}$.

(b) If $x = \sqrt{vw}, y = \sqrt{uw}, z = \sqrt{uv}$ and
$u = r sin\,\theta cos\varphi,\ v = r\, sin\theta\, sin\varphi\ and\ w = r cos\theta$, find $\frac{\partial(x,y,z)}{\partial(r,\theta,\varphi)}$. [8+8]

5.(a) Expand $f(x,y) = e^y \ln(1+x)$ in powers of x and y using MacLaurin's Series

(b) Solve $y'' - 8y' + 15y = 9te^{2t},\ y(0) = 5\ and\ y'(0) = 10$ using Laplace transforms [8+8]

6.(a) Solve $(y + xz)p - (x + yz)q = x^2 - y^2$.

(b) Solve the partial differential equation px+qy =1. [8+8]

7.(a) Find the partial differential equation of all spheres whose centers lie on z- axis.

(b) Find the solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$, if the initial deflection is

$f(x) = \begin{cases} \frac{2k}{l} x & if\ 0 < x < l/2 \\ \frac{2k}{l}(l - x) & if\ \frac{l}{2} < x < l \end{cases}$ and initial velocity equal to 0. [8+8]

Set No - 2

I B. Tech I Semester Regular Examinations Feb./Mar. - 2014

MATHEMATICS-I

(Common to All Branches)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**
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PART-A

1.(i) Find the complete solution of $(D^4 + 16)y = 0$.

(ii) If $x = r\cos\theta, y = r\sin\theta, z = z$, find $\frac{\partial(r,\theta,z)}{\partial(x,y,z)}$, given that $\frac{\partial(x,y,z)}{\partial(r,\theta,z)} = r$.

(iii) Solve $x^2p^2 + y^2q^2 = z^2$.

(iv) Find the solution, by Laplace transform method, of the integro-differential equation $y' + 3y + 2\int_0^t y(t)dt = t$

(v) Find the differential equation of the orthogonal trajectories for the family of parabola through the origin and foci on y-axis.

(vi) Find the solution of wave equation in one dimension using the method of separation of variables.

[3+3+4+4+4+4]

PART-B

2.(a) Solve $y(y^2 - 2x^2)dx + x(2y^2 - x^2)dy = 0$

(b) Find the complete solution of $y'' + 5y' - 6y = \sin 4x \sin x$.

[8+8]

3.(a) Solve $\cos x\, dy = y(\sin x - y)dx$.

(b) Find the solution of $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = 2xe^{3x} + 3e^x \cos 2x$.

[8+8]

4.(a) Find the Laplace transform of $f(t) = \int_0^t e^{-u}\cos u\, du$.

(b) Find the shortest distance from origin to the surface $xyz^2 = 2$.

[8+8]

5.(a) Find $\frac{\partial(u,v)}{\partial(r,\theta)}$ if $u = 2axy$ and $v = a(x^2 - y^2)$, where $x = r\cos\theta$ and $y = r\sin\theta$.

(b) Solve $y'' - 8y' + 15y = 9te^{2t}$, $y(0) = 5$ and $y'(0) = 10$ using Laplace transforms

[8+8]

6.(a) Form the partial differential equation by eliminating the arbitrary function from $xyz = f(x + y + z)$.

(b) Find the solution of $(D^2 - DD' - 2D'^2)z = (y - 1)e^x$, where $D = \frac{\partial}{\partial x}$ and $D' = \frac{\partial}{\partial y}$.

[8+8]

7.(a) Solve the partial differential equation $xzp + yzq = xy$.

(b) Find the temperature in a bar of length l which is perfectly insulated laterally and whose ends O and A are kept at 0^{o}C, given that the initial temperature at any point P of the rod is given by f(x).

[8+8]

Subject Code: R13102/R13 **Set No - 3**

I B. Tech I Semester Regular Examinations Feb./Mar. - 2014

MATHEMATICS-I

(Common to All Branches)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**
*****

PART-A

1.(i) Find the dimensions of rectangular box of maximum capacity whose surface area is S.
(ii) Find the orthogonal trajectories of the family of curves $x^{2/3} + y^{2/3} = a^{2/3}$.
(iii) A generator having emf 100 volts is connected in series with a 10 ohm resistor and an inductor of 2 henries. If the switch is closed at a time t =0, find the current at time t>0.
(iv) Find the Laplace transform of $f(t) = \begin{cases} t, & 0 < t < 1 \\ 0, & t > 1 \end{cases}$ using Heaviside function.
(v) Solve pq+qx = y.
(vi) Find the solution of $2x\frac{\partial z}{\partial x} - 3y\frac{\partial z}{\partial y} = 0$ by the method of separation of variables.

[4+4+4+4+3+3]

PART- B

2.(a) Solve $y(1+xy)dx + x(1-xy)dy = 0$
(b) Find the complete solution of $y'' + 4y = e^x sin^2 x$.

[8+8]

3.(a) Solve $2x\,y' + y = \frac{2x^2}{y^3}, y(1) = 2$.
(b) Find the solution of $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 5y = e^{2x} + 3\cos(4x+3)$.

[8+8]

4.(a) Find the Laplace transform of $f(t) = te^{-2t}cos\, t$.
(b) Find the maxima and minima of $x^3 + 3xy^2 - 15x^2 - 15\, y^2 + 72x$.

[8+8]

5.(a) Expand $f(x,y) = e^{xy}$ in powers of (x-1) and (y-1).
(b) Solve $y'' + 7y' + 10\, y = 4e^{-3t},\ y(0) = 0\ and\ y'(0) = -1$ using Laplace transforms.

[8+8]

6.(a) Form the partial differential equation by eliminating the arbitrary constants ‘a’ and ‘b’ from $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$.
(b) Find the solution of $\left(4D^2 + 12DD' + 9D'^2\right)z = e^{3x-2y}$, where $D = \frac{\partial}{\partial x}$ and $D' = \frac{\partial}{\partial y}$.

[8+8]

7.(a) Solve the partial differential equation $p\tan x + q\tan y = \tan z$.
(b) A tightly stretched string with fixed end points x=0 and x=l is initially in a position given by $y = y_0 sin^3\frac{\pi x}{l}$. If it is released from rest from this position, find the displacement $y(x,t)$.

[8+8]

Subject Code: R13102/R13 **Set No - 4**

I B. Tech I Semester Regular Examinations Feb./Mar. - 2014

MATHEMATICS-I

(Common to All Branches)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**
*****

PART-A

1.(i) Find the distance from the centre at which the velocity in simple harmonic motion will be 1/3rd of the maximum.

(ii) Find a point with in a triangle such that the sum of the squares of its distances from the three vertices is minimum.

(iii) Find the solution, by Laplace transform method, of the integro-differential equation $y' + 4y = \int_0^t y(t)dt$, $y(0) = 0$.

(iv) Uranium disintegrates at a rate proportional to the amount present at that time. If M and N grams of Uranium that rae present at times T_1 and T_2 respectively, find the half life of Uranium.

(v) Find the complete solution of $(D^3 - 3D^2 D' + 3 \; DD'^2 - D'^3)z = 0$.

(vi) Solve $z^2 = 1 + p^2 + q^2$.

[4+4+4+4+3+3]

PART- B

2.(a) Solve $(3y^2 + 4xy - x)dx + x(x + 2y)dy = 0$

(b) Find the solution of $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} - 6y = sin4x\; cosx$.

[8+8]

3.(a) Find the complete solution of $y'' + 2y = x^2e^{3x} + e^x \cos 2x$.

(b) Solve $x z' + z\log z = z(\log z)^2$.

[8+8]

4.(a) Find the Laplace transform of $f(t) = te^{2t}cos\, 2t$.

(b) If $u = sin^{-1}(\frac{x^3+y^3}{\sqrt{x}+\sqrt{y}})$, prove that $xu_x + yu_y = \frac{5}{2}\tan u$.

[8+8]

5.(a) If $w = (y - z)(z - x)(x - y)$, find the value of $\frac{\partial w}{\partial x} + \frac{\partial w}{\partial y} + \frac{\partial w}{\partial z}$.

(b) Solve $y'' + 2y' + 5\,y = e^{-t}\sin t$, $y(0) = 0 \; and \; y'(0) = 1$ using Laplace transforms.

[8+8]

6.(a) Form the partial differential equation by eliminating the arbitrary constants ‘a’ and ‘b’ from $z = ax + by + a^2 + b^2$.

(b) Using method of separation of variables, solve $u_{xt} = e^{-t}cosx$ with $u(x,0) = u(0,t) = 0$.

[8+8]

7.(a) Find the temperature in a thin metal rod of length L, with both ends insulated and with initial temperature in the rod is $sin(\frac{\pi x}{L})$.

(b) Solve the partial differential equation $p\,x^2 + qy^2 = z^2$.

[8+8]

Code No: R10102/R10

Set No. 1

I B.Tech I Semester Supplementary Examinations, Feb/Mar 2014
MATHEMATICS-I
(Common to Civil Engineering, Electrical & Electronics Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Computer Engineering, Aeronautical Engineering, Bio-Technology, Automobile Engineering, Mining and Petroliem Technology)

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Solve $(x^2 + y^2 - a^2)x\,dx + (x^2 - y^2 - b^2)y\,dy = 0$. [7+8]
   (b) If air is maintained at $20^0\,C$and the temperature of the body cools from $80^0\,C$ to $60^0\,C$ in 10 minutes, find the temperature of the body after 30 minutes.
2. (a) Solve $(D^2 + a^2)y = Sec\,ax$
   (b) Solve $(D^2 + 4)y = e^x + Sin\,2x$ [8+7]
3. (a) If V = $\log(x^2 + y^2) + x - 2y$ find $\frac{\partial V}{\partial x}.,\frac{\partial V}{\partial y},\frac{\partial^2 V}{\partial x^2}.\frac{\partial^2 V}{\partial y^2}$.
   (b) If U = $xe^{xy}$where $x^2 + y^2 + 2xy = 1$, find $\frac{\partial^2 U}{\partial x^2}$. [8+7]
4. (a) Trace the curve r = 2 + 3 sinθ.
   (b) Trace the curve $y^2(2a - x) = x^3$. [8+7]
5. (a) Find the surface of the solid generated by revolution of the lemniscate $r^2 = a^2\cos^2\theta$ about the initial line.
   (b) Show that the whole length of the curve $x^2(a^2 - x^2) = 8a^2y^2$ is $\pi a\sqrt{2}$. [8+7]
6. (a) Show that $\int_0^{4a}\int_{\frac{y^2}{4a}}^{y}\frac{x^2-y^2}{x^2+y^2}$ dx dy = $8a^2\left(\frac{\pi}{2} - \frac{5}{3}\right)$.
   (b) Evaluate $\iint_R ydxdy$ where R is the domain bounded by y-axis, the curve y=$x^2$and the line $x + y = 2$ in the first quadrants . [8+7]
7. (a) If V= e^{xyz}(i+j+k), find curl V.
   (b) Find the constants a and b so that the surface ax^2-byz = (a+2)x will be orthogonal to the surface 4x^2y +z^3 =4 at the point (1,-1,2) [8+7]
8. (a) Show that the area of the ellipse $x^2/a^2 + y^2/b^2 = 1$ is πab
   (b) If f = (2x^2 − 3z)i − 2xyj − 4xzk, evaluate
   (i) $\int_v \nabla.f dV$and
   (ii) $\int_v \nabla\times f dV$ where V is the closed region bounded by x = 0, y = 0, z = 0, 2x + 2y +z = 4. [8+7]

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I B.Tech I Semester Supplementary Examinations, Feb/Mar 2014
MATHEMATICS-I
(Common to Civil Engineering, Electrical & Electronics Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Computer Engineering, Aeronautical Engineering, Bio-Technology, Automobile Engineering, Mining and Petroliem Technology)

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Solve $e^y\left(1+\frac{dy}{dx}\right)=e^x$
   (b) Show that the family of curves $\frac{x^2}{a^2+\lambda}+\frac{y^2}{a^2+\lambda}=1$, where '$\lambda$' is a parameter is self orthogonal. [8+7]
2. (a) Solve $(D^2+9)y=2\,Cos\,^2x$. (b) Solve $\frac{d^2y}{dx^2}+4\,y=2e^xSin^2\,x$. [8+7]
3. (a) Calculate the approximate value of $\sqrt{10}$ to four decimal places using Taylor's theorem.
   (b) Find 3 positive numbers whose sum is 600 and whose product is maximum. [8+7]
4. (a) Trace the curve $y=x^2\,(x^2-4)$. (b)Trace the curve r = cosθ. [8+7]
5. (a) The figure bounded by a parabola and the tangents at the extremities of its latusrectum revolves about the axis of the parabola, Find the volume of the solid thus generated. [8+7]
   (b) The segment of the parabola y^2=4ax which is cutoff by the latus rectum revolves about the directrix.Find the volume of rotation of the annular region.
6. (a) Evaluate $\int\int(x+y)^2dx$ dy. over the area bounded by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$.
   (b) Transform the following to Cartesian form and hence evaluate $\int_0^\pi\int_0^a r^3\sin\theta dr d\theta$. [8+7]
7. (a) Prove that ∇r = $\overline{r}$/r
   (b) Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the point (2,-1,2). [8+7]
8. (a) Evaluate $\iint_S(yzi+zxj+xyk).dS$ where S is the surface of the sphere $x^2+y^2+z^2=a^2$ in the first octant.
   (b) Evaluate $\oint_c(x^2-2xy)dx+(x^2y+3)dy$ around the boundary of the region defined by y^2=8x and x=2. [8+7]

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I B.Tech I Semester Supplementary Examinations, Feb/Mar 2014
MATHEMATICS-I
(Common to Civil Engineering, Electrical & Electronics Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Computer Engineering, Aeronautical Engineering, Bio-Technology, Automobile Engineering, Mining and Petroliem Technology)

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
⋆⋆⋆⋆⋆

1. (a) Solve $y(Sinx - y)\,dx = Cos\,x\ dy$
   (b) If the temperature of air is maintained at $20^0\,C$and the temperature of the body cools from $100^0\,C$to$80^0\,C$ in 10 minutes, find the temperature of the body after 20 minutes. [8+7]
2. (a) Solve $(D^2 - 4D + 13)y = e^{2x}$
   (b) Solve $(D^2 - 3\,D + 2)\,y = Cos\,h\,x$ [8+7]
3. (a) If r + s + t = x, s + t = xy, t = xyz, find$\frac{\partial(r,s,t)}{\partial(x,y,z)}$.
   (b) Find the extreme points of $f(x, y) = xy + \frac{8}{x} + \frac{8}{y}$. [8+7]
4. (a) Trace the curve $y = 5\cosh\left(\frac{x}{5}\right)$.
   (b) Trace the curve $y^2 = (4 - x)\,(3 - x^2)$ .. [8+7]
5. (a) Find the length of the arc of the curve y =log (secx) from $x = o$ to $\frac{\pi}{3}$.
   (b) Find the perimeter of the loop of the curve 3ay^2 =x(x-a)$^{2.}$ [8+7]
6. (a) Evaluate $\int\int r dr d\theta$ over the region bounded by the cardioid r=a(1+cosθ) and out side the circle r=a .
   (b) Change the order of Integration & evaluate $\displaystyle\int_0^{4a}\int_{\frac{x^2}{4a}}^{2\sqrt{\mathrm{ax}}} dydx$ [8+7]
7. (a) Prove that (F×∇)×$\overline{r}$ = -2F
   (b) Determine the constant a so that the vector V = (x+3y)i+(y-z)j+(x+az)k is solenoidal. [8+7]
8. Apply Stokes theorem, to evaluate $\oint_c ydx + zdy + xdz$where C is the curve of intersection of the sphere x^2+ y^2+ z^2= a^2 and x + z = a. [15]

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Code No: R10102/R10

Set No. 4

I B.Tech I Semester Supplementary Examinations, Feb/Mar 2014
MATHEMATICS-I
(Common to Civil Engineering, Electrical & Electronics Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Computer Engineering, Aeronautical Engineering, Bio-Technology, Automobile Engineering, Mining and Petroliem Technology)

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Solve $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$
   (b) Find the orthogonal trajectory of the family of curves $x^{2/3}+y^{2/3} = a^{2/3}$, where 'a' is a parameter [8+7]
2. (a) Solve $(D^3 - 6D^2 + 11D - 6)y = e^{-2x} + e^{-3x}$
   (b) Solve $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 15y = 0$ [8+7]
3. (a) If a = $\frac{yz}{x}$, b = $\frac{xz}{y}$, c = $\frac{xy}{z}$, find $\frac{\partial(x,y,z)}{\partial(a,b,c)}$.
   (b) Find the minimum value of $x^2 + y^2 + z^2$, give that $xyz = a^3$ [8+7]
4. (a) Trace the curve r = cos 4θ.
   (b) Trace the curve$y^2(1-x) = x^2(1+x)$.. [8+7]
5. Prove that the volume of the solid generated by the revolution about the $x - axis$ of the loop of the curve $x = t^2, y = t - \frac{1}{3}t^3$ is $\frac{3\pi}{4}$. [8+7]
6. (a) By changing the order of integration evaluate $\int_0^1 \int_0^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dydx$.
   (b) Evaluate $\int_0^a \int_{a-x}^{\sqrt{a^2-x^2}} y$ dx dy by using change of order of integration . [8+7]
7. (a) If V= e^{xyz}(i+j+k), find curl V.
   (b) Find the constants a and b so that the surface ax^2-byz = (a+2)x will be orthogonal to the surface 4x^2y +z^3 =4 at the point (1,-1,2) [8+7]
8. (a) Use divergence theorem to evaluate $\iint_S (x^3 i + y^3 j + z^3 k).N ds$, and S is the surface of the sphere x^2+y^2+z^2=r^2.
   (b) Using Green's theorem, Find the area bounded by the hypocycloid $x^{2/3}$+$y^{2/3}$= $a^{2/3}$, a>0. Given that the parametric equations are x =a $\cos^3\theta$, y =a $\sin^3\theta$. [8+7]

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