Code No: RR10102 **RR** **Set No. 2**

I B.Tech Examinations,December 2010
MATHEMATICS - I
Common to CE, ME, CHEM, BME, IT, MECT, MEP, AE, BT, AME, ICE, E.COMP.E, MMT, ETM, E.CONT.E, EIE, CSE, ECE, CSSE, EEE

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Prove that curl($\mathbf{A}\times\mathbf{B}$)=$\mathbf{A}div\mathbf{B}$–$\mathbf{B}div\mathbf{A}$ +($\mathbf{B}.\nabla$)$\mathbf{A}$–($\mathbf{A}.\nabla$)$\mathbf{B}$.
   (b) Find the directional derivative of ϕ (x,y,z) = $x^2yz + 4xz^2$ at the point (1, –2, –1) in the direction of the normal to the surface f(x,y,z) = x logz $-y^2$ at (–1, 2,–1). [8+8]

2. (a) Test the convergence of the series $\frac{\sqrt{2}-1}{3^2-1} + \frac{\sqrt{3}-1}{4^2-1} + \frac{\sqrt{4}-1}{5^2-1} + \ldots.$ [5]
   (b) Test whether the following series converges absolutely or conditionally. $1.\frac{2}{3} - \frac{1}{2}.\frac{3}{4} + \frac{1}{3}.\frac{4}{5} - \frac{1.5}{4.6} + \ldots..$ [5]
   (c) Verify Rolle's theorem for f(x) = x (x+3) $e^{-x/2}$ in [-3, 0] [6]

3. (a) If u = $\sin^{-1}\left[\frac{x^{1/3}+y^{1/3}}{\sqrt{x}+\sqrt{y}}\right]^{1/2}$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -\frac{1}{12}\tan u$ and $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{\tan u}{144}\left(13 + \tan^2 u\right)$
   (b) Find the evolute of the curve x = a $\cos^3\theta$, y = a $\sin^3\theta$. [8+8]

4. (a) Form the differential equation by eliminating the arbitrary constant x tan(y/x) = c. [3]
   (b) Solve the differential equation: $\frac{dy}{dx}$ + y cos x = y^3sin $2x$. [7]
   (c) Find the orthogonal trajectories of the family of circles $x^2 + y^2$ = ax. [6]

5. (a) Trace the curve : $x^4 + y^4 = 2a^2$ xy.
   (b) Find the surface area got by rotating one loop of the curve $r^2 = a^2\cos 2\theta$ about the initial line. [8+8]

6. (a) Solve the differential equation: $(D^2 + 1)y$ = sinx sin2x.
   (b) Solve the differential equation: $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4$ [8+8]

7. Verify divergence theorem for F = 4xzi – y^2 j + yzk, where S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0 and z = 1. [16]

8. (a) Find $L\left[\frac{\sin^2 t}{t}\right]$ [5]
   (b) Find $L^{-1}\left[\frac{s+2}{s^2-4s+13}\right]$ [6]
   (c) Evaluate the triple integral $\int_0^{\pi/2}\int_0^{a\sin\theta}\int_1^{\frac{a^2-r^2}{a}} r\,dz\,dr\,d\theta$ [5]

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Code No: RR10102 **RR** **Set No. 4**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) If u = $\sin^{-1}\left[\frac{x^{1/3}+y^{1/3}}{\sqrt{x}+\sqrt{y}}\right]^{1/2}$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=-\frac{1}{12}\tan u$ and $x^2\frac{\partial^{2}u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=\frac{\tan u}{144}\left(13+\tan^2 u\right)$
   (b) Find the evolute of the curve x = a $\cos^3\theta$, y = a $\sin^3\theta$. [8+8]

2. (a) Test the convergence of the series $\frac{\sqrt{2}-1}{3^2-1}+\frac{\sqrt{3}-1}{4^2-1}+\frac{\sqrt{4}-1}{5^2-1}+\ldots$ [5]
   (b) Test whether the following series converges absolutely or conditionally. $1.\frac{2}{3}-\frac{1}{2}.\frac{3}{4}+\frac{1}{3}.\frac{4}{5}-\frac{1.5}{4.6}+\ldots..$ [5]
   (c) Verify Rolle's theorem for f(x) = x (x+3) $e^{-x/2}$ in [-3, 0] [6]

3. (a) Trace the curve : $x^4+y^4=2a^2xy$.
   (b) Find the surface area got by rotating one loop of the curve $r^2=a^2\cos 2\theta$ about the initial line. [8+8]

4. (a) Solve the differential equation: $(D^2+1)y=$ sinx sin2x.
   (b) Solve the differential equation: $x^2\frac{d^2y}{dx^2}-2x\frac{dy}{dx}-4y=x^4$ [8+8]

5. (a) Form the differential equation by eliminating the arbitrary constant x tan(y/x) = c. [3]
   (b) Solve the differential equation: $\frac{dy}{dx}$ + y cos x = y^3sin $2x$. [7]
   (c) Find the orthogonal trajectories of the family of circles $x^2+y^2=ax$. [6]

6. Verify divergence theorem for F = 4xzi – y^2 j + yzk, where S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0 and z = 1. [16]

7. (a) Prove that curl(**A**×**B**)=**A**div**B**–**B**div**A** +(**B**.∇)**A**–(**A**.∇)**B.**
   (b) Find the directional derivative of ϕ (x,y,z) = $x^2yz+4xz^2$ at the point (1, –2, –1) in the direction of the normal to the surface f(x,y,z) = x logz –y^2 at (–1, 2,–1). [8+8]

8. (a) Find $L\left[\frac{\sin^2 t}{t}\right]$ [5]
   (b) Find $L^{-1}\left[\frac{s+2}{s^2-4s+13}\right]$ [6]
   (c) Evaluate the triple integral $\int_0^{\pi/2}\int_0^{a\sin\theta}\int_1^{\frac{a^2-r^2}{a}} r\,dz\,dr\,d\theta$ [5]

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Code No: RR10102 **RR** **Set No. 1**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Solve the differential equation: $(D^2 + 1)y =$ sinx sin2x.
   (b) Solve the differential equation: $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4$ [8+8]

2. (a) If u = $\sin^{-1}\left[\frac{x^{1/3}+y^{1/3}}{\sqrt{x}+\sqrt{y}}\right]^{1/2}$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -\frac{1}{12}\tan u$ and $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x\partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{\tan u}{144}(13 + \tan^2 u)$
   (b) Find the evolute of the curve x = a $\cos^3\theta$, y = a $\sin^3\theta$. [8+8]

3. Verify divergence theorem for F = 4xzi – y^2 j + yzk, where S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0 and z = 1. [16]

4. (a) Find $L\left[\frac{\sin^2 t}{t}\right]$ [5]
   (b) Find $L^{-1}\left[\frac{s+2}{s^2-4s+13}\right]$ [6]
   (c) Evaluate the triple integral $\int_0^{\pi/2}\int_0^{a\sin\theta}\int_1^{\frac{a^2-r^2}{a}} r\,dz\,dr\,d\theta$ [5]

5. (a) Prove that curl(**A**×**B**)=**A**div**B**–**B**div**A** +(**B**.∇)**A**–(**A**.∇)**B.**
   (b) Find the directional derivative of ϕ (x,y,z) = x^2yz + 4xz^2 at the point (1, –2, –1) in the direction of the normal to the surface f(x,y,z) = x logz –y^2 at (–1, 2,–1). [8+8]

6. (a) Test the convergence of the series $\frac{\sqrt{2}-1}{3^2-1} + \frac{\sqrt{3}-1}{4^2-1} + \frac{\sqrt{4}-1}{5^2-1} + ...$ [5]
   (b) Test whether the following series converges absolutely or conditionally. $1.\frac{2}{3} - \frac{1}{2}.\frac{3}{4} + \frac{1}{3}.\frac{4}{5} - \frac{1.5}{4.6} + ...$ [5]
   (c) Verify Rolle's theorem for f(x) = x (x+3) $e^{-x/2}$ in [-3, 0] [6]

7. (a) Trace the curve : $x^4 + y^4 = 2a^2$ xy.
   (b) Find the surface area got by rotating one loop of the curve $r^2 = a^2 \cos2\theta$ about the initial line. [8+8]

8. (a) Form the differential equation by eliminating the arbitrary constant x tan(y/x) = c. [3]
   (b) Solve the differential equation: $\frac{dy}{dx}$ + y cos x = y^3sin $2x$. [7]
   (c) Find the orthogonal trajectories of the family of circles $x^2 + y^2$ = ax. [6]

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Code No: RR10102 **RR** **Set No. 3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Test the convergence of the series $\frac{\sqrt{2}-1}{3^2-1}+\frac{\sqrt{3}-1}{4^2-1}+\frac{\sqrt{4}-1}{5^2-1}+\ldots.$ [5]

   (b) Test whether the following series converges absolutely or conditionally. $1.\frac{2}{3}-\frac{1}{2}.\frac{3}{4}+\frac{1}{3}.\frac{4}{5}-\frac{1.5}{4.6}+\ldots..$ [5]

   (c) Verify Rolle's theorem for f(x) = x (x+3) $e^{-x/2}$ in [-3, 0] [6]

2. (a) Trace the curve : $x^4 + y^4 = 2a^2$ xy.

   (b) Find the surface area got by rotating one loop of the curve $r^2 = a^2 \cos 2\theta$ about the initial line. [8+8]

3. Verify divergence theorem for F = 4xzi – y^2 j + yzk, where S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0 and z = 1. [16]

4. (a) Prove that curl(**A**×**B**)=**A**div**B**–**B**div**A** +(**B**.∇)**A**–(**A**.∇)**B.**

   (b) Find the directional derivative of ϕ (x,y,z) = $x^2yz + 4xz^2$ at the point (1, –2, –1) in the direction of the normal to the surface f(x,y,z) = x logz –y^2 at (–1, 2,–1). [8+8]

5. (a) Solve the differential equation: $(D^2 + 1)y$ = sinx sin2x.

   (b) Solve the differential equation: $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4$ [8+8]

6. (a) Form the differential equation by eliminating the arbitrary constant x tan(y/x) = c. [3]

   (b) Solve the differential equation: $\frac{dy}{dx}$ + y cos x = y^3sin $2x$. [7]

   (c) Find the orthogonal trajectories of the family of circles $x^2 + y^2$ = ax. [6]

7. (a) Find $L\left[\frac{\sin^2 t}{t}\right]$ [5]

   (b) Find $L^{-1}\left[\frac{s+2}{s^2-4s+13}\right]$ [6]

   (c) Evaluate the triple integral $\int_0^{\pi/2}\int_0^{a\sin\theta}\int_1^{\frac{a^2-r^2}{a}} r\,dz\,dr\,d\theta$ [5]

8. (a) If u = $\sin^{-1}\left[\frac{x^{1/3}+y^{1/3}}{\sqrt{x}+\sqrt{y}}\right]^{1/2}$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=-\frac{1}{12}\tan u$ and $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=\frac{\tan u}{144}(13+\tan^2 u)$

   (b) Find the evolute of the curve x = a $\cos^3\theta$, y = a $\sin^3\theta$. [8+8]

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