Code No: R10102/R10

I B.Tech I Semester Regular Examinations, February 2013 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  $dy + (2y \cot x + \sin 2x)dx = 0$ 
  - (b) Find the orthogonal trajectory of the family of curves  $2xy + y^2 x^2 = a$ , where 'a' is a parameter [8+7]
- 2. (a) Explain the procedure to find Complete solution of second order non homogeneous differential equation with constant coefficients.

(b) Solve 
$$(D^2 - 4)y = x \sin \lambda x$$
 [8+7]

- 3. (a) Find the dimensions of a open rectangular tank of maximum capacity whose surface area is 54 square feet.
  - (b) In a right angled triangle ABC with  $\angle B = 90^{\circ}$ , find the maximum of cosA cosB cosC. [8+7]
- 4. (a) Trace the curve  $r = 4\theta$ .
  - (b) Trace the curve  $r = \frac{1}{4} + 2\sin\theta$ .
- 5. (a) Find the cost of plating of the front portion of the parabolic reflector of an automobile head light of 12cm diameter and 4 cm deep if the cost of plating is Rs. 2.00 per Sq. cm.
  - (b) Find the volume of the right circular cone of height 'h' and base radius 'r'.
    - [8+7]

[8+7]

- 6. (a) Evaluate  $\int \int \int_{v} dx dy dz$  where V is the finite region of space formed by the planes x=0,y=0, z = 0 &2x + 3y + 4z = 12.
  - (b) Evaluate  $\int \int_R y \, dxdy$  where R is the region bounded by the Parabolas  $y^2 = 4x$  and  $x^2 = 4y$ . [8+7]
- 7. (a) Find the directional derivative of  $xyz^2 + xz$  at (1,1,1) in a direction of the normal to the surface  $3x^2y + y = z$  at (0,1,1).
  - (b) Show that the vector  $(x^2-yz)i (y^2-zx)j + (z^2-xy)k$  is irrotational and find its scalar potential. [8+7]

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- 8. (a) If  $f = 4xzi -y^2j + yzk$ , evaluate  $\int_s f N ds$  where S is the surface of the cube bounded by x = 0, x = a, y = 0, y = a, z = 0, z = a.
  - (b) Evaluate by Green's theorem,  $\oint_c (y \sin x) dx + \cos x dy$  where C is the triangle enclosed by the lines  $x = 0, x = \frac{\pi}{2}, \pi y = 2x$ . [8+7]

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Time: 3 hours

### Max Marks: 75

## Answer any FIVE Questions All Questions carry equal marks \*\*\*\*

1. (a)Solve (xy Sin xy + Cos xy)y dx + (xy Sin xy - Cos xy)x dy = 0 [8+7]
(b) Radium decomposes at a rate proportional to the amount present. If 5 % of the original amount disappears in 50 years, how much will remain after 100 years.

2. (a) Solve 
$$(D^2 + 9)y = \sec 3x$$
  
(b) Solve  $\frac{d^2y}{dx^2} + 4y = xCos x$ 
[8+7]

- 3. (a) Find Taylor's series expansion of the f(x,y) = cos x about x = π/3 and hence find the approximate value of cos 35°.
  (b) If x = u√(1-r<sup>2</sup>), y = v√(1-r<sup>2</sup>), z = w√(1-r<sup>2</sup>) such that x<sup>2</sup> + y<sup>2</sup> + z<sup>2</sup> = r<sup>2</sup> then find ∂(u,v,w)/∂(x,y,z). [8+7]
- 4. (a) Trace the curve  $r^2 = a^2 \cos 2\theta$ . (b) Trace the curve  $\mathbf{x} = \mathbf{a} \ (\theta + \sin \theta), \ \mathbf{y} = \mathbf{a} \ (1 + \cos \theta)$ . [8+7]
- 5. (a) A man walks along the curve 20y=3(4x<sup>2</sup>-20x+9) between the points, Where x=<sup>1</sup>/<sub>2</sub> and x = <sup>9</sup>/<sub>2</sub> find the distance covered by the man?
  (b) Find the surface area of the solid generated by the revolution of the astroid x<sup>2/3</sup> + y<sup>2/3</sup> = a<sup>2/3</sup> about the x-axis. [8+7]
- 6. (a) Evaluate  $\int_0^4 \int_{y^2/4}^y \frac{y}{x^2+y^2} \, dx \, dy.$ (b) Evaluate  $\int_0^1 \int_0^{1-x^2} \int_0^{1-x^2-y^2} xyz \, dz \, dy \, dx.$  [8+7]
- 7. (a)If V= e<sup>xyz</sup>(i+j+k), find curl V.
  (b) Find the constants a and b so that the surface ax<sup>2</sup>-byz = (a+2)x will be orthogonal to the surface 4x<sup>2</sup>y +z<sup>3</sup> =4 at the point (1,-1,2) [8+7]
- 8. (a)Let C be the curve  $x = 1 y^2$  from (0,-1) to (0, 1). Evaluate  $\oint_c y^3 dx + x^2 dy$ (b) Use Gauss divergence theorem to evaluate  $\iint_S (yz^2i + zx^2j + 2z^2k) \cdot Nds$ , where S is the surface bounded by the xy-plane and the upper half of the sphere  $x^2 + y^2 + z^2 = a^2$  above the this plane. [8+7]

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Set No. 3

Code No: R10102/R10

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Time: 3 hours

Max Marks: 75

[8+7]

[8+7]

## Answer any FIVE Questions All Questions carry equal marks \*\*\*\*\*

- 1. (a) Solve  $x \frac{dy}{dx} + y = x^3 y^6$ 
  - (b) Find the orthogonal trajectory of the family of curves  $r^2 = a \cos 2\theta$ , where 'a' is a parameter [7+8]
- 2. (a) Solve  $(D^2 3D + 2)y = e^x$ (b) Solve  $(D^4 - a^4)y = 0$ [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.

- 4. (a) Trace the curve  $r = \frac{3a \sin \theta \cos \theta}{\sin^3 \theta + \cos^3 \theta}$ (b) Trace the curve  $r = \tan \theta$ .
- 5. (a) Find the length of the arc of the semi-cubical parabola  $ay^2 = x^3$  from the vertex to the ordinate x=5a.
  - (b) Find the area of the surface of revolution generated by revolving one arc of the curve y=sinx about the x-axis . [8+7]
- 6. (a) Evaluate  $\int \int \frac{r dr d\theta}{a^2 + r^2}$  over one loop of the lemniscates  $r^2 = a^2 \cos 2\theta$ .
  - (b) Evaluate the integral  $\int_0^a \int_0^{\sqrt{a^2-x^2}} (1-x^2-y^2)^{1/2} dx dy$  by changing into polar coordinates and hence evaluate it. [8+7]
- 7. (a) Prove that  $\overline{F} = r^2 \overline{r}$  is conservative and find the scalar potential.
  - (b) Show If  $\theta$  is the acute angle between the surfaces  $xy^2z = 3x + z^2$  and  $3x^2 y^2 + 2z = 1$  at the point (1,-2,1), show that  $\cos \theta = \frac{3}{7\sqrt{6}}$ . [8+7]
- 8. Verify Green's theorem for  $\oint_c (xy + y^2)dx + x^2dy$  where C is a bounded by y=x and y =x<sup>2</sup>. [15]

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Time: 3 hours

### Max Marks: 75

## Answer any FIVE Questions All Questions carry equal marks \*\*\*\*\*

- 1. (a)Solve  $dy + (2y \cot x + Sin 2x)dx = 0$ (b) Find the orthogonal trajectory of the family of curves  $2xy + y^2 - x^2 = a$ , where 'a' is a parameter [8+7]
- 2. (a) Explain the procedure to find Complete solution of second order non homogeneous differential equation with constant coefficients.

(b) Solve 
$$(D^2 - 4)y = x \sin \lambda x$$
 [8+7]

- 3. (a) If U =  $f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$ , P.T.  $x^2\frac{\partial f}{\partial x} + y^2\frac{\partial f}{\partial y} + z^2\frac{\partial f}{\partial z} = 0$ .
  - (b) Expand  $u = x^y$  in powers of (x-1) and (y-1) up to third degree terms. [8+7]
- 4. (a) Trace the curve  $\mathbf{r} = \cos 4\theta$ . (b) Trace the curve $y^2(1-x) = x^2(1+x)$ ..
  [8+7]
- 5. (a) Find the surface area generated by rotating the arc of the catenary  $y=a \cosh \frac{x}{a}$  from x=0 to a about the x-axis.
  - (b) Find the volume of the solid generated by revolving about the x-axis of the loop of the curve  $y^2 = x^2 \frac{(a+x)}{a-x}$ . [8+7]
- 6. (a) Evaluate  $\int \int r dr d\theta$  over the region bounded by the cardioid  $r=a(1+\cos\theta)$  and out side the circle r=a.
  - (b) By Transforming into cylindrical coordinates evaluate the integral  $\int \int \int z(x^2 + y^2 + z^2) dxdydz$  taken over the volume of the cylinder  $x^2 + y^2 = a^2$  intercepted by the plus z=0 and z=h. [8+7]
- 7. (a) Find div f and curl f where  $f = grad(x^3 + y^3 + z^3 3xyz)$ 
  - (b) Find the angle of intersection at (4,-3,2) of spheres  $x^2 + y^2 + z^2 = 29$  and  $x^2 + y^2 + z^2 + 4x 6y 8z 47 = 0$  [8+7]
- 8. Verify Stokes theorem for F = (y-z+2)i+(yz+4)j-xzk where S is the surface of the cube x=0, y=0,z=0,x=2,y=2,z=2 above the xy-plane [15]

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