Code No: R7100102 **R07**

I B.Tech Supplementary Examinations, January/February 2010
MATHEMATICS-I
(Common to Civil Engineering, Electrical & Electronics Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Computer Engineering, Bio Technology)

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

Answer any FIVE questions
All questions carry equal marks

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1. (a) Form the differential equation by eliminating the arbitrary constant, $\sin^{-1} x + \sin^{-1} y = c$.
   (b) An object whose temperature is 75^0c cools in an atmosphere of constant temperature 25^0c at the rate of $k\theta$, θ being the excess temperature of the body over that of the body over that of the temperature. If after 10 minutes, the temperature of the object falls to 65^0c, find its temperature after 20 minutes. Also find the time required to cool down to 55^0c.
2. (a) Solve: $(D^2 - 3D + 4)y = 0$.
   (b) Solve: $y'' - y' - 2y = 3e^{2x}$ given that $y(0) = 0, y'(0) = -2$.
3. (a) Verify Lagrange's mean value theorem for f(x)=log x in [1, e].
   (b) If x=v+w, y=w+u, z=u+v, then show that $\frac{\partial(x,y,z)}{\partial(u,v,w)} = 2$.
4. (a) Find the radius of curvature at the point $\left(\frac{3a}{2}, \frac{3a}{2}\right)$ of the curve $x^3 + y^3 = 3axy$.
   (b) Trace the curve: $y^2(a + x) = x^2(3a - x)$.
5. (a) Find the length of the arc of the curve $x = e^\theta \sin\theta, y = e^\theta \cos\theta$ from $\theta = 0$ to $\theta = \frac{\pi}{2}$.
   (b) Evaluate: $\int_0^5 \int_0^{x^2} x(x^2 + y^2)dxdy$
6. (a) Test for convergence of the series:
   $\sum_{n=1}^{\infty} \left[\sqrt{n^4 + 1} - \sqrt{n^4 - 1}\right]$.
   (b) Test the convergence of the series:
   $\sum_{n=1}^{\infty} \frac{x^{2n}}{(n+1)\sqrt{n}}$.
7. (a) 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).
   (b) Use divergence theorem to evaluate:
   $\int\int_s F.ds$ where $F = x^3 i + y^3 j + z^3 k$ and 'S' is the surface of the sphere $x^2 + y^2 + z^2 = a^2$.
8. (a) Find the Laplace transform of the function:
      i. $e^{at} \cosh bt$.
      ii. $t^2.e^{-2t}$.
   (b) Find the inverse transform of the following functions:
      i. $\frac{1}{s^2(s^2+a^2)}$.
      ii. $\frac{1}{s(s+1)(s+2)}$.

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