Code No: R5100102 **R5**

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

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

Answer any FIVE questions
All questions carry equal marks

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1. (a) Test for Convergence: $\Sigma \left[\frac{2^n+3}{3^n+1}\right]^{1/2}$.
   (b) Test for the convergence of $\frac{1}{2} + \frac{2}{3}x + \left(\frac{3}{4}\right)^2 x^2 + \left(\frac{4}{5}\right)^3 x^3 + ...$
2. (a) Examine for minimum and maximum values of $\sin x + \sin y + \sin(x+y)$.
   (b) Show that the evolute of the curve $x = a(\cos t + \log \tan \frac{t}{2})$, $y = a \sin t$ is the catenary $y = a \cosh\left(\frac{x}{a}\right)$.
3. (a) Trace the curve $x^3 + y^3 = 3axy$.
   (b) Find the surface area generated by the revolution of an arc of the catenary $y = c \cosh \frac{x}{c}$ about the x-axis.
4. (a) Solve $(x^2 + y^2)\,dx = 2xy\,dy$.
   (b) Solve $(D^2 - 5D + 6)y = e^x \sin x$.
5. (a) Find Laplace transform of
      i. $\frac{e^{-at} - e^{bt}}{t}$.
      ii. $\frac{\sin 3t - \cos t}{t}$.
   (b) Using Laplace transform method, solve
   $(D^2 + 1)y = 6 \cos 2t$, $t > 0$
   If y=3, Dy=1 when t=0.
6. (a) $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$.
   (b) Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} xy\,dx\,dy$ and hence evaluate the double integral.
7. (a) i. Prove that $div(\bar{a} \times \bar{b}) = \bar{b}.\, curl\ \bar{a}$ - $\bar{a}.\, curl\ \bar{b}$.
      ii. $curl\ \left(\bar{a} \times \bar{b}\right) = \bar{a}\ div\ \bar{b}$ - $\bar{b}\ div\ \bar{a}$+ $(\bar{b}.\nabla)\bar{a} - (\bar{a}.\nabla)\bar{b}$.
   (b) Find $\int_c \overline{F}.d\bar{r}$ where $\overline{F} = x^2y^2\bar{i} + y\bar{j}$ and the curve $y^2 = 4x$ in the xy-plane from (0,0) to (4,4).
8. Verify Stoke's theorem for $\overline{F} = (x^2 + y^2)\bar{i} - 2xy\bar{j}$ taken round the rectangle bounded by the lines $x = \pm a$, y=0, y=b.

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