Code :RR100102

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B.Tech I Year (RR) Supplementary Examinations, December 2010
MATHEMATICS-I
(Common to all branches)

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

Answer any FIVE questions
All questions carry equal marks
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1. (a) Test the following series for convergence or divergence.
   $\frac{1}{2} + \frac{\sqrt{2}}{3} + \frac{\sqrt{3}}{8} + \ldots\ldots + \frac{\sqrt{n}}{n^2-1}$
   (b) Test whether the following series is absolutely convergent.
   $\sum_{1}^{\infty} (-1)^{n+1} \left(\sqrt{n+1} - \sqrt{n}\right)$
   (c) Verify Lagrange's mean value theorem f(x) = $log_e{}^x$ in [1,e].
2. (a) If u = log (x^2+y^2) + $\tan^{-1}$(y/x) prove that u_{xx} + u_{yy} = 0.
   (b) Define curvature, center of curvature, radius of curvature and circle of curvature.
3. (a) Trace the curve $9ay^2 = x\,(x-3a)^2$.
   (b) Prove that the length of the arc of the parabola y^2 = 4ax cut off by its latus rectum is $2a[\sqrt{2} + \log(1 + \sqrt{2})]$.
4. (a) Form the differential equation by eliminating the arbitrary constant : log y/x = cx.
   (b) Solve the differential equation: dr + (2r cotθ + sin2θ) dθ = 0.
   (c) The number N of bacteria in a culture groups at a rate proportional to N. The value of N was initially 100 and increased to 332 in one hour. What was the value of N after 1 ½ hour.
5. (a) Solve the differential equation: $(D^2 + 4)y = \cos x$.
   (b) Solve the differential equation: $x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + 4y = (1+x)^2$
6. (a) Solve the differential equation $\frac{d^2x}{df^2} + 4\frac{dx}{dt} + 12x = e^{3t}$ given that x(0) =1 and x(0)= -2 using laplace transforms.
   (b) Evaluate by transforming in to polar co ordinates
   $\int_0^a \int_0^{\sqrt{a^2-x^2}} y\sqrt{x^2+y^2}\, dx\, dy$
7. (a) Find curl[$\mathbf{r}f(r)$] where $\mathbf{r}$ = x$\mathbf{i}$+y$\mathbf{j}$+z$\mathbf{k}$, r = |$\mathbf{r}$|.
   (b) Find the work done in moving a particle in the force field
   $\mathbf{F}=3x^2 i + (2xz - y)j + zk$ along the straight line from (0, 0, 0) to (2, 1, 3).
8. Verify Green's theorem for $\oint_C [(3x - 8y^2)dx + (4y - 6xy)dy]$ where C is the region bounded by x=0, y=0 and x + y = 1.

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