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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL - 576 104

FIRST SEMESTER B.E DEGREE END SEMESTER EXAMINATION – May, 2008

SUB: ENGINEERING MATHEMATICS 1 (MAT –101)
(REVISED CREDIT SYSTEM)

Time : 3 Hrs. **Max.Marks : 50**

✍ **Note : a) Answer any FIVE full questions.**
b) All questions carry equal marks.

1A. Find the n^{th} derivative of

(i) $\dfrac{x^2}{(x+2)(2x+3)}$ (ii) $e^{-2x}\sin^2 x$

1B. Find the evolute of $y^2 = 4ax$.

1C. Find the angle between two diagonals of a unit cube.

(4 + 3+ 3)

2A. If $y = a\cos(\log x) + b\sin(\log x)$ show that
$x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2 + 1)y_n = 0$

2B. Find the radius of curvature of $r^2 = a^2\cos 2\theta$ at any point on it.

2C. Find the volume bounded by revolving one arch of the curve $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ about its base.

(4 + 3+ 3)

3A. Find the angle of intersection between the curves
$r^m = a^m \cos m\theta$, $r^m = a^m \sin m\theta$.

3B. (i) Prove that every absolutely convergent series is convergent.

(ii) Test the nature of the series $\sum_{n=1}^{\infty} \dfrac{x^n}{n}$.

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3C. Find the error in calculating area of an ellipse if 1% error is made in measuring semi major and semi minor axes.

(3 + 4+ 3)

4A. Sketch and find the area bounded by the loop of the curve
$3ay^2 = x(x-a)^2 \quad (a > 0)$

4B. Find the first three non zero terms in the Taylor series expansion of $y = \log\sec x$ about $x = 0$.

4C. (i) State Cauchy's root test

(ii) Test the nature of $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+....$

(4 + 3+ 3)

5A. Obtain the reduction formula for $\int \sin^m x \cos^n x \, dx$ and hence evaluate $\int_0^{\pi/2} \sin^m x \cos^n x \, dx$.

5B. State and prove Cauchy's mean value theorem.

5C. Trace and find the perimeter of $x^{2/3} + y^{2/3} = a^{2/3} \quad (a > 0)$

(4 + 3+3)

6A. Find center and radius of the circle $x^2 + y^2 + z^2 - 2x - 3y + 4z + 8 = 0$ and $x - 2y + z = 8$.

6B. Evaluate

(i) $\lim_{x\to\infty} x^x$ (ii) $\lim_{x\to 2}\left(\frac{1}{x-2}-\frac{1}{\log(x-1)}\right)$

6C. Find the distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$ measured parallel to the line $\frac{x}{2}=\frac{y}{3}=\frac{z}{(-6)}$.

(3 + 4+3)

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