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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL - 576 104

FIRST SEMESTER B.E DEGREE MAKE UP EXAMINATION- 2011

SUB: ENGG. MATHEMATICS I (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} derivatives of

i) $\frac{x+1}{x^2-4}$ (ii) cosx cos2x cos3x

1B. Find the area bounded by r = a (1 – cosθ), a>0.

1C. Show that the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-5}{6}=\frac{z-6}{7}$

Intersect at each other. Find the coordinates of the point of intersection.

(4 + 3 + 3)

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

2B. Verify Lagrange's mean value theorem for f(x) = (x– 1)(x– 2)(x– 3), x∈[0, 4]

2C. Trace the curve x = a(θ– sinθ), y = a(1– cosθ), a > 0, $0 \le \theta \le 2\pi$.

(4 + 3+ 3)

3A. Evaluate:

(i) $\int_0^1 \frac{x^6}{\sqrt{1-x^2}}\,dx$ (ii) $\int_0^\infty \frac{x^4}{1+x^2{}^7}\,dx$

3B. Evaluate $\lim_{x \to 0}\left(\frac{\sin x}{x}\right)^{1/x}$.

3C. If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$, $x \neq y$, show that $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = \text{Sin}2u$.

(4 +3+ 3)

4A. Find the entire length of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$, $a > 0$.

4B. Test the convergence of the series: $\sum_{n=1}^{\infty} \sqrt{n^3+1} - \sqrt{n^3}$

4C. Find the equation of the plane passing through the point (5, -5, 9) and perpendicular to the line with direction ratios are 6, 3, 2. (4 + 3+ 3)

5A. Find the points on the lines $\frac{x-6}{3} = \frac{y-7}{-1} = \frac{z-4}{1}$ and $\frac{x}{-3} = \frac{y+9}{2} = \frac{z-2}{4}$ which are nearest to each other. Hence find the shortest distance between the lines.

5B. Test for the convergence of the series $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \ldots\ldots\ldots\infty$

5C. If y = a cos(logx) + b sin(logx), show that

x^2y_{n+2}+ (2n+1) x y_{n+1} + $(n^2+1)y_n$=0. (4 + 3+ 3)

6A. Obtain the expansion of log(secx) in ascending powers of x.

6B. Let ρ be the radius of curvature at any point P on the parabola $y^2 = 4ax$. Show that ρ^2 varies as $(SP)^3$, where S is the focus of the parabola.

6C. Show that plane x + 2y – 2z – 8 = 0 touches the sphere

$x^2 + y^2 + z^2 - 2x4y - 6z + 5 = 0$. Find the point of contact.

(4 + 3+ 3)

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