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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL - 576 104

FIRST SEMESTER B.E DEGREE MAKEUP EXAMINATION 2009 - 10

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} derivative of

(i) $\dfrac{x^4}{(x-1)^2(x+2)}$ (ii) $xe^{2x}\cos^2 2x$

1B. Trace the following curve with explanations

$x(x^2+y^2) = a(x^2 - y^2)$, $a>0$

1C. Find the perpendicular distance of the point (1,1,1) from the line

$\dfrac{x-2}{2} = \dfrac{y+3}{2} = \dfrac{z}{-1}$

(4 + 3+ 3)

2A. If $y = e^{m\cos^{-1}x}$, show that $(1-x^2)y_{n+2} - (2n+1)\,x\,y_{n+1} - (n^2 + m^2)y_n = 0$.

2B. Evaluate : (i) $\displaystyle\int_0^{\pi} \frac{\sin^4\theta}{(1+\cos\theta)^2}d\theta$ (ii) $\displaystyle\int_0^{\infty} \frac{x^2}{(1+x^2)^{7/2}}dx$

2C. Obtain the equation of the plane through the line of intersection of the planes
$7x - 4y + 7z + 16 = 0 = 4x + 3y - 2z + 13$
and perpendicular to the plane $x - y - 2z + 5 = 0$

(3 +4+ 3)

3A. Find the nature of the following series

(i) $\displaystyle\sum\left(\frac{n}{n+1}\right)^{n^2}$ (ii) $\displaystyle\sum\frac{n+1\;x^n}{n+2\quad n+3}$

3B. Find the area inside $r = a\sin\theta$ and outside $r = a(1-\cos\theta)$.

3C. Find the evolute of $x^{2/3} + y^{2/3} = a^{2/3}$

(4 + 3+ 3)

4A. Evaluate :

(i) $\lim_{x\to 0} \frac{x\, e^x - \log(1+x)}{x^2}$ (ii) $\lim_{x\to 0} \cos x^{1/x^2}$

4B. Find the angle between the curves :

$r = \frac{a\theta}{1+\theta}$, $r = \frac{a}{1+\theta^2}$

4C. Find the equation of the sphere having the circle $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0$, x+y+z = 3 as a great circle.

(4 + 3+ 3)

5A. Find the first three terms in the Maclaurin's series expansion of tanx

5B. If ρ is the radius of curvature at any point P on the parabola $y^2 = 4ax$ and S be its focus then prove that ρ^2 varies as $(SP)^3$.

5C. Find the volume of solid obtained by revolving one arc of the curve $x = a(\theta + \sin\theta)$, $y = a(1+\cos\theta)$ about the x – axis.

(4 + 3+ 3)

6A. If $z = f(x, y)$ where $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$, then prove that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}$

6B. Verify the Cauchy's mean value theorem for

$f(x) = \sqrt{x}$ and $g(x) = \sqrt{\frac{1}{x}}$ in [a,b]

6C. At a distance 50 meters from the foot of the tower, the elevation of the top is 30° . If the possible errors in measuring the distance and elevation are 2cms and 0.05 degrees, find the approximate error in calculating the height.

(3+ 3+ 3)

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