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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL UNIVERSITY, MANIPAL - 576 104

I SEMESTER B.E DEGREE MAKE UP EXAMINATION – JULY, 2012

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 the followings:

(i) $\dfrac{1}{(3x-1)(2x-1)}$ (ii) $\sin x \sin 2x \sin 3x$.

1B. Trace the curve with explanations $y^2(a-x)=x^3, a>0.$

1C. Find the reflection of the point (2,-1,2) in the plane $2x+y+z=6.$

(4+3+3)

2A. Evaluate the following integrals:

(i) $\int_0^{\frac{\pi}{6}} \cos^6(3\theta)\sin^2(6\theta)d\theta$ (ii) $\int_0^5 \frac{x^7}{\sqrt{25-x^2}}dx$.

2B. Find the angle of intersection of the curves $r^2=a^2\cos 2\theta$ and $r=a(1+\cos\theta)$.

2C. If $y=\left[\log\left(x+\sqrt{1+x^2}\right)\right]^2$, show that $(1+x^2)y_{n+2}+(2n+1)xy_{n+1}+n^2y_n=0.$

(4+3+3)

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

3B. Find the length and equations of the shortest distance between the lines $\frac{x+3}{2}=\frac{y-6}{3}=\frac{z-3}{-2}$ and $\frac{x}{2}=\frac{y-6}{2}=\frac{z}{-1}$.

3C. Sketch and find the perimeter of the curve $r=a(1+\cos\theta), a>0.$

(4+3+3)

4A. Test for the convergence of the following series:

(i) $\sum_{n=0}^{\infty} \frac{2n^3+5}{4n^5+1}$ (ii) $\frac{x}{1}+\frac{1}{2}\frac{x^3}{3}+\frac{1\cdot 3}{2\cdot 4}\frac{x^5}{5}+\frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6}\frac{x^7}{7}+\ldots$

4B. If $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{1}{2}\tan u$.

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. Prove that the radius of curvature at a point on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is given by $\rho=\frac{a^2b^2}{P^3}$, where P is the length of the perpendicular from the centre on to the tangent at that point.

5B. Obtain first three nonzero terms in the Maclaurin's series expansion of $\tan x$.

5C. Find the equation of the right circular cone generated by rotating the line $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ about the line $\frac{x}{-1}=y=\frac{z}{2}$. **(4+3+3)**

6A. Find the volume of the solid generated by revolving the curve $xy^2=4a^2(2a-x)$ about y-axis.

6B. Evaluate: $\lim_{x\to 0}\left(\frac{\sin x}{x}\right)^{\frac{1}{x}}$.

6C. State and prove Lagrange's mean value theorem.

(4+3+3)

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