

Code No: C0306

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I SEMESTER EXAMINATIONS, APRIL/MAY-2012
BASIC ENGINEERING MATHEMATICS
(BIOTECHNOLOGY)

Time: 3 hours

Max.Marks:60

Answer any five questions
 All questions carry equal marks

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1.a) Prove that $\left(\frac{1}{\sec^2\theta - \cos^2\theta} + \frac{1}{\operatorname{cosec}^2\theta - \sin^2\theta} \right) \frac{\sin^2\theta \cos^2\theta}{\theta} = \frac{1 - \sin^2\theta \cos^2\theta}{2 + \sin^2\theta \cos^2\theta}$.

b) If $\sin\alpha = \frac{3}{5}$, $\cos\beta = \frac{9}{41}$, find the value of $\sin(\alpha - \beta)$ and $\sin(\alpha + \beta)$.

2.a) Evaluate $\lim_{x \rightarrow 0} \frac{e^{\sin x} - 1}{x}$.

b) Find whether $f(x) = \begin{cases} x^2 & \text{when } 0 < x < 1 \\ x, & \text{when } 1 \leq x < 2 \\ \frac{x^2}{4}, & \text{when } 2 \leq x < 3 \end{cases}$

is continuous at $x = 1$ and $x = 2$.

3.a) Find the differential coefficient of $\frac{(x-1)}{(x^2+1)}$.

b) Find the differential coefficient of $(2x+1)^4 x\sqrt{x}$.

4.a) Find the length of the normal at any point P of the rectangular hyperbola $x^2 - y^2 = a^2$ and show that it is equal to the distance of P from the origin.

b) Find the length of the subnormal to the curve $x^2 = 4ay$ at $(4a, 4a)$.

5.a) If $u = f(r)$ where $x^2 + y^2 = r^2$ then prove that

$$\frac{\partial^2 u}{\partial x^2} = \frac{x^2}{r^2} f''(r) + \frac{(r^2 - x^2)}{r^3} f'(r).$$

b) If $u = \sin^{-1} \left(\frac{(\sqrt{x} - \sqrt{y})}{(\sqrt{x} + \sqrt{y})} \right)$, then prove that

$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0.$$

Contd...2

6.a) Evaluate $\int \frac{\log x \log(\log x)}{x} dx$.

b) Evaluate $\int_0^{\pi/2} \log(\tan x) dx$.

7.a) Form the differential equation, from the relation $y = ae^{2x} + be^{-3x} + ce^x$.

b) Solve the differential equation $\frac{dy}{dx} = \frac{x-y}{x+y}$.

8. Solve the following differential equations

a) $ye^y dx = (y^3 + 2xe^y) dy$.

b) $(1 + e^{x/y}) dx + (1 - x/y) e^{x/y} dy = 0$.

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