

1E1022

Roll No. : _____

Total Printed Pages : **4**

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**B. Tech. (Sem. I) (Main) Examination, January/February - 2011
Engineering Mathematics - I
(Common to all Branches of Engg.)**

Time : 3 Hours]

[Total Marks : 80
[Min. Passing Marks : 24

*Attempt overall five questions selecting one question from each unit.
All questions carry equal marks.*

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. _____ Nil _____

2. _____ Nil _____

UNIT - I

1 (a) Find the asymptotes of the following curve :

$$(x + y)^2 (x + 2y + 2) = x + 9y - 2$$

8

(b) Find the radius of curvature of the following curve :

$$y^2 = \frac{4a^2(2a - x)}{x} \text{ as its vertex.}$$

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2 (a) Show that every point on the curve $y = b \sin\left(\frac{x}{a}\right)$, where the curve meets the axes of x , is a point of inflexion.

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(b) Trace the following curve :

$$y^2(a + x) = x^2(3a - x)$$

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UNIT - II

3 (a) If $u = x \sin^{-1}(y/x)$, prove that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = 0$$

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- (b) If the side and angles of a plane triangle ABC vary in such a way that its circumradius remains constant, then prove that :

$$\frac{\delta a}{\cos A} + \frac{\delta b}{\cos B} + \frac{\delta c}{\cos C} = 0$$

where, $\delta a, \delta b$ and δc are small increments in sides a, b and c respectively.

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- 4 (a) Find the maximum value of u , where

$$u = \sin x \sin y \sin(x + y)$$

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- (b) Find the Maxima and minima of $u = x^2 + y^2 + z^2$ subject to the conditions $ax^2 + by^2 + cz^2 = 1$ and $lx + my + nz = 0$. Interpret the result geometrically.

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UNIT - III

- 5 (a) Find the length of the arc of the parabola $x^2 = 4ay$ from the vertex to an extremity of the latus rectum.

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- (b) Find the surface area of the solid generated by the revolution of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$ about the x -axis.

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- 6 (a) Evaluate the following integral by changing to polar coordinates :

$$\int_0^1 \int_x^{\sqrt{2x-x^2}} \sqrt{x^2 + y^2} \, dx \, dy$$

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- (b) Show that :

$$B(m, n) = a^m b^n \int_0^{\infty} \frac{x^{m-1}}{(ax+b)^{m+n}} = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$$

8



UNIT - IV

7 Solve :

(i) $x \sin(y/x)dy = [y \sin(y/x) - x]dx$

4

(ii) $\frac{dy}{dx} = \left[\frac{x+2y-3}{2x+y-3} \right]$

4

(iii) $(x^3 + xy^4)dx + 2y^3dy = 0$

4

(iv) $(x^3y^3 - xy)dx = dy$

4

8 Solve :

(i) $\frac{d^2y}{dx^2} + a^2y = \sec ax$

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(ii) $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} - 6\frac{dy}{dx} = 1 + x^2$

5

(iii) $(D^2 - 4D + 4)y = 8x^2e^{2x} \sin 2x$

6

UNIT - V

9 (a) Solve :

$$x^2 \frac{d^2y}{dx^2} - (x^2 + 2x) \frac{dy}{dx} + (x + 2)y = x^3e^x$$

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(b) Solve :

$$\frac{d^2y}{dx^2} + (\tan x - 3 \cos x) \frac{dy}{dx} + 2y \cos^2 x = \cos^4 x$$

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10 (a) Solve by the method of variation of parameters :

$$(1-x) \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = (1-x)^2$$

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(b) Solve :

$$x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10 \left[x + \frac{1}{x} \right]$$

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