

**1E2002**

Roll No. : \_\_\_\_\_

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**B. Tech. (Sem. I) (Main/Back) Examination, December - 2013**  
**102 Engineering Mathematics - I**  
**(Common to All Branch)**

Time : 3 Hours]

[Total Marks : 80

[Min. Passing Marks : 26 (Main)

Min. Passing Marks : 24 (Back)

*Attempt any five questions. Selecting one question from each unit.*

*All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

*Units of quantities used / calculated must be stated clearly.*

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

1. NIL2. NIL**UNIT - I**

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

$$x^3 - x^2y - xy^2 + y^3 + x^2 - y^2 - 1 = 0$$

8

(b) The tangents at two points A and B on the cycloid

$$x = a(\theta - \sin\theta), \quad y = a(1 - \cos\theta)$$

are at right angles. If  $\rho_1$  and $\rho_2$  be the radii of curvature at these points, then prove that :

$$\rho_1^2 + \rho_2^2 = 16a^2$$

8

**OR**

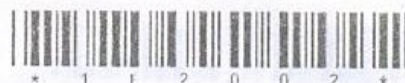
1 (a) Find the points of inflexion on the curve :

$$y^2 = x(x+1)^2$$

8

(b) Trace the curve :  $r^2 = a^2 \cos 2\theta$ .

8



## UNIT - II

2 (a) If  $z(x+y) = x^2 + y^2$ , show that

$$\left(\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$$

8

(b) If  $u = f(r)$ , where  $r = \sqrt{x^2 + y^2}$ , then prove that

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f''(r) + \frac{1}{r} f'(r)$$

8

OR

2 (a) Find the points where the function

$$x^3 y^2 (1 - x - y)$$

has maximum or minimum value and also find the value of the function at these points.

8

(b) Find the minimum value of

$$x^2 + y^2 + z^2$$

subject to the condition

$$ax + by + cz = p$$

8

## UNIT - III

3 (a) Find the volume of the solid generated by the revolution of the curve

$$y(a^2 + x^2) = a^3 \text{ about its asymptotes.}$$

8

(b) Evaluate :  $\iint_A y \, dx \, dy$

where  $A$  is the region of integration bounded by the parabolas  $y^2 = 4ax$  and  $x^2 = 4ay$ .

8

OR



- 3 (a) Change the order of integration in the following double integral :

$$\int_0^{a \cos \alpha} \int_{x \tan \alpha}^{\sqrt{a^2 - x^2}} f(x, y) dx dy$$

8

- (b) Prove that :

$$B(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}, \quad m > 0, \quad n > 0$$

8

### UNIT - IV

- 4 Solve the following differential equations :

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

5

(ii)  $2 \frac{dy}{dx} = \frac{y}{x} + \frac{y^2}{x^2}$

5

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

6

OR

- 4 Solve the following differential equations :

(i)  $(D^3 - 2D^2 + 4D - 8)y = 0$

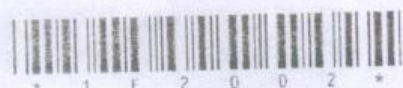
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(ii)  $(D^2 - 4D + 4)y = e^{2x} + \sin 2x$

5

(iii)  $(D^3 - D^2 - 6D)y = 1 + x^2$

6



## UNIT - V

5 (a) Solve :

$$x \frac{d^2 y}{dx^2} - \frac{dy}{dx} - 4x^3 y = x^5$$

8

(b) Solve :

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

8

## OR

5 (a) Solve :

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

8

(b) Solve the differential equation :

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

by using the method of variation of parameters.

8

## OR

