1E1022

Roll No. : _____ Total Printed Pages : 4

# 1E1022

**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 :

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

8

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

8

(b) Trace the following curve :

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

8

## UNIT - II

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

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

8

(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 $\delta c$ are small increments in sides $a$, $b$ and $c$ respectively. 8

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

$u=\sin x \sin y \sin(x+y)$ 8

(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. 8

## 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. 8

(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. 8

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

$$\int_0^1 \int_x^{\sqrt{2x-x^2}} \sqrt{x^2+y^2}\, dx\, dy$$ 8

(b) Show that :

$$B(m,n)=a^m b^n \int_0^\infty \frac{x^{m-1}}{(ax+b)^{m+n}}=\frac{\lceil m \lceil n}{\lceil (m+n)}$$ 8

## UNIT - IV

7 Solve :

(i) $x\sin(y/x)dy=\left[y\sin(y/x)-x\right]dx$ **4**

(ii) $\frac{dy}{dx}=\left[\frac{x+2y-3}{2x+y-3}\right]$ **4**

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

(iv) $\left(x^3y^3-xy\right)dx=dy$ **4**

8 Solve :

(i) $\frac{d^2y}{dx^2}+a^2y=\sec ax$ **5**

(ii) $\frac{d^3y}{dx^3}-\frac{d^2y}{dx^2}-6\frac{dy}{dx}=1+x^2$ **5**

(iii) $\left(D^2-4D+4\right)y=8x^2e^{2x}\sin 2x$ **6**

## UNIT - V

9 (a) Solve :

$$x^2\frac{d^2y}{dx^2}-\left(x^2+2x\right)\frac{dy}{dx}+(x+2)y=x^3e^x$$ **8**

(b) Solve :

$$\frac{d^2y}{dx^2}+(\tan x-3\cos x)\frac{dy}{dx}+2y\cos^2 x=\cos^4 x$$ **8**

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

$$(1-x)\frac{d^2y}{dx^2}+x\frac{dy}{dx}-y=(1-x)^2$$ **8**

(b) Solve :

$$x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10\left[x+\frac{1}{x}\right]$$ **8**