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1E1022

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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

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

8

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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. 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

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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. 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 :

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

8

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

(iv) $(x^3y^3 - xy)dx = dy$ 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) $(D^2 - 4D + 4)y = 8x^2e^{2x}\sin 2x$ 6

UNIT - V

9 (a) Solve :

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

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