

1E1022

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B.Tech. I - Sem.(Main/Back) and Reback

Exam - Jan-Feb. 2012

102 - Engineering Mathematics-I

(Common to all Branches of Engg.)

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

Attempt overall 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. _____ Nil 2. _____ Nil

UNIT-I

1. (a) Find the equation of the curve on which lie the points of intersection of the curve

$$x^3 - 5x^2y + 8xy^2 - 4y^3 + x^2 - 3xy + 2y^2 - 1 = 0$$

and its asymptotes.

8

1. (b) Show that every point where the curve $y = c \sin \frac{x}{a}$ meets the x-axis is a point of inflexion.

8

OR

1. (a) Trace the curve: $y^2(a+x) = x^2(3a-x)$

8

1. (b) Show that in the parabola $y^2 = 4ax$, the radius of curvature at any point

$$P \text{ is } \frac{2(SP)^{\frac{3}{2}}}{\sqrt{a}}$$

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[Contd...]

Where S is the focus of the parabola. Also if P_1 and P_2 are radius of curvatures at the extremities of a focal chord of the above parabola, show that:

$$(P_1)^{-2/3} + (P_2)^{-2/3} = (2a)^{-2/3} \quad [8]$$

UNIT-II

- 2 (a) State Euler's theorem on homogeneous functions.

Verify Euler's theorem for the function

$$f(x,y) = \frac{x^{\frac{1}{4}} + y^{\frac{1}{4}}}{x^{\frac{1}{5}} + y^{\frac{1}{5}}}$$

[8]

- 2 (b) Find the maximum value of u, where

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

[8]

OR

- 2 (a) ABC is an acute angled triangle with fixed base BC. If δb , δc , δA and δB are small increments in b, c, A and B respectively when the vertex A is given a small displacement parallel to BC. Prove that

$$\delta A = h \delta x \left(\frac{1}{c^2} - \frac{1}{b^2} \right)$$

Where h is the unaltered height of the triangle. [8]

- (b) A rectangular box, open at the top, is to have a volume of 32 cubic meters. Find its dimensions so that total surface is minimum. [8]

UNIT-III

- 3 (a) Prove that the surface and volume of the solid generated by revolving the loop of the curve $x=t^2$, $y=t-\frac{t^3}{3}$ about the X-axis are respectively

$$3\pi \text{ and } \frac{3\pi}{4}$$

[8]



(b) Prove that: $\int_0^1 \sqrt{1-x^4} dx = \frac{\left\{\sqrt{\frac{1}{4}}\right\}^2}{6\sqrt{(2\pi)}}$ [8]

OR

3 (a) Prove that the whole length of the curve $x^2(a^2-x^2)=8a^2y^2$ is $\pi a\sqrt{2}$ [8]

3 (b) Evaluate $\int_0^1 \int_0^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dx dy$ [8]

By changing the order of integration.

UNIT-IV

4. Solve:

(a) $\frac{dy}{dx} = \frac{2x-y+1}{x+2y-3}$ [5]

(b) $\frac{dy}{dx} = \frac{x^2+y^2+1}{2xy}$ [5]

(c) $(D-1)^2(D^2+1)^2y = \sin^2 \frac{x}{2} e^x$ [6]

OR

4 Solve:

(a) $\frac{dy}{dx} = \frac{1}{xy(x^2y^2+1)}$ [5]

(b) $(xy^3+y)dx + 2(x^2y^2+x+y^4)dy = 0$ [5]

(c) $(D^2-3D+2)y = \sin 3x + x^2 + x + e^{4x}$ [6]



UNIT-V

5. Solve:

[8] (a) $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = 4 \cos \log(1+x)$ [5]

[8] (b) $\frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + (4x^2 - 3)y = e^{x^2}$ [5]

(c) $\sin^2 x \frac{d^2y}{dx^2} = 2y$ [6]

[8]

OR

5 (a) $(1+x^2) \frac{d^2y}{dx^2} + 2x(1+x^2) \frac{dy}{dx} + 4y = 0$ [8]

(b) Use the method of variation of parameters to solve:

(c) $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$ [8]

OR

