1E2002

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B. Tech I Sem. (Main/Back) Exam. Jan. 2016
102 Engineering Mathematics-I
Common to all Branches

Time: 3 Hours **Maximum Marks: 80**
Min. Passing Marks: 24

Instructions to Candidates:

*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.

1. NIL 2. NIL

UNIT-I

Q.1 (a) Find the asymptotes of the curve

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

(b) Show that the radius of curvature at any point P on the parabola $y^2 = 4ax$, is $\frac{2(SP)^{3/2}}{\sqrt{a}}$; where S is the focus of the parabola. [8]

OR

Q.1 (a) Prove that the curve $x^3 + y^3 = a^3$ has point of inflexion at the point of inflexion at the points where it crosses the co-ordinate axes. [8]

(b) Trace the curve $r=a(1+\cos\theta)$. (Cardioid). [8]

UNIT-II

Q.2 (a) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$, then show that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\partial^2 u/\partial y^2 = \sin 2u\,(1 - 4\sin^2 u)$$ [8]

(b) If measurements of radius of base and height of a right circular cone are incorrect by -1% & 2% respectively, find the error in its volume. [8]

OR

Q.2 (a) Find the minimum value of $x^2+y^2+z^2$, given that $ax + by + cz = p$ [8]

(b) Find the volume of the greatest rectangular parallelopiped inscribed in the ellipsoid whose equation is $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ [8]

UNIT-III

Q.3 (a) Find the surface area of the solid formed by revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, about the major axis. [8]

(b) Find the volume of the solid generated by revolving the curve $(a-x)\,y^2 = a^2x$, about its asymptote. [8]

OR

Q.3 (a) Change the order of integration in the integral $\int_0^a \int_{\{a - \sqrt{a^2 - y^2}\}}^{\{a + \sqrt{a^2 - y^2}\}} xy\,dx\,dy$ and then evaluate it. [8]

(b) Show that $\int_0^\infty \frac{x^2 dx}{(1 + x^4)^3} = \frac{5\pi\sqrt{2}}{128}$. [8]

UNIT-IV

Q.4 (a) Solve:-

(i) $(1+y^2) + \left(x - e^{-\tan^{-1}y}\right)\frac{dy}{dx} = 0$. [5]

(ii) $x\frac{dy}{dx} + y = y^2 \log x$. [5]

(b) $(D^2 + 1)^2 y = 24x \cos x$; D = d/dx, Solve it. [6]

OR

Q.4 (a) Solve:

(i) $(3x^2y + y/x)\,dx + (x^3 + \log x)\,dy = 0$ [5]

(ii) $(xy \sin xy + \cos xy)\,y\,dx + (xy \sin xy - \cos xy)\,x\,dy = 0$. [5]

(b) Solve:

$\frac{d^2x}{dt^2} + 2n\cos\alpha\frac{dx}{dt} + n^2x = a\cos nt$, such that x = 0 and dx/dt = 0 at t = 0. [6]

UNIT-V

Q.5 (a) Solve:

$(1+x)^2 \, {d^2y}/{dx^2} + (1+x)\, {dy}/{dx} + y = 4\cos\{\log(1+x)\}$. [8]

(b) Solve:

$\frac{d^2y}{dx^2} + (3\sin x - \cot x)\frac{dy}{dx} + (2\sin^2 x)y = \sin^2 x\, e^{-\cos x}$ [8]

OR

Q.5 (a) Solve:

$(2x^2 + 3x)\, {d^2y}/{dx^2} + (6x+3)\, {dy}/{dx} + 2y = (x+1)e^x$. [8]

(b) Solve by the method of variation of parameters-

$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = x^2e^x$. [8]
