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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL - 576 104

SECOND SEMESTER B.E. DEGREE END SEMESTER EXAMINATION- May 2012

SUB: ENGINEERING MATHEMATICS II (MAT 102)
(REVISED CREDIT SYSTEM -2011)

Time : 3 Hrs. **Max.Marks : 50**

Note : a) Answer any FIVE full questions.b)All questions carry equal marks.

1A. Solve: $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$

1B. Expand $f(x, y) = e^x \log(1+y)$ in powers of x and y upto third degree terms .

1C. Using Gram-Schmidt process construct an orthonormal basis from the set of vectors { (1, 1, 1), (0, 1, 1), (1, 2, 3) } in E^3.

(3 + 3 + 4)

2A. Find the inverse of the matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & 3 \\ 4 & -3 & 8 \end{bmatrix}$, using elementary row transformations, if it exists.

2B. Evaluate $\int_0^1 \int_{x^2}^{2-x} xydydx$ by changing the order of integration.

2C. Solve:

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

ii) $(x^2 - y^2)dx - 2xy\,dy = 0$ (3 + 3 + 4)

3A. Find the area enclosed between the curves $y^2 = 4ax$ and $x^2 = 4ay$.

3B. Find the maximum and minimum distances of the point (1, 2, 3) fromthe sphere $x^2 + y^2 + z^2 = 56$.

3C. Solve: $(2x - 1)^2 \frac{d^2y}{dx^2} + (2x - 1)\frac{dy}{dx} - 2y = 8x^2 - 2x + 3$.

(3 + 3 + 4)

4A. Rewrite the following function in terms of unit step functions and hence find its Laplace transform

$$f(t)=\begin{cases} t^2, & 0\le t<2 \\ 2t+5, & 2\le t<4 \\ 9, & t\ge 4 \end{cases}$$

4B. Solve: $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=x\,e^{3x}+\sin 2x$.

4C. Using triple integral find the volume of the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$

(3 + 3 + 4)

5A. Solve: $\frac{dy}{dx}=\frac{(2x-3y-2)}{(3x+8y-1)}$.

5B. Prove the relation between Beta and Gamma function $\beta(m,n)=\frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$.

5C. Find: (i). $L\left[\frac{e^{-t}\sin^2 t}{t}\right]$ (ii). $L^{-1}\left\{\frac{1-e^{-2s}\quad 1-3e^{-2s}}{s^2}\right\}$

(3 + 3 + 4)

6A. A spring is stretched 3 inches by an 8 pound weight. The weight is attached to the spring and pulled down 6 inches below the equilibrium position and let go. If an impressed force 4sin2t is acting on the spring, describe the motion.

6B. Solve the system of equations using Gauss elimination method:
x +3y + 6z = 4, 3x − y + 4z =8, x −4y + 2z = 7

6C. Solve by Laplace transform method: $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+5y=e^t\sin t$ with $y(0)=0$ and $y'(0)=1.$

(3 + 3 + 4)

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