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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL UNIVERSITY, MANIPAL - 576 104

SECOND SEMESTER B.E DEGREE END SEMESTER EXAMINATION –2009

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

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

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

1A. Expand f(x, y) = sin xy with center at $\left(1, \frac{\pi}{2}\right)$ upto second degree terms.

1B. Change the order of integration and evaluate $\int_0^1 \int_{x^2}^{2-x} xy \, dy \, dx$.

1C. Define a maximal linearly independent set of vectors in a vector space V. Show that it forms a basis of V.

(3 + 4+ 3)

2A. Find the extreme values of $x^3 + y^3 - 3x - 12y + 20$.

2B. Find the area of the region enclosed by $y^2 = 4 - x$ and $y^2 = 4 - 4x$.

2C. Use Gram – Schmidt process to obtain an orthonormal set of vectors from the vectors (1,0,1), (0, 1, 1), (1, –1, 3).

(4 + 3+ 3)

3A. Solve : $x(x^2 + 1)dy + (2y - (x^2+1)^3)\, dx = 0$.

3B. Find the volume bounded by $x^2 + y^2 + z^2 = a^2$ and $x^2 + y^2 = ay$

3C. Solve the following system of equations by Gauss elimination method

$2x - 2y + z = 1$
$x + 2y + 2z = 2$
$2x + y - 2z = 7$

(3 + 4+3)

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

4B. Find

(i) $L\{t\sinh 2t\cos^2 t\}$ (ii) $L^{-1}\left\{\frac{e^{-2s}}{s(s^2+1)}\right\}$

4C. Find the inverse of the following matrix by elementary row operations.

$$\begin{pmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix}$$

(3 + 4+ 3)

5A. Solve : $y'' - 6y' + 10y = \cos 2x + e^{-3x} + x$.

5B. Express the following function interms of unit step functions and hence find its Laplace transform

$$f(t) = \begin{cases} t^2, & 0 \le t \le 2 \\ 2t - 7, & 2 < t \le 3 \\ 8, & t \ge 3 \end{cases}$$

5C. Solve the following differential equation by Laplace transform method

$x''(t) - 4x'(t) + 4x(t) = 4\cos 2t$, $x(0)=2$, $x'(0)=5$

(4 + 3 + 3)

6A. Solve : $(D^2 - 1)y = 2\left(1 - e^{-2x}\right)^{-1/2}$.

6B. Solve :

$$\frac{dx}{dt} + 2x - 3y = 5t$$

$$\frac{dy}{dt} - 3x + 2y = 2e^{2t}$$

6C. Evaluate the following integrals using Beta and Gamma functions

(i) $\int_0^{\pi/2} \sqrt{\cot\theta}\, d\theta$

(ii) $\int_0^1 x^m (\log x)^n dx$ where m > –1 and n, positive integer

(3 +4 + 3)

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