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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL - 576 104

SECOND SEMESTER B.E DEGREE MAKEUP EXAMINATION – July 2014

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

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

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

1A. Expand $f(x, y) = e^x \log(1 + y)$ about (0,0) up to third degree terms.

1B. Evaluate : $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dydx$ by changing into polar co-ordinates

1C. Solve :

$$\frac{dx}{dt} = 5x + y, \quad \frac{dy}{dt} = y - 4x$$

(3 + 3+ 4)

2A. Discuss the extreme values of the function f given by
$f(x, y) = x^3 + y^3 - 63(x + y) + 12xy$

2B. Solve $(D^2 + 1)y = \sec x \tan x$.

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

(3 + 3 + 4)

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

3B. Solve by Gauss – Elimination method
$x + y + z = 9$
$2x + y - z = 0$
$2x + 5y + 7z = 52$

3C. Find the volume inside the cone $x^2 + y^2 = z^2$ bounded by the sphere $x^2 + y^2 + z^2 = a^2$.

(3 + 3 + 4)

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

4B. Find the inverse of the following matrix by elementary row transformations

$$\begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}$$

4C. Find (i) $L\{e^{2t}\cos 2t\}$ (ii) $L^{-1}\left\{\dfrac{s}{s^2+4s+13}\right\}$.

(3 + 3 + 4)

5A. Solve : $y'' - 4y' + 4y = \sin 2x + x^2$.

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

$$f(t) = \begin{cases} t^2, & 0 \le t < 2 \\ 2t - 1, & 2 \le t < 3 \\ 7, & t \ge 3 \end{cases}$$

5C. A spring is such that it is stretched 6 inch by a 12 *l*b. The 12 *l*b weight is pulled down 3 inches below the equilibrium point and then released. If there is an impressed force of magnitude 9 sin4t *l*b, describe the motion. Assume that the impressed force acts downward for very small t.

(3 + 3 + 4)

6A. Find the area bounded by $y = 4x - x^2$ and $y = x$.

6B. Solve : $x^2y'' - xy' + y = \log x$.

6C. Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\sin\theta}\,d\theta \cdot \int_0^{\frac{\pi}{2}} \dfrac{d\theta}{\sqrt{\sin\theta}}$ using Beta and Gamma functions.

(3 + 3+ 4)

**** GOOD LUCK ****