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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL - 576 104

SECOND SEMESTER B.E DEGREE END SEMESTER EXAMINATION – May/June 2011

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. Solve : $xy\ 1+xy^2\ \dfrac{dy}{dx}=1.$

1B. Expand $\tan^{-1}\left(\dfrac{y}{x}\right)$ in the neighbourhood of (1,1) upto second degree terms.

1C. Using the Gram-Schmidt process construct an orthonormal basis from the vectors (1, 0, 1), (1, 2, 3) (2, –1, 2).

(3 + 3+ 4)

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

2B. Change the order of integration and hence evaluate $\displaystyle\int_0^3 \int_1^{\sqrt{4-y}} x+y\ dxdy$.

2C. Solve :

a) $(x^2 – ay)dx + (y^2 – ax)\, dy = 0$

b) $y\,(2xy + e^x)dx = e^x dy$ (3 + 3+ 4)

3A. Solve : $\dfrac{dy}{dx}=\ 4x+y+1\ ^2,\quad y(0) =1$

3B. Find by double integration, the area between the parabola $y = 4x – x^2$ and the line $y = x$.

3C. Find the extremum of $xy^2 z^3$ subject to the condition $x + y + z = 6$.

(3 + 3+ 4)

4A. Solve : $(D^2 - 2D + 4)\, y = e^x \cos x$

4B. Using double integration, find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$

4C. (i) Find the Lapalce transform of $f(t) = \begin{cases} e^{2t} & 0 < t < 1 \\ 2 & t > 1 \end{cases}$

(ii) Find $L^{-1}\left\{ \dfrac{s+2}{s^2 + 4s + 5 \;^{2}} \right\}$

(3 + 3+4)

5A. Solve : $\dfrac{d^2y}{dx^2} - 3\dfrac{dy}{dx} + 2y = \cos\ e^{-x}$ by the method of variation of parameters.

5B. Investigate the value of λ and μ so that the equations

$2x + 3y + 5z = 9$
$7x + 3y - 2z = 8$
$2x + 3y + \lambda z = \mu$

have

(i) no solution (ii) a unique solution (iii) an infinite number of solutions

5C. A spring is such that it would be stretched 6 inches by a 12 pound weight. Let the weight be attached to the spring and pulled down 4 inches below the equilibrium point. If the weight is started with an upward velocity of 2ft/sec describe the motion. No damping or impressed force is present.

(3 + 3+ 4)

6A. Solve : $(1+x)^2 \dfrac{d^2y}{dx^2} + \ 1+x \ \dfrac{dy}{dx} + y = 2\sin\ \log(1+x)$.

6B. Obtain the relation between Beta and Gamma functions.

6C. Find the Laplace transform of

$$f(t) = \begin{cases} \sin \omega t, & 0 < t < \dfrac{\pi}{\omega} \\ 0, & \dfrac{\pi}{\omega} < t < \dfrac{2\pi}{\omega} \end{cases} \quad , \quad f\left(t + \frac{2\pi}{\omega}\right) = f(t) \quad \forall\ t$$

(3 + 3+ 4)

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