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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, B.E. - Semester End Examination; June - 2016

Engineering Mathematics - II

(Common to All Branches)

Time: 3 hrs   *Max. Marks: 100*

Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

UNIT - I

1. a. Test for consistency and hence solve the following system of linear equations, $2x+y+z=10, \quad 3x+2y+3z=18, \quad x+4y+9z=16$.   6

   b. Solve the system of equations by using Gauss-Jordan Method:
   $4x+3y+z=13; \quad 2x-y-z=-3; \quad 7x+y-3z=0$.   7

   c. Solve the following linear equation :
   $2x+3y+z=9; \quad x+2y+3z=6; \quad 3x+y+2z=8$, by LU-decomposition method.   7

2. a. Find all the Eigen values and Eigen vector corresponding to the largest Eigen value of the matrix
   $$A=\begin{pmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{pmatrix}$$ 6

   b. Find the inverse of the matrix using Cayley-Hamilton theorem
   $$\begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{pmatrix}$$ 7

   c. Find the model Matrix P which diagonalizes the matrix $\begin{bmatrix} 2 & 6 \\ 0 & -1 \end{bmatrix}$.   7

UNIT - II

3. a. Solve: $\dfrac{d^4y}{dx^4}+4y=0$.   6

   b. Solve: $\left(D^2+3D+2\right)y=2x^2+4x+1$.   7

   c. Solve: $y''-4y'=x\sinh x$.   7

4. a. Solve: $y''-2y'+y=e^x\log x$ by the method of variation of parameter.   6

   b. Solve: $y''+y=2\cos x$ by the method of undetermined coefficients.   7

   c. Solve: $(1+x)^2\dfrac{d^2y}{dy^2}+(1+x)\dfrac{dy}{dx}+y=2\sin\left[\log(1+x)\right]$.   7

UNIT - III

5 a. Find Laplace transform of :

   i) $te^{-t}\sin 3t$

   ii) $\dfrac{1-\cos 2t}{t}$ 6

b. Define a unit of step function. Using this, find the Laplace transform of $f(t) = t^2$ for $0 < t \le 2$ and $f(t) = 0$ for $t > 2$.   7

c. Find the Laplace transform,

$$f(t) = \begin{cases} \sin wt & 0 < t < \pi/w, \\ 0, & \pi/w < t < 2\pi/w \end{cases} \quad \text{and} \quad f\left(t + 2\pi/w\right) = f(t).$$ 7

6 a. Find the Inverse Laplace transform of the following :

$$\frac{5s+3}{(s-1)(s^2+2s+5)}$$ 6

b. Find $L^{-1}\left\{\dfrac{s}{(s^2+1)(s^2+4)}\right\}$ by using convolution theorem.   7

c. Solve: $y'' + 4y' + 4y = e^{-t}$ $y(0) = y'(0) = 0$ by Laplace transform method.   7

UNIT - IV

7 a. Find the possible percentage error in computing the resistance 'r' from the formula,

$$\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}, if \ r_1, \ r_2 \quad \text{are both in error by 2\%.}$$ 6

b. Expand $e^{ax} \cos by$ in Taylor Series upto second degree terms about the origin.   7

c. Find the stationary value of $x^2 y^3 z^4$ subject to the condition $x + y + z = 5$.   7

8 a. If $F = (5xy - 6x^2)\hat{i} + (2y - 4x)\hat{j}$, Evaluate $\int_c F.dr$ along the curve C in the xy- plane, $y = x^3$ from the point $(1,1)$ to $(2,8)$.   6

b. Apply Green theorem to evaluate $\int_c (2x^2 - y^2)dx + (x^2 + y^2)dy$ where C is the boundary of the area enclosed by x-axis and the upper-half of the circle $x^2 + y^2 = a^2$.   7

c. Evaluate by using Gauss Divergence theorem $\iint_s \left(yz\hat{i} + zx\hat{j} + xy\hat{k}\right).\hat{n}ds$ where s is the surface of the sphere $x^2 + y^2 + z^2 = a^2$ in the first Octant.   7

UNIT - V

9 a. Evaluate: $\displaystyle\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}dx \ dy \ dz$.   6

b. Evaluate: $\displaystyle\iint_R xy(x+y)dxdy$ over the area between $y = x^2$ and $y = x$.   7

c. Evaluate: $\displaystyle\int_0^\infty \int_0^x xe^{-x^2/y} \ dxdy$ by change the order of integration.   7

10 a. Find the area of the circle $x^2 + y^2 = a^2$ by double integration.   6

b. Find the volume of the tetrahedron bounded by the planes $x = 0, y = 0, z = 0$ and $x + y + z = 1$.   7

c. Using Beta and Gamma function Show that,

$$\int_0^{\frac{\pi}{2}} \sqrt{\cot \theta} \ d\theta \ = \frac{\pi}{2}$$ 7

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