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

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, B.E. - Semester End Examination; July / Aug. - 2022

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. Investigate the values of λ and μ such that the system of equations:

$x + y + z = 6,\ x + 2y + 3z = 10,\ x + 2y + \lambda z = \mu$ has; 6

i) Unique solution ii) Infinite many solution iii) No solution

b. Apply Gauss-Jordon method to solve, 7

$x + y + z = 9,\ 2x - 2y + 3z = 8,\ 2x + y - z = 3.$

c. Solve the following system of equation by using the LU-decomposition method: 7

$x + y - z = 1,\ 3x + y + z = 1,\ 4x + 3y + 2z = -1.$

2 a. Using the Cayley-Hamilton theorem, compute the inverse of the matrix, 6

$A = \begin{bmatrix} 1 & 2 & 4 \\ -1 & 0 & 3 \\ 3 & 1 & -2 \end{bmatrix}$

b. Find all the Eigen values and the Eigen vector corresponding to the largest Eigen value of the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ 7

c. Diagonalize the matrix $\begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ 7

UNIT - II

3 a. Solve: $(D^2 + 6D^2 + 11D + 6)\, y = 0$. 6

b. Solve: $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = \cos 2x$. 7

c. Solve: $y'' + 3y' + 2y = 12x^2$. 7

4 a. Solve by the method of undetermined coefficients $y'' - 4y' + 4y = e^x$. 6

b. Solve $(D^2 + 1)\, y = \tan x$ by the method of variation of parameters. 7

c. Solve: $x^2y'' - 3xy' + 4y = (1 + x^2)$. 7

UNIT - III **18**

5 a. Find the Laplace transform of, i) $t \cos t\ t$ ii) $\frac{\sin at}{t}$ 6

b. Given $f(t)=\begin{cases} E, & 0 < t < \frac{a}{2} \\ -E, & \frac{a}{2} < t < a \end{cases}$ 7

Where $f(t + a) = f(t)$ show that $L[f(t)] = \frac{E}{}\tanh\left(\frac{as}{}\right)$.

c. Using unit step function find the Laplace transform of $\begin{cases} 1, & 0 < t \leq 1 \\ t, & 1 < t \leq 2 \\ t^2, & t > 2 \end{cases}$ 7

6 a. Find the inverse Laplace transform of,

i) $\frac{s+2}{s^2-4s+13}$ ii) $\frac{s}{(2s-1)(3s-1)}$ 6

b. Find the inverse Laplace form $\frac{s^2}{(s^2+a^2)(s^2+b^2)}$ by using the convolution theorem. 7

c. Solve the Laplace transform method: $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = e^{-t}$ with $y(0) = 0$ and $y'(0) = 0$ 7

UNIT - IV

7 a. If $u = \frac{yz}{x}, v = \frac{zx}{y}, w = \frac{xy}{z}$ *show that* $\frac{\partial(u,v,w)}{\partial(x,y,z)} = 4$ 6

b. Expand $e^x \cos y$ in a Taylor's series about the point $\left(1, \frac{\pi}{4}\right)$. 7

c. Find the minimum value of $x^2 + y^2 + z^2$ when $x + y + z = 3a$. 7

8 a. If $\vec{F} = 3xyi - y^2 j$, evaluate $\int_C \vec{F}.dr$ where c is the curve in the xy – plane $y = 2x^2$ from (0, 0) to (1, 2). 6

b. Verify Green's theorem for $\int_C [(xy + y^2)\, dx + x^2\, dy]$ where c is bounded by $y = x$ and $y = x^2$. 7

c. Verify Stoke's theorem for $\frac{1}{F} = (x^2 + y^2)\, i - 2xyj$ taken around the rectangle bounded by $x = 0, x = a, y = 0, y = b$. 7

UNIT - V

9 a. Evaluate;$\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x + y + z)\, dxdydz$. 6

b. Evaluate $\iint xy(x + y)\, dxdy$ taken over the area between $y = x^2$ and $y = x$. 7

c. Evaluate: $\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}}(2 - x)\, dydx$ by changing the order of integration. 7

10 a. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by double integration. 6

b. Calculate the volume of the solid bounded by the planes, $x = 0, y = 0, x + y + z = a$ and $z = 0$. 7

c. Show that, $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\pi/2}\sqrt{\sin\theta}\, d\theta = \pi$. 7

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