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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; June - 2017
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 solve the following system of linear equations :
$2x + y + 4z = 12$, $4x + 11y - z = 33$, $8x - 3y + 2z = 20$.   6

b. Apply Gauss-Jordan method to solve the system of equations :
$2x + 5y + 7z = 52$, $2x + 3y - z = 0$, $x + y + z = 9$.   7

c. Solve the following linear equations by L-U decomposition method :
$x + y + z = 9$, $2x - 3y + 4z = 13$, $3x + 4y + 5z = 40$.   7

2 a. Find all the Eigen values and the Eigen vector corresponding to the largest Eigen value of the matrix

$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.   6

b. Find the inverse of the matrix of using Cayley-Hamilton theorem $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$.   7

c. Find the modal matrix P which diagonalizes the matrix

$A = \begin{bmatrix} 2 & 6 \\ 0 & -1 \end{bmatrix}$ and hence find the diagonal matrix D.   7

UNIT - II

3 a. Solve: $(D^4 - 2D^3 + 5D^2 - 8D + 4) y = 0$.   6

b. Solve: $y'' + 2y' + y = 2x + x^2$.   7

c. Solve: $(D^2 - 2D + 1) y = x \cos x$.   7

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

b. Solve: $y'' + 4y = x^2 + e^{-x}$, by the method of undetermined coefficients.   7

c. Solve: $(3x + 2)^2 y'' + 3(3x + 2) y' - 36y = 3x^2 + 4x + 1$.   7

UNIT - III

5 a. Find the Laplace transform of : (i) $te^{-2t} \cos 2t$ (ii) $\dfrac{e^{-at} - e^{-bt}}{t}$.   6

b. Derive a unit step function. Using this, find the Laplace transform of,

$f(t) = \begin{cases} t^2, & 0 < t < 2 \\ 4t, & t > 2 \end{cases}$ 7

c. A periodic function $f(t)$ of period $2a$ is defined by,

$$f(t) = \begin{cases} a & for\ 0 \le t < a \\ -a & for\ a \le t \le 2a \end{cases} \qquad \text{Show that } L\{f(t)\} = \frac{a}{s} \tanh\left(\frac{as}{2}\right).$$ 7

6 a. Find the Inverse Laplace transform of : $\dfrac{3s+1}{(s-1)(s^2+1)}$.   6

b. Solve $L^{-1}\left\{\dfrac{S^2}{(S^2+a^2)(S^2+b^2)}\right\}$, by using convolution theorem.   7

c. Solve by using Laplace transform $\dfrac{d^2y}{dt^2} - \dfrac{3dy}{dt} + 2y = 4e^{2t}$, given that $y(0) = -3,\ y'(0) = 5$.   7

UNIT - IV

7 a. Find the percentage error in the area of an ellipse, when an error of +1% is made in measuring the major and minor axis.   6

b. Expand $\tan^{-1}\left(\dfrac{y}{x}\right)$ about the point (1, 1) using Taylor's theorem upto the second degree terms.   7

c. Find the extreme values of the function $x^3y^2(1-x-y)$.   7

8 a. Evaluate $\displaystyle\int_c \vec{F}.\vec{dr}$ where $\vec{F} = xyi + (x^2+y^2)j$ along

(i) The path of straight line from (0, 0) to (1, 0) and then to (1,1)
(ii) The straight line joining the origin and (1, 2).   6

b. Verify Green's theorem for $\displaystyle\oint_c (xy+y^2)dx + x^2dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.   7

c. Evaluate $\displaystyle\int_c xy\,dx + xy^2dy$ by Stoke's theorem where C is the square in the x-y plane with vertices (1, 0), (-1, 0), (0, 1), (0, -1).   7

UNIT - V

9 a. Evaluate $\displaystyle\int_0^1 \int_0^{1-x} \int_0^{1-x-y} \dfrac{dz\,dy\,dx}{(1+x+y+z)^3}$ 6

b. Evaluate $\displaystyle\iint_R x^2y\,dx\,dy$ where R is the region bounded by the lines $y = x,\ x+y = 2$ and $y = 0$.   7

c. Change the order of integration and hence evaluate $\displaystyle\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} xy\,dy\,dx$.   7

10a. Evaluate $\displaystyle\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}dx\,dy$, by changing to polar coordinates.   6

b. Find the area of the ellipse by double integration.   7

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

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