U.S.N | | | | | | | | | | |

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

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, B.E. - Make-up Examination; Jan/Feb - 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. Find the rank of the following matrix by applying elementary row transformations,

$$A = \begin{bmatrix} 1 & 1 & 1 & 4 \\ 1 & 7 & 1 & 1 \\ 1 & 1 & 6 & 1 \\ 5 & 1 & 1 & 1 \end{bmatrix}$$ 6

b. Solve the following equations by LU-decomposition method,

$x + y + z = 9;\ 2x - 3y + 4z = 13;\ 3x + 4y + 5z = 40$. 7

c. Apply Gauss-Jordan method to solve the following system of equation,

$x + y + z = 9;\ 2x + 5y + 7z = 52;\ 2x + y - z = 0$. 7

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

$$A = \begin{bmatrix} -2 & 3 & -1 \\ 2 & -1 & 3 \\ 6 & -2 & 2 \end{bmatrix}$$ 6

b. State Cayley-Hamilton theorem and use it to compute the inverse of the matrix,

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$ 7

c. When do you say that two matrices are similar? Find the model matrix P which diagonalizes the matrix $\begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$. 7

UNIT - II

3 a. Solve: $\frac{d^4y}{dx^4} - \frac{2d^3y}{dx^3} - \frac{3d^2y}{dx^2} + \frac{4dy}{dx} + 4y = 0$. 6

b. Solve: $\frac{d^3y}{dx^3} + y = 5\,e^x x^2$. 7

c. Solve: $\frac{d^3y}{dx^3} + 8y = x^4 + 2x + 1$. 7

Contd…2

4 a. Solve : $(3x+2)^2 \dfrac{d^2y}{dx^2} + 3(3x+2)\dfrac{dy}{dx} - 36y = 8x^2 + 4x + 1$. 6

b. Solve by the method of variation of parameters :

$$\frac{d^2y}{dy^2} + 2\frac{dy}{dx} + 2y = e^{-x}\sec^3 x.$$ 7

c. Solve by the method of undetermined coefficients :

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = x^2 + x + 1.$$ 7

UNIT - III

5 a. Find the Laplace transform of the following :

i) $\left(3\sqrt{t} + \dfrac{4}{\sqrt{t}}\right)$ ii) $t\sin at$. 6

b. Evaluate the following :

i) $\int_0^\infty te^{-3t}\cos 2t\, dt$ ii) $\int_0^\infty \dfrac{e^{-t}\sin t}{t}\,dt$. 7

c. Given $f(t)\begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$ where $f(t+a) = a$ 7

S.T. $L\{f(t)\} = \dfrac{E}{s}\tanh\left(\dfrac{as}{4}\right)$.

6 a. Express $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \cos 2t, & \pi < t < 2\pi \\ \cos 3t, & t > 2\pi \end{cases}$ 6

in terms of Heaviside unit step function and hence find the Laplace transforms.

b. Find the inverse Laplace transforms of the following :

$i)\ \dfrac{s^2}{(s^2+1)(s^2+4)}$ $ii)\ \cot^{-1}(s/a)$. 7

c. Find the inverse Laplace transform of $\dfrac{1}{(s^2+a^2)^2}$ using convolution theorem. 7

UNIT - IV

7 a. If the kinetic energy T is given by $T = \dfrac{1}{2}mv^2$, find approximately the change in T as the mass 'm' changes from 49 to 49.5 and the velocity V changes from 1600 to 1590. 6

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

Contd…3

c. Find the extreme values of the function $x^3y^2 - x^4y^2 - x^3y^3$. 7

8 a. Evaluate $\int_c \vec{F}.d\vec{r}$ where $\vec{F} = xy\hat{i} + \left(x^2 + y^2\right)\hat{j}$ along,

i) The path of the straight line from (0, 0) to (1, 0) and then to (1, 1) 6

ii) The straight line joining the origin and (1, 2).

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

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

UNIT - V

9 a. Evaluate: $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}\left(x + y + z\right)dy\,dx\,dz.$ 6

b. Evaluate: $\iint y\,dx\,dy$ over the region bounded by the first quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$ 7

c. Change the order of integration and evaluate: $\int_0^\infty\int_x^\infty \frac{e^{-y}}{y}\,dy\,dx$. 7

10 a. Evaluate: $\int_0^a\int_0^{\sqrt{a^2-x^2}} y^2\sqrt{\left(x^2 + y^2\right)}\,dy\,dx$ by changing into polar coordinates. 6

b. Find the area enclosed between the parabolas $y^2 = 4\,ax$ and $x^2 = 4\,ay$ using the double integral. 7

c. Using Gamma function evaluate,

$\int_0^\infty x\,e^{-x^8}dx \times \int_0^\infty x^2\,e^{-x^4}dx.$ 7

* * *