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

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, B.E. - Make - up Examination; July - 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. Find the constant values of λ and μ such that the system of equations $2x + 3y + 5z = 9$, $7x + 3y - 2z = 8$, $2x + 3y + \lambda z = \mu$ may have, — 6

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

b. Solve: $2x+y+z=10;\ 3x+2y+3z=18;\ x+4y+9z=16$, using Gauss-Jordan Method. — 7

c. Solve: $4x+y+z=4;\ x+4y-2z=4;\ 3x+2y-4z=6$, using LU-decomposition method. — 7

2 a. Find all the Eigen values and Eigen vector corresponding to the largest Eigen value of the matrix. — 6

$$A=\begin{bmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{bmatrix}$$

b. State Cayley-Hamilton theorem and use the same to compute the inverse of the matrix. — 7

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

c. Find the model Matrix P which diagonolizes the matrix $\begin{bmatrix}-1 & 3\\ -2 & 4\end{bmatrix}$. — 7

UNIT - II

3 a. Solve: $y''-3y'+2y=0;\ \ y(0)=-1,\ y'(0)=0.$ — 6

b. Solve: $y''-4y'+4y=e^{2x}+\cos 2x+4$. — 7

c. Solve: $y''-2y'+y=xe^{x}\sin x.$ — 7

4 a. Solve: $y''+3y'+2y=12x^2$, by the method of undermined co-efficient. — 6

b. Solve: $y''+2y'+y=e^{-x}\log x,$ by the method of variation of parameter. — 7

c. Solve : $(1+x)^2\, y''+(1+x)\,y'+y=2\sin\left[\log(1+x)\right].$ — 7

Contd…2

UNIT - III

5 a. Find Laplace transform of, i) $e^t \cos^2 t$ ii) $\frac{1-\cos at}{t}$. 6

b. Find the Laplace transform of the triangular wave of period *2a* given by

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

Hence show that $L\{f(t)\}=\frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$.

c. Express $f(t)=\begin{cases} 1, & 0\le t\le 1 \\ t, & 1<t\le 2 \\ t^2, & t>2 \end{cases}$ 7

in terms of Heaviside unit step function and hence find its Laplace transform.

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

i) $\frac{3s^2+4}{s^5}$ ii) $\log\left(\frac{s+a}{s+b}\right)$. 6

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

c. Solve: $y'''+2y''-y'-2y=0;\ y(0)=y'(0)=0\ and\ y''(0)=6$ by the method of Laplace transform. 7

UNIT - IV

7 a. If $u=\frac{yz}{x},\quad v=\frac{zx}{y},\quad w=\frac{xy}{z},\quad S.T.\ J\left(\frac{u,v,w}{x,y,z}\right)=4$. 6

b. Obtain the Taylor's expansion of $f(x,y)=\tan^{-1}\left(\frac{y}{x}\right)$ about (1, 1) upto second degree terms. 7

c. Using the Lagrange's method of undetermined multipliers. Find the stationary value of the function $f(x,y,z)=x^2+y^2+z^2$ subject to the constraint $xy+yz+zx=3a^2$. 7

8 a. Using Green's theorem in the plane, evaluate $\int_c \left(2x^2-y^2\right)dx+\left(x^2+y^2\right)dy$ where C is the boundary of the region bounded by $x=0,\ y=0,\ x+y=1$. 6

b. If $\vec{F}=2xy\hat{i}+yz^2\hat{j}+xz\hat{k}\ and\ S$ is the rectangular parallel piped bounded by $x=0,\ y=0,\ z=0,\ x=2,\ y=1,\ z=3$ evaluate $\iint_s \vec{F}.\hat{n}\ ds$ using Gauss divergence theorem. 7

c. Evaluate $\int_c \vec{F}.d\vec{r}$ by Stoke's theorem where $\vec{F}=y^2\hat{i}+x^2\hat{j}-(x+z)\hat{k}\ and\ C$ is the boundary of the triangle with vertices at $(0,0,0),(1,0,0)\ and\ (1,1,0)$. 7

UNIT - V

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

b. Evaluate: $\iint_R xy\, dx\, dy$ Where R is the region bounded by the co-ordinate axes and the line $x + y = 1.$ 7

c. Evaluate: $\int_0^3 \int_1^{\sqrt{4-y}} (x+y)\, dx\, dy$ by changing the order of integration. 7

10 a. Find by double integration the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay.$ 6

b. Using triple integrals, find the volume of the tetrahedron bounded by the planes $x = 0, y = 0, z = 0$ *and* $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1.$ 7

c. Define Gamma function Show that,

$$\int_0^{\frac{\pi}{2}} \sqrt{\sin\theta}\, d\theta \times \int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{\sin\theta}}\, d\theta = \pi.$$ 7

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