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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; May/June - 2018

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. Solve the following system of equations by using the LU - decomposition method:
$x+y+z=1,\ 3x+y-3z=5$ and $x-2y-5z=10.$ — 7

c. Apply Gauss-Jordon method to solve $x+2y+z=8,\ 2x+3y+4z=20,$ and $4x+3y+2z=16.$ — 7

2 a. State Cayley-Hamilton theorem and use it to compute the inverse of the matrix $\begin{bmatrix}1&0&2\\0&2&1\\2&0&3\end{bmatrix}$ — 6

b. Find all the Eigen value and the Eigen vector corresponding to the least Eigen value of the matrix $\begin{pmatrix}6&-2&2\\-2&3&-1\\2&-1&3\end{pmatrix}$ — 7

c. Find the model matrix P which diagonalizes the matrix $A=\begin{bmatrix}1&4\\2&3\end{bmatrix}$ — 7

UNIT - II

3 a. Solve: $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=0$ given that $y=0,\ y'=\text{-}1$ at $x=1$ — 6

b. Solve: $y''+y'+y=x^2+x+1.$ — 7

c. Solve: $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+5y=e^{2x}\sin x.$ — 7

4 a. Solve by the method of undetermined coefficients $\frac{d^2y}{dx^2}+\frac{dy}{dx}-2y=x+\sin x.$ — 6

b. Solve by the method of variation of Parameters $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=\frac{e^{3x}}{x^2}.$ — 7

c. Solve $(x+1)^2\frac{d^2y}{dx^2}+(x+1)\frac{dy}{dx}+y=4\cos\left[\log(x+1)\right].$ — 7

UNIT - III

5 a. Find the Laplace transform of (i) $\frac{\sin at}{t}$ (ii) $e^{3t}\sin 5t\sin 3t.$ — 6

b. *If* $f(t)=\begin{cases} t, & 0\le t\le a \\ 2a-t, & a\le t\le 2a \end{cases}$, $f(t+2a)=f(t)$. Then show that $L\{f(t)\}=\frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$. 7

c. Express $f(t)=\begin{cases} \cos t, & 0<t\le\pi \\ 1, & \pi<t\le 2\pi \\ \sin t, & t>2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. 7

6 a. Find the inverse Laplace transform of (i) $\frac{s+1}{s^2+s+1}$ (ii) $\log\left(\frac{s+1}{s+2}\right)$. 6

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

c. Solve the Laplace transform method: $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+3y=e^{-t}$ with $y(0) = 1$ and $y'(0) = 1$. 7

UNIT - IV

7 a. If $x=r\cos\theta$ and $y=r\sin\theta$ prove that JJ´ = 1. 6

b. Expand $e^x\log(1+y)$ in powers of x and y upto third degree terms by Taylor's theorem. 7

c. The temperature T at any point (x, y, z) in space is $T = 400\,xyz^2$. Find the highest temperature at the surface of the unit sphere $x^2 + y^2 + z^2 = 1$. 7

8 a. Evaluate $\int \vec{F}.d\vec{r}$ from (0, 0) to (1, 1) along (i) $y = x$ (ii) $y=\sqrt{x}$, where $\vec{F}=x^2i+xyj$. 6

b. Apply Stoke's theorem to evaluate $\oint_c (x+y)dx+(2x-z)dy+(y+z)dz$, where C is the boundary of the triangle with vertices $A = (2, 0, 0)$, $B = (0, 3, 0)$ and $C = (0, 0, 6)$. 7

c. Apply Gauss divergence theorem to evaluate $\iint_s \vec{F}.\hat{n}\,ds$ where $\vec{F}=(x^2-yz)\,\hat{i}+(y^2-zx)\,\hat{j}+(z^2-xy)\,\hat{k}$. Taken over the rectangular paralleopiped $0\le x\le a$, $0\le y\le b$, $0\le z\le c$. 7

UNIT - V

9 a. Evaluate $\int_0^4\int_0^{2\sqrt{z}}\int_0^{\sqrt{4z-x^2}} dy\,dx\,dz$. 6

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

c. Evaluate $\int_0^1\int_0^{\sqrt{1-x^2}}(y^2)dxdy$ by changing the order of integration. 7

10 a. Find the area of the ellipse $\frac{x^2}{9}+\frac{y^2}{16}=1$ by double integration. 6

b. Evaluate the integral $\iiint_R (xy)dxdydz$ where R is the positive octant of the sphere $x^2+y^2+z^2=a^2$. 7

c. Define Beta function. Evaluate $\int_0^4 x^{3/2}(4-x)^{5/2}\,dx$. 7

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