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

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, B.E. – Semester End Examination - June/July-2014

Engineering Mathematics - II

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **ALL** full questions. Any missing data may be assumed.*

1 a. Solve : $\left(D^4 - 2D^3 + D^2 - 12D + 20\right) y = 0$ 6

b. Solve : $\left(D^2 - 4D + 3\right) y = e^x \cos 2x$ 7

c. Solve : $\left(D^2 + 3D + 2\right) y = e^{-2x} + x^2 + 2x + 4$ 7

OR

2 a. Solve: $y'' - 2y' + 2y = e^x \tan x$ by the method of variation of parameters. 6

b. Solve: $x^2 \dfrac{d^2 y}{dx^2} + 2x \dfrac{dy}{dx} - 12y = x^2 \log x$ 7

c. Solve: $\dfrac{d^2 y}{dx^2} + 4\dfrac{dy}{dx} + 5y + 2\cosh x = 0,$ given $y = 0,$ $\dfrac{dy}{dx} = 1$ at $x = 0$ 7

3 a. Find i) $L\left\{e^{2t} + 4t^3 - \sinh 2t\right\}$ ii) $L\left\{e^{-t} \cos^2 t\right\}$ 6

b. Evaluate :

i) $\displaystyle\int_0^\infty t e^{-2t} \cos t \, dt$ ii) $\displaystyle\int_0^\infty \frac{e^{-t} \sin^2 t}{t} dt$ 7

c. Find the Laplace transform of the triangular wave of period $2a$ given by,

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

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

OR

4 a. Find the inverse Laplace transforms of the following functions,

i) $\dfrac{s+5}{s^2 - 6s + 13}$ ii) $\log\left[\dfrac{s^2 + 1}{s(s+1)}\right]$ 6

b. Express $f(t) = \begin{cases} \cos t, & 0 < t \le \pi \\ 1, & 0 < t \le 2\pi \\ \sin t, & t > 2\pi \end{cases}$ 7

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

Contd.. 2

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

5 a. If $x = r\sin\theta\cos\phi, y = r\sin\theta\sin\phi, z = r\cos\theta,$ show that $J\left(\dfrac{x,y,z}{r,\theta,\phi}\right) = r^2\sin\theta$ 6

b. Expand $x^2y + 3y - 2$ in powers of $(x-1)$ and $(y+2)$ as far as terms of the third degree using Taylor's theorem. 7

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

OR

6 a. Evaluate : $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \dfrac{dzdydx}{\sqrt{1-x^2-y^2-z^2}}$ 6

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

c. Evaluate $\int_0^1 \int_{x^2}^{2-x} xy\ dydx$ by changing the order of integration. 7

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

b. Find, by triple integration, the volume of the sphere $x^2 + y^2 + z^2 = a^2$ 7

c. Define Beta and Gamma function. Show that $\beta(m,n) = \int_0^\infty \dfrac{x^{m-1}dx}{(1+x)^{m+n}}$ 7

OR

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

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

c. If $\vec{F} = 2xy\hat{i} + yz^2\hat{j} + xz\hat{k}$ and S is the rectangular parallelepiped 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

9 a. For what values of λ and μ do the system of equations $x + y + z = 6,\ x + 2y + 3z = 10,\ x + 2y + \lambda z = \mu$ have (i) a unique solution (ii) infinite solutions (iii) no solution. 6

b. Solve: $x + y + z = 9,\ 2x - 3y + 4z = 13,\ 3x + 4y + 5z = 40$ using Gauss- Jordon method. 7

c. Solve: $2x+3y+2z=2,\ 3x+6y+z=-6,\ 10x+3y+4z=16$, using LU-decomposition method. 7

OR

10 a. Find all eigen values and the eigen vector corresponding to the largest eigen value of the matrix 6

$$A=\begin{bmatrix}1 & 1 & 3\\ 1 & 5 & 1\\ 3 & 1 & 1\end{bmatrix}$$

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

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

c. Find the modal matrix P which diagnolizes the matrix 7

$$\begin{bmatrix}-19 & 7\\ -42 & 16\end{bmatrix}$$

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