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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; Sep. / Oct. - 2023

Engineering Mathematics - II

(Common to All Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Explain linear system of equations, Eigen values/vectors similarity and diagonalization of matrices.

CO2: Solve linear second order differential equations. Evaluate Laplace transforms and inverse Laplace transforms.

CO3: Evaluate the Jacobians and the Taylor's series expansion and find the extreme value.

CO4: Analyse the vector integration to use in the study of line integrals.

CO5: Evaluate the multiple integrals and Evaluate application-oriented problems.

***Note:** **I) PART - A** is compulsory. **Two** marks for each question.*

*   **II) PART - B**: Answer any **Two** sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART – A	**10**			
1 a.	Find the rank of $A = \begin{bmatrix} 1 & 5 \\ 3 & 15 \end{bmatrix}$	2	L1	CO1	PO1
b.	Solve $y'' + 3y' + 2y = 0$.	2	L1	CO2	PO1
c.	Find Laplace transform of $e^{-t} sin2t$.	2	L1	CO3	PO1
d.	If $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$ find $div\vec{F}$.	2	L1	CO4	PO1
e.	Evaluate $\int_0^1 \int_a^b xy\,dydx$	2	L1	CO5	PO1
	II : PART – B	**90**			
	UNIT – I	**18**			
2 a.	Investigate the values of μ and λ for the following system of equations: $x + 2y + z = 8, 2x + y + 3z = 13, 3x + 4y - \lambda z = \mu$ may have i) Unique solution ii) Infinite solution iii) No solution.	9	L2	CO1	PO1
b.	Solve: $x + y + z = 1, 3x + y - 3z = 15, x - 2y - 5z = 10$ using L-U decomposition method.	9	L3	CO1	PO1
c.	Reduce the matrix $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ to a diagonal form.	9	L2	CO1	PO2
	UNIT – II	**18**			
3 a.	i) Solve: $(D^3 + D^2 + 4D + 4)y = 0$ ii) Solve: $y'' + y' + y = x + 1$	9	L2	CO2	PO1
b.	Solve: $\frac{d^2y}{dx^2} + a^2 y = \sec ax$, by the method of variation of parameter.	9	L2	CO2	PO1
c.	Solve: $(1+x)^2 y'' + (1+x)y' + y = 2\sin[\log(1+x)]$	9	L3	CO2	PO2

Q. No.	Question	Marks	Level	CO	PO
	UNIT – III	**18**			
4 a.	Find the Laplace Transform of, $(i)\ t^2 \sin 2t \quad (ii)\ \frac{\cos at - \cos bt}{t}$	9	L2	CO3	PO2
b.	Find the Laplace transform of the triangular wave of period $2a$ given by, $f(t) = \begin{cases} E, & 0 < t < a \\ -E, & a < t < 2a \end{cases}$. Hence show that, $L\{f(t)\} = \frac{E}{s} \tan h \left(\frac{as}{2}\right)$.	9	L3	CO3	PO2
c.	i) Find the inverse Laplace Transform of $\frac{s+4}{s^2+6s+25}$. ii) Solve $y'' + 4y' + 4y = e^{-t}$ with $y(0) = y'(0) = 0$ by using Laplace Transform method.	9	L3	CO3	PO2
	UNIT – IV	**18**			
5 a.	Define Jacobian of functions in three variables. If $x - r\cos\theta$ and $y = r\sin\theta$ prove that $JJ' = 1$.	9	L2	CO4	PO2
b.	The temperature T at point (x, y, z) in space is $T = 400\, xyz^2$. Find the highest temperature at the surface of the unit sphere $x^2 + y^2 + z^2 - 1$	9	L3	CO4	PO2
c.	Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy\,j$ taken around the rectangle bounded by the lines $x = 0, x = a, y = 0, y = b$.	9	L2	CO4	PO2
	UNIT – V	**18**			
6 a.	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dz\, dy\, dx}{\sqrt{1-x^2-y^2-z^2}}$.	9	L2	CO5	PO1
b.	Evaluate $\int_0^1 \int_{x^2}^{x} xy\, dy\, dx$ by changing the order of integration.	9	L2	CO5	PO2
c.	Show that $\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\frac{\pi}{2}} \sqrt{\sin\theta}\, d\theta = \pi$	9	L2	CO5	PO2

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