U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

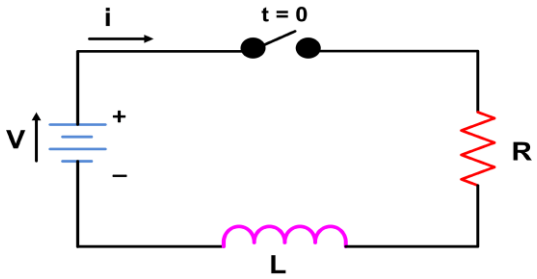
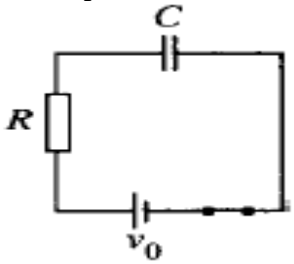
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**

Course Code: 23EE4BSMAE **Max Marks: 100**

Course: Mathematical Applications to Electrical Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Define ODE. Differentiate between homogeneous and non-homogeneous ODE. Give example for each.	*CO1*	*PO1*	**05**
	b)		Consider an RL with R= 100 Ω and L= 1mH circuit with a source voltage V = 100 V and initial current I(0) = 0. Find the current I(t) for t > 0 using Bernoulli equation. 	*CO1*	*PO1*	**08**
	c)		Find the solution of IVP using Eulers method for x= 0 to 1.0, y′=y+x, y(0)=0, h=0.2.	*CO1*	*PO1*	**07**
			OR			
2	a)		The RC circuit in Figure is initially relaxed and is closed at time t=0. Write the differential equation for the circuit and find the solution equation for charge after the switch is closed at t=0. Construct a table of solutions using Eulers method with five values for R= 100 Ω , C= 1μF, Step size = 0.1. 	*CO1*	*PO1*	**10**

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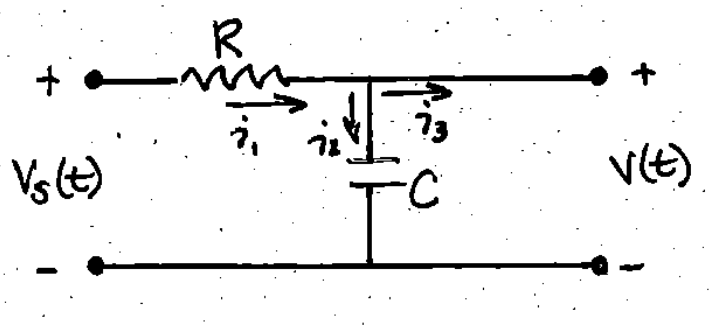
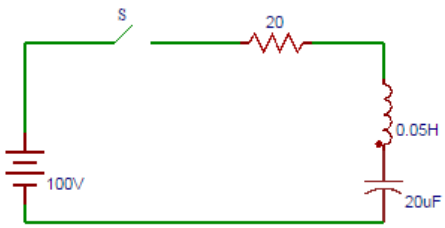
		b)	Find the output voltage expression for the filter circuit shown using Bernoulli's equation when, (i) R = 159 Ω, C = 0.1 F (ii) R = 10k Ω, C = 0.36 F. Given $v_s(t) = 10$ V 	*CO1*	*PO1*	**10**
			UNIT - II			
	3	a)	Briefly explain the method of undetermined coefficients to solve nonhomogeneous ODE.	*CO1*	*PO1*	**10**
		b)	For the series RLC circuit shown in fig, switch is opened at t=0. Find the expression for current and charge in the circuit at t>0. I(0) = 0 and I′(0)= 10 A. 	*CO1*	*PO1*	**10**
			OR			
	4	a)	Verify by substitution that the functions $y = x^2$ and y=1 are solutions of the nonlinear ODE y″y-xy′=0, but their sum is not a solution.	*CO1*	*PO1*	**08**
		b)	Explain the method of obtaining solution for linear homogeneous second order ODEs with constant coefficients.	*CO1*	*PO1*	**12**
			UNIT - III			
	5	a)	Solve the IVP using Laplace Transform. y"+7y'+12y=21e^{3t}, y(0)=3.5, y'(0) = -10	*CO1*	*PO1*	**07**
		b)	A DC voltage of 3V is applied to an RC circuit with R = 2000_ and C = 0.001 F, where q(0) = 0. Find the voltage across the capacitor as a function of t using Laplace transformation method.	*CO1*	*PO1*	**07**
		c)	Find the Laplace transform of (i) cos(at) (ii) sin (at)	*CO2*	*PO2*	**06**
			OR			
	6	a)	For the series RLC circuit shown, find the expression for charge and current in the circuit using Laplace transformation. Initial current and charge is zero.	*CO2*	*PO1*	**10**

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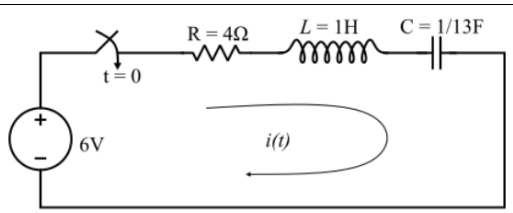
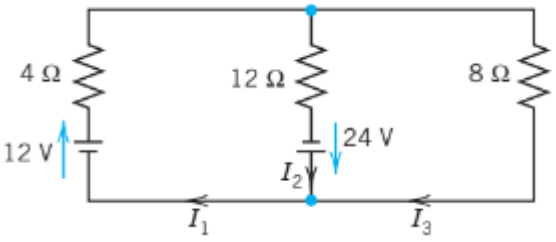
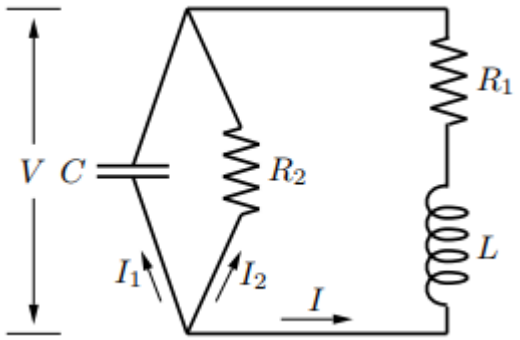
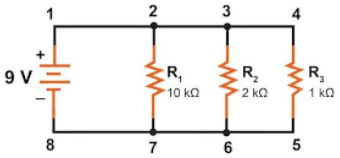
						
		b)	Find Laplace transform of (i) first and second derivatives of y(t) and integral of y(t).	*CO1*	*PO1*	**10**
			UNIT - IV			
	7	a)	Find the branch currents for the circuit shown using Gaussian Elimination method. 	*CO1*	*PO2*	**10**
		b)	For the circuit shown, find the Eigen values and Eigen vectors. Given, C = 2/3 , R1 = 1, R2 = 3/5 and L = 2. 	*CO1*	*PO2*	**10**
			OR			
	8	a)	Find Eigen values and Eigen vectors for the circuit shown. 	*CO1*	*PO1*	**10**
		b)	Solve the linear system using gauss elimination method $4y + z = 0$ $12x - 5y - 3z = 34$ $-6x + 4z = 8$	*CO1*	*PO1*	**10**
			UNIT - V			
	9	a)	Find Fourier series for f(x) = $\begin{cases} x & 0 < x < 1 \\ 1 - x & 1 < x < 2 \end{cases}$	*CO2*	*PO2*	**10**

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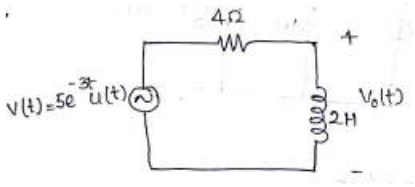
		b)	Obtain 4 point DFT of the sequence x(n)= { 1,1,0,0}	*CO1*	*PO1*	**10**
			OR			
	10	a)	Find half range cosine series for f(x) = xsinx in the range (0, π).	*CO2*	*PO1*	**08**
		b)	Describe the properties of Fourier transforms.	*CO1*	*PO1*	**07**
		c)	For the circuit shown, find the output voltage $V_0(t)$ using Fourier Transforms. 	*CO2*	*PO1*	**05**

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