AJ Institute of Engineering and Technology Mangaluru.

VTU Question Papers

Electronic & Communication Engineering
Supplementary Exam
III to VIII Semester
2022 SCHEME

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INDEX

CBCS SCHEME

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BEC302

Third Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

Digital System Design using Verilog

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain with a neat block diagram, the steps involved in realizing logic circuit from a problem statement.	06	L1	CO1
	b.	Identify the prime implicants and essential prime implicants of the following functions using Karnaugh map. i) $f(a, b, c, d) = \Sigma m(0, 1, 2, 5, 6, 7, 8, 9, 10, 13, 14, 15)$ ii) $f(a, b, c, d) = \prod M(0, 2, 3, 8, 9, 10, 12, 14)$	10	L2	CO1
	c.	Express the equation in proper canonical form: $G = f(w, x, y, z) = w'x + yz'$	04	L2	CO1
		OR			
Q.2	a.	Simplify the following equation $S = f(w, x, y, z) = \Sigma(1, 3, 13, 15) + \Sigma d(8, 9, 10, 11)$ using Quine – McClusky technique.	12	L2	CO1
	b.	An electric motor powering a conveyor used to move material is to be turned on when one of two operators is in position. If material is present to be moved and if the protective interlock switch is not open input and output variables are to expressed in binary, that is, if operator 1 is in position and the associated variable is a logical 0. The motor is running (on) if its output control variable is a '1' and the motor is off if the output variable is 0. write the truth table for the control problem and write the switching equation for the output that turns the motor ON.	08	L3	CO1
		Module – 2			
Q.3	a.	Explain the need for look ahead carry adders in reduction of propagation of delay by considering 4-bit parallel look ahead carry adder and deriving relevant equations at each stage.	12	L2	CO2
	b.	What are Decoders? Implement the following functions using a 3 to 8 line decoder: i) $f_1(a, b, c) = \Sigma m(0, 4, 6, 7)$ ii) $f_2(a, b, c) = \prod M(1, 4, 5)$	08	L2	CO2
		OR			
Q.4	a.	With a neat block diagram, explain decimal adders. Write a truth table to show decimal SUM, Binary SUM and BCD SUMS. Also generate the correction function from the truth table.	10	L2	CO2
	b.	Define encoders. Design a 8 to 3 line priority encoder with a neat truth table and write Boolean expressions for the outputs.	10	L4	CO2
		Module – 3			
Q.5	a.	Explain the operation of Master-Slave SR Flip-Flop with relevant waveforms.	10	L3	CO3
	b.	Derive the characteristic equations for SR, JK, D and T flip-flops from their respective functional tables.	10	L3	CO3

		OR			
Q.6	**a.**	What are registers? Illustrate the four possible ways through which registers transfer information.	10	L2	CO3
	b.	Design a synchronous mod-6 counter using clocked JK flip flops.	10	L4	CO3
		Module – 4			
Q.7	**a.**	Explain the structure of a verilog module and list out the various operator used in verilog coding with examples.	10	L4	CO4
	b.	Write a verilog code for a 2:1 multiplexer with necessary logic diagram and simulation waveforms.	10	L3	CO4
		OR			
Q.8	**a.**	Explain the different types of descriptions used in verilog coding.	10	L3	CO4
	b.	Write a verilog code using dataflow description for a half adder with necessary waveforms and truth table.	06	L3	CO4
	c.	Write a verilog code for the Boolean expressions given below: $Y_1 = ab'c + ab + (a \oplus b)$ $Y_2 = (wx) + (w'y) + w\,x\,y$	04	L3	CO4
		Module – 5			
Q.9	**a.**	With necessary flow chart explain D-latch along with a verilog code and simulation waveform.	10	L3	CO5
	b.	With necessary logic diagram, explain behavioural description for a 3-bit Binary counter using case statements in verilog code.	10	L3	CO5
		OR			
Q.10	**a.**	Differentiate case X and case Z statements in verilog and write a verilog code for a 4-bit priority encoder using case X statement.	10	L3	CO5
	b.	With necessary flow chart explain Booth multiplication algorithm and write a verilog code for the same.	10	L3	CO5

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CBCS SCHEME

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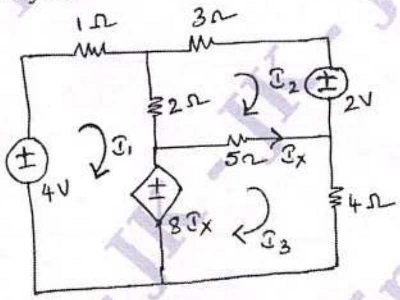
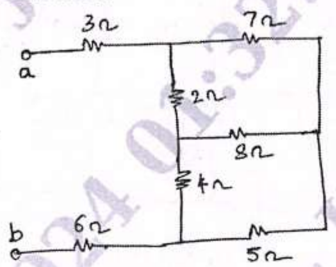
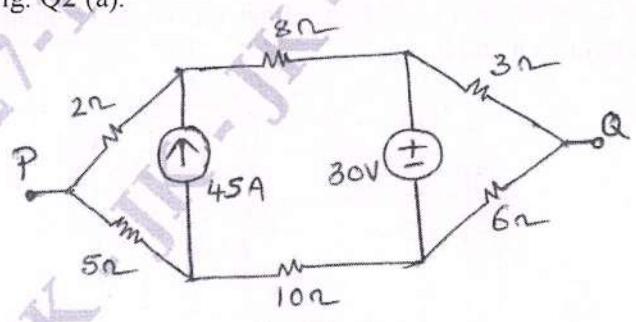
BEC304

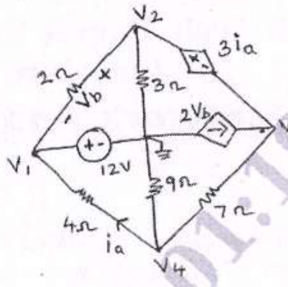
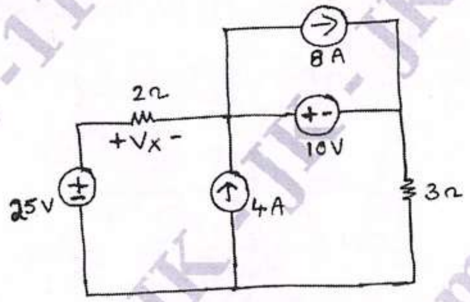
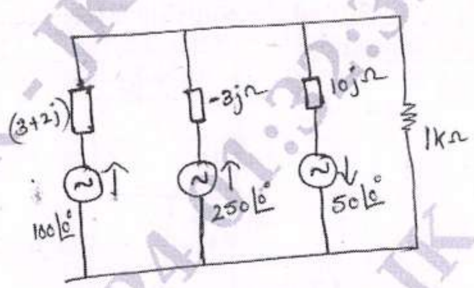
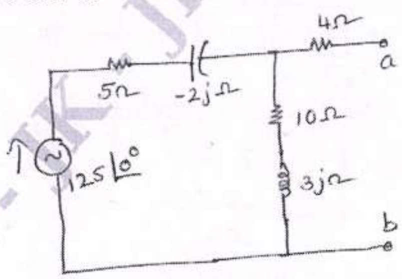
Third Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

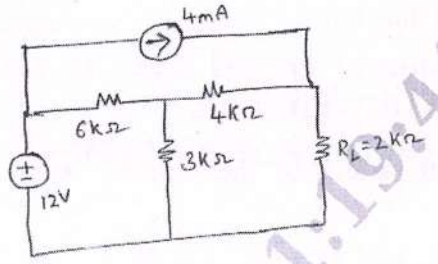
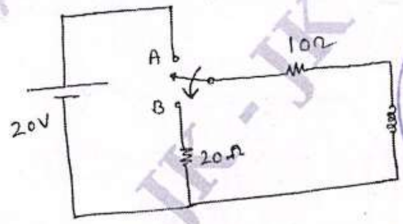
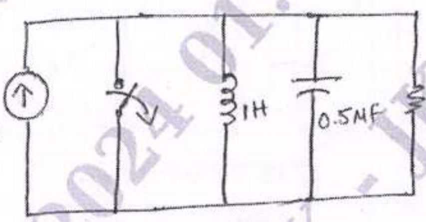
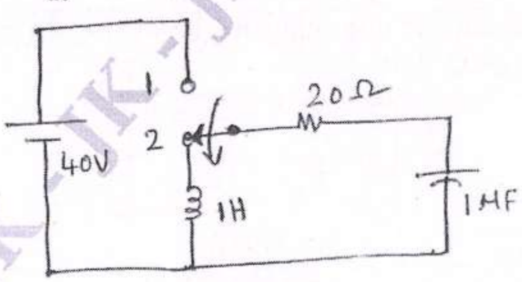
Network Analysis

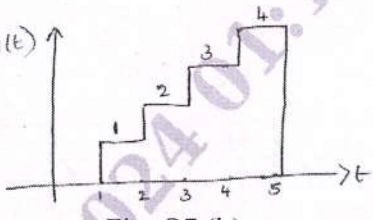
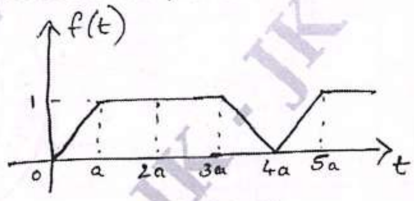
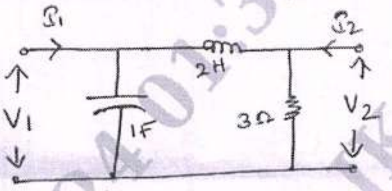
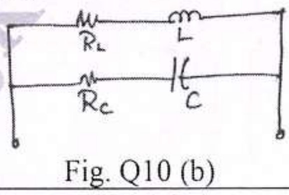
Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Compare the following : (i) Active and Passive elements (ii) Linear and Non-linear elements	4	L2	CO1
	b.	For the circuit shown below in Fig. Q1 (b), find the mesh currents and the value I_X using mesh analysis.  Fig. Q1 (b)	8	L3	CO1
	c.	For the circuit of Fig. Q1 (c), find the equivalent resistance between a and b using star to delta transformation.  Fig. Q1 (c)	8	L3	CO1
		OR			
Q.2	a.	Using source shift and source transformations, simplify the circuit between P and Q in Fig. Q2 (a).  Fig. Q2 (a)	10	L4	CO1

	b.	For the circuit in Fig. Q2 (b), find all the node voltages using node analysis.  Fig. Q2 (b)	10	L3	CO1
		Module – 2			
Q.3	a.	State and prove Thevnin theorem.	5	L2	CO2
	b.	For the circuit shown in Fig. Q3 (b), find the voltage V_X using superposition theorem.  Fig. Q3 (b)	8	L4	CO2
	c.	Find the current through the load of 1 KΩ, using Millman's theorem in Fig. Q3 (c).  Fig. Q3 (c)	7	L3	CO2
		OR			
Q.4	a.	State and prove maximum power transfer theorem for DC circuit with variable load R_L.	6	L2	CO2
	b.	For the circuit shown in Fig. Q4 (b). Find the Norton equivalent circuit across the terminal's a and b.  Fig. Q4 (b)	6	L3	CO2

Q. No.		Question	Marks	Level	CO
	c.	For the circuit shown in Fig. Q4 (c). Find the current through the load using Thevnin approach.  Fig. Q4 (c).	8	L3	CO2
		Module – 3			
Q.5	a.	Explain the importance of study of initial conditions in electric circuit analysis and also explain the behavior of R, L and C elements for transients.	10	L2	CO3
	b.	For the circuit shown in Fig.Q5 (b), steady state has been reached with the switch K on Position 'A'. The switch is moved to position B at t = 0. Determine the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t(0^+)$.  Fig. Q5 (b)	10	L3	CO3
		OR			
Q.6	a.	For the network shown in Fig. Q6 (a) at t = 0, switch is opened, calculate v, $\frac{dv}{dt}$ and $\frac{d^2v}{dt^2}$ at $t = 0^+$.  Fig. Q6 (a)	10	L3	CO3
	b.	For the network shown in Fig. Q6 (b). Switch is changed from position 1 to position 2 at t = 0. Steady condition have reaced before switching. Find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$.  Fig. Q6 (b)	10	L3	CO3

		Module – 4			
Q.7	a.	Find the Laplace transform's of the following functions : (i) Unit step function (ii) $\sin \omega t$ (iii) $\cosh(at)$ (iv) $t.\cos(at)$	10	L3	CO4
	b.	Find the Laplace transform of the staircase waveform shown in the Fig. Q7 (b).  Fig. Q7 (b)	10	L3	CO4
		OR			
Q.8	a.	State and explain the following : (i) STEP function (ii) Impulses responses	10	L2	CO4
	b.	Find the Laplace transform of the periodic waveform shown in Fig. Q8 (b).  Fig. Q8 (b)	10	L3	CO4
		Module – 5			
Q.9	a.	Define the following : (i) Resonance (ii) Quality factor	4	L1	CO5
	b.	Obtain Z-parameters interms of Y-parameters.	6	L3	CO5
	c.	Find the H parameters for the circuit shown in the Fig. Q9 (c).  Fig. Q9 (c)	10	L3	CO5
		OR			
Q.10	a.	A series RLC circuit has R = 10 Ω, L = 0.01 H and C = 100 μF, which is connected across 100 V supply. Calculate (i) F_r (ii) Q (iii) B.W (iv) I_r (v) f_1 and f_2	10	L3	CO5
	b.	Derive the expression of resonating frequency for the parallel resonant circuit shown in Fig. Q10 (b)  Fig. Q10 (b)	10	L3	CO5

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BEC401

Fourth Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

Electromagnetics Theory

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	State and explain Coulomb's law of force between two point charges in vector form.	6	L1	CO1
	b.	Given the two points C(-3, 2, 1) and D(5, 20°, -70°) find i) Spherical coordinates of c ii) The rectangular coordinates of D.	6	L2	CO1
	c.	Identical point charges of 3μc are located at the four corners of square of 5cm side. Find magnitude of force on any one charge.	8	L2	CO1
		OR			
Q.2	a.	Define electric field intensity. Derive an expression for electric field intensity due to infinite line charge.	8	L3	CO1
	b.	Define electric flux and flux density. Let a point charge Q_1 = 25nc be located at A(4, -2, 7) and charge Q_2 = 60nc be at B(-3, 4, -2). Find E at C(1, 2, 3) and find direction of $\overline{E}$.	12	L3	CO1
		Module – 2			
Q.3	a.	State and prove Gauss law.	6	L1	CO2
	b.	Evaluate both side of the divergence theorem for the defined plane with $1 \le x \le 2$, $2 \le y \le 3$ and $3 \le z \le 4$, if $D = 4xa_x + 3y^2a_y + 2z^3a_z$ C/m^2.	10	L3	CO2
	c.	Derive continuity of current equation.	4	L3	CO2
		OR			
Q.4	a.	Obtain the expression for the work done in moving a point charge in an electric field.	6	L1	CO2
	b.	Given that the field $D = \frac{5\sin\theta\cos\varphi}{r} a_\varphi$ c/m^2. Find: i) Volume charge density ii) The total electric flux leaving the surface of the spherical volume of radius 2m.	8	L3	CO2
	c.	Define potential difference. Derive the expression for potential field of a point charge.	6	L3	CO2

		Module – 3			
Q.5	**a.**	State and explain Biot Savarts law.	**8**	**L1**	**CO3**
	b.	From the point form of Gauss's law derive Poissons and Laplace's equation. Solve the laplaces equation for potential field in the homogeneous region between the two concentric conducting spheres with radii 'a' and 'b' such that b > a, if potential v = 0 at r = b and v = v_0 at r = a. Also find capacitance between concentric spheres.	**12**	**L3**	**CO3**
		OR			
Q.6	**a.**	Define Stoke's theorem. Use this theorem to evaluate both sides of theorem for the field H = 6xy ax -3y^2ay v/m and rectangular path around the region $2 \leq x \leq 5$, $-1 \leq y \leq 1$ and z = 0. Let the positive direction of ds be a_z.	**12**	**L2**	**CO3**
	b.	Define Ampere's law and derive expression for magnetic field intensity due to infinite long straight conductor using Biot-Savart law.	**8**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Derive an expression for Lorentz force equation.	**6**	**L3**	**CO4**
	b.	If B = 0.05xa_y Tesla in a material for which $\chi_m = 2.5$, find : i) u_r ii) μ iii) H iv) M v) J v0) J_b.	**8**	**L3**	**CO4**
	c.	Derive the expression for force between two different current elements.	**6**	**L2**	**CO4**
		OR			
Q.8	**a.**	Discuss the magnetic boundary conditions as applicable to B and H at the interface between two different magnetic materials.	**10**	**L2**	**CO4**
	b.	Write short notes on : i) Magnetic circuits ii) Forces on magnetic materials.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	List Maxwell's equations in free space for point form and integral form. Derive the modification of Ampere's circuit law to suit for time varying conditions.	**12**	**L2**	**CO5**
	b.	Let $\mu = 3 \times 10^{-5}$ H/m $\varepsilon = 1.2 \times 10^{-10}$ F/m and $\sigma = 0$ every where. If H = 2cos (10^{10}t – βx)a_z A/m. Use Maxwell's equation to obtain B, D and E.	**8**	**L3**	**CO5**
		OR			
Q.10	**a.**	State and prove Poynting theorem.	**10**	**L2**	**CO5**
	b.	A 15GHz plane wave travelling in a medium has an amplitude E_0 = 20V/m. Find phase velocity, propagation constant and impedance. Assume $\varepsilon_r = 2$ and $\mu_r = 5$.	**10**	**L3**	**CO5**

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CBCS SCHEME

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BEC402

Fourth Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

Principles of Communication System

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the autocorrelation and cross – relation functions. Infer the properties of autocorrelation function.	6	L2	CO5
	b.	Determine the characteristics function of a Gaussian random variable, with a given mean and variance.	8	L2	CO5
	c.	Define Probability. Illustrate the relationship between sample space, events and probability.	6	L2	CO5
		OR			
Q.2	a.	What is Conditional probability? Prove that P(B/A) = P(A/B).P(B)/P(A).	6	L2	CO5
	b.	Explain Central Limit theorem as applied to Gaussian random process.	6	L2	CO5
	c.	Develop a program to generate the probability density function of Gaussian distribution function.	8	L3	CO5
		Module – 2			
Q.3	a.	With relevant expression, explain the time domain and frequency domain description of AM.	7	L2	CO1
	b.	Explain how amplitude modulated wave generated using diode modulator.	8	L2	CO1
	c.	An AM transmitter has a carrier power of 30W. The percentage of modulation is 85 percent. Calculate i) the total power ii) the power in one sideband.	5	L3	CO1
		OR			
Q.4	a.	Explain the generation of DSBSC signal using lattice modulator.	8	L2	CO1
	b.	Explain the working of transmitter and receiver of Frequency Division Multiplexing (FDM).	6	L2	CO1
	c.	An audio frequency signal $10 \sin 2\pi\, 500t$ is used to amplitude modulate a carrier of $50 \sin 2\pi \times 10^5 t$. Assume $\mu = 0.2$. Calculate the followings : i) Sideband frequencies ii) Amplitude of each sideband frequencies iii) Bandwidth required iv) Total power delivered to the load of 600Ω.	6	L3	CO1
		Module – 3			
Q.5	a.	Explain with neat diagram, generation of frequency modulation with an IC VCO.	8	L2	CO2

	b.	A 93.2 MHz carrier is frequency modulated by a 5KHz sine wave. The resultant FM signal has a frequency deviation of 40 KHz. Determine the followings : i) Carrier swing of the FM signal. ii) Highest and lowest frequencies attained by the FM signal. iii) Modulation index.	6	L3	CO2
	c.	Compare amplitude modulation versus frequency modulation.	6	L2	CO2
		OR			
Q.6	a.	Draw the block diagram of a super heterodyne receiver and explain the function of each block.	6	L2	CO2
	b.	Explain Noise suppression effect of FM and how noise is introduced to effect on phase shift.	7	L3	CO3
	c.	Explain the demodulation process of frequency modulation using slope detector.	7	L2	CO2
		Module – 4			
Q.7	a.	List the advantages of digital signals over analog signals.	6	L2	CO3
	b.	State and prove the sampling theorem.	10	L2	CO3
	c.	What is aperature effect in PAM system? How it can be minimized?	4	L2	CO3
		OR			
Q.8	a.	Explain the each block of a PCM system with neat diagram.	10	L2	CO3
	b.	Explain the generation of PPM waves.	6	L2	CO3
	c.	For the given binary sequence 01101001, draw the following line codes waveforms : i) Unipolar NRZ ii) Polar NRZ iii) Unipolar RZ iv) Bipolar RZ.	4	L3	CO3
		Module – 5			
Q.9	a.	Define Signal to Noise Ratio (SNR). Explain the different types of external and internal noise.	6	L2	CO1
	b.	Define Inter Symbol Interference (ISI). Outline the baseband binary data transmission system with neat block diagram and equations.	8	L2	CO4
	c.	Develop a code to generate and plot eye diagram.	6	L3	CO4
		OR			
Q.10	a.	Illustrate the concept of noise in cascaded stages with a diagram. Write Friis formula and mention its terms.	6	L2	CO1
	b.	Explain the following concept briefly : i) Nyquist criterion for distortionless transmission. ii) Baseband M – array PAM transmission.	8	L2	CO4
	c.	Write a note on short noise and thermal noise.	6	L2	CO1

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CBCS SCHEME

USN | | | | | | | | | | | **BEC403**

Fourth Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1

			M	L	C
Q.1	a.	For the mechanical system shown in Fig.Q1(a), (i) Draw the nodal equivalent circuit (ii) Write the differential equations governing its dynamic behaviour (iii) Write the force voltage and force current analogous electrical networks along with equations.	10	L3	CO3

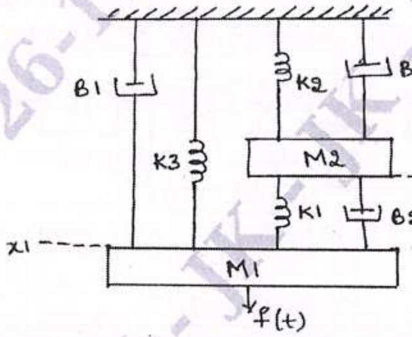


Fig.Q1(a)

			M	L	C
	b.	Compare open loop and closed loop control system with example.	10	L1	CO2

OR

			M	L	C
Q.2	a.	The force voltage analogy of the translational mechanical system is given below Fig.Q2(a). Obtain its analogous mechanical system. Also write the differential equations governing the mechanical system.	10	L4	CO4

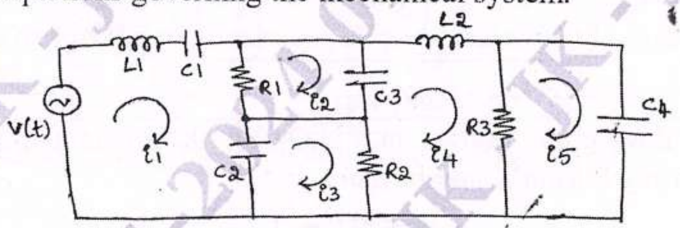


Fig.Q2(a)

			M	L	C
	b.	For the mechanical shown in Fig.Q2(b), i) Construct the nodal equivalent circuit and write the differential equations governing its dynamic behaviour. ii) Develop force voltage and force current analogous circuit. Also write the differential equations governing the system.	10	L3	CO4

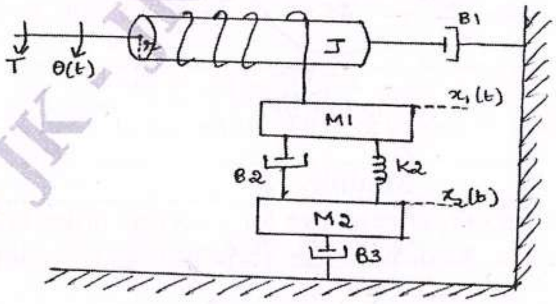
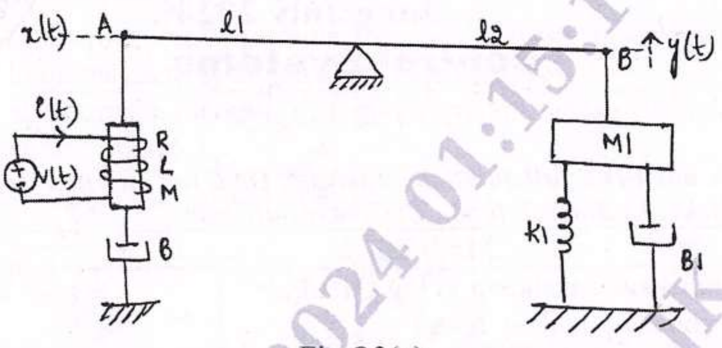
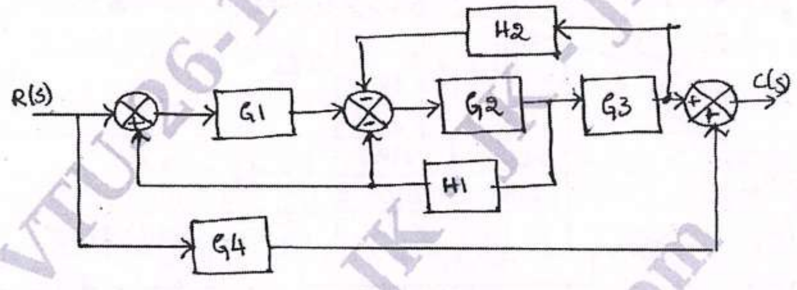
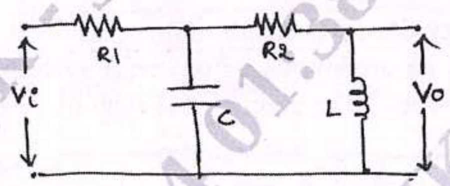
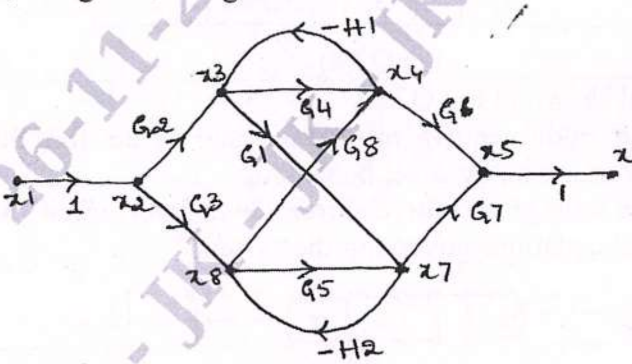
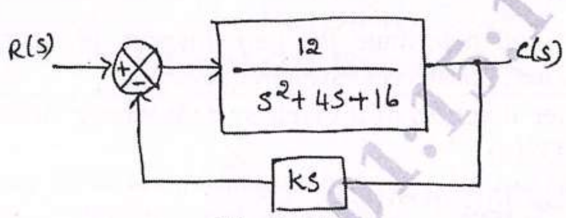
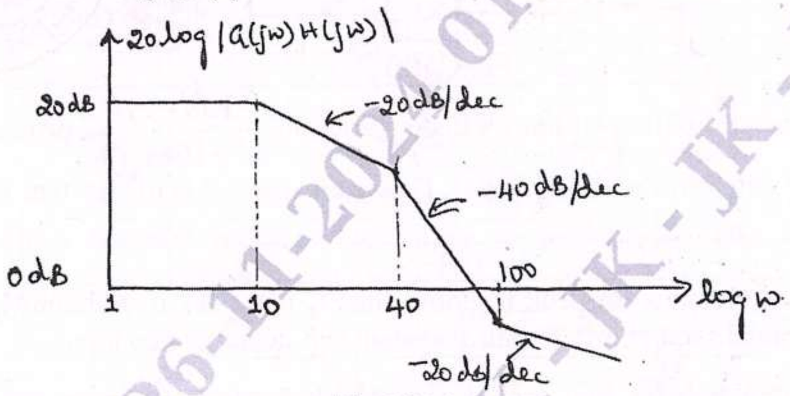


Fig.Q2(b)

		Module – 2			
Q.3	**a.**	For the electro-mechanical system shown in Fig.Q3(a), determine the transfer function Y(s)/V(s).  Fig.Q3(a)	10	L3	CO4
	b.	Apply block diagram reduction technique to find the transfer function C(s)/R(s) for the system shown in Fig.Q3(b).  Fig.Q3(b)	10	L3	CO4
		OR			
Q.4	**a.**	Construct the signal flow graph for the electrical network shown in Fig.Q4(a) and obtain the transfer function using Mason's gain formula.  Fig.Q4(a)	10	L3	CO4
	b.	For the signal flow graph shown in Fig.Q4(b), determine the transfer function x_6 / x_1 using Mason's gain formula.  Fig.Q4(b)	10	L3	CO4
		Module – 3			
Q.5	**a.**	Derive the expression for output response for a second order under-damped system with step input. Also plot the response and comment on the stability.	10	L2	CO1

	b.	A feedback control system shown in Fig.Q5(b) has a damping factor of 0.8. Determine the constant K and all time domain specifications.  Fig.Q5(b)	06	L3	CO3
	c.	A control system with open loop transfer function $\frac{K(s+2)}{s^2+10s+20}$ produces 20% steady state error with step input. Determine the value of constant K.	04	L3	CO4
		OR			
Q.6	a.	Derive the expressions for peak response time t_p and peak overshoot M_p of an underdamped second order control system subjected to step input.	08	L2	CO2
	b.	The open loop transfer function of a feedback control system is $\frac{K}{s+1}$. Determine the error series and steady state error when inputs are (i) $r(t) = a + bt + ct^2 + de^{-t}$ (ii) $r(t) = \sin 0.1t$	08	L3	CO3
	c.	Write short notes on proportional plus derivative control (PD Control).	04	L1	CO1
		Module – 4			
Q.7	a.	Find the range of K for which the system with closed loop transfer function $\frac{K}{s(s^2+s+1)(s+2)+K}$ is stable. For what K, the system oscillates and what is the corresponding frequency of oscillation.	06	L3	CO3
	b.	Construct the root locus of a control system with characteristic equation $(s^2 + 2s + 2) + K(s + 4) = 0$. Determine the stability of closed loop system. Show that a part of the root locus is a circle of radius $\sqrt{10}$ units with centre at (-4 , 0).	14	L3	CO4
		OR			
Q.8	a.	A unity feedback system has open loop transfer function of $\frac{K(s+13)}{s(s+3)(s+7)}$ (i) Determine the range of K for which the system is stable. (ii) Determine the range of K such that it has roots more negative than $s = -1$	08	L3	CO3
	b.	Construct the root locus of a control system with open loop transfer function of $\frac{K}{s(s+3)(s^2+2s+2)}$. Determine the stability of closed loop system.	12	L3	CO4
		Module – 5			
Q.9	a.	The closed loop transfer function of a feedback control system is $\frac{100}{s^2+8s+100}$ Determine resonant peak and resonant frequency.	04	L3	CO4

			Marks	Level	CO
	b.	Open loop transfer function of a unity feedback control system is $\frac{80}{s(s+2)(s+20)}$ Draw the Bode plot and determine the gain margin, phase margin, gain cross over frequency and phase crossover frequency.	10	L3	CO4
	c.	Determine the transfer function of a given system whose Bode Magnitude plot is shown in Fig.Q9(c).  Fig.Q9(c)	06	L3	CO4
		OR			
Q.10	a.	Construct the Nyquist plot for a control system with open loop transfer function $\frac{K(s+1)}{s(s-1)}$. From the plot, determine the stability of closed loop system.	08	L3	CO4
	b.	The transfer function of a control system is given by $\frac{Y(s)}{U(s)} = \frac{s^2+3s+4}{s^3+2s^2+3s+2}$ Obtain state model using signal flow grpah.	06	L3	CO3
	c.	Obtain state model by direct decomposition method for a system with transfer function $\frac{Y(s)}{U(s)} = \frac{5s^2+6s+8}{s^3+3s^2+7s+9}$	06	L3	CO3

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