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RAMAIAH Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
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SEMESTER END EXAMINATIONS – APRIL / MAY 2023

Program	:	**B.E. – Electronics and Communication Engineering**	**Semester**	:	**III**
Course Name	:	**Network Analysis and Control Systems**	**Max. Marks**	:	**100**
Course Code	:	**EC34**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT - I

1. a) Find the voltage across A-B in the given circuit. CO1 (10)

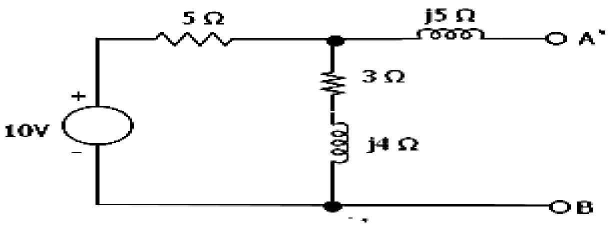

Fig.1(a)

b) Find the mesh currents in the circuit shown in Fig.1(b). CO1 (10)

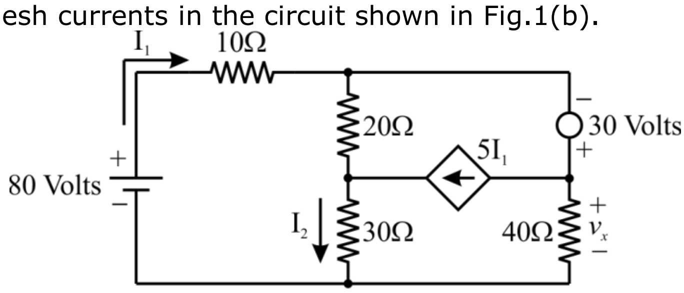

Fig.1(b)

2. a) Find the node voltages in the given circuit. CO1 (10)

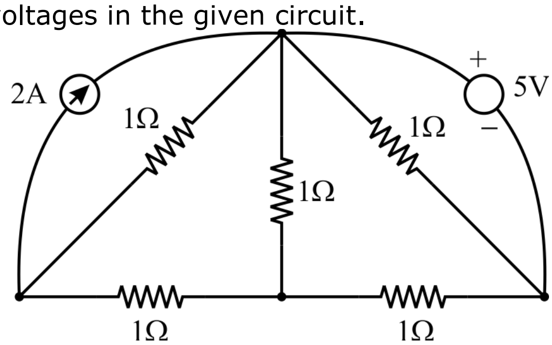

Fig.2(a)

b) Find R in the given circuit when (i) open circuit voltage across A – B is 2.5 volts and (ii) short circuit current through A - B is 0.5 Amps. CO1 (10)

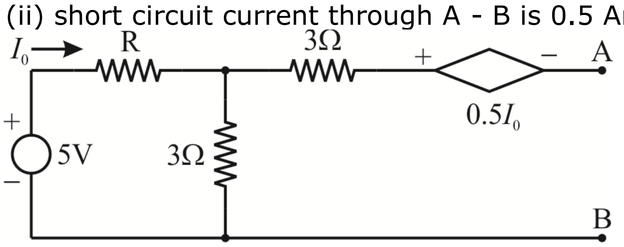

Fig.2(b)

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UNIT - II

3. a) Obtain the overall transfer function of the block diagram shown in Fig. 3(a), by using reduction technique. CO2 (10)

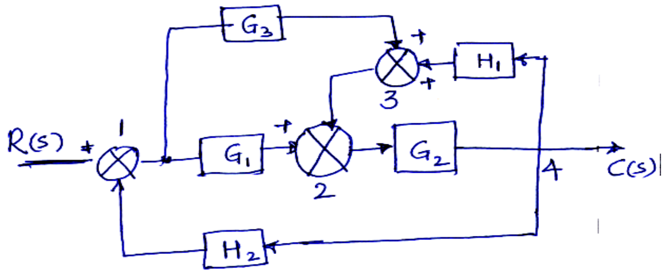

Fig.3(a)

b) State and Prove the following properties in Laplace Transform: CO2 (10)
   i. Frequency Shifting ii. Integration in Time domain.
   Apply the Laplace Transform to find v(t) given v(0)=2 and dv(0)/dt=4
   $d^2v(t)/dt^2+(5dv(t)/dt)+6v(t)=10e^{-t}\,u(t)$.

4. a) State and Prove the initial and final value theorem in Laplace Transform. Find the Laplace Transform of the following signal, CO2 (10)
   $x(t)=6te^{-3t}$ for $2\leq t\leq 4$ and $x(t)=0$ for others.

b) Reduce the block diagram shown in Fig. 4(b), to its simplest possible form and find its closed loop transfer function. CO2 (10)

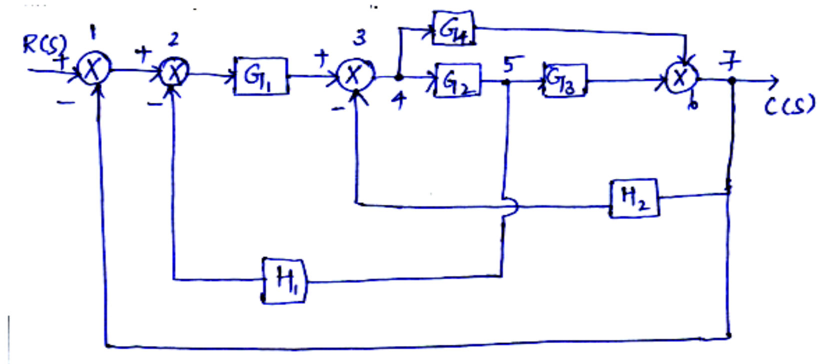

Fig.4(b)

UNIT - III

5. a) Determine the transfer function for the signal flow graph as shown using Mason's gain formula. CO3 (10)

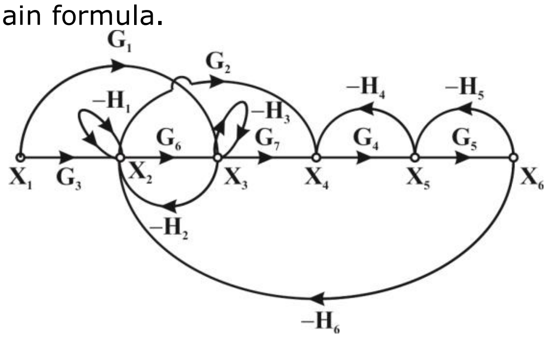

Fig.5(a)

b) The OLTF of a unity feedback system is given by $G(s) = k/(s\,(1+\tau s))$, where k and τ are positive constants. CO3 (10)
   i) By what factor should the amplifier gain be multiplied so that damping ratio is increased from 0.2 to 0.8.
   ii) By what factor should the time constant τ be multiplied so that the damping ratio is reduced from 0.6 to 0.3.

6. a) Find $C(s)/R(s)$ for the signal flow graph given in the following Fig.6(a) using Mason's Gain formula. CO3 (10)

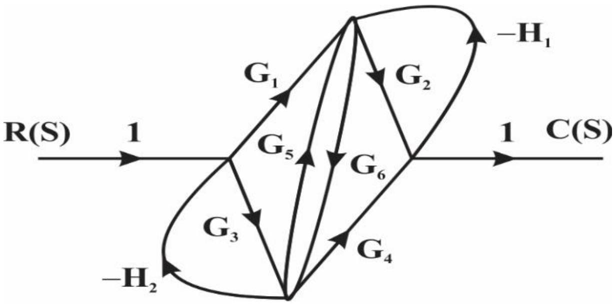

Fig.6(a)

b) Find the time response of a second order under damped system subjected to a unit step input. Plot the response. CO3 (10)

UNIT- IV

7. a) Sketch the root locus diagram of the control system with a open loop transfer function G(s)H(s)=K(s+1)/s^2(s+10) and find the maximum value of K for the stability CO5 (10)

b) Using RH criterion calculate the range of K that keeps the system stable and has its closed loop poles more negative than -1, for the unity-feedback system with G(s)=K(s+13)/s(s+3) (s+7). CO5 (10)

8. a) Sketch the root locus plot for the system whose open loop transfer function is given by G(s)H(s)=K/s(s+2) (s^2+8s+20) and find the value of K for stability. CO4 (10)

b) Given the unity feedback system with G(s)=K(s+4)/s(s+1) (s+2) using Routh-Hurwitz criterion find the following: CO4 (10)
   i. Range of K that keeps the system stable
   ii. Value of K that makes the system oscillates and the corresponding frequency.

UNIT - V

9. a) The open loop transfer function of a unity feedback system is given by G(s) = 15/ s$(s+10)^2$, then sketch the polar plot and determine the gain margin and phase margin. CO5 (10)

b) A unity feedback control system is characterized by an open loop transfer function: CO5 (10)
G(s)H(s) = K / s(s + 1)(0.1s + 1). Using Bode plots find i) The value of K to a give gain margin of 10dB ii) Value of K to give a phase margin of 24^0.

10. a) The open loop transfer function of a unity feedback system is given by G(s) = 1/ s(s+1)(s+2) , then sketch the polar plot and determine the gain margin and phase margin. CO5 (10)

b) Discuss the Stability of the closed loop system by drawing Bode plot whose open loop transfer function is CO5 (10)
G(s) H(S) = 100(S+2)/S(S+3)(S+5). Hence obtain gain cross over frequency and phase margin. Comment on stability of the system.

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