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RAMAIAH
Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – MARCH 2024

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) For the network shown in Fig.1(a), find the resistance between the terminals A and B — CO1 (06)

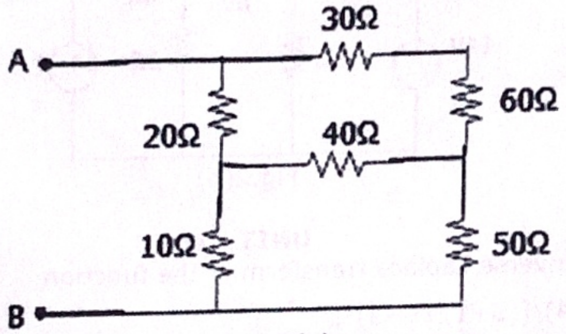


Fig.1(a)

b) For the network shown in Fig.1(b), apply node voltage analysis and hence find V_0. — CO1 (06)

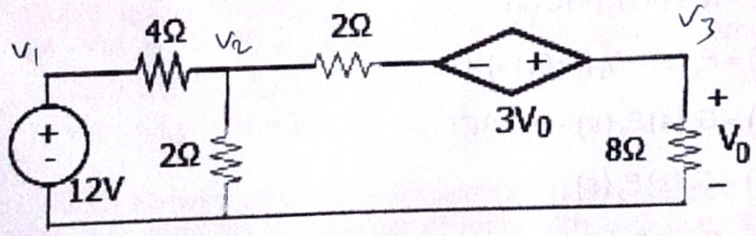


Fig.1(b)

c) Apply mesh current analysis to find V_0 and V_{CE} for the transistor circuit shown in Fig.1(c), Let $\beta = 100$ and $V_{BE} = 0.7$ V . — CO1 (08)

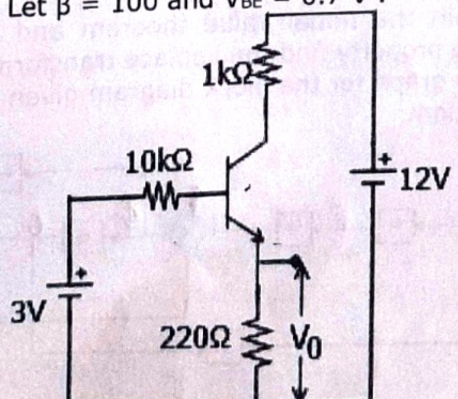


Fig.1(c)

2. a) Apply node voltage analysis for the network shown in Fig.2(a) to determine what value of 'E' will cause V_x to be zero. CO1 (10)

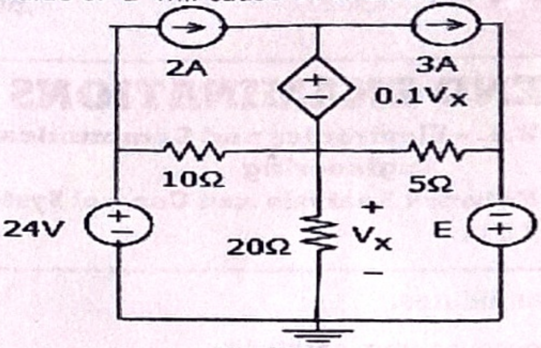


Fig.2(a)

b) Apply mesh current analysis for the network shown in Fig.2(b) to find the voltage across 2Ω resistor. CO1 (10)

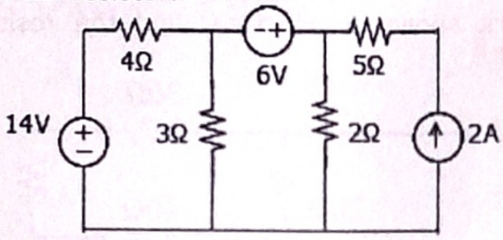


Fig.2(b)

UNIT - II

3. a) Obtain the inverse Laplace transform of the function CO2 (10)

$F(S)= (S+4)/[(S+1)^2(S+3)^2]$

b) The performance equations of a controlled system are given by the following set of linear algebraic equations. Draw the block diagram and determine C(S)/R(S) by reducing the block diagram in steps. CO2 (10)

$$E_1(s) = R(s) - H_3(s)C(s)$$

$$E_2(s) = E_1(s) - H_1(s)E_4(s)$$

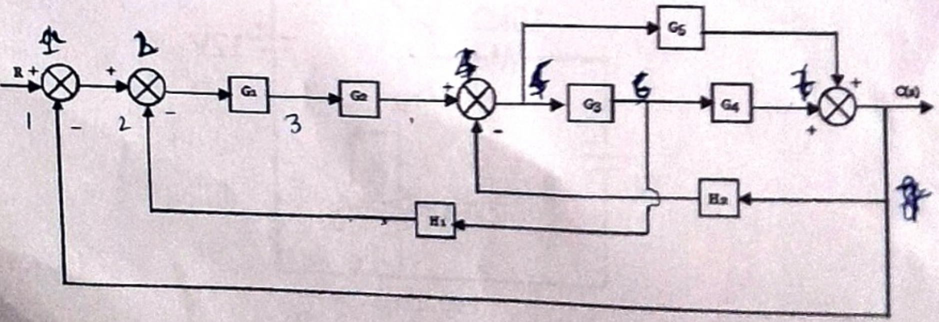
$$E_3(s) = G_1(s)E_2(s) - H_2(s)C(s)$$

$$E_4(s) = G_2(s)E_3(s)$$

$$C(s) = G_3(s)E_4(s)$$

4. a) State and explain the Initial value theorem and final value theorem, applying suitable property find the Laplace transform of the $e^{-t}\cos(wt)$. CO2 (10)

b) Draw signal flow graph for the block diagram given below and determine its transfer function. CO2 (10)



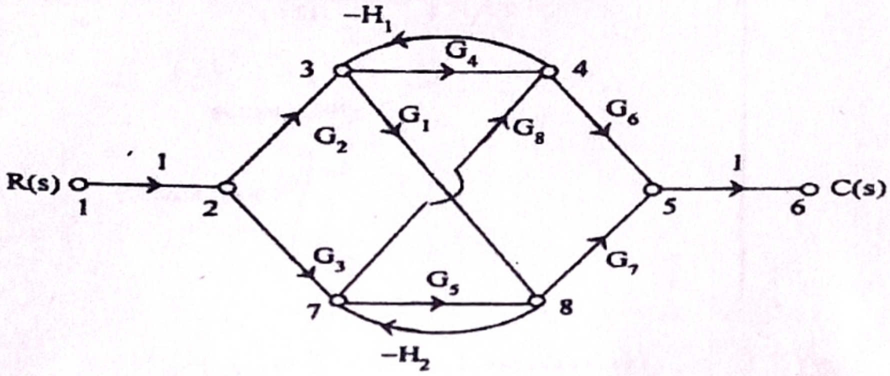
UNIT – III

5. a) A unity feedback system has the forward path transfer function $G(s) = \dfrac{k(2s+1)}{s(5s+1)(1+s)^2}$. The input r(t)=1+6t is applied to the system. Determine the minimum value of k if the steady state error is to be less than 0.1. CO3 (10)

   b) Find and draw the step response of the first order system and undamped second order system. CO3 (10)

6. a) Derive expressions for different parameters of transient response of a second order system to step input when system is under damped. CO3 (10)

   b) Find the transfer function of a system using Mason's gain formula for the system represented by the given signal flow graph. CO3 (10)



UNIT- IV

7. a) Unity feedback system has a forward path transfer function $G(s) = \dfrac{k(s+1)}{s(1+Ts)(1+2s)}$. Then using R – H criterion find the condition for k and T so that system is stable. CO4 (08)

   b) Sketch the root locus of a system whose loop transfer function is $G(s)H(s) = \dfrac{k}{s(s+4)(s^2+4s+20)}$. CO4 (12)

8. a) Apply the Routh Hurwitz criterion to determine (i) the number of roots with positive real parts (ii) the number of roots with zero real parts and (iii) the number of roots with negative real parts for the following equation. CO4 (08)

$$s^5 - s^4 - 2s^3 + 2s^2 - 8s + 8 = 0.$$

   b) Sketch the root locus for the following open loop transfer function: CO4 (12)

$$G(s) = \frac{k(s^2+6s+25)}{s(s+1)(s+2)}.$$

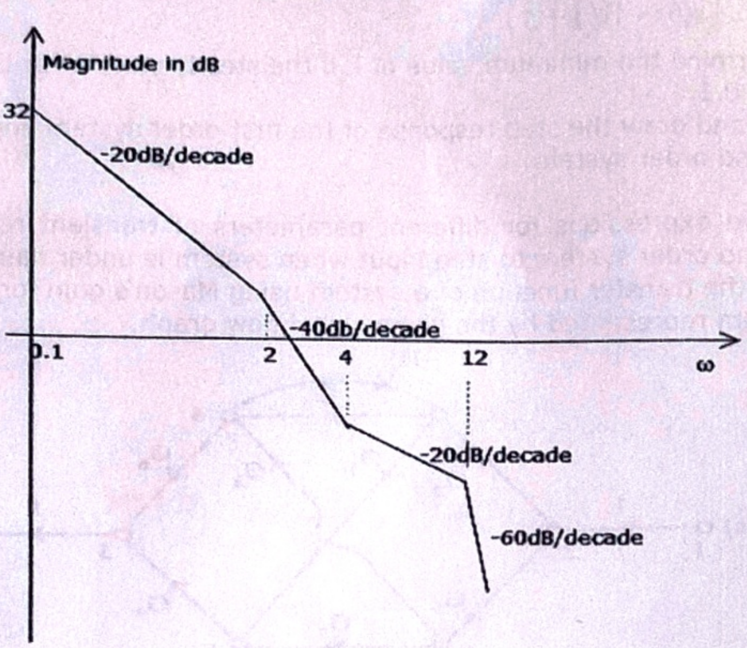
UNIT – V

9. a) Sketch the Bode plot for the open loop transfer function $G(s)H(s) = \dfrac{k\,(1+0.2s)}{s^2(1+0.001s)(1+0.005s)}$. Find the range of k for which the system is stable. CO5 (12)

   b) Explain the terms gain margin and phase margin. CO5 (08)

10. a) Sketch the Bode plots for the system with $G(s)H(s) = \frac{10}{s(1+0.2s)(1+0.05s)}$ and determine the GM and PM. CO5 (12)

b) For the Bode plot shown in Fig.10(b) obtain the transfer function. CO5 (08)



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