CBCS SCHEME

USN | 1 | AY21EC102 | 21EC43

Fourth Semester B.E. Degree Examination, June/July 2024
Circuits and Controls

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With help of circuits explain independent electrical sources. **(06 Marks)**

b. Using mesh current analysis, find the currents in various branches and node voltages at 'a' and 'b' points shown in Fig.Q.1(b). **(08 Marks)**

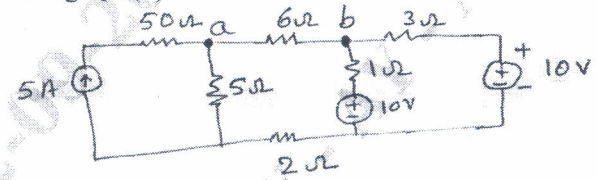

Fig.Q.1(b)

c. Using mesh current analysis, find the current in $(2 + j3)\Omega$ shown in Fig.Q.1(c).

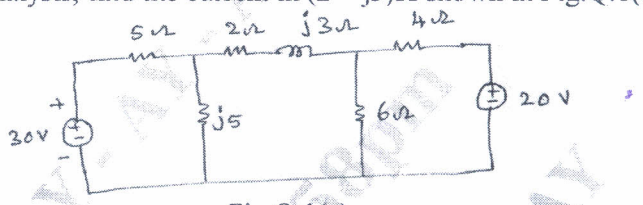

Fig.Q.1(c)

(06 Marks)

OR

2 a. State and explain Thevenin's theorem. **(08 Marks)**

b. Using nodal analysis, find the node voltages at 'a' and 'b' shown in circuit Fig.Q.2(b).

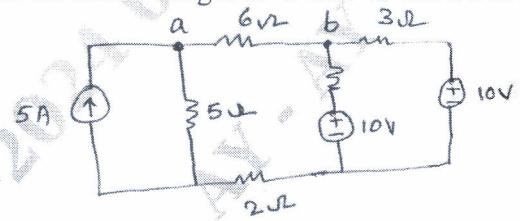

Fig.Q.2(b)

(08 Marks)

c. Define and explain briefly, the super position theorem. **(04 Marks)**

Module-2

3 a. Find the Z-parameters of given circuit shown in Fig.Q.3(a). **(08 Marks)**

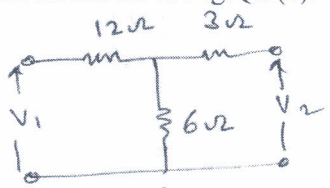

Fig.Q.3(a)

b. Find the Y-parameters of circuit shown in Fig.Q.3(b). **(08 Marks)**

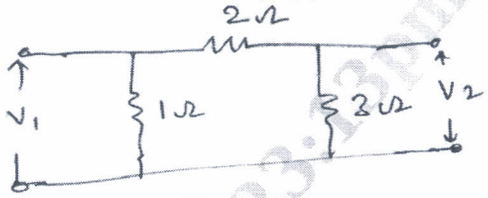

Fig.Q.3(b)

c. Explain the standard test signals unit step, unit ramp and unit impulse. **(04 Marks)**

OR

4 a. Define and prove that initial value theorem and final value theorem. **(08 Marks)**

b. Find the expression for current when switch 'SW' is closed at t = 0 shown in Fig.Q.4(b). (Use Laplace transform). **(08 Marks)**

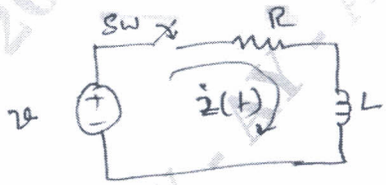

Fig.Q.4(b)

c. Obtain the Laplace transform of a gate function shown in Fig.Q.4(c). **(04 Marks)**

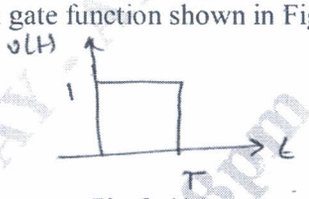

Fig.Q.4(c)

Module-3

5 a. What is control system? List the differences between open loop control system and closed loop control system with examples. **(10 Marks)**

b. Determine the overall transfer function shown in the Fig.Q.5(b) using block diagram reduction technique. **(10 Marks)**

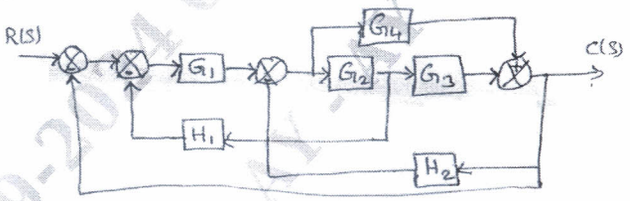

Fig.Q.5(b)

OR

6 a. Find the transfer function of the circuit shown in the Fig.Q.6(a). **(10 Marks)**

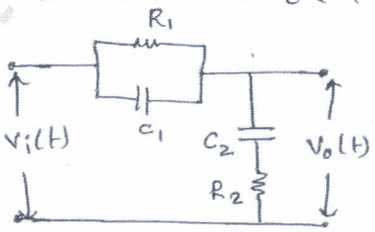

Fig.Q.6(a)

b. Find the overall gain of the SFG system shown in the Fig.Q.6(b) using Mason's gain formula. **(10 Marks)**

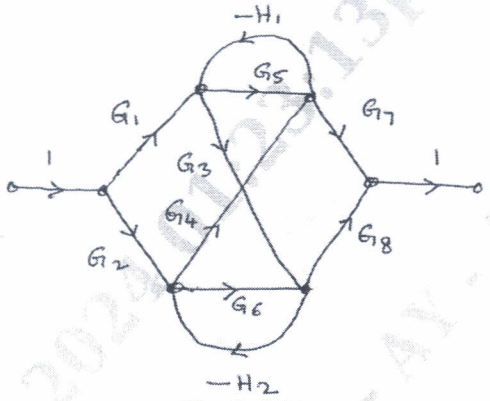

Fig.Q.6(b)

Module-4

7 a. Derive the expression for underdamped second order system with unit step input. **(10 Marks)**

b. Discuss the stability of the closed loop system as a function of K for the open loop transfer function using RH criterion.

$$G(S)H(S)=\frac{K(S+1)}{S(S-1)(S^2+4S+16)}$$ **(10 Marks)**

OR

8 a. A vfb system having transfer function $\frac{C(S)}{R(S)}=\frac{2}{S(S^2+PS+4K)}$ is marginally stable and oscillates with frequency 2 rad/sec. Find K_{mar} and 'P' using RH criterion. **(10 Marks)**

b. Starting from the output equation C(t) derive expressions for: i) Rise time (t_r) ii) Peak overshoot. **(10 Marks)**

Module-5

9 a. Sketch the complete root locus of the system having open loop transfer function $G(S)H(S)=\frac{K}{S(S+1)(S+2)(S+3)}$ and determine values of K for which the system is stable. **(16 Marks)**

b. Construct the state model using phase variable if the system is described by the difference equation

$$\frac{d^3y(t)}{dt^3}+4\frac{d^2y(t)}{dt^2}+7\frac{dy(t)}{dt}+2y(t)=5U(t)$$ **(04 Marks)**

OR

10 Plot the Bode magnitude and phase diagram for a open loop transfer function

$$G(S)H(S)=\frac{10(1+0.5S)}{S(1+0.25S)(1+0.2S)}$$ **(20 Marks)**

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