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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 2022

Program	:	B.E.: Electrical and Electronics Engineering	Semester	:	V
Course Name	:	Control Systems	Max. Marks	:	100
Course Code	:	EE52	Duration	:	3 Hrs

Instructions to the Candidates:
- Answer one full question from each unit.

UNIT- I

1. a) Determine the transfer function of a system whose block diagram is as shown in Fig.1(a) using block diagram reduction technique. CO1 (10)

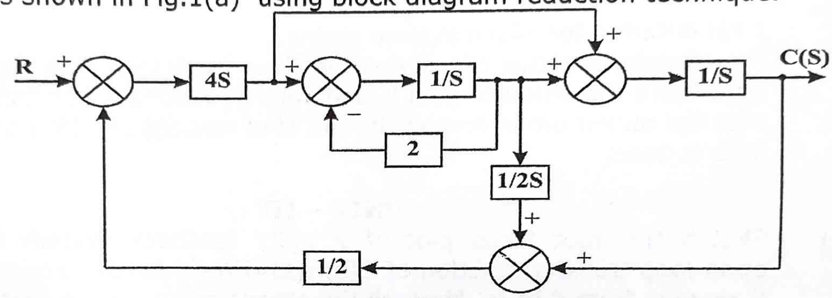

Fig.1(a)

b) Derive the transfer function of armature controlled DC motor. Also give the block diagram representation for the same. CO1 (10)

2. a) Find $C(s)/R(s)$ for the signal flow graph given below using Mason's Gain formula. CO1 (10)

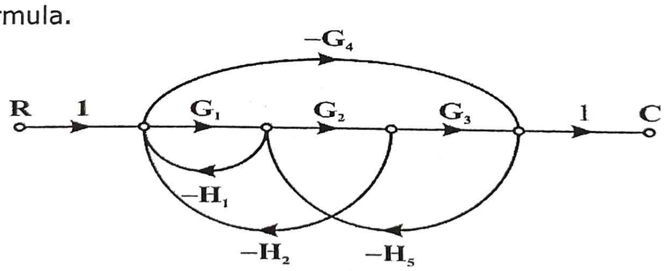

Fig.2(a)

b) For the electric circuit shown in fig below, evaluate the transfer function $E_0(s)/E_i(s)$. CO1 (06)

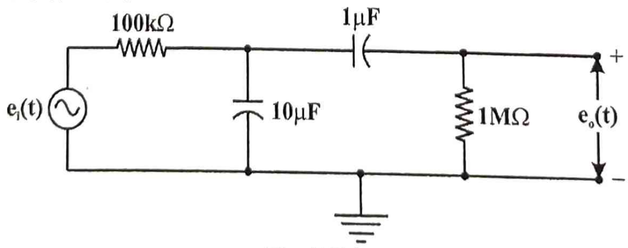

Fig.2(b)

c) Define the following terms with respect to signal flow graph: CO1 (04)
   i) Forward path gain
   ii) Forward loop
   iii) Mixed node
   iv) Sink node.

UNIT – II

3. a) Define: i) Rise time ii) Peak time with respect to an under damped system. Hence derive the expression for the same. CO2 (06)

b) The transfer function of a system is given by C(s)/R(s) = 9/ (s^2+4s+9). Compute the output response for unit step input. CO2 (08)

c) The closed loop transfer function of a second order system is given by $T(s)=25/(S^2+6S+25)$. Determine the damping ratio, peak time and peak overshoot if subjected to unit step input. CO2 (06)

4. a) A flywheel is driven by a motor which develops a torque of 1600Nm/rad. The moment of inertia of the system is $100kgm^2$. The flywheel is controlled by a hand wheel. If the hand wheel is suddenly given a movement through π/4 radians from rest, calculate the output response of flywheel. The coefficient of viscous friction is 400Nm/rad/sec. CO2 (08)

b) A negative unity feedback system is having OLTF $G(s)H(s)=\frac{K(s+4)(s+20)}{s^3(s+100)(s+500)}$. Find the range of K from 1 RH criterion for which system stable. CO2 (07)

c) The transfer function of a system is given by $G(s) = K/(s^2+Kk_1s+K)$. Determine the value of gain K and velocity feedback constant k_1, so that the maximum overshoot in unit step response is 25% and peak time is 2sec. CO2 (05)

UNIT – III

5. a) Sketch the root locus plot of a unity feedback system with an open-loop transfer function of $G(s)H(s)=K/(s^2+4s+5)$. For values of K ranging from 0 to ∞. Mark all the salient points on the root locus. CO3 (10)

b) What is polar plot? Draw the polar plot for a unity negative feedback system whose open-loop transfer function is given by G(s) = 1/(1+0.1s). CO3 (10)

6. a) The open loop transfer function of a control system is given as $G(s)H(s)=\frac{k}{(s+1)(s+10)(s+30)}$. Draw the root locus. Determine the value of K for which the system is critically damped and also the value of K for which the system becomes unstable. CO3 (12)

b) Derive mathematical expressions for frequency domain specifications: resonant peak, resonant frequency and bandwidth for a second order system. CO3 (08)

UNIT – IV

7. a) Sketch the Nyquist plot for a negative feedback control system having open loop transfer function given by $T.f\ G(s)=\frac{5}{s(1-s)}$. Determine the stability of the system using Nyquist stability criterion. CO4 (10)

b) Draw the Bode plot for the transfer function: $T.f\ H(s)=\frac{100}{S+30}$ CO4 (10)

8. a) Sketch the Nyquist contour and the Nyquist plot for the transfer function $T.f\ G(s)=\frac{1}{S^2}$. Comment on its stability. CO4 (08)

b) With reference to Bode plot explain gain margin and phase margin and explain the produre to determine the same. CO4 (06)

c) Obtain the transfer function of a lag lead network. CO4 (06)

UNIT – V

9.	a)	Briefly explain with suitable example the necessity of a controller in a practical control system.	CO5	(07)
	b)	Explain the behavior of differential controller on the time domain behavior of a control system.	CO5	(07)
	c)	Write a brief note on the Zeigler-Nichols Method for designing PID controller.	CO5	(06)
10.	a)	With relevant block diagrams explain feed forward and feedback controllers.	CO5	(08)
	b)	Explain the behavior of integral controller on the time domain behavior of a control system.	CO5	(07)
	c)	Comment on the effect of poles and zeros in plant transfer function on its stability.	CO5	(05)

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