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18EE61

Sixth Semester B.E. Degree Examination, June/July 2025
Control Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain briefly the following terms :
- i) Control system
- ii) Plant
- iii) Actuating signal
- iv) Controlled signal
- v) Disturbance **(10 Marks)**

b. Determine transfer function of the system shown in Fig.Q.1(b).

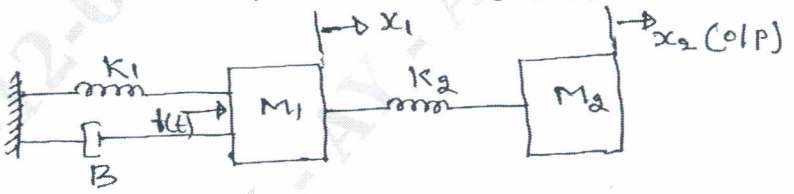

Fig.Q.1(b)

(10 Marks)

OR

2 a. Obtain transfer function of a DC motor by armature controlled with field constant.

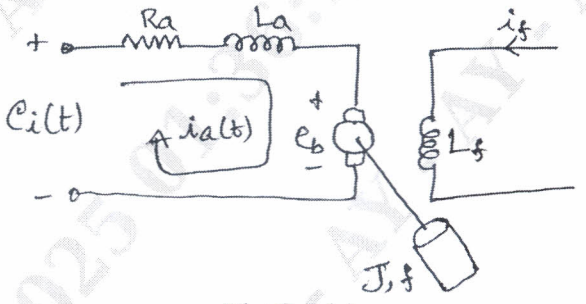

Fig.Q.2(a)

(10 Marks)

b. If 'K' stiffness of the spring, draw analogous circuit based on f-v anology and determine the transfer function in each case of the figure shown in Fig.Q.2(b)(i) and (ii). **(10 Marks)**

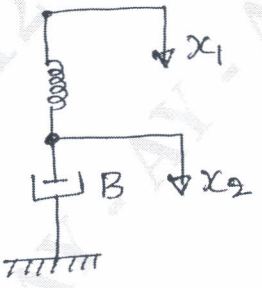

Fig.Q.2(b)(i)

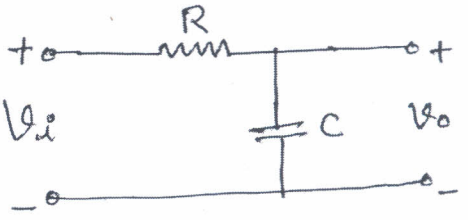

Fig.Q.2(b)(ii)

Module-2

3 a. What do you understand by block diagram? What are the limitations of block diagram? **(10 Marks)**

b. For the block diagram shown in Fig.Q.3(b) find
i) Open loop transfer function
ii) Feedback ratio
iii) Control ratio
iv) Characteristic equation.

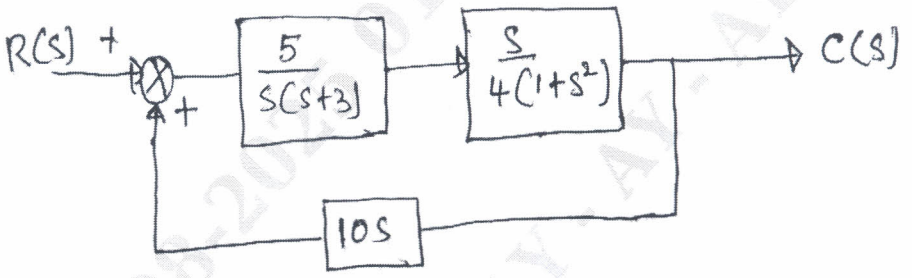

Fig.Q.3(b)

(10 Marks)

OR

4 a. Explain various properties of signal flow graph representation. **(08 Marks)**

b. Obtain transfer function from the signal flow graph shown in Fig.Q.4(b).

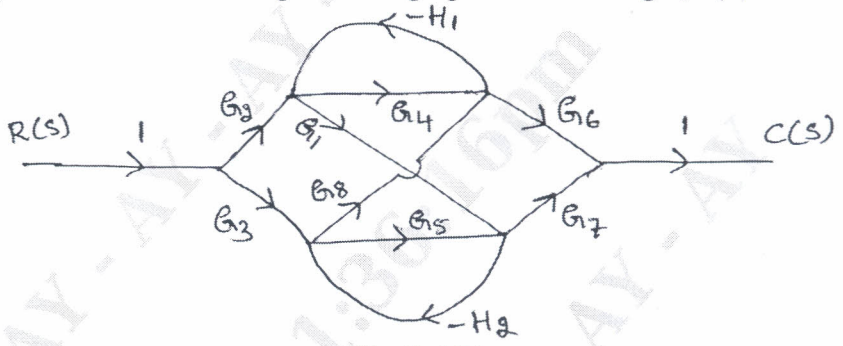

Fig.Q.4(b)

(12 Marks)

Module-3

5 a. Determine range of K for the absolute stability of the system also determine the frequency of sustained oscillation for limiting values of K. **(12 Marks)**

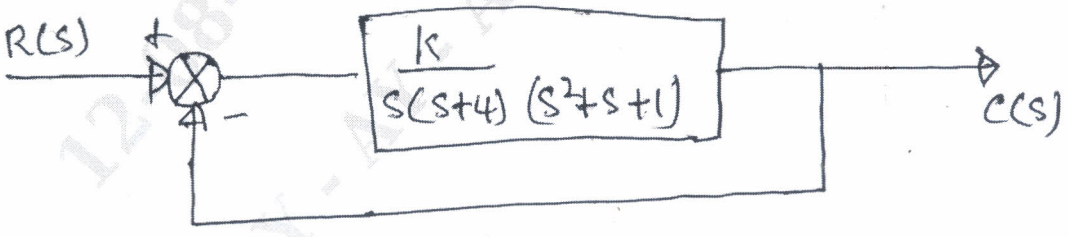

Fig.Q.5(a)

b. A closed loop control system has the characteristic equation given by
$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$
Investigate the stability using R-H criterion. **(08 Marks)**

OR

6 a. Derive the values of static error and steady state error coefficient for a system with unit step i/p. **(10 Marks)**

b. For the given unity feedback control system determine

i) Type of system
ii) Static error constant
iii) Steady state error.

$$G(s) = \frac{50}{s(s+10s^2+5s)}$$ **(10 Marks)**

Module-4

7 a. Sketch the root locus for positive feed back shown in Fig.Q.7(a) comment on stability. **(12 Marks)**

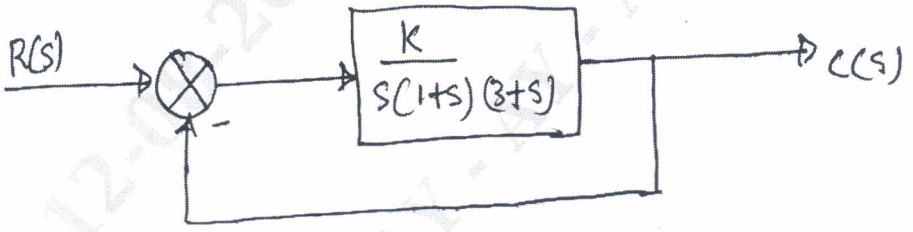

Fig.Q.7(a)

b. Explain the rules for construction of root locus. **(08 Marks)**

OR

8 a. For the following log magnitude plot of the OLTF G(s) is as shown in Fig.Q.8(a). Determine:

i) Transfer function G(s) if it is known that the system is of minimum phase type.
ii) Estimate the phase angle at each corner frequencies.

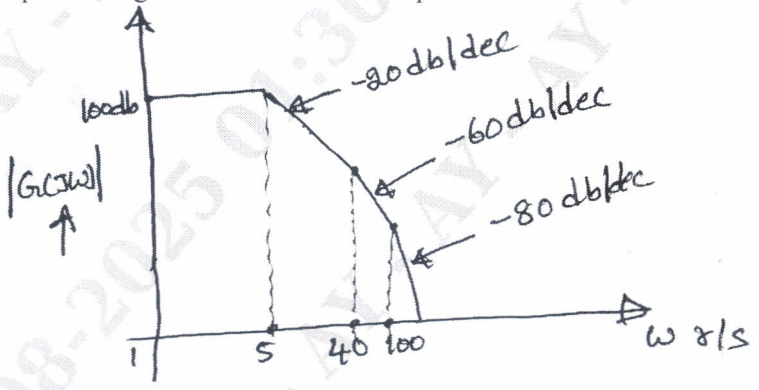

Fig.Q.8(a)

(08 Marks)

b. Draw the bode plot for the transfer function

$$G(S) = \frac{16(1+0.5S)}{S^2(1+0.125S)(1+0.1S)}$$

From the graph determine :

i) Phase cross over frequency
ii) Gain cross over frequency
iii) Phase margin
iv) Gain margin
v) Stability of the system **(12 Marks)**

Module-5

9 a. Explain the procedural steps of Nyquist stability criterion. **(08 Marks)**

b. Use Nyquist criterion, determine the CLCS having the following OLTF is stable or not

$$G(S)H(S) = \frac{1}{S(1+2S)(1+S)}$$ **(12 Marks)**

OR

10 a. A PD controller used for the system is shown in Fig.Q.10(a). Determine the value of T_d so that system will be critically damped. Calculate its setting time.

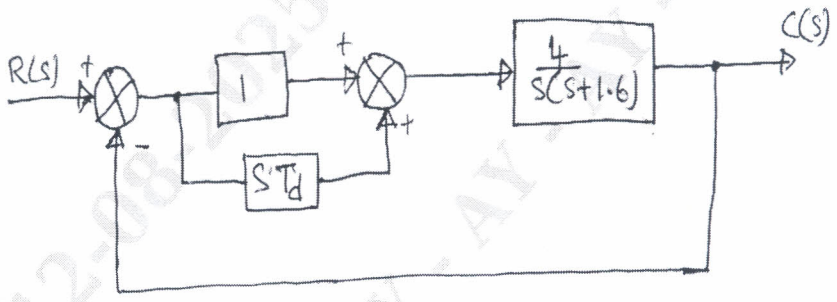

Fig.Q.10(a)

(10 Marks)

b. Explain the step by step procedure for design of lead compensating network. **(06 Marks)**

c. Explain the characteristic of PD mode. **(04 Marks)**

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