



Course Code: MR301

Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

- | | | Marks |
|---|---|-------|
| 1 | Write the block diagram reduction algebra for the following cases: | (5) |
| | i) Combining cascaded blocks | |
| | ii) Moving a summing point before a block | |
| | iii) Moving a take off point after a block | |
| | iv) Elimination of negative feedback | |
| | v) Elimination of positive feedback | |
| 2 | What is meant by Mathematical modelling? How do you model a mechanical rotational system? | (5) |
| 3 | Derive the unit impulse response of first order system. | (5) |
| 4 | What is the relationship between system poles and stability? | (5) |
| 5 | List any five advantages of frequency response analysis. | (5) |
| 6 | Write the rules for constructing a Bode plot. | (5) |
| 7 | Why is tuning important in a PID controller? | (5) |
| 8 | What is the working principle of automatic street light controller using LDR? | (5) |

PART B

Answer any three questions, each carries 10 marks.

- 9 a) Convert the block diagram shown in fig.1 into signal flow graph and determine the transfer function using Mason's gain formula. (10)

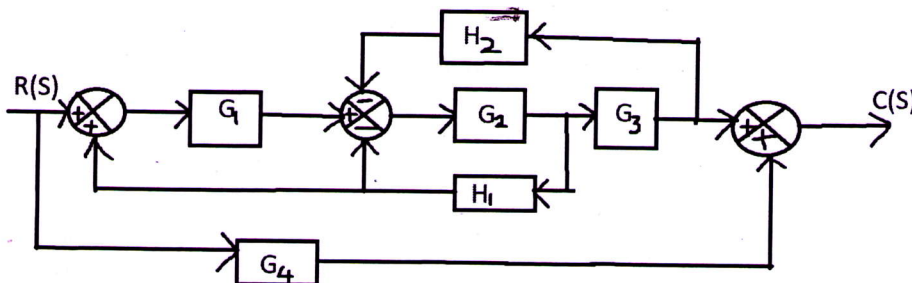


Fig.1

- 10 a) State D'Alembert's principle. (2)
 b) Write the equations of motion in s-domain for the mechanical system shown in Fig.2. Obtain the transfer function of the system. (8)

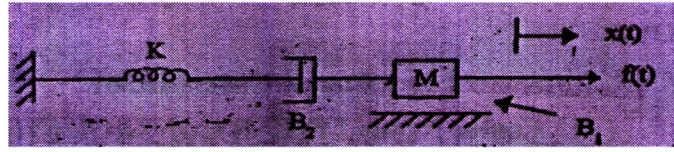
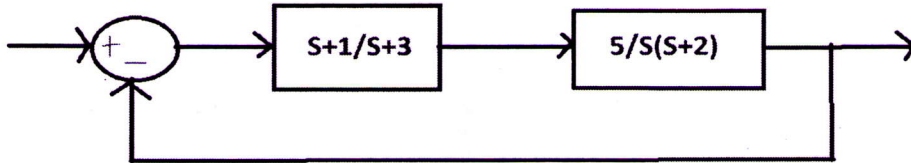


Fig.2

- 11 a) Derive the transfer function and hence construct the block diagram of an armature-controlled DC motor. (10)
 12 a) Find the position, velocity and acceleration error constants for the system given in fig.3. (8)



- b) What is steady state error? (2)
 13 a) Draw the root locus diagram for a closed loop control system whose open loop transfer function is given by $G(S)= K/ S(S+5)(S+10)$. (10)
 Also find if the system is stable or not.

PART C

Answer any two questions, each carries 15 marks.

- 14 a) For the following transfer function, draw a logarithmic plot and obtain gain cross over frequency. (15)
 $G(S)= 20/ S(1+3S)(1+4S)$
- 15 a) Consider a unity feedback system having an open loop transfer function (15)
 $G(S)=K/ S(1+0.2S)(1+0.05S)$. Sketch the polar plot and determine the value of gain margin and phase margin at $K=1$.
- 16 a) Explain automatic traffic light control with necessary sketches. (10)
 b) Compare PI and PD controllers. (5)
- 17 a) What is compensator in control system? (5)
 b) Explain phase lag and phase lead compensators in detail. (10)
