

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) - EXAMINATION – SUMMER 2018

Subject Code:2150909

Date:04/05/2018

Subject Name:Control System Engineering

Time:02:30 PM to 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- | | | |
|-----|--|-----------|
| (a) | Explain the principle of superposition for the control system. | 03 |
| (b) | Explain any two properties of Laplace transform. | 04 |
| (c) | Explain the requirements of an ideal control system. | 07 |
- Q.2**
- | | | |
|-----|--|-----------|
| (a) | Give disadvantages of Transfer function. | 03 |
| (b) | Give difference between open loop and close loop control system. | 04 |
| (c) | Obtain the overall transfer function of the system whose block diagram is given in following Figure-1 using block diagram reduction technique. | 07 |

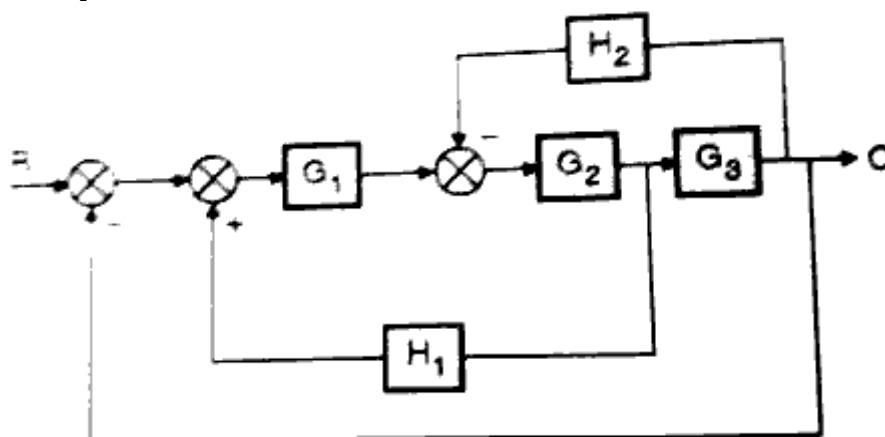


Figure-1

OR

- Q.3**
- | | | |
|-----|--|-----------|
| (c) | Derive the transfer function of armature controlled D.C. motor. | 07 |
| (a) | Define following terms in relation of signal flow graph: sink node, chain node and forward path. | 03 |
| (b) | Derive steady state error constants of the Type-1 system for a Step input. | 04 |

- (c)

Obtain the transfer function of the system shown in following Figure-2 using Mason's gain formula.

07

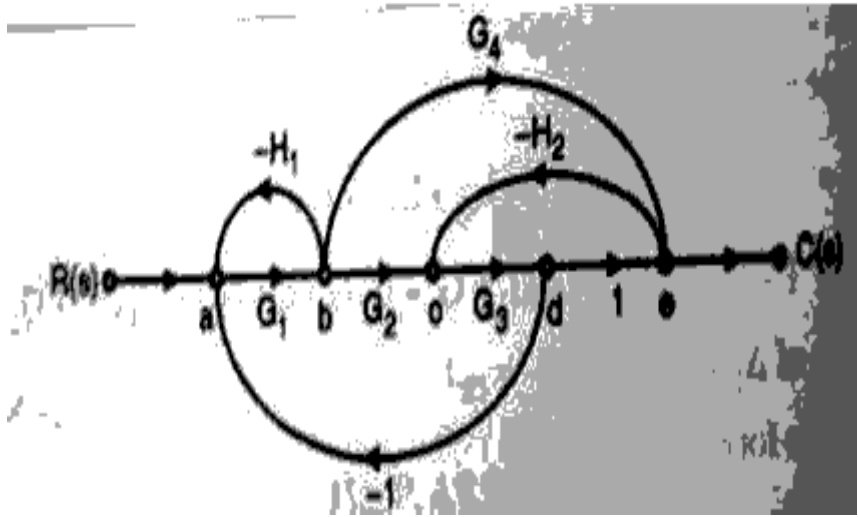


Figure-2

OR

- Q.3

(a) Explain standard test signals used in the control system.

03
- (b) Derive steady state error constants of the Type-0 system for a Ramp input.

04
- (c) Obtain differential equations describing the mechanical system shown in following Figure-3 and draw the electrical network using force-voltage analogy.

07

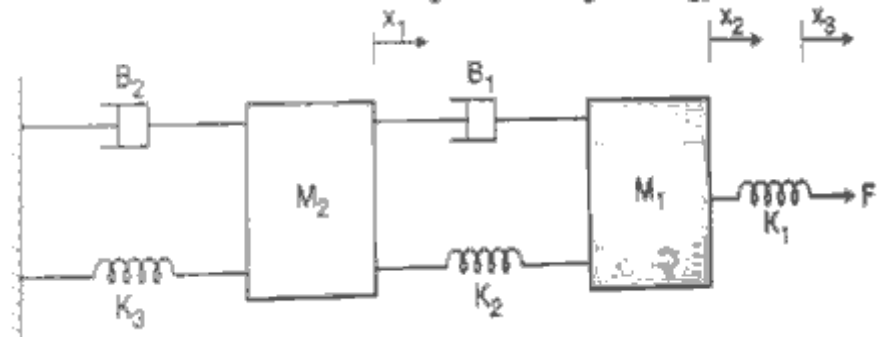


Figure-3

- Q.4

(a) State and explain nyquist stability criteria.

03
- (b) Check the stability of the given characteristic equation $S^5+2S^4+3S^3+6S^2+2S+1=0$ using Routh's method.

04
- (c) A unity feedback control system has $G(S) = \frac{k}{S(S+5)(S+10)}$, draw its root locus.

07

OR

- Q.4

(a) Define: rise time, peak over shoot and settling time.

03
- (b) Explain correlation between time domain and frequency domain.

04
- (c) For a second order system with unity feedback $G(S) = \frac{200}{S(S+8)}$, find the frequency response specifications.

07
- Q.5

(a) Define: Phase margin and Gain margin.

03
- (b) Explain bode plot of Lag-Lead compensator.

04
- (c) Write short note on PID controller.

07

OR

- Q.5

(a) List out types of compensation and explain any one.

03
- (b) Write a brief note on polar plots with a sketch of a simple example.

04
- (c) Write steps to design Lag Compensator using Root Locus.

07
