

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019**

**Subject Code: 2151908**

**Date: 18/12/2019**

**Subject Name: Control Engineering**

**Time: 10:30 AM TO 01:00 PM**

**Total Marks: 70**

**Instructions:**

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

MARKS

- Q.1** (a) What is control Engineering ? Claassify it **03**
- (b) What is state space analysis in control engineering ? explain advantage of state variable method over conventional one. **04**
- (c) Determine the system equations for the physical system shown in figure 1.c **07**
- Q.2** (a) Derive equation of transfer function for closed loop control system **03**
- (b) What is analogues system ? Explain force voltage analogy **04**
- (c) Reduce block diagram by block reduction technique and find the overall transfer function in figure 2c **07**

**OR**

- (c) Apply masons rule and find the transfer function for following figure.2c (or) **07**
- Q.3** (a) Explain standard test signals used in control engineering **03**
- (b) For a first oder system with unit step input find the steady state error and explain it **04**
- (c) A unity feed back control system has an open loop transfer function  $G(s) = \frac{5}{s(s+1)}$  find the peak time, rise time, percentage overshoot settling time for step input of 20 units. Also determine the peak overshoot. **07**

**OR**

- Q.3** (a) Define position error constant, velocity error constant , Acceleration error constant. **03**

- (b) Derive the equation for peak time , rise time, and for second order system for underdamped system 04
- (c) The control system shown in figure 3 b. employs proportional plus error rate control. Determine the value of error rate constant  $K_e$ , so that damping ratio is 0.5. Determine the value of settling time, maximum overshoot . Find the steady state error if the input is unit ramp input. 07

- Q.4**
- (a) Explain nozzle flapper amplifier 03
  - (b) Explain basic hydraulic system component and draw any circuit showing at least six components 04
  - (c) Explain pneumatic proportional plus integral control action and obtain its transfer function. 07

**OR**

- Q.4**
- (a) Differentiate hydraulic and pneumatic control system 03
  - (b) Explain 3/2 DCV, 3/3 DCV , directional control valve with its construction figure. 04
  - (c) Obtain the transfer function for hydraulic system with proportional plus integral plus derivative control action. 07
- Q.5**
- (a) Explain terms; stable system, unstable system, marginally stable system 03
  - (b) Write a short not on bode plot 04
  - (c) For a system having characteristic polynomial  $S^6 + 4S^5 + 16S^3 + 41S^2 + 36S + 72$  discuss about the stability criteria using routh stability theory. 07

**OR**

- Q.5**
- (a) Explain terms; critically stable system, conditionally stable system, relative stability 03
  - (b) Write a short note on Niquist stability criteria. 04
  - (c) Sketch the root locus of the system whose open loop transfer function is  $G(s) = K/S(S+1)(S+3)$  , determine the value of  $K$  for damping ratio equal 0.5 07

Figures (C.E.)

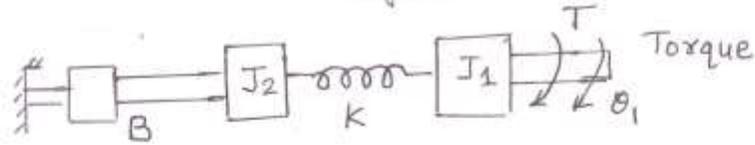


Fig 1 (C)

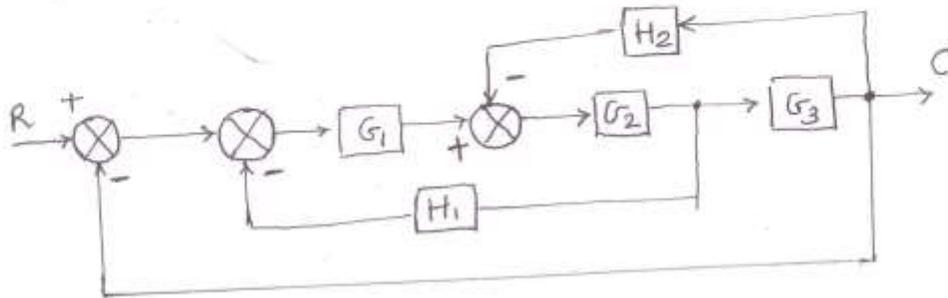
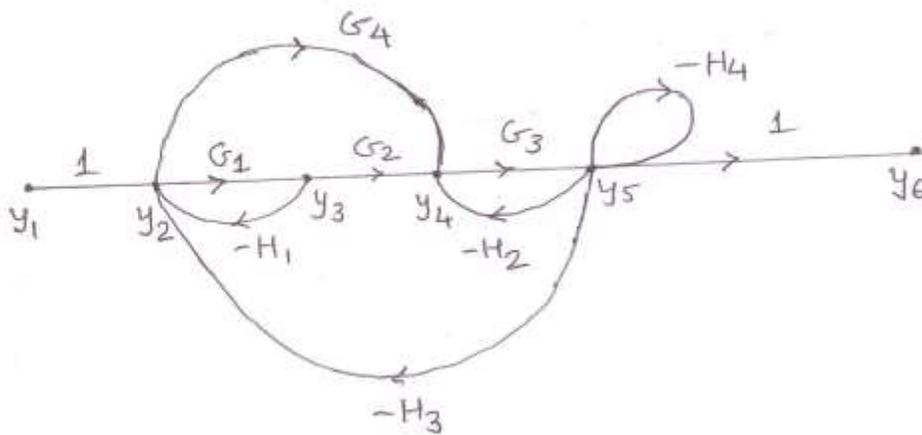


Fig 2 (C)



OR Fig 2 (C)

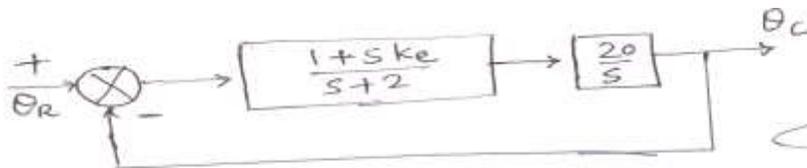


Fig 3 (C)

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