

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (OLD) - EXAMINATION – SUMMER 2018

Subject Code:161905

Date:01/05/2018

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.

- Q.1 (a)** State whether following statements are TRUE or FALSE. Justify your answer with appropriate reason. **07**
- i. Feedback is sometimes used to improve the sensitivity of a control system.
 - ii. The transfer function is defined only for a linear, time-invariant system.
 - iii. Fixed-time traffic light control system is an example of closed loop control system.
 - iv. In stochastic control system the response is not predictable and repeatable.
 - v. A negative feedback control system is the one where the output signal is fed back so that it is added to the input signal.
 - vi. In a linear system the response produced by simultaneous action of two different forcing functions is the difference of individual responses.
 - vii. If type-2 system is subjected to unit ramp input, the steady state error would be zero.
- (b)** Briefly explain complete classification of control system. **07**
- Q.2 (a)**
- i. Determine transfer function for a torsional/rotational mechanical system. **03**
 - ii. Determine the unit step response for a system with transfer function given as:
$$\frac{C(s)}{R(s)} = \frac{1}{(s+1)(s^2+1)}$$
 04
- (b)** For the translational mechanical system as shown in **figure-1**, write differential equations and derive its transfer function $\frac{X_2(s)}{U(s)}$. **07**
- OR**
- (b)** Prepare mathematical model for the liquid-level system as shown in **figure-2**, and derive its transfer function $\frac{Q_o(s)}{Q_i(s)}$. Also draw its block diagram. **07**
- Q.3 (a)**
- i. Define following terms with reference to signal flow graph. **03**
a) Input or source node b) Loop and c) forward path gain
 - ii. Determine damping condition (un-damped, under damped, critically damped or over damped) for the following systems: **04**
a) $\frac{900}{s^2+90s+900}$ and b) $\frac{225}{s^2+30s+225}$
- (b)** Reduce the block diagram for the system as shown in **figure-3** and obtain its transfer function. **07**
- OR**
- Q.3 (a)**
- i. With neat sketch explain rule for: **03**
a) Eliminating blocks in series and b) eliminating blocks in parallel.
 - ii. Derive equation of unit ramp response and unit impulse response for the 1st order system. **04**
- (b)** Convert the block diagram shown in **figure-3** into signal flow graph and obtain its transfer function using mason's gain formula method. **07**

- Q.4 (a)** Prepare root locus for the unity feedback system for the forward path transfer function given by $G(s) = \frac{k}{s(s+1)(s+2)(s+4)}$ **07**
- (b)** Define following terminologies in reference to transient response specifications of second order system using neat sketch: **07**
- Peak time
 - Rise time
 - Delay time
 - Settling time
 - Maximum overshoot
 - Steady state error

OR

- Q.4 (a)** Explain boiler feed control system using neat sketch. **07**
- (b)** Define programmable logic controller. What are the components of PLC? State the Advantages & Disadvantages of it. **07**
- Q.5 (a)** State the various types of Industrial controllers and describe any two of them. **07**
- (b)** With the help of a sketch explain a pneumatic proportional plus integral controller and derive its transfer function. **07**

OR

- Q.5 (a)** Briefly explain and derive transfer function for a DC motor. **07**
- (b)** Explain the construction, working and application of a hydraulic intensifier. **07**

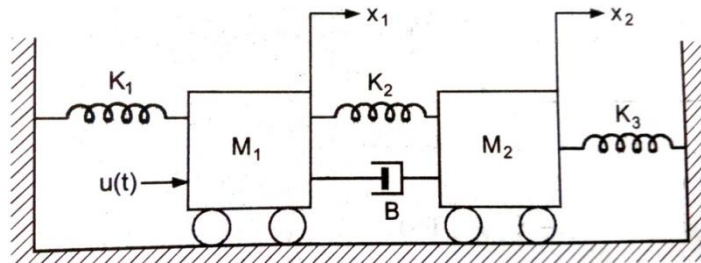


Figure-1

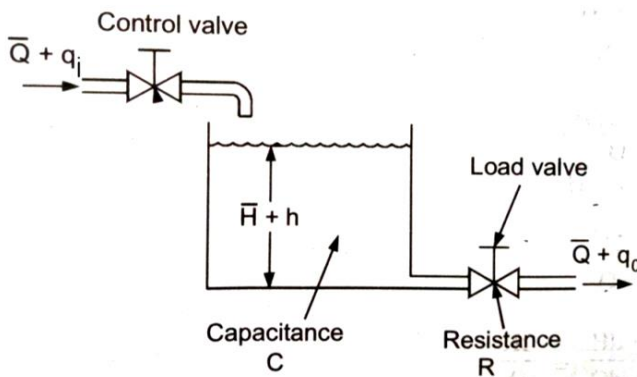


Figure-2

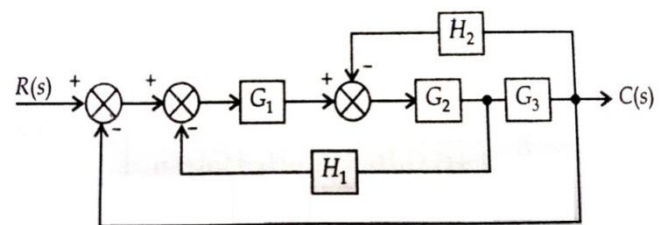


Figure-3
