

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-IV • EXAMINATION – WINTER • 2014****Subject Code: X41102****Date: 29-12-2014****Subject Name: Control Theory****Time: 02:30 pm - 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) Define control system. Explain with suitable example both open loop & close loop control system. **07**
- (b) Derive transfer function for an armature controlled DC motor. **07**
- Q.2** (a) Define transient & steady state response of a control system. And derive the expression for the step response of 1st order control system. **07**
- (b) Determine the transfer function for the given block diagram using block diagram reduction techniques.(See Fig. 1) **07**
- OR**
- (b) Enlist the rules for drawing signal flow graph. Also find the transfer function for the given block diagram using Mason's gain formula.(See Fig. 1) **07**
- Q.3** (a) What is analogous system? Explain Force-Voltage and Force-Current Analogy in brief. **07**
- (b) Write the differential equations for given mechanical system (See Fig. 2). Also obtain an analogous electrical circuit based on F-I analogy. **07**
- OR**
- Q.3** (a) Define the term sensitivity. Derive the effect of forward path transfer function parameter variation in a closed loop control system. **07**
- (b) The maximum overshoot for a unity feedback control system having its forward path transfer function as $G(s) = K/[s(sT+1)]$ is to be reduced from 60% to 20%.The system input is a unit step function. Determine the factor by which K should be reduced to achieve aforesaid reduction. **07**
- Q.4** (a) Write a brief note on thermal system. **07**
- (b) A unity feedback control system has an open loop transfer function $G(s) = K/[s(s+4)]$. Draw the root locus and determine the value of K if the damping ratio is to be 0.707. **07**
- OR**
- Q.4** (a) Explain in brief Nyquist stability criterion. **07**
- (b) Enlist the limitations of Routh's Criterion and for given characteristic eq. $s^8 + 5s^6 + 2s^4 + 3s^2 + 1 = 0$, Comment on the stability using Routh's criterion. **07**
- Q.5** (a) Define the term stability and marginal stability for a control system. And explain in brief Routh-Hurwitz criterion. **07**
- (b) A unity feedback control system has $G(s) = 80/[s(s+2)(s+20)]$. Draw the bode plot & determine the GM, PM, ω_{gc} & ω_{pc} & comment on stability **07**
- OR**
- Q.5** (a) Explain the correlation between transient response & frequency response. **07**
- (b) Write a brief note on controllability. **07**

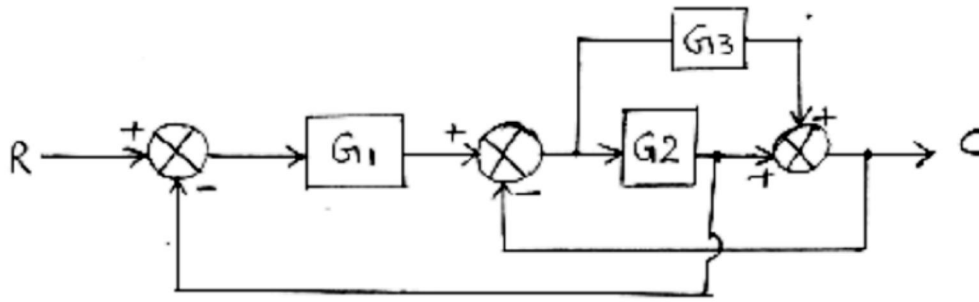
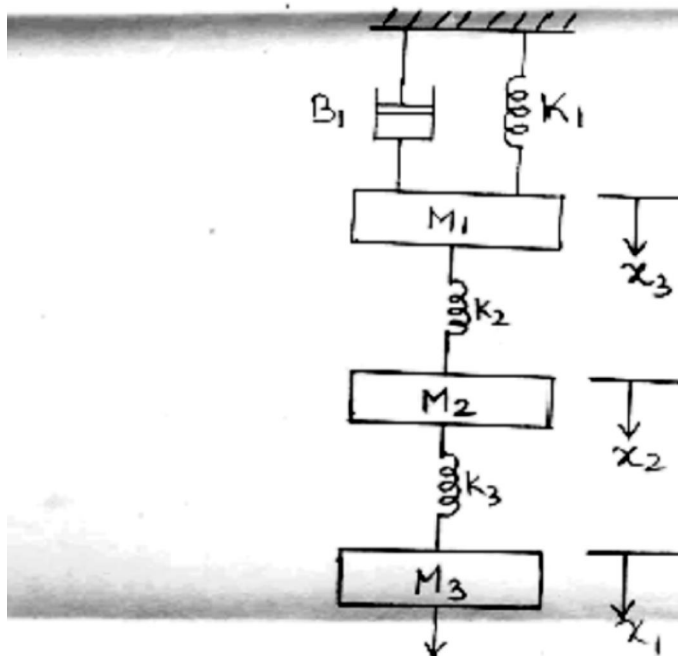


Fig. 1



$$f(t) = f \cos \omega t$$

Fig. 2
