

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – VI (OLD).EXAMINATION – WINTER 2016

Subject Code: 160104

Date: 26/10/2016

Subject Name: Basic Control Theory

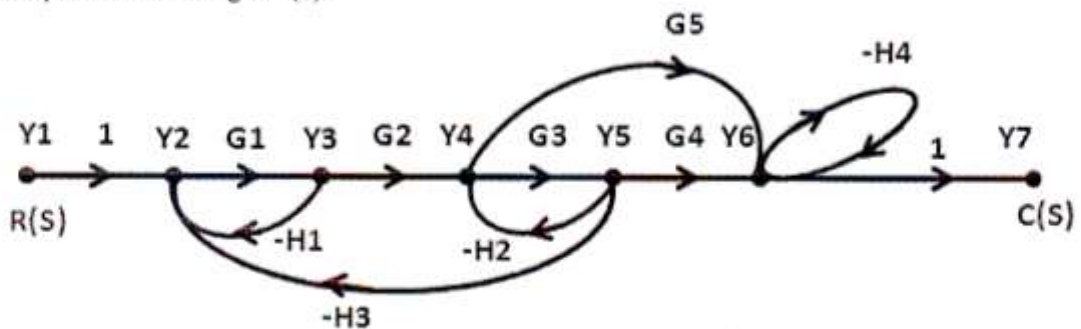
Time: 10:30 AM to 01:00 PM

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) Compare following 07
 1. Open loop System and Closed loop system
 2. Block diagram method and Signal flow graph
- (b) Using Mason's Gain Formula, Find the transfer function $C(S)/R(S)$ for the Signal Flow Graph shown in Figure (a). 07



- Q.2 (a) What is analogous system? Establish Force – Voltage and Force – Current analogy. 07
 (b) Derive mathematical model of a parallel R, L, C circuit. 07
- OR**
- (b) Explain the rules for block diagram reduction method. 07
- Q.3 (a) What is meant by order & type of systems? What are position, velocity and acceleration error constant? Explain the performance of type 0 system of step input. 07
 (b) Derive the unit step response of the first order system. 07
- OR**
- Q.3 (a) The characteristic equation of a feedback system is $F(s) = s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16$ Using the Routh's Hurwitz criterion determine the stability of the system. 07
 (b) Define transient response specifications with neat diagram along with equations. 07
- Q.4 (a) Which two plots constitute Bode plot? What steps are followed to sketch Bode plot? What are frequency response specifications? Explain with the help of diagrams. 07
 (b) Draw the Root Locus diagram for a closed loop system whose loop transfer function is given by, $G(s)H(s) = K/s(s+5)(s+10)$. Comment on the stability. 07
- OR**
- Q.4 (a) Explain steps for plotting root locus. 07
 (b) Sketch bode plot for the following system and find gain margin, phase margin, gain crossover frequency and phase crossover frequency. 07
 $G(s) = 4(s+0.5)/s(s+0.2)(s+1)$
- Q.5 (a) Comparison between Modern Control Theory and Conventional Control Theory. 07
 (b) Explain the following terms: State, State Variables and State models. 07

OR

- Q.5** (a) Draw the polar plot of $GH(s) = 100/(s+2)(s+4)(s+8)$. **07**
- (b) Explain Nyquist stability criteria. Explain generalized Nyquist path and its mapping. **07**
Write steps to solve problems by Nyquist criteria.
