**B.Tech. SEM -V Electrical 2014 Course (CBCS) : WINTER - 2018**

**SUBJECT : LINEAR CONTROL SYSTEMS**

Day : Thursday | **W-2018-2397** | Time : 02.30 PM TO 05.30 PM

Date : 22/11/2018 | Max. Marks : 60

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**N. B. :**

**1)** All questions are **COMPULSORY**.

**2)** Figures to the right indicate **FULL** marks.

**3)** Draw neat diagrams **WHEREVER** necessary.

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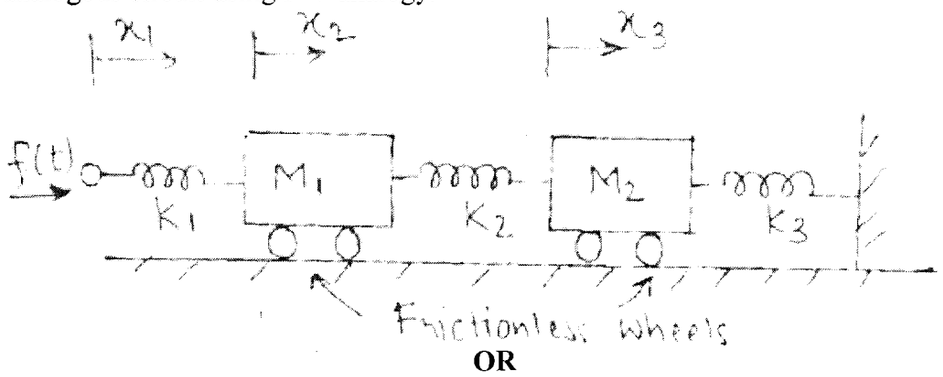
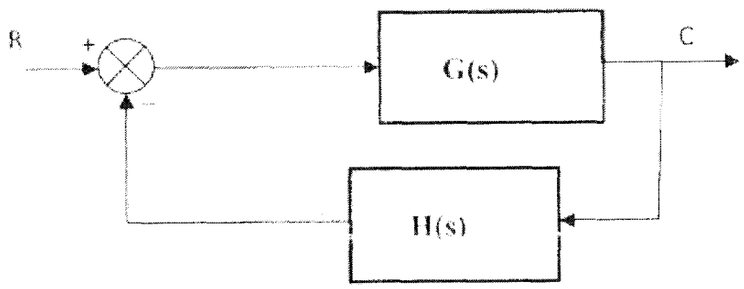
**Q.1** Draw mechanical equivalent network of a given system and also draw the electrical analogous circuit using F-V analogy. **(10)**

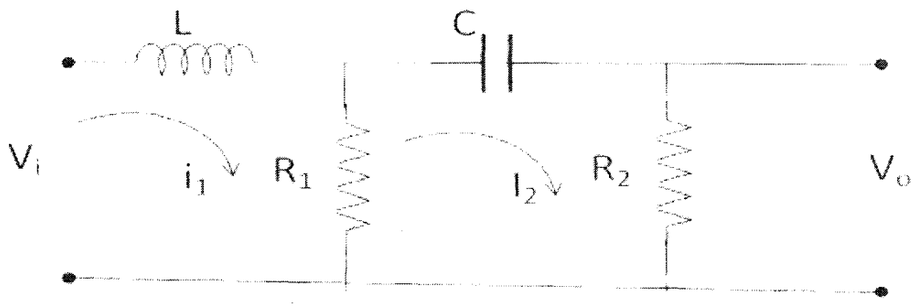



**OR**

**Q.1 a)** Define transfer function. Derive transfer function of following: **(05)**




**b)** Determine transfer function of following electrical network. **(05)**




**Q.2** A unity feedback system characterized by the open loop transfer function. **(10)**

$$G(s)=\frac{1}{s(0.5s+1)(0.2s+1)}$$

Determine the steady state errors for unit step, unit ramp and unit acceleration inputs.

**OR**

**P.T.O.**

**Q.2** **a)** A unity feedback system is characterized by an open loop transfer function **(06)**

$$G(s)=\frac{k}{s(s+10)}$$

Determine the gain K so that the system will have damping ratio of 0.7. For this value of K , determine settling time, peak overshoot and time to peak overshoot.

**b)** What are different standard test signals? Sketch them and find their Laplace transform. **(04)**

**Q.3** Using Routh Hurwitz criterion for the unity feedbadk control system with open loop transfer function **(10)**

$$G(s)=\frac{k}{s(s+1)(s+2)(s+5)}$$

**i)** Find range of K for stability.

**ii)** Find the value of K for marginally stable and corresponding close loop poles.

**OR**

**Q.3** State magnitude criterion and angle criterion for point to be on root locus. Explain any three rules for root locus. **(10)**

**Q.4** A unity feedback system has $G(s)=\frac{1}{s(s+1)}$ .A PID controller is used in the system. What is the effect of PID controller on unit step response of system? Describe with mathematical equation. And sketch unit step response without controller and with controller. **(10)**

**OR**

**Q.4** Describe stepwise procedure for lead compensator design using root locus method with sketch. What are the performance specifications for design using root locus. **(10)**

**Q.5** A unity feedback system has $G(s)=\frac{200}{s(s+1)(s+5)}$ **(10)**

Draw bode plot. Determine gain margin, phase margin, gain crossover frequency, phase crossover frequency. Comment about stability.

**OR**

**Q.5** Draw complete Nyquist plot for the system with $G(s)H(s)=\frac{200}{s(s+1)(s+5)}$ **(10)**

and comment about stability.

**Q.6** Describe stepwise procedure for design of lag compensator using bode plot. **(10)**

**OR**

**Q.6** **a)** Describe use of SISO tool for design of compensator in MATLAB **(06)**

**b)** What is the effect of lag compensator on system response **(04)**

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