**B.Tech Odd Semester (CBCS) Exam., December—2016**

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

**( 5th Semester )**

Course No. : ETC–505

**( Control System )**

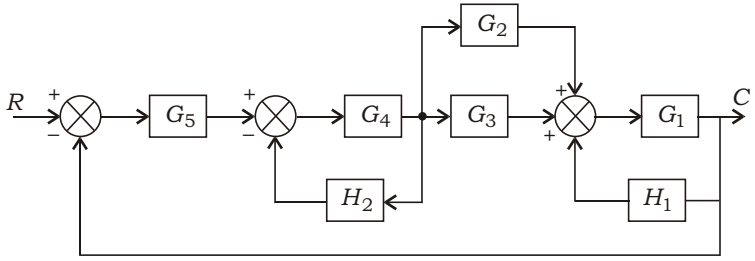
*Full Marks* : 75
*Pass Marks* : 30

*Time* : 3 hours

*Note* : 1. Attempt **five** questions, selecting **one** from each Unit.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. The figures in the margin indicate full marks for the questions.
5. Assume reasonable data wherever required.

UNIT—I

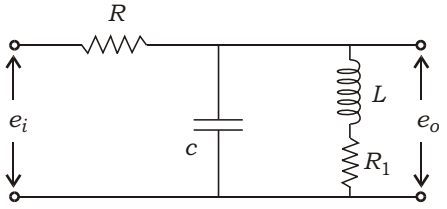
**1.** *(a)* Reduce the block diagram using reduction rules and obtain $C(s)/R(s)$ : 9



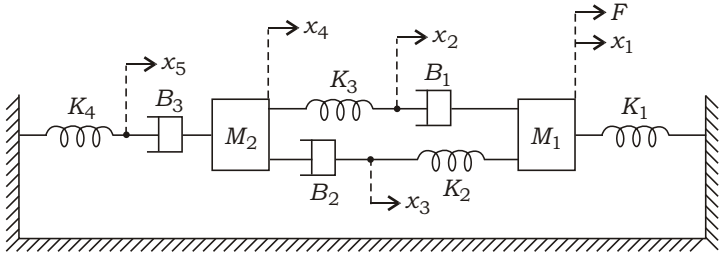





*(b)* Derive the transfer function for the network given below : 6




**2.** *(a)* Find the system equation of the mechanical system




Also obtain the *F-V* and *F-I* analogous electrical system. 12

*(b)* What is the procedure to find the transfer function of a system? 3

UNIT—II

**3.** *(a)* Find the output response of a second-order system if a ramp input is applied as input. 8

*(b)* A unity feedback system has an open-loop transfer function

$$G(s) \quad \frac{10}{s(s \quad 2)}$$

*(i)* Find the time domain response for a unit step input.

*(ii)* Find the natural frequency of oscillation and damping ratio.

*(iii)* Find steady-state error to an input $(1 \quad 4t)$.

*(iv)* In the above system, if two poles are introduced in open-loop pole at $j\sqrt{3}$, find the absolute stability of the closed-loop system. 7

**4.** *(a)* What do you mean by stable system? State Routh's stability criterion. Find the range of $K$ for stability of

$$s^5 \quad 2s^4 \quad 3s^3 \quad 4s^2 \quad K(s \quad 1) \quad s \quad 5 \quad 0$$

2+2+5=9





*(b)* A unity feedback system has the following forward transfer function :

$$G(s) \quad \frac{10(s \quad 8)}{(s \quad 7)(s \quad 9)}$$

*(i)* Evaluate system type, $K_p$, $K_v$ and $K_a$.

*(ii)* Find the steady-state errors for the standard step, ramp and parabolic inputs. 3+3=6

UNIT—III

**5.** *(a)* Define all the frequency response specifications. 10

*(b)* What is Nyquist stability criterion? Explain with an example. 5

**6.** *(a)* What are the importance of gain and phase margins? 5

*(b)* For the unity feedback control system

$$G(s) \quad \frac{10}{s(s \quad 1)(s \quad 5)}$$

Sketch the Bode plot. Determine the gain and phase margin. If the gain is increased by 150%, what is the new gain margin? Comment on stability. 10

UNIT—IV

**7.** *(a)* Define and explain the following terms : 2×5=10

*(i)* State variable

*(ii)* State vector

*(iii)* State trajectory

*(iv)* State

*(v)* State space

*(b)* Write a short note on advantages and limitations of state variable approach. 5

**8.** Sketch root locus for the system

$$G(s) \quad \frac{K(s \quad 2)}{s^4 \quad 3s^3 \quad 4s^2 \quad 2s} \qquad 15$$

UNIT—V

**9.** *(a)* What is compensation? What is compensator? What are the various compensation schemes used in practice? 6

*(b)* Compare the characteristics of three types of compensators. 9

**10.** What are PI, PD and PID controllers? Explain. 5×3=15

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