

Total No. of printed pages = 3

**ECE 181504**

Roll No. of candidate

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EIMT & IIPS  
221X, Hatia, Ranchi, Jharkhand  
2017

**B.Tech. 5<sup>th</sup> Semester End-Term Examination**

**ECE**

**CONTROL SYSTEMS**

**(New Regulation & New Syllabus)**

Full Marks – 70

Time – Three hours

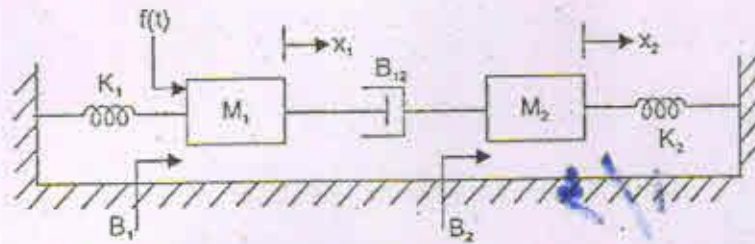
The figures in the margin indicate full marks  
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following (Fill in the blanks): (10 × 1 = 10)
- (a) What is feedback?
  - (b) Why negative system is invariably preferred in a closed loop system?
  - (c) Define transfer function?
  - (d) What is transient and steady state response?
  - (e) What is the order of the system?
  - (f) Define resonant peak?
  - (g) Define BIBO stability?
  - (h) What is characteristic equation?
  - (i) Define non-touching loops.
  - (j) What is servomechanism?

**[Turn over**

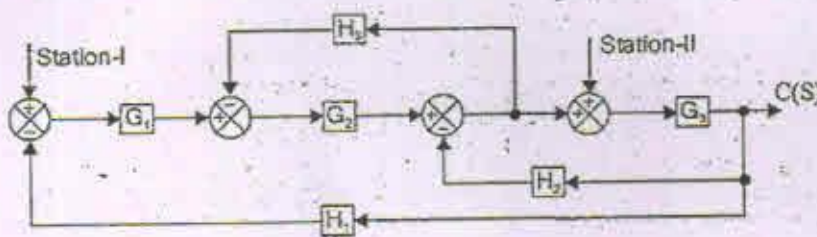
2. (a) Define the transfer function  $\frac{X_1(s)}{F(s)}$  and  $\frac{X_2(s)}{F(s)}$  for the system shown below. (8)



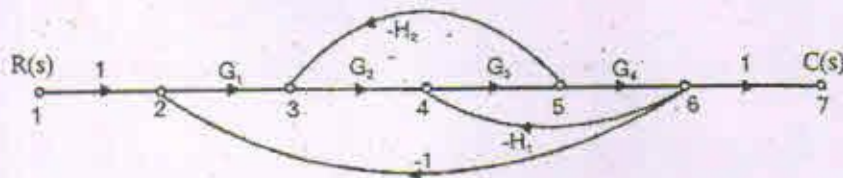
- (b) Compare open and closed loop system and explain with an example. (7)
3. (a) Evaluate the closed loop transfer function when the out R is at
- at station-I
  - at station-II

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The system is represented by the block diagram shown below. (10)



- (b) Find the overall gain  $\frac{C(s)}{R(s)}$  for the signal flow graph shown below. (5)



4. (a) Derive and draw the response of the first order system for unit step input. (7)
- (b) For a unity feedback control system the open loops transfer function,  

$$G(s) = \frac{10(s+2)}{s^2(s+1)}$$
 Find
- The position, velocity and acceleration constant, (3)
  - The steady state error when the input is  $R(s)$ , where  

$$R(s) = \frac{3}{s} - \frac{2}{s^2} + \frac{1}{3s^3}$$
 (5)

5. (a) A unity feedback control system has an open loop transfer function,  

$$G(s) = \frac{k}{s(s^2 + 4s + 13)}$$
. Sketch the root locus. (10)
- (b) Construct Routh array and determine the stability of all the system whose characteristic equation is  $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ . Also determine the number of roots lying on right half of s-plane, left half of s-plane and on imaginary axis. (5)
6. (a) Discuss lead and lag compensators. (10)
- (b) Explain the concept of controllability and observability. (5)
7. (a) Sketch Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5rad/sec. (10)

$$G(s) = \frac{ks^2}{(1 + 0.2s)(1 + 0.02s)}$$

- (b) What are the advantages of frequency response analysis? (5)

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