5E3125

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5E3125

B.Tech. Vth Semester (Main/Back) Examination, Dec.-2010/Jan.-2011

Electrical Engineering

5EE3 Control Systems (Common With EX)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions. All questions carry **equal** marks.*

1. a) Explain the concept of Open Loop and Closed Loop Control System, with suitable examples. **(6)**
   b) Explain Missile launching and guidance system. **(6)**
   c) What are the applications of control theory in engineering and Non-engineering fields? Explain. **(4)**

OR

2. a) What is Servo Mechanism? Explain a position control system. **(6)**
   b) Explain Rocket Autopilot system. **(6)**
   c) What are the elements of Basic Control System? Explain. **(4)**
3. a) Obtain the Transfer Function and Block Diagram of Armature-Controlled DC motor as shown in Figure 1. **(8)**

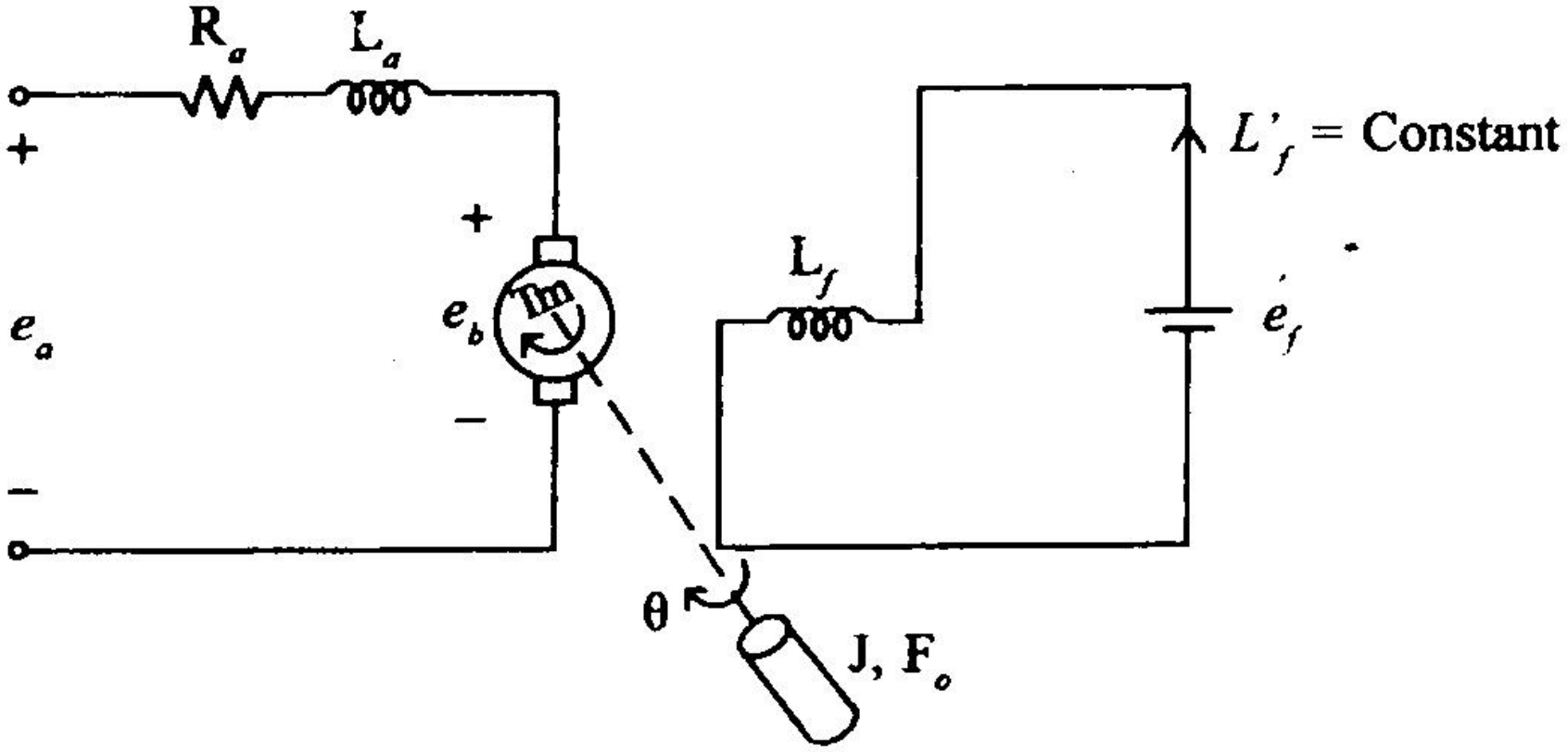

Figure - 1

[Contd....

b) For the system shown in Figure 2, Evaluate the close Loop Transfer function, when the input R is

i) at station I

ii) at station II. **(8)**

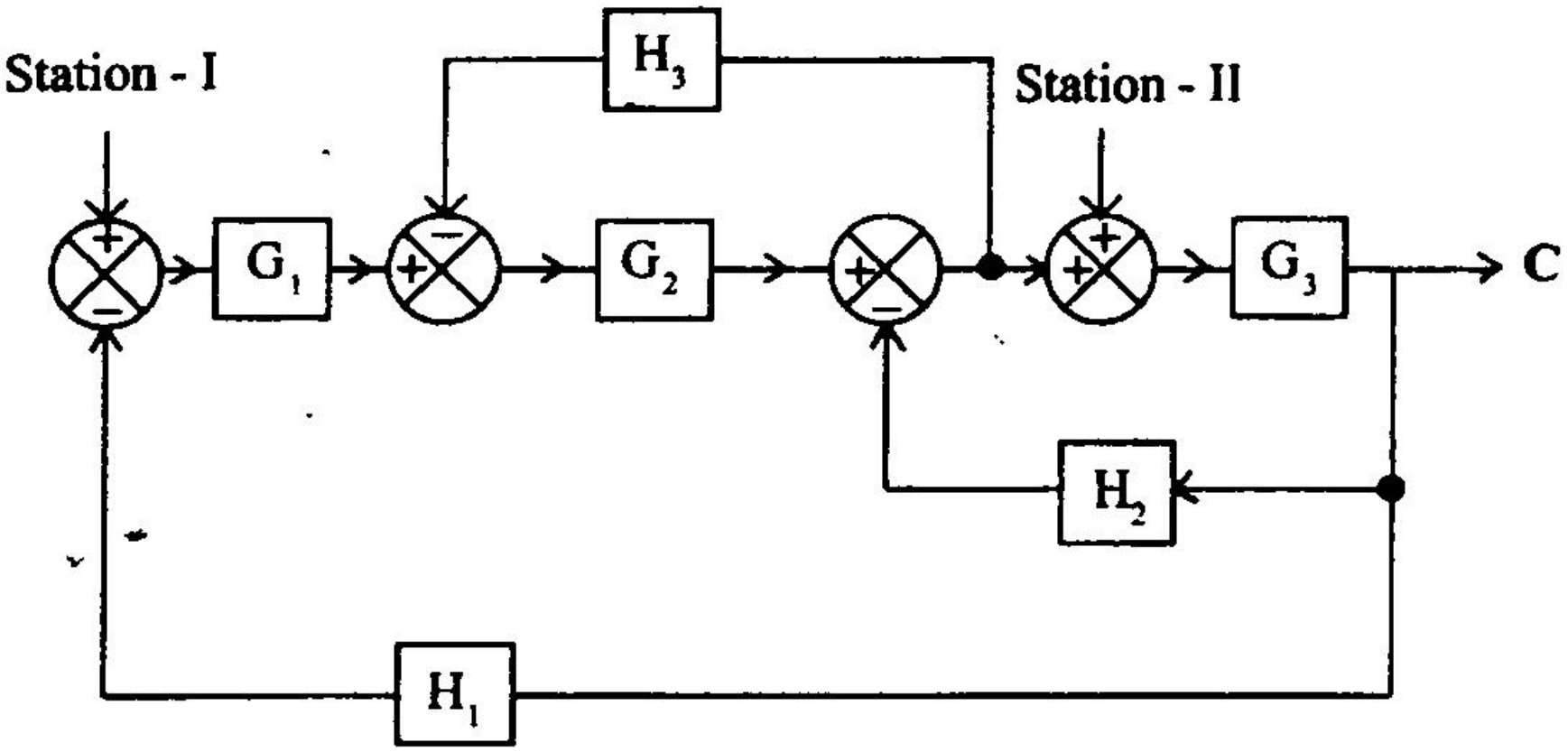

Figure - 2

OR

4. a) Obtain the Overall Transfer Function C/R from the signal flow graph shown in Figure 3. **(8)**

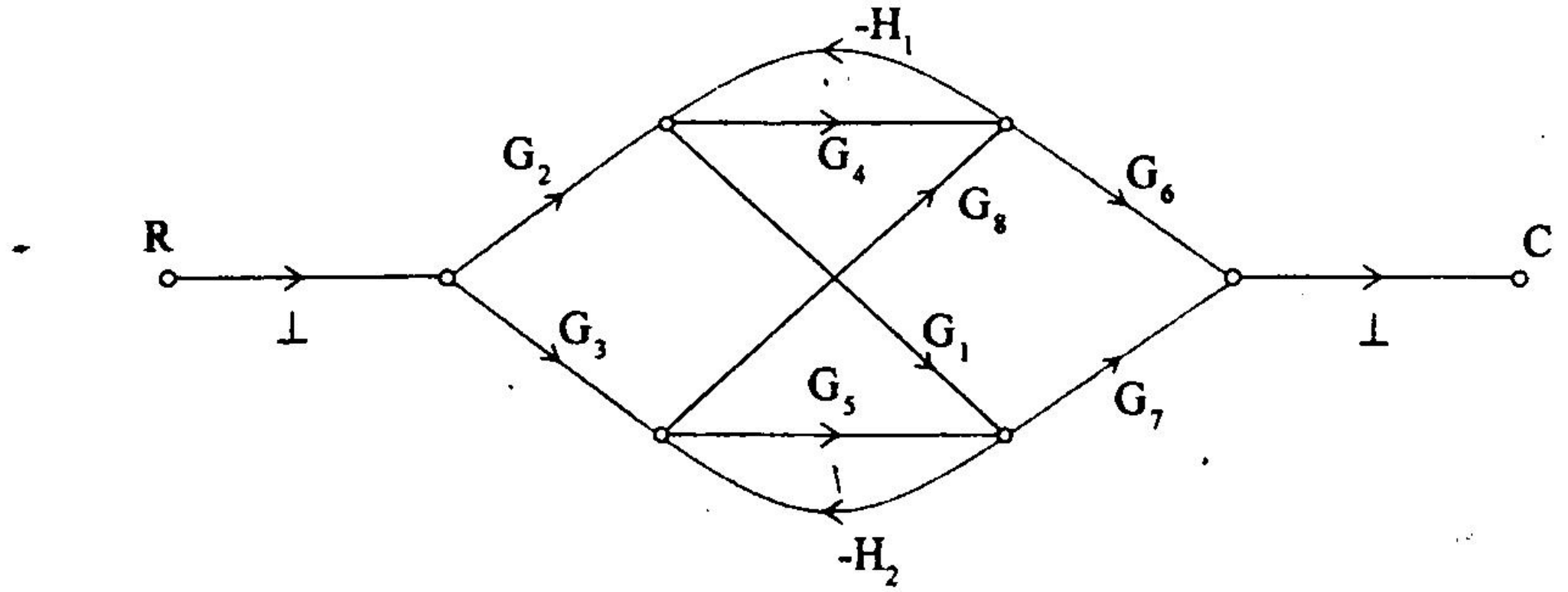

Figure - 3

b) Obtain the transfer function X(s)/E(s) for the Electro-mechanical system, shown in Figure. 4. **(8)**

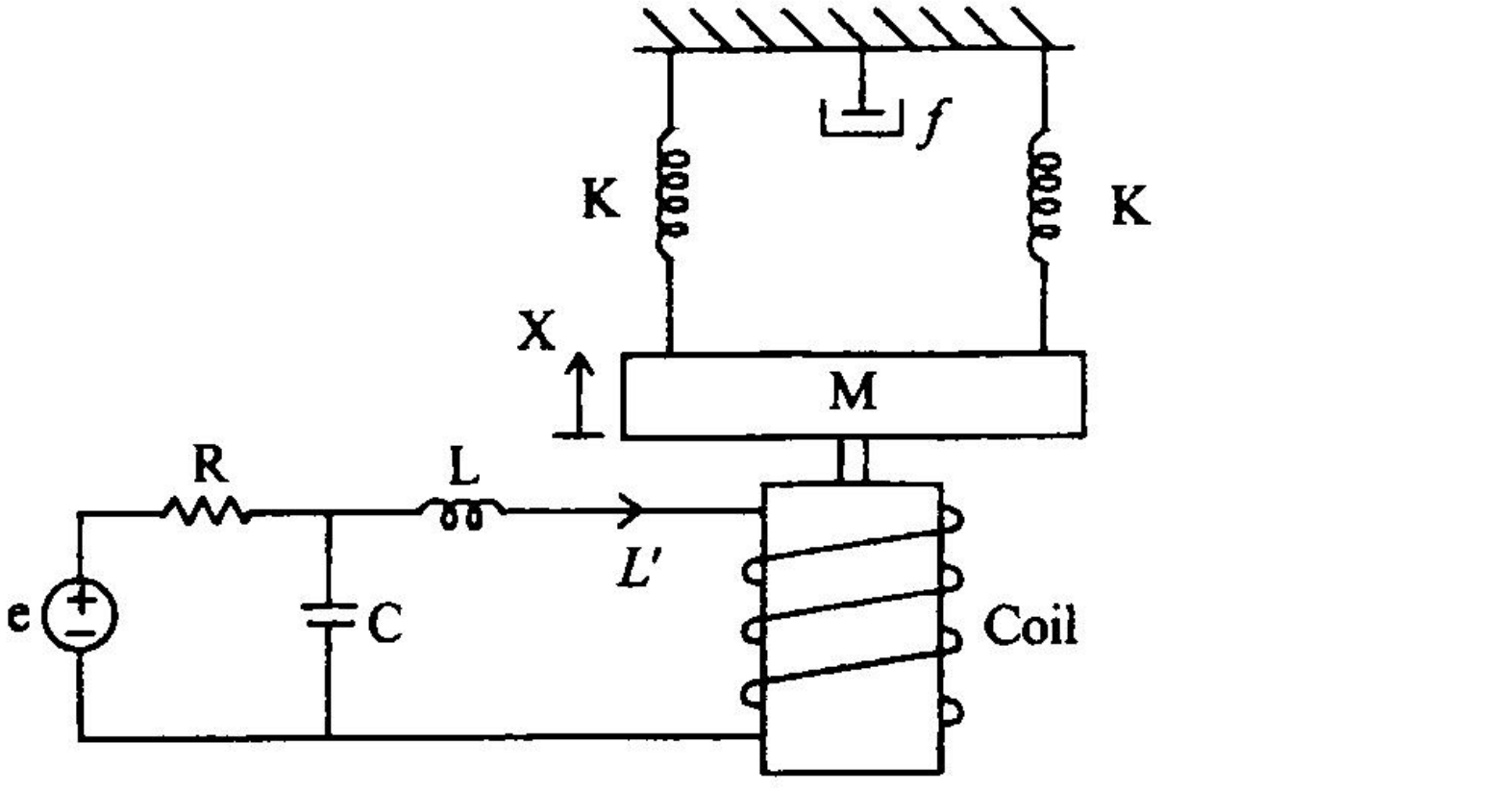

Figure - 4

5. a) What is an First order & Second order system? Compare them. Also find the response of First Order system to the unit-step input. **(6)**

b) Explain the types of Feedback Control System. **(4)**

c) Explain the steady state error with following types of inputs -
i) Unit-Step; (ii) Unit-Ramp; (iii) Unit-parabolic. **(6)**

OR

6. a) Explain :
i) Derivative Error Compensation and
ii) Derivative Output Compensation. **(6)**

b) A feedback system employing output-rate damping is shown in figure 5.
i) In the absence of Derivative Feedback (K_0=0), determine the damping factor and natural frequency of the system. What is the steady-state error resulting from unit-ramp input.
ii) Determine the derivative feedback Constant (K_0), which will increase the damping factor of the system to 0.6. What is the steady-state error resulting from unit-ramp input with this setting of the derivate feedback constant? **(10)**

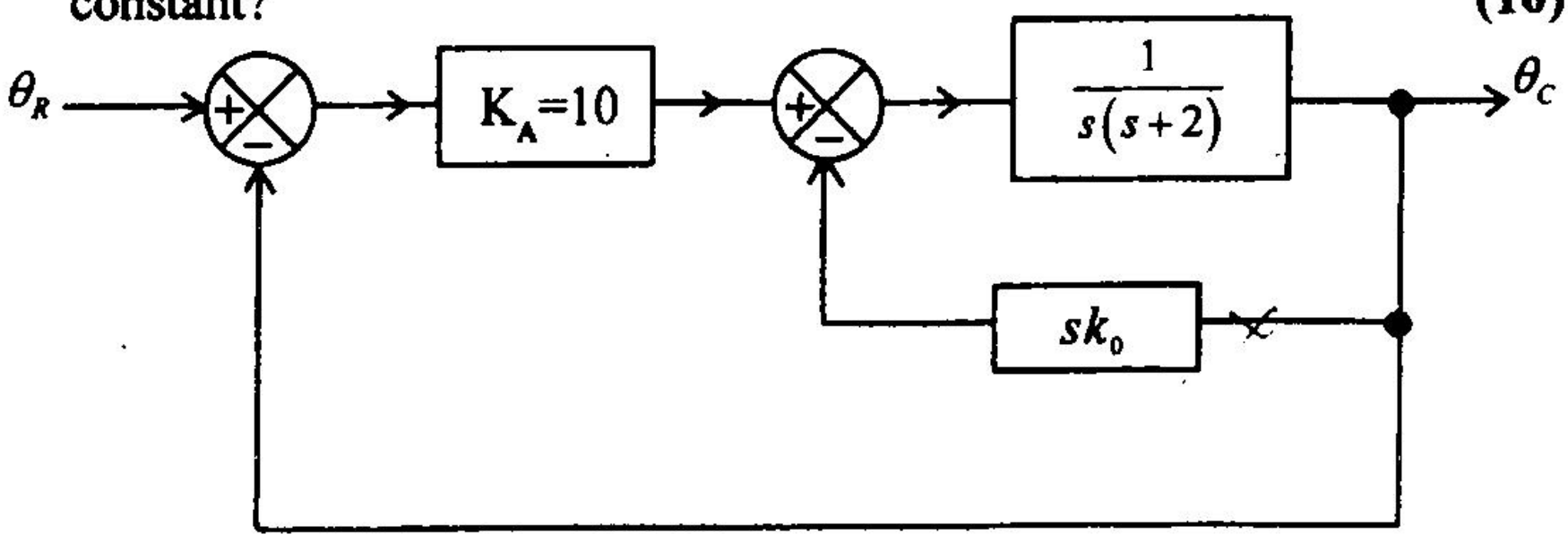

Figure - 5

7. a) A unity negative feedback control system has an open loop transfer function consisting of two Poles, two zeros and a variable gain K. The zeros are located at **-2 & -1**; and the poles at **0.1 & +1.** Using Routh-Stability Criterion, determine the range of values of K for which the closed loop system has 0,1 or 2 poles in the right-half plane. **(6)**

b) A unity feedback control system has an open loop transfer function of

$$G(s)=\frac{K(s+4/3)}{s^2(s+12)}$$

Plot root locus. Find the value of K for which all the roots are equal. Also find the values of these roots. **(6)**

c) By using Routh-Criterion, show that the system having following characteristic equation is stable or not.

$$s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$$ **(4)**

OR

8. a) Sketch the Nyquist plot and determine there from the stability of the following open loop transfer function of unity feedback control systems.

i) $GH(s)=\frac{K(s+2)}{s^2(s+1)}$; ii) $GH(s)=\frac{K}{s(s^2+s+4)}$ **(12)**

b) Define following terms :-

i) Gain and Phase Margin;

ii) Stability of System. **(4)**

9. Write short notes on followings (Any **Two**) :-

i) Lag Networks;

ii) PID Controllers;

iii) Lag-Lead Network. **(16)**

OR

10. Write short notes on followings (Any **Two**) :-

i) Cascade and Feed back Compensation;

ii) Tuning of PID Controllers;

iii) Lead Compensation. **(16)**
