05-CP

QUIZ # 01

CONTROL ENGG.

26-03-08

MAX. TIME : 45 mins

MAX. MARKS : 40

Close Book.

Show clearly which one is your final answer.

Calculators are allowed, but are not needed for the following questions.

Q#01 :- Draw a typical feed back control loop diagram. Name the Elements and define each of them. (10)

Q#02 :- Define the following Terms with e.gs. (10)

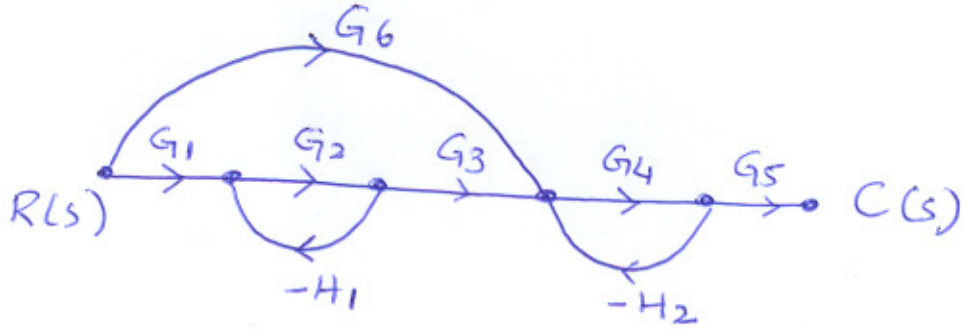
(a) PATH (b) LOOP GAIN (c) SINK NODE

(d) ELECTROMECHANICAL SYSTEMS

(e) TRANSFER FUNCTION.

Q#03 :- Find the T.F. of DC generator (10) Also draw its Block diagram.

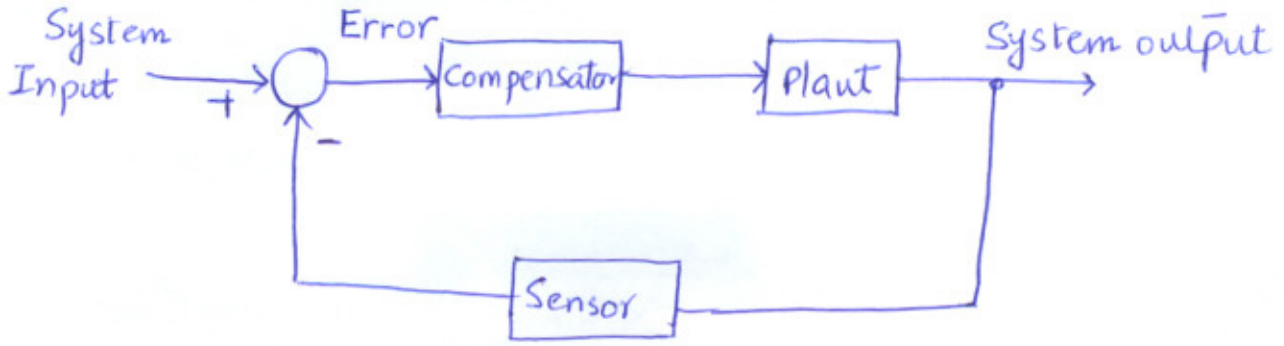
Q#04 :- Using Mason's gain, Find the T.F. (10)



BEST OF LUCK

SOLUTION (QUIZ #01)
CONTROL ENGG.

SOLN #1 :-



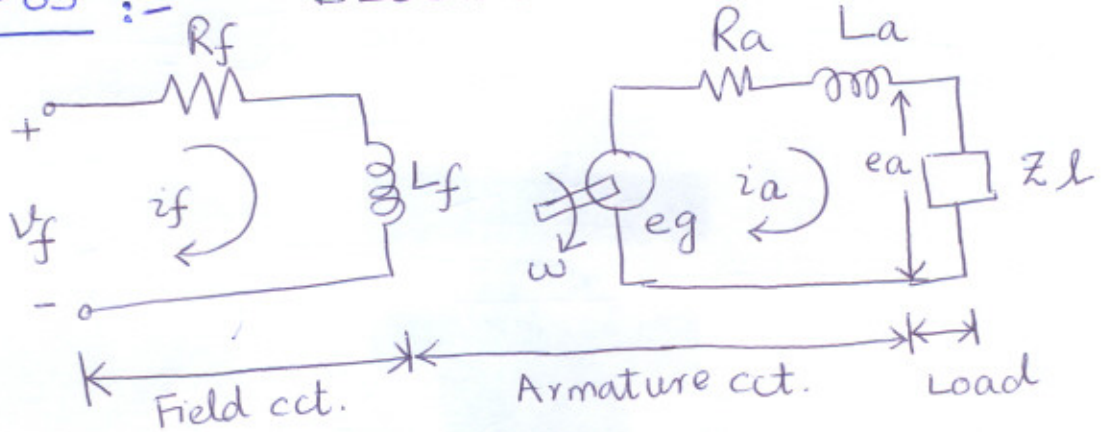
- "System Input" is a reference signal, In the home temp. control system system input is the setting of the thermostat.
- "Compensator" or Controller is a filter that is used to obtain the satisfactory X-tics for the total system.
- "Plant" of a control system is the part of the system to be controlled.
- "Sensor" is a device which is used to measured the output.

SOLN # 02 :-

- "PATH" is a continuous connection of branches from one node to another with all arrowheads in the same direction.
- "LOOP GAIN" is the product of the T.F. of all branches that form the loop.
- "SINK NODE" is a node for which signals flow only towards the node.
- "ELECTROMECHANICAL SYSTEMS" are the combinations of electrical and mech. systems. i.e, dc generator and servomotor.

– "TRANSFER FUNCTION" is the ratio of Laplace Transform of output Var. to the Laplace Trans. of input variable.

SOLN #03 :- "BLOCK DIAGRAM"



Transfer Function = $G(s) = \frac{E_a}{V_f} = ?$

Equation for Field cct.

using KVL, we have

$$V_f = R_f i_f + L_f \frac{di_f}{dt}$$

$$V_f = R_f I_f + s L_f I_f \quad \text{(Taking L.T.)}$$

$$\boxed{\frac{I_f}{V_f} = \frac{1}{R_f + sL_f}}$$

Equation for Armature cct.

Similarly using KVL, we have

$$e_g = R_a i_a + L_a \frac{di_a}{dt} + i_a Z_l$$

$$E_g = R_a I_a + L_a s I_a + I_a Z_l \quad \text{(Taking L.T.)}$$

$$E_g = I_a [R_a + Z_l + sL_a]$$

$$\boxed{\frac{I_a}{E_g} = \frac{1}{sL_a + R_a + Z_l}}$$

Equation for flux

$$\boxed{e_g = K_g i_f}$$

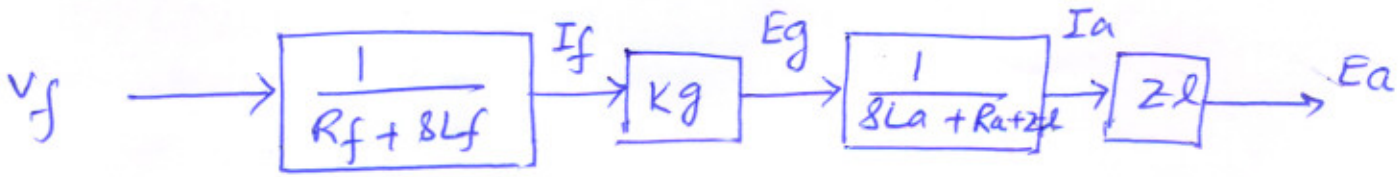
Similarly Equation for Load

$$e_a = Z_l i_a$$

$$E_a = Z_l I_a$$

$$\boxed{\frac{E_a}{I_a} = Z_l}$$

Combining all the Equations in blocks, we have



$$T.F. = \frac{E_a}{V_f} = \frac{K_g Z_l}{(R_f + sL_f)(sL_a + R_a + Z_l)}$$

SOLN #04 :- Saw page 38, 39 on course book.