Kafr El-sheikh University
Faculty of Engineering
Course code: MEP3110

Mechanical power engineering department
3rd Year final exam of 1st semester 2020 - 2021
Automatic control Time allowed: 3 Hours

The maximum mark for the examination paper is 90 marks, and the mark obtainable for each part of a question is shown in brackets alongside the question.

Instructions to the candidates:

- Clarify your answer with the suitable sketches as you can.
- Please use a pen or heavy pencil to ensure legibility.
- Any missing data could be reasonably assumed
- Please attempt all questions.

QUESTION NUMBER ONE [40 MARKS]

1. List the advantages and disadvantages of the open loop control system. After that, modify the system used a human operator as part of a control system to show how the systems could be automatically controlled. [8 Marks]

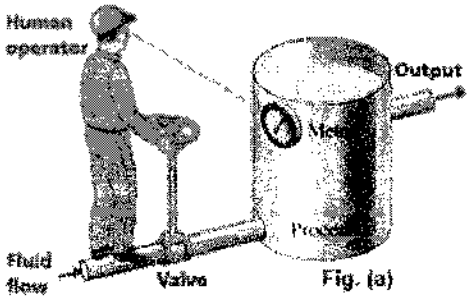


Fig. (a)

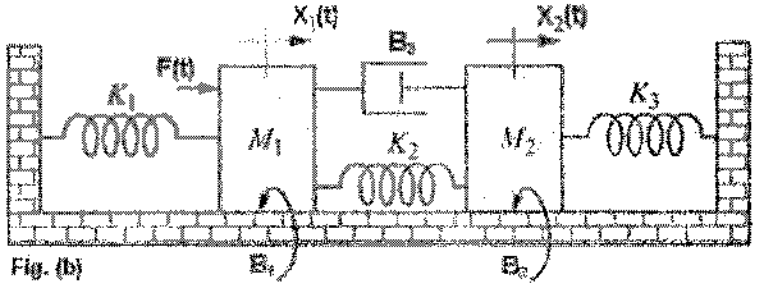
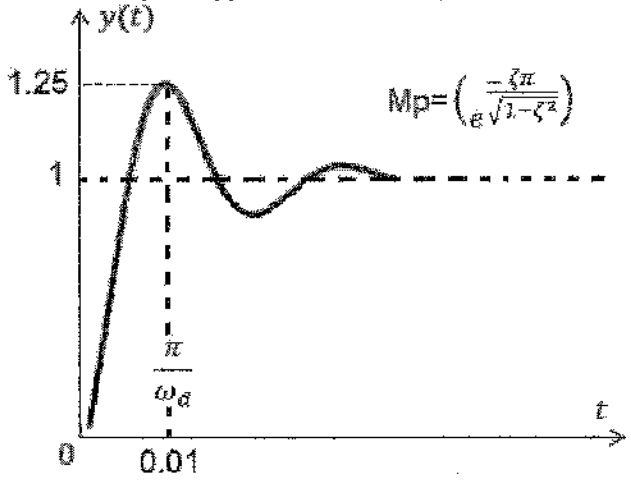


Fig. (b)

2. Find the overall transfer function for the network shown in fig (b). [12 Marks]
3. State the limitations of Hurwitz criterion. After that, examines the stability of the system given by the following characteristic equation using Routh criterion. [13 Marks]

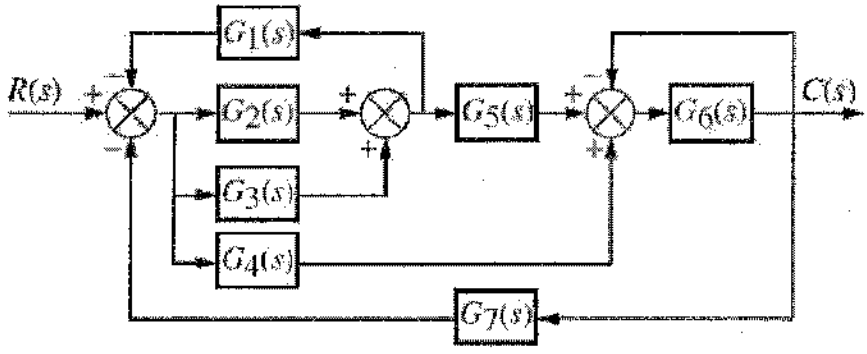
$$S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2 = 0$$

4. The unit-step response of a linear control system is shown below. Find the transfer function of a second order prototype to model the system. [7 Marks]

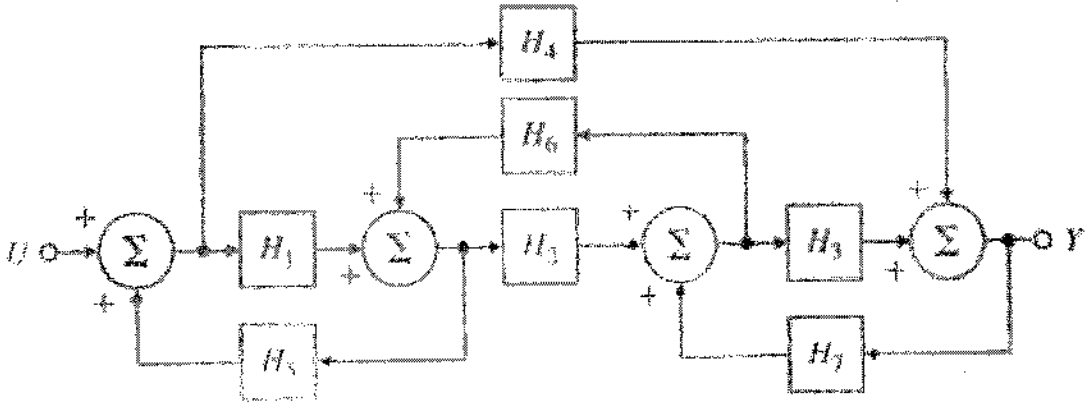


Question number two [50 Marks]

1. Obtain the closed-loop transfer function for the given block diagram. [8 Marks]



2. Draw the corresponding signal flow graph for the given block diagram. After that, find it's' transfer function using Mason's rule. [10 Marks]



3. Deduce that, DC-motor can be considered as an integrator. [10 Marks]

4. Sketch the approximate root locus diagram for the given unity feedback system; [14 Marks]

$$G(S) = \frac{K(S+2)(S+3)}{S(S+1)}$$

5. Find the transfer function Y(s)/R(s) for the following differential equations. After that, examines the stability of the system. [8 Marks]

$$\frac{d^3y(t)}{dt^3} + 10\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) + 2\int y(t)dt = \frac{dr(t)}{dt} + 2r(t)$$