VIT
Vellore Institute of Technology

SCHOOL OF ELECTRONICS ENGINEERING

Continuous Assessment Test - II, August 2019
B.Tech (ECE) FALL Semester, 2019-2020

Course Code	: ECE 2010	**Duration**	: 90 Mins
Course Name	: Control Systems	**Max. Marks**	: 50
Faculty-In-Charge:	Dr. Mugelan RK	**Slot**	: D2

Answer ALL the questions

PART-A

1. (a) For a system having open loop transfer function, $G(s) = \frac{10}{(s+1)(s+6)}$ with a unity feedback, determine the time at which the first undershoot will occur and the number of cycles output will perform before settling down. **(5 marks)**

   (b) An artificial heart works in closed loop by varying its pumping rate according to changes in signals from the recipient's nervous system. For feedback compensation design it is important to know the heart's open-loop transfer function. To identify this Transfer function, an artificial heart is implanted in a calf while the main parts of the original heart are left in place. Then the atrial pumping rate in the original heart is measured while step input changes are effected on the artificial heart. It has been found that, in general, the obtained response closely resembles that of a second-order system. In one such experiment it was found that the step response has a % Over Shoot = 30% and a time of first peak T_p = 127 sec. Find the corresponding transfer function. **(5 marks)**

2. A unity feedback control system as shown in figure.1, has an amplifier gain K_A=10 and gain ratio in the feed forward path as, $(s) = \frac{1}{S(s+2)}$. A derivative feedback, $H(s) = sK_o$ is introduced as a minor loop around G(s). Determine the derivative feedback constant K_o, so that the system damping factor is 0.6 **(10 marks)**

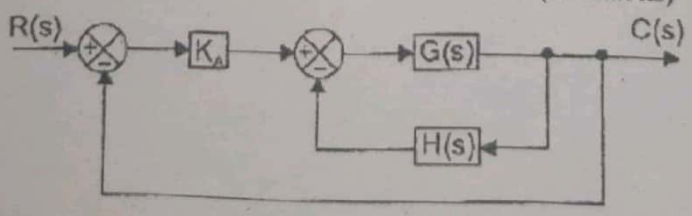

Figure.1

3. For each pair of second-order system specifications that follow, find the location of the second-order pair of poles.
   a. %OS = 12%; Ts = 0.6 second
   b. %OS = 10%; Tp = 5 seconds
   c. Ts = l seconds; Tp = 3 seconds

4. Find the range of values of K for the closed loop system in figure.2 to remain stable. Find the frequency of sustained oscillations under limiting conditions. **(10 marks)**

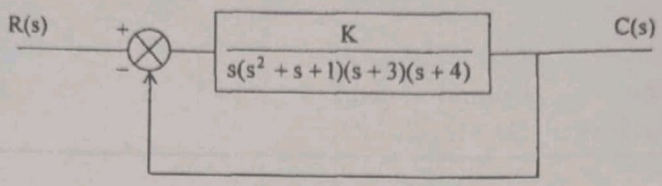

Figure. 2

5. Figure. 3 shows open-loop poles and zeros. There are two possibilities for the sketch of the root locus. Sketch each of the two possibilities. Be aware that only one can be the real locus for specific open-loop pole and zero values.

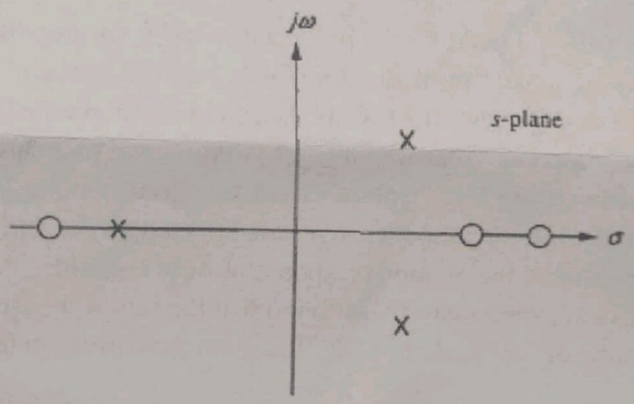

Figure.3

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