MINISTRY OF EDUCATION
MANDALAY TECHNOLOGICAL UNIVERSITY
Department of Mechatronic Engineering
2018-2019 Academic Year

Fourth Year **Second Semester Examination**

McE-42077 Control Engineering II

Date: 25.9.2019(WED) **Time: 1:00 to 4:00 pm**

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Attempt **ALL** Questions.

1. (a)The goal of vertical takeoff and landing (VTOL) aircraft is to achieve operation from relatively small airports and yet operate as a normal aircraft in level flight. A control system using adjustable jets can control the vehicle, as shown in Figure.1(a). (a) Determine the range of gain for which the system is stable, (b) Determine the gain K for which the system is marginally stable and the roots of the characteristic equation for this value of K. **(10.Marks)**

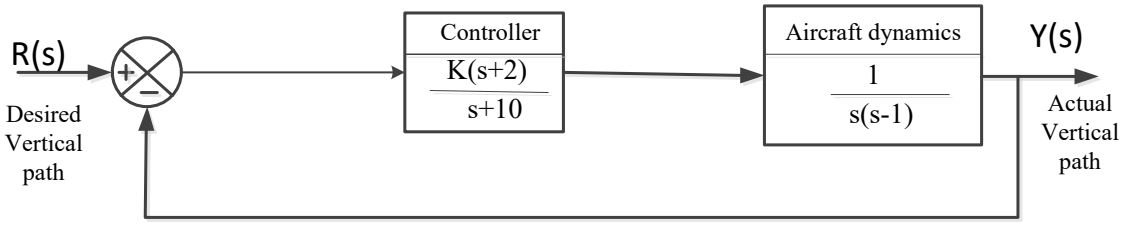

Figure.1.(a)

1. (b) A unity feedback system has a loop transfer function

$$L(s) = \frac{K}{(s+1)(s+3)(s+5)}$$

where $K = 30$. Find the roots of the closed-loop system's characteristic equation. (**10.Marks)**

2. A unity feedback system has the loop transfer function

$$L(s) = KG(s) = \frac{K(s+4)}{s(s+2)}$$

(a) Find the breakaway and entry points on the real axis.
(b) Find the gain and the roots when the real part of the complex roots is located at - 2 .
(c) Sketch the locus. **(20.Marks)**

3. (a) A specific closed-loop control system is to be designed for an underdamped response to a step input. The specifications for the system are as follows:

20% < percent overshoot < 30%,
Settling time < 0.7 s.

(a) Identify the desired area for the dominant roots of the system,
(b) Determine the smallest value of a third root; if the complex conjugate roots are to represent the dominant response. **(15.Marks)**

3.(b) A unity feedback control system shown in Figure.3.(b) has the process below, design a PID controller by **using Ziegler-Nichols tuning method**. **(15.Marks)**

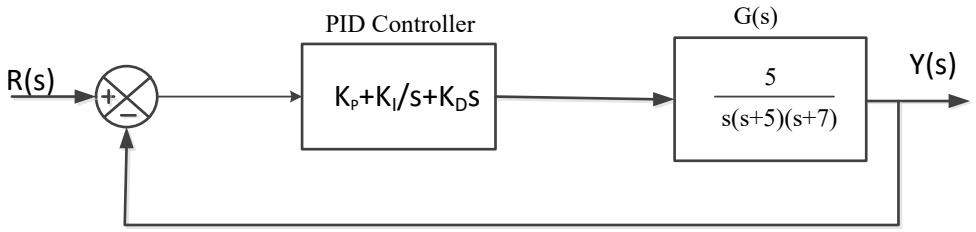

Figure.3.(b) A Unity Feedback Control System

4. Design the **lower order transfer function** of the given system. Determine the **percent overshoot and the peak time** of the lower order transfer function. The overall transfer function of the system is

$$G_H(s) = \frac{7}{s^3+6s^2+11s+7}$$ **(20.Marks)**

5. When the system shown in Figure.5(a).i. is subjected to a unit-step input, the system output responds as shown in Figure.5. Determine the values of K and T from the response curve.

(10.Marks)

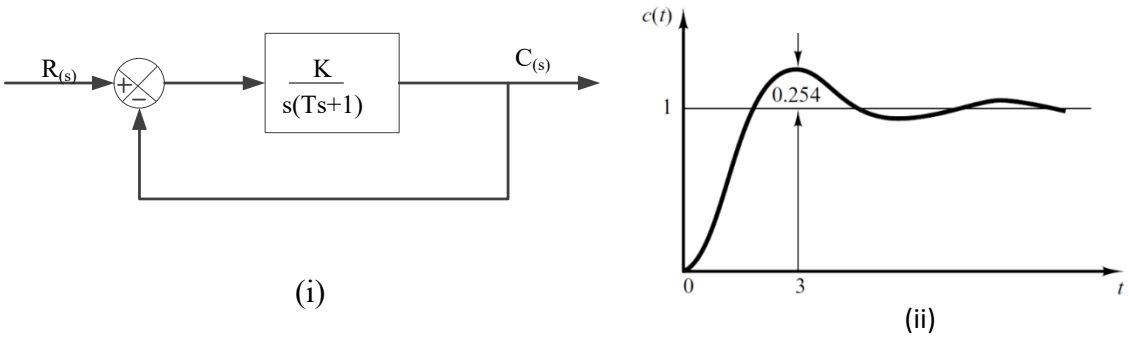

Figure. 5

----------End of the Questions----------