B.Sc. in EEE, 6th Sem, B.Sc.TE 2nd Sem, B.Sc.TE 4th Sem

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination   Summer Semester, A. Y. 2022-2023
Course No.: EEE 4605 / EEE 4691   Time: 90 Minutes
Course Title: Control System Engineering I   Full Marks: 75

There are 4 (**four**) questions. Answer all 3 (**three**) questions. The symbols have their usual meanings.
Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are
written in the brackets.

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1. Simplify the block diagram shown in Figure 1. Then find the closed-loop transfer   15
   function C(s)/R(s).   (CO2,
                                                                                              PO2)
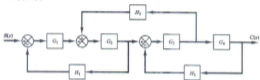

Figure 1

2. Convert the block diagram of Figure 1 into a signal flow graph and apply Mason's rule   15
   to verify the result obtained in question 1.   (CO2,
                                                                                              PO2)

3. In s-plane show the region where the poles of a 2nd order underdamped should be to meet   10
   following specifications.   (CO1,
   i.   Less than 10% overshoot.   PO1)
   ii.   Settling time less than 2s.
   iii. Peak time less than 0.5s.

4. Consider the following characteristic equation: 10
   $$s^4 + 2s^3 + (4+k)s^2 + 9s + 25 = 0$$ (CO2,
                                                                                              PO2)
   Using the Routh-Hurwitz criterion, determine the range of k for stability.

5. Derive the transfer function of a DC motor that relates output torque to input armature   15
   voltage using schematic diagram in Figure 2.   (CO1,
                                                                                              PO1)
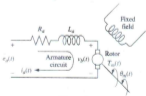

Figure 2

6. For the system shown in Figure 3, a) Find the transfer function of the system, and hence   10
   find the ζ, ω_n, %OS, T_s, T_p, T_r.   (CO1,
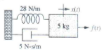   PO2)

Figure 3