**Reg. No. \_\_\_\_\_\_\_\_**

**Karunya University**

**(Karunya Institute of Technology and Sciences)**

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

**Supplementary Examination - June 2011**

**Subject Title: CONTROL SYSTEMS Time: 3 hours**

**Subject Code: EI203 Maximum Marks: 100**

#### **Answer ALL questions**

**PART – A (10 x 1 = 10 MARKS)**

1. In Torque-Current analogy, Moment of Inertia J is analogous to \_\_\_\_\_\_\_\_.

2. List any two advantages of closed loop control systems.

3. Write the time domain representation of a unit parabolic signal. Also write the Laplace transform of unit parabolic signal.

4. For a unity feedback control system the open loop transfer function is given by,Acceleration error constant = \_\_\_\_\_\_\_\_.

5. Mention any two limitations of Routh-Hurwitz stability criterion.

6. State the magnitude criterion of Root Locus technique.

7. State the Nyquist stability criterion.

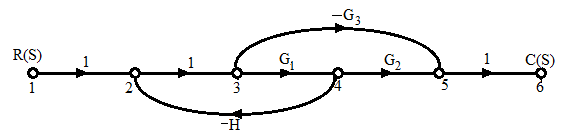
8. What is Nichols plot?

9. What are the properties of proportional controllers?

10. What is the meaning of crisp set?

**PART – B (5 x 3 = 15 MARKS)**

11. Find the transfer function of the given signal flow graph using Mason’s gain formula.



12. Obtain an expression and plot the time response curve of a first order system for step input signal with A=2.

13. For the given systems, write the expression for m(t), plot the impulse response and comment on the stability of the systems.

a. M(s) =  b. 

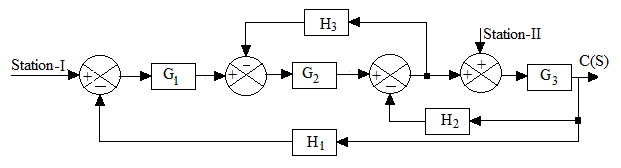
14. For a unity feedback system, open loop transfer function is given by, Using Routh-Hurwitz criterion find the value of K for which the given system will be stable.

15. What is PI controller and what are its effects on system performance? Also write the transfer function of PI controller.

[P.T.O]

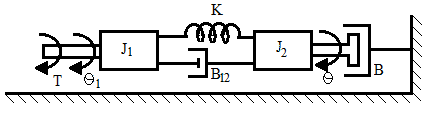
**PART – C (5 x 15 = 75 MARKS)**

16. For the system represented by the block diagram shown below, find the closed loop transfer function when the input is given at, a. Station- I b. Station – II (7.5 +7.5)

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(OR)

17. a. Write the differential equations governing the mechanical rotational system shown below and determine the transfer function  (7)



b. Write a short note on potentiometers. (8)

18. Obtain the time response expression of a second order,

a. Under-damped system subjected to unit step input signal. (10)

b. Critically-damped system subjected to unit step input signal. (5)

(OR)

19. a. For a negative feedback control system it is given that,  and. i) Find the damping ratio of the system. (2)

ii) For a unit step input, find the time response expression, c(t). (5)

iii) Calculate rise time, peak time and maximum overshoot. (3)

b. A unity feedback system has the forward transfer function  . For an input signal, r(t)=1+6t, determine the minimum value of K1 so that the steady state error is less than 0.1. (5)

20. Obtain the root locus for the unity feedback system whose loop transfer function is given by, (Note : Use Lin’s method to find the real root of )

(OR)

21. Using Routh-Hurwitz criterion, determine the location of roots on s-plane and hence comment on the stability of a control system, whose characteristic equation is given by, 

[P.T.O]

22. Consider a unity feedback system having an open loop transfer function Sketch the polar plot and determine,

a. The values of Gain margin and Phase margin for K=1, (9)

b. The value of K for a Gain margin of 18 db and (3)

c. The value of K for a Phase margin of 60°. (3)

(OR)

23. Sketch the bode plot for the following transfer function and determine Gain margin and Phase margin, 

24. Consider a unity feedback system having an open loop transfer function G(s) = . Design a PID controller so that the phase margin of the system is 45° at a frequency of 4 rad/sec and the steady state error for unit ramp input is 0.1.

(OR)

25. a. Briefly explain about Fuzzy set theory and operations. (7)

b. Briefly explain about different membership functions in fuzzy logic based control system.

(8)