Code No.: 10296

FACULTY OF ENGINEERING

B.E. III/IV Year (ECE) I Semester (Supplementary) Examination, May 2006

AUTOMATIC CONTROL SYSTEMS

Time : 3 *Hours*] [*Max. Marks* : 75

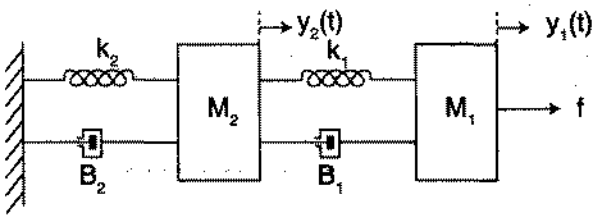
Answer **all** *questions from* Part A *and any* **five** *questions from* Part B.

Part A – (Marks : 25)

1. Construct the signal flow graph of the following set of simultaneous equations making y_4 as output node.
   $y_2 = t_{21}y_1 + t_{23}y_3$
   $y_3 = t_{31}y_1 + t_{32}y_2 + t_{33}y_3$
   $y_4 = t_{42}y_2 + t_{43}y_3$ 3
2. Define order and type of a system. 2
3. Calculate the steady state error of type 'O' system having unit step displacement input and position error constant of $\frac{1}{19}$. 3
4. Write the formula to find out the value of K at any point on the root locus. 2
5. Obtain the transfer function of a PID controller. 2
6. Define phase margin and gain margin w.r.t. Bode plot. 3
7. What are the advantages and disadvantages of digital control systems? 2
8. Derive the transfer function of lag-lead network and mention its applications. 3
9. Define : (a) State space (b) State vector 2
10. Explain briefly about observability and the related test to find out observability. 3

Part B – (Marks : 5 × 10 = 50)

11. (a) Explain briefly about Masons Gain formula. 2
    (b) Draw the classical and mobility analogies of the mechanical system shown in fig. Also write the equilibrium equations of the mechanical system. 8



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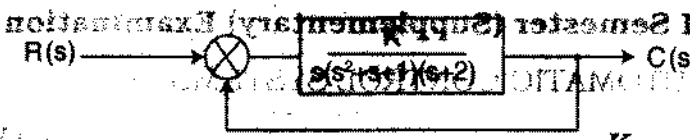
12. (a) Determine the range of K for the system shown in fig to be stable. 5

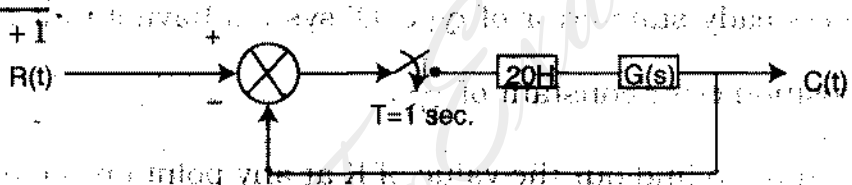


(b) For unity feedback system having $G(s) = \frac{K}{s^2(s+5)(s+2)}$, find steady state errors for unit step position, unit ramp and unit acceleration inputs. Also obtain generalised error coefficients and write the error series. 5

13. (a) Sketch the Nyquist plot for $GH(s) = \frac{1}{(s+P_1)(s+P_2)}$ $P_1, P_2 > 0$ and find stability. 5

(b) Mention various advantages for investigating the system performance in frequency domain than time domain. 5

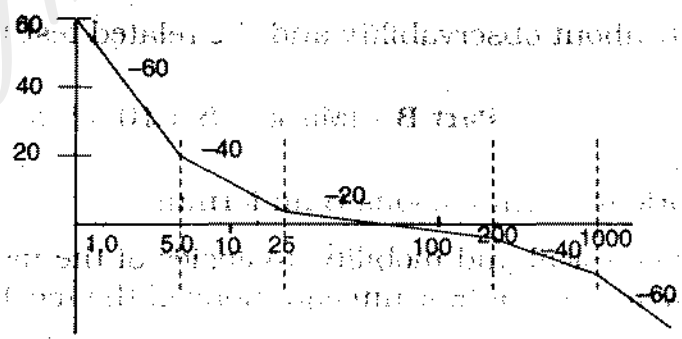
14. For the sampled data system shown in fig, find out the response to unit step input. With $G(s) = \frac{1}{s+1}$. 10



15. A system is characterised by the transfer function $\frac{y(s)}{u(s)} = \frac{2}{s^3+6s^2+11s+6}$. Find the state and output equations in matrix form and also test the controllability and observability. 10

16. (a) Define phase margin and gain margin w.r.t. Nyquist plot. 4

(b) Obtain the transfer function of the system whose magnitude Vs. frequency plot is given. 6



17. Write short notes on : 10

(a) Error sensing devices

(b) PID controller

(c) Observability.