D 90150 (Pages : 3) Name.....

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FIFTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, NOVEMBER 2015

EE/PTEE 09 503—LINEAR CONTROL SYSTEMS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

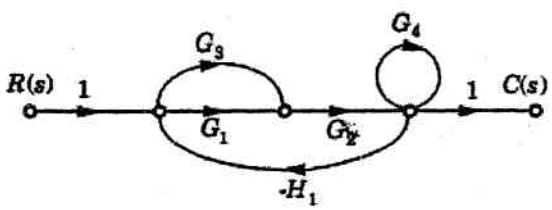
1. List the properties of transfer function.
2. What is the drawback of static coefficients ?
3. What is angle criterion ?
4. How is the Resonant Peak (Mr), resonant frequency (Wr) and band width determined from Nichols chart ?
5. Why compensation is necessary in feedback control system ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Find the gain C(s) / R(s) of the signal flow graph shown in figure below.

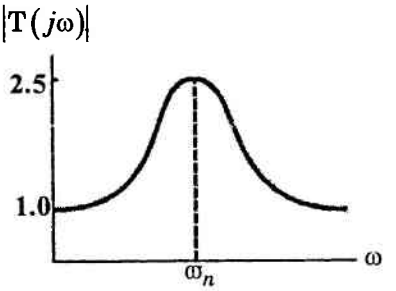


7. For a second order system settling time is Ts = 7 s and peak time is Tp = 3 s. Find the locations of poles.
8. An under damped second order system having a transfer function of the form

$$T(s) = \frac{K\omega_n^2}{s^2 + 2\xi\omega_n s + \omega_n^2}$$

Turn over

has a frequency response plot shown in figure below. Find the system gain K



9. In the Bode-plot of a unity feedback control system, the value of magnitude of G (*jw*) at the phase crossover frequency is 1/2. Find the gain margin.

10. Define compensator. What is the need of compensator and explain its types?

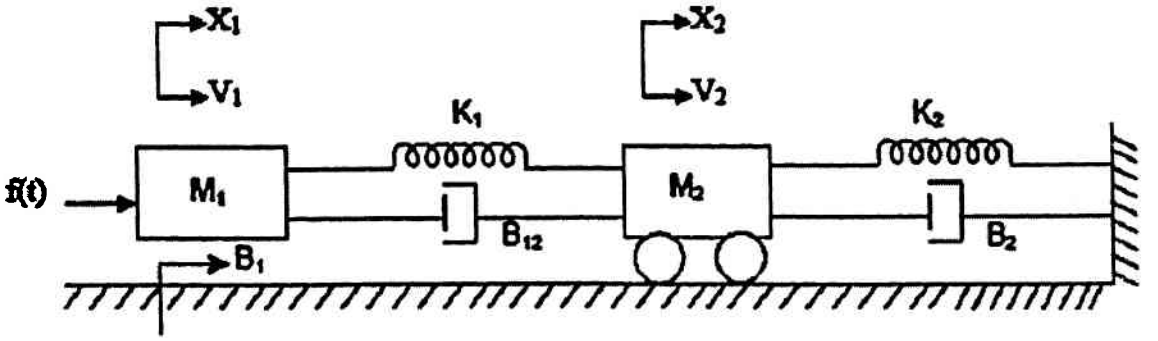
11. Explain the Routh stability criterion for discrete data systems.

(4 × 5 = 20 marks)

Part C

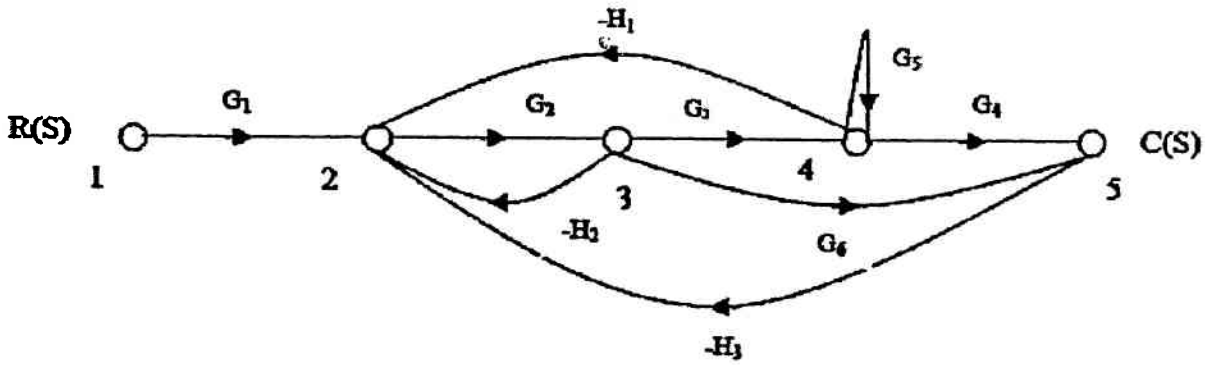
Answer **all** *questions.*

12. (a) Write the differential equations governing the mechanical systems shown below. Draw the force-voltage and force-current electrical analogous circuits and verify by writing mesh and node equations.



Or

(b) Find the overall gain C(s) / R(s) for the signal flow graph shown below.



13. (a) A unity feedback control system has an open loop transfer function G (S) = K (S + 1.5) / S (S + 1) (S + 5). Sketch the root locus.

Or

(b) (i) Using Routh criterion determine the stability of the system whose characteristics equation is S4 + 8S3 + 18S2 + 16S + 5 = 0.

(ii) F(S) = S6 + S5 – 2S4 – 3S3 – 7S2 – 4S – 4 = 0. Find the number of roots falling in the RHS plane and LHS plane.

14. (a) Explain sampling theorem and Sample and Hold operation briefly.

Or

(b) Sketch the polar plot for the following transfer function and find Gain cross-over frequency, Phase cross-over frequency, Gain margin and Phase margin.

G(S) = 10 (S + 2) (S + 4) / S (S2 – 3S + 10).

15. (a) A unity feedback system has an open loop transfer function G(S) = K/ S (S +1) (0.2S + 1). Design a suitable phase lag compensators to achieve following specifications K_v = 8 and Phase margin 40 deg with usual notation.

Or

(b) Explain the procedure for design of Lead compensator.

(4 × 10 = 40 marks)