DIPLOMA IN ELECTRICAL ENGINEERING (DELVI)

Term-End Examination

December, 2014

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BIEE-035 : CONTROL SYSTEMS

Time : 2 hours   *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Question no. 1 is **compulsory**.*

1. Write *True/False* and justify.   *7×2=14*

    (a) Roots of the closed loop control system can be obtained from Bode plot.

    (b) The polar plot for negative frequencies is the image reflection of positive frequencies plot.

    (c) Phase lag network is used to increase system stability as well as bandwidth.

    (d) The capacitance is not used to fabricate a lag network.

    (e) The steady state error for type-1 system is zero.

    (f) The system $G = \dfrac{1}{s}$, $H = 1$ is a type 0 system.

(g) Source nodes represent independent variables and have only outgoing branches.

2. (a) Draw the block diagram for the current shown in the figure, where v_i and i_L are the input and output variables respectively. 7
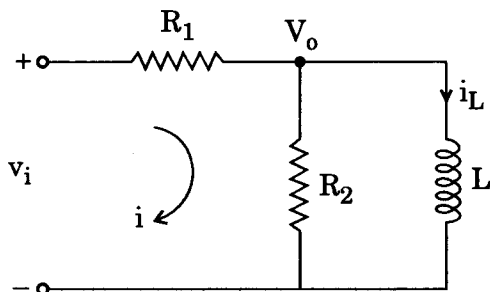
(b) A thermometer has a time constant of 15.33 sec. It is quickly taken from a temperature 0°C to a water bath having a temperature 100°C. What temperature will be indicated by the thermometer after 60 sec. ? 7

3. (a) The open loop transfer function of a servo system with unity feedback is given by,

$$G(s) = \frac{10}{(s + 2)(s + 5)}.$$

Determine the damping ratio, undamped natural frequency of oscillation. What is the percentage overshoot of the response to a unit step input ? 7

(b) Measurements conducted on a servomechanism show the system response to be

$$c(t) = 1 + 0{\cdot}2\ e^{-60t} - 1{\cdot}2\ e^{-10t}$$

when subjected to a unit step input.

(i) Obtain the expression for the closed loop transfer function.

(ii) Determine the undamped natural frequency and damping ratio of the system. 7

4. (a) Derive the values of static error coefficients and steady-state error for a type-1 system with unit step input. 7

(b) Sketch the polar plot for

$$G(s) = \frac{20}{s(s + 1)(s + 2)}.$$ 7

5. (a) Write a short note on correlation between time domain and frequency domain specification. 7

(b) Apply Routh-Hurwitz criterion to the following equation and investigate the stability.

$$s^5 + 2s^4 + 2s^3 + 4s^2 + 11s + 10 = 0$$ 7

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6. (a) Using Nyquist criterion, determine the stability of the feedback system which has the following open loop transfer function.

$$G(s) H(s) = \frac{K}{s^2(1 + sT)}$$ 7

(b) Steady state error increases by using the derivative feedback control. Prove.   7

7. (a) With a suitable diagram show the elements of industrial automatic controller.   7

(b) Draw and explain the torque-speed characteristics of a two-phase servomotor.   7

8. (a) Explain the use of synchro pair as an error detector. Give a trade name of synchro.   7

(b) Explain the functional diagram of robotics. Also give the classification of robotics.   7