C 61440 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, APRIL 2014

(2009 Scheme)

EC / PTEC 09 604—CONTROL SYSTEMS

(Regular / Supplementary / Improvement)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Define type and order of a system.
2. Write down the expression for rise time of a second order system when excited by unit step input.
3. State Sampling theorem.
4. Sketch the shape of polar plot for the open-loop transfer function $G(s)\,H(s) = \frac{k}{s(1+Ts)}$.
5. List out any *four* properties of a state transition matrix.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Write down the Force-Torque voltage analogy table.
7. Derive the expression for the response of a first order system when excited by unit ramp input.
8. Determine the stability of a closed loop system whose characteristic equation is given by $s^5 + s^4 + 2s^3 + 2s^2 + 11s + 10 = 0$.
9. Find the z-transform of $f(t) = e^{-at} \cos wt$.
10. Find the state transition matrix for $A = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix}$.

Turn over

11. Obtain the state space representation for electrical network shown in Figure (1). Select i and V_C as state variables

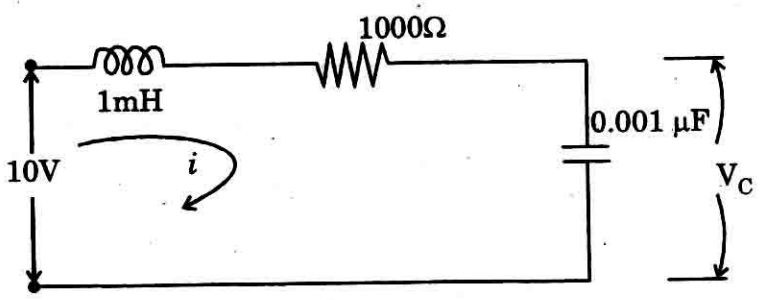

Fig. 1.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*

12. Derive the transfer function of circuit shown in Figure (2) using signal flow graph reduction technique

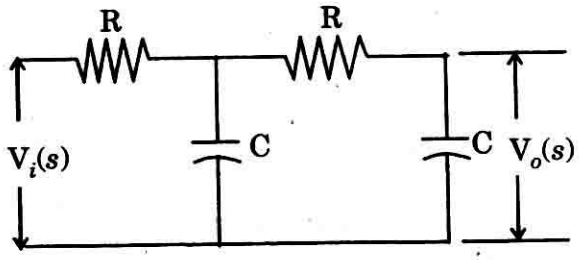

Fig. 2

(10 marks)

Or

13. Derive the transfer function of an armature controlled d.c. servo motor. (10 marks)

14. Sketch the root locus for the open-loop transfer function given by $G(s)H(s) = \frac{k}{s(s+1)(s+3)}$.

Comment on range of k for stability.

(10 marks)

Or

15. Sketch the Bode plot for the open-loop transfer function $G(s)\,H(s) = \dfrac{2(s+0.25)}{s^2(s+1)(s+0.5)}$. Determine gain cross over frequency and phase cross over frequency.

(10 marks)

16. What is sample and hold ? Derive transfer function of a zero order hold circuit. (10 marks)

Or

17. Determine the stability of a sampled-data control system having characteristic polynomial $2z^4 + 8z^3 + 12z^2 + 5z + 1 = 0$. Using Jury's stability criterion.

(10 marks)

18. Give $\dot{X} = AX\,Bu$ and $Y = CX$ where $A = \begin{bmatrix} 1 & 4 \\ -2 & -5 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ and $C = [1 \quad 0]$. Given $X(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$. Determine time response. Use diagonalization process for matrix A.

(10 marks)

Or

19. For the transfer function given $\dfrac{Y(s)}{U(s)} = \dfrac{6s}{s^3 + 6s^2 + 11s + 6}$. Obtain state space representation in phase variable form and parallel decomposition form.

(10 marks)

[4 × 10 = 40 marks]