Reg. No. : | | | | | | | | | | |

Question Paper Code: 45302

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fifth Semester

Electrical and Electronics Engineering

14UEE502 - CONTROL SYSTEMS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions
(Polar Graph sheets to be provided)

PART A - (10 x 1 = 10 Marks)

1. The principles of homogeneity and superposition are applied to
   (a) Linear time variant systems (b) Non-linear time variant systems
   (c) Linear time invariant systems (d) Non-linear time invariant systems

2. The type of boring, used for making deep excavations is
   (a) Cylindrical augers (b) Percussion boring
   (c) Rotary boring (d) Wash boring

3. The impulse response of the system is $5e^{-10t}$. Its step response is equal to
   (a) $0.5e^{-10t}$ (b) $(1 - e^{-10t})$
   (c) $0.5(1 - e^{-10t})$ (d) $(1 - e^{-10t})$

4. The Terzaghi's general bearing capacity equation is represented as
   (a) qf = 5.7 c + $\bar{\sigma}$ (b) qf = c Nc + $\bar{\sigma}$. Nq + 0.5γBNγ
   (c) qf = c Nc + $\bar{\sigma}$. Nq (d) qf = c Nc

5. When two column loads are unequal, which of the possible footing can be provided?
   (a) Strap footing (b) Raft footing
   (c) Trapezoidal combined footing (d) Mat footing

6. The Phase Margin of the system is 0^0. It represents a
   (a) Stable system (b) Unstable system
   (c) Conditionally stable system (d) Marginally stable system

7. The number of sign changes in the element of the first column of the routh array denotes
   (a) the number of zeros of the closed loop system in the RHP
   (b) the number of poles of the closed loop in the RHP
   (c) the number of zeros of the closed loop system in the LHP
   (d) the number of poles of the closed loop in the LHP

8. A lead compensator
   (a) improves the steady state accuracy
   (b) reduces the bandwidth
   (c) increases the bandwidth
   (d) reduces the speed of response

9. The number of state variable of a system is equal to
   (a) the number of integrators present in the system
   (b) the number of differentiators present in the system
   (c) the sum of the number of integrators and differentiators present in the system
   (d) none of the these

10. The earth pressure at rest is calculated by using
   (a) Euler's theory
   (b) Rankine's theory
   (c) Bending theory
   (d) Theory of elasticity

PART - B (5 x 2 = 10 Marks)

11. List out the various methods of site exploration.

12. Draw the pressure distribution diagram for sand and clay layer at the beneath of rigid footing.

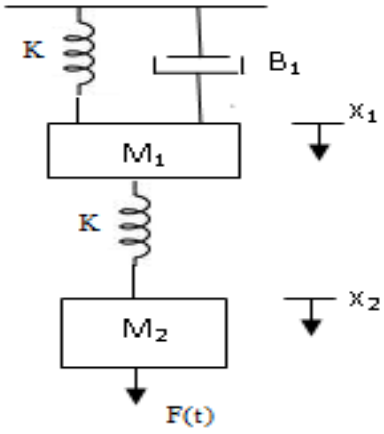
13. What are the advantages of frequency response design?

14. Define absolute stability and relative stability.

15. State the properties of the state transition matrix.

PART - C (5 x 16 = 80 Marks)

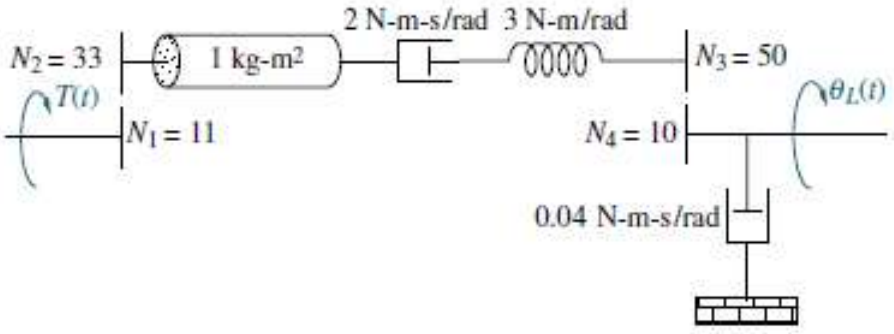
16. (a) (i) Obtain the transfer function $\frac{X_2(s)}{F(s)}$ of the given mechanical translational system. (8)



(ii) Derive the expression for transfer function of armature controlled DC servomotor. (8)

Or

(b) For the rotational mechanical system shown in figure, find the transfer function. Also find the torque-current analogues circuit. (16)



17. (a) A unity feedback system has a loop transfer function $\frac{K}{s(s+3)(s^2+4s+7.84)}$

Sketch the root locus plot and determine the following: (i) Centroid and angle of asymptotes (ii) Angle of departure of root loci from the poles (iii) Break away point if any, The value of K and the frequency at which root loci cross the imaginary axis. (16)

Or

(b) Sketch the Root Locus of the control system whose forward path transfer function is $G(s)=\frac{K}{s(s+2)(s+5)}$. (16)

18. (a) Compare the properties of different phase compensators. Realize them using electrical network. (16)

Or

(b) Derive the expression for constant *M* and *N* circles. Show that their loci are circles. (16)

19. (a) Define pile foundation. Briefly discuss about the type of pile and their functions. (16)

Or

(b) Design a lead compensator for a unity feedback system with open loop transfer function $G(s)=\frac{k}{s(s+1)(s+5)}$ to satisfy the following specifications.

(i) Velocity error constant $K_v \geq 50$

(ii) phase margin is $\geq 20^0$ (16)

20. (a) (i) Obtain the state space representation of this system in three canonical forms $T(s)=\frac{5(S+4)}{S^3+10S^2+31S+20}$. (8)

(ii) Compute the state transition matrix e^{At} for the state model whose system matrix $A=\begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$. (8)

Or

(b) Explain in details about the Culmann's graphical method for finding active pressure with a neat sketch. (16)