



**B.E DEGREE EXAMINATIONS: MAY 2017**

(Regulation 2014)

Sixth Semester

**ELECTRICAL AND ELECTRONICS ENGINEERING**

U14EET602: Control Systems

**COURSE OUTCOMES**

CO1: Express all types of physical systems into its mathematical model.

CO2: Analyze the systems in time domain and frequency domain

CO3: Design compensators in frequency domain

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. Match with appropriate options using Force - Voltage Analogy

CO1 [K2]

List I		List II	
A. Mass		i. Capacitor	
B. Damper		ii. Voltage	
C. Spring		iii. Resistance	
D. Force		iv. Inductor	

- |    | A   | B   | C   | D  |
|----|-----|-----|-----|----|
| a) | ii  | i   | iii | iv |
| b) | iii | iv  | ii  | i  |
| c) | ii  | iv  | iii | i  |
| d) | iv  | iii | i   | ii |

2. A signal which is available for short duration of time is called

CO1 [K2]

- |                   |                     |
|-------------------|---------------------|
| a) Step signal    | b) Ramp signal      |
| c) Impulse signal | d) Parabolic signal |

3. State TRUE or FALSE

CO1 [K<sub>1</sub>]

A: Simultaneous equations can be solved by using signal flow graph technique

B: Mason's gain formula is used to determine the overall gain of the system.

- |                             |                             |
|-----------------------------|-----------------------------|
| a) A is True but B is false | b) A is false but B is True |
| c) Both A and B are true    | d) Both A and B are true    |

4. A synchro system is formed by interconnection of the devices called CO1 [K<sub>2</sub>]
- a) synchro transmitter and synchro receiver      b) synchro transmitter and synchro control transformer
- c) synchro transmitter and synchro potentiometer      d) synchro transmitter and synchro control detector
5. Assertion (A) : If the open loop transfer function of a system has unstable roots then it will remain closed loop unstable. CO2 [K<sub>1</sub>]
- Reason (R) : The roots of the characteristic equation of a closed loop system are given by  $1 + G(s)H(s) = 0$
- a) Both A and R are Individually true and R is the correct explanation of A      b) Both A and R are Individually true but R is not the correct explanation of A
- c) A is true but R is false      d) A is false but R is true
6. Root locus diagram can be used to determine CO2 [K<sub>2</sub>]
- a) Absolute stability      b) Relative stability
- c) Conditional stability      d) Marginal stability
7. Arrange the statements in sequential order with respect to root locus technique. CO2 [K<sub>1</sub>]
1. Angles of asymptotes and centroid
  2. Breakaway and break in points
  3. Location of poles and zeros
  4. Angle of departure and angle of arrival
  5. Point of intersection of rootlocus with imaginary axis
  6. Test point and root locus
- a) 1-2-3-4-5-6      b) 3-4-5-6-1-2
- c) 1-4-5-6-2-3      d) 3-1-2-4-5-6
8. The polar plot of a transfer function with 'ω' as the parameter is known as CO2 [K<sub>2</sub>]
- a) Bode plot      b) Root locus
- c) Nyquist plot      d) Signal flow graph
9. Assertion (A) : Stability is major problem in closed loop control systems. CO3 [K<sub>2</sub>]
- Reason (R) : Introduction of feedback affects the location of open loop systems.
- a) Both A and R are Individually true and R is the correct explanation of A      b) Both A and R are Individually true but R is not the correct explanation of A
- c) A is true but R is false      d) A is false but R is true

10. Addition of zeros in a transfer function causes CO3 [K2]
- a) Lead Compensation b) Lag Compensation
- c) Lag-Lead Compensation d) Improves steady state response

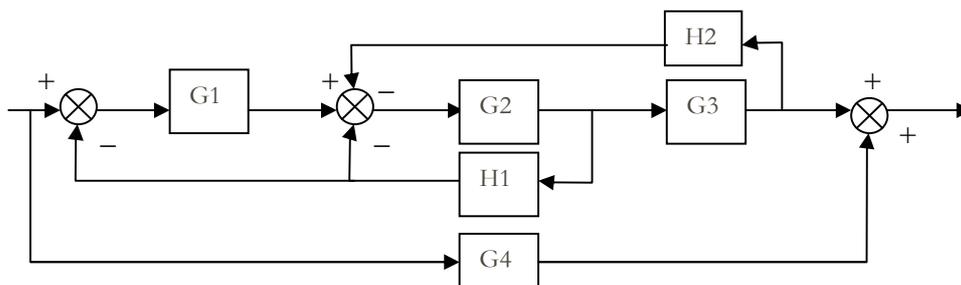
**PART B (10 x 2 = 20 Marks)**  
**(Answer not more than 40 words)**

11. What is feedback? What type of feedback is employed in control system? CO1 [K2]
12. Write the force balance equation of ideal dashpot. CO1 [K2]
13. List out the time domain specifications. CO2 [K1]
14. Write the transfer function of P, PI, PID Controller. CO2 [K2]
15. What is steady state error? CO2 [K2]
16. What are M and N circles? CO2 [K3]
17. Define Nyquist stability criterion. CO2 [K2]
18. State the relation between stability and coefficient of characteristic polynomial. CO3 [K2]
19. What is the use of adding compensator to a plant? CO3 [K3]
20. Draw the circuit of Lag-Lead compensator and derive its transfer function. CO3 [K2]

**Answer any FIVE Questions:-**  
**PART C (5 x 14 = 70 Marks)**  
**(Answer not more than 300 words)**

**Q.No. 21 is Compulsory**

21. Using Block diagram reduction technique, Find the Closed loop TF. CO1 [K2]



22. Describe the Two phase A.C servo Motor and derive its transfer function. CO1 [K3]

23. A unity feedback control system has an open loop transfer function  $G(s) = 10/S(S+2)$ . Find the rise time, percentage overshoot, peak time and settling time for a step input of 12 units. CO2 [K<sub>2</sub>]
24. Construct the routh array and determine the stability of the system whose characteristic equation is  $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ . Also determine the number of roots lying on right half of s-plane and on imaginary axis. CO2 [K<sub>2</sub>]
25. Sketch the Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec.  $G(s) = KS^2 / (1+0.2S) (1+0.02S)$  CO2 [K<sub>3</sub>]
26. The open loop transfer function of a unity feedback system is given by  $G(s) = K(S+9) / S(S^2+4S+11)$ . Sketch the root locus of the system. CO3 [K<sub>2</sub>]
27. Explain the procedural design steps of Lag Compensator. CO3 [K<sub>2</sub>]

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