



M.E DEGREE EXAMINATIONS: JUNE 2017

(Regulation 2015)

Second Semester

APPLIED ELECTRONICS

P15AET202 : Advanced Control Engineering

COURSE OUTCOMES

- CO1:** Solve difference equation using z – transform.
- CO2:** Review D/A and A/D conversion techniques.
- CO3:** Apply steady-state techniques for analysis of systems.
- CO4:** Design discrete-time control system using transform methods.
- CO5:** Analyze time and frequency response of discrete time systems.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The main advantage of digital control system is CO2 [K₁]
 - a) Use of rugged components
 - b) High sensitivity
 - c) Low cost
 - d) precision
2. One sided z-transform assumes that CO1 [K₁]
 - a) $x(t) = 1$ for $t < 0$
 - b) $x(t) = \alpha$ for $t < 0$
 - c) $x(t) = -1$ for $t < 0$
 - d) $x(t) = 0$ for $t < 0$
3. The characteristic equations of discrete time system is given by CO3 [K₁]
 - a) $|zI + G| = 0$
 - b) $|zI - G| = 0$
 - c) $(zI - G) = 0$
 - d) $(zI + G) = 0$
4. Matching elements of List I with II with respect to state definitions: CO3 [K₁]

List I	List II
A. state	i. n-dimensional coordinates
B. state space	ii. relationship between input and output variables
C. state vector	iii. set of variables
D. state equation	iv. n variables that define the system

- a) ii – iv – i - iii
- b) ii – i – iv - iii
- c) iii – iv – i - ii
- d) iii – i – iv - ii

5. Pre-warping concerns with design using CO4 [K₁]
 a) Impulse invariance method b) Bilinear transformation
 c) Step invariance method d) Frequency response method
6. The sampling frequency in discrete control system is approximately CO4 [K₁]
 a) Equal to system bandwidth b) 1/10th of system bandwidth
 c) 10 times system bandwidth d) 100 times system bandwidth
7. Assertion (A): Root – locus method is an important technique in the design of CO4 [K₂]
 continuous time control systems.
 Reason (R): The characteristic equation in root – locus method is similar in
 continuous – time and discrete – time design approaches.
 a) Both A and R are true and R is the b) Both A and R are true but R is not the
 correct explanation of A. correct explanation of A.
 c) A is true and R is false d) Both A and R are true
8. The primary input in frequency response method of design is CO4 [K₁]
 a) step b) cos wt
 c) ramp d) sin wt
9. A digital controller is also called CO5 [K₁]
 a) sampler b) compensator
 c) Hold circuit d) plant
10. The main advantage of velocity form of PID controller is CO5 [K₂]
 a) simplicity b) Low cost
 c) Initialization is not necessary d) Slower response

PART B (10 x 2 = 20 Marks)

11. State the typical errors that occur in A/D convertors. CO2 [K₁]
12. List the properties of E*(s). CO1 [K₁]
13. Distinguish between controllability and observability. CO3 [K₁]
14. List any two transformations used in state-space analysis. CO3 [K₁]
15. What is the transformation used for 's' in BLT method? CO4 [K₁]
16. State the assumptions made in step invariance method. CO4 [K₁]
17. What are the drawbacks in Routh – Hurwitz method of stability analysis? CO5 [K₁]
18. Illustrate the effects of s-plane to z-plane mapping. CO5 [K₁]
19. Distinguish between differentiator and integrator. CO1 [K₁]
20. What is the need for compensation in the design of discrete systems? CO1 [K₁]

PART C (6 x 5 = 30 Marks)

21. Define sinusoidal function. Also, obtain its z-transform. CO1 [K₂]
22. List the state space equations for continuous and discrete time – invariant and time varying systems. CO3 [K₂]
23. Obtain the z – transform for mth order discrete system using backward difference method. CO4 [K₂]
24. Illustrate the transient response specification of discrete system with schematic. CO5 [K₂]
25. Discuss the salient features involved in the design of phase – lead compensation. CO5 [K₂]
26. State the advantages of using Bode plot approach to the design of compensators. CO5 [K₁]

Answer any Four questions

PART D (4 x 10 = 40 Marks)

27. Illustrate digital control system with a block diagram. Also, obtain an expression for steady state actuation error to a step input. CO1 [K₂]
28. Obtain solution for linear, time-invariant discrete time state equation using
i) Recursive procedure ii) z-transform method. CO3 [K₂]
29. Outline the design of discrete control system using impulse invariance method. A system is described by $H(s) = 10/(s + 10)$. Use Bilinear transformation to obtain $H(z)$. CO4 [K₂]
30. Obtain an expression for pulse positional form of transfer function of a digital PID controller. CO5 [K₂]
31. A DCS is characterized by the generic polynomial, $P(z) = a_0z^4 + a_1z^3 + a_2z^2 + a_3z + a_4 = 0$. State Jury's conditions for stability. Construct Jury's table and also evaluate stability of the system. CO5 [K₂]
