

Roll No.

Total No. of Pages : 02

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**B.Tech.(EE/Electrical & Electronics Engg.) (Sem.-6)**  
**B.Tech. (Electronics & Electrical Engg.)**  
**NON-LINEAR AND DIGITAL CONTROL SYSTEMS**  
**Subject Code : BTEE-603**  
**M.Code : 71149**  
**Date of Examination : 07-07-22**

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A**

**1. Answer briefly :**

- a) Discuss the advantages of state space approach over transfer function approach.
- b) Explain the term controllability.
- c) Write down the condition for a system to be observable.
- d) Discuss any two properties of non linear systems.
- e) What are limit cycles?
- f) Draw the characteristics of an ideal and an actual relay.
- g) Explain dead zone with a suitable example.
- h) What do you mean by a positive definite function?
- i) How can you convert an analog signal into a digital signal?
- j) What are the limitations of Z transform?

### SECTION-B

2. Draw the state diagram and obtain the state equation for the following transfer function :

$$G(s) = \frac{7(s+2)}{s(s+3)(s+4)}$$

3. Draw the phase portrait of the following system :

$$\ddot{\theta} + \dot{\theta} + 0.5\theta = 0$$

4. Find out the describing function for deadzone non-linearity.  
 5. An autonomous system is expressed as follows :

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = -m_1x_2 - m_2x_1$$

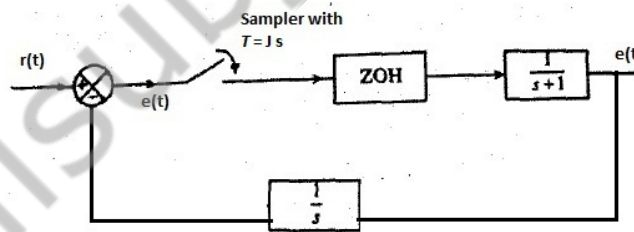
Study the stability of the system using Lyapunov's method and considering the Lyapunov's function as:

$$W = x_1^2 + x_2^2$$

6. Write a short note on Lyapunov's stability criterion.

### SECTION-C

7. A closed loop control system is shown below :



Determine the output in discrete form when a unit step is applied to the input.

8. a) How can you find out Lyapunov's function by with Variable gradient method?  
 b) Digital PID controller.  
 9. Write short notes on :  
 a) Jury's test of stability  
 b) Z transform.

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**