

Seat No. : \_\_\_\_\_

**AG-141**

**April-2015**

**M.Sc., Sem.-IV**

**Electronic Science**

**ELE-508 : Control System-II and Power and Industrial Electronics-II**

**Time : 3 Hours]**

**[Max. Marks : 70**

- Instructions :** (1) All symbols carry usual meanings.  
(2) Attempt all questions.  
(3) Scientific calculators are allowed.  
(4) Semi-log graph should be provided.

1. (a) Determine the stability of following system using Routh's stability criterion.

$$S^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$$

Comment on stability.

7

**OR**

- (i) By Hurwitz criterion, examine the stability of a system

3

$$s^3 + s^2 + s + 4 = 0$$

- (ii) The transfer function of a second order system is given by

4

$$T(s) = \frac{5}{s^2 + 2s + 5}$$

Find out the following frequency domain specifications :

- (i) Response peak ( $M_r$ )  
(ii) Resonance frequency ( $\omega_r$ )

- (b) Find the range of k for stable operation of a unity feedback control system with open loop gain as

7

$$G(s) = \frac{k(s+1)}{s^2(s+2)(s+5)}$$

**OR**

Plot the root locus for the unity feedback system with

7

$$G(s) = \frac{k(s+1)}{s^2(s+9)}$$

2. (a) List different types of controllers. Describe proportional – Integral (P-I) controller. 7

**OR**

Define Gain Margin and Phase Margin. Discuss relative stability of the system in terms of Gain Margin and Phase Margin.

- (b) Draw Bode plot of the following system and find out gain and phase margin. 7

$$G(s).H(s) = \frac{10}{s(1+s)}$$

**OR**

- (i) List the different methods used in frequency domain analysis. Write the advantages of Bode Plots. 4
- (ii) Write a note on Integral Controller. 3
3. (a) Describe series and parallel operation of thyristors. 7

**OR**

Explain the basic requirements for successful firing of thyristor. Giving neat circuit diagram, explain working of resistance firing circuit.

- (b) Discuss any two method of Forced Commutation. 7

**OR**

Explain how the operation of PUT differs from UJT. What are the advantages of PUT over UJT ?

4. (a) Derive  $V_{dc}$ ,  $I_{dc}$ ,  $V_{rms}$  and  $I_{rms}$  for single phase-half wave controlled rectifier. Obtain the ripple factor. 7

**OR**

Write a note on Automatic battery charger.

- (b) Discuss UPS in detail. 7

**OR**

Discuss the following thyristor applications with circuit diagram :

- (i) Over voltage protection
- (ii) Zero voltage switch

5. Answer the following : (each question carry **one** mark)

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- (1) What is the location of poles for marginally stable system ?
- (2) Write two advantages of Routh's stability criteria.
- (3) For a system if GM is infinity and PM is positive then it is stable. True or False.
- (4) Define Inverse Root locus.
- (5) What is the effect of adding zeros in the transfer function of a system ?
- (6) The open loop transfer function of a unity feedback system is  
$$G(s) = \frac{k.s}{s+3}$$
, find out where the root locus begins and ends.
- (7) An octave is a frequency band from  $f_1$  to  $f_2$  where  $f_2/f_1 = 10$ . True or False.
- (8) What steps should be taken to provide di/dt protection to the thyristor ?
- (9) What is pulse transformer ?
- (10) What is holding current in Thyristor ?
- (11) Define di/dt rating of a thyristor.
- (12) What are the advantages of bridge controlled rectifier ?
- (13) What are optoisolators ?
- (14) What are the advantages and disadvantages of switched mode power supplies ?

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