



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(ICE-OLD)/SEM-4/IC-401/2012**

**2012**

**BASIC CONTROL THEORY**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) The transfer function of a system is its
  - a) square response
  - b) step response
  - c) ramp response
  - d) impulse response.
- ii) In a signal flow graph
  - a) nodes represent variables
  - b) branches represent variable
  - c) both of these
  - d) none of these.

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- ix) The system represented by its transfer function has some poles lying on the imaginary axis of the s-plane, the system is
- absolute stable
  - conditionally stable
  - unstable
  - marginally stable.
- x) By increasing the gain,  $k$  of the system, the steady-state error of the system
- increases
  - decreases
  - remains unchanged
  - none of these.

### GROUP – B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

- The open-loop transfer function of a unity negative feedback system is given below :  
 $G(s) = 500 / s(s + 15)$ .  
  - the transient response for a unit step input
  - the value of rise time and peak time.
- Determine the stability of system whose characteristic equation is given by  
 $s^5 + 2s^4 + 3s^3 + 6s^2 + 5s + 3 = 0$ .
- Draw the polar plot of transfer function :  
 $G(s) = 5 / s(s + 15)(s - 7)$ .
- Find the transfer function of armature-controlled dc motor.
- For the system having  $G(s) = 25 / s(s + 10)$  and feedback, find the following parameters when excited a unit step input.
  - $\omega_n$
  - $\omega_d$
  - $T_p$
  - $M_p$
  - $\zeta$ .



**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) State the Nyquist stability criteria.  $3 + 10 + 2$   
 b) Using Nyquist stability criteria, determine whether the unity feedback close loop system having open loop transfer function  
 $G ( S ) H ( S ) = 10 \backslash S ( 1 + S ) ( 1 + 0.05S )$  is stable or not.
8. a) Sketch the root locus for the system having  $G ( S ) H ( S ) = K \backslash ( S^3 + S^2 + S - 3 )$ .  $8 + 7$   
 b) A unity feedback control system has open loop transfer function  $G ( S ) H ( S ) = 10 \backslash S ( 1 + S ) ( 1 + 0.05 S )$ . Find the range of values of K so that the close-loop system is stable.
9. a) Explain the meaning and significance of phase margin and gain margin of a control system. How will you obtain the values of these margins from Bode plot ?  
 b) Sketch the Bode plot for the following function and find out the approximate values of the gain margin & phase margin :  
 $G ( s ) = 10 ( S + 2 ) \backslash S ( S + 6 ) ( S + 10 )$ .  $7 + 8$
10. Write the short notes on any *three* :  $5 + 5 + 5$ 
  - a) Servo motor
  - b) PID controller
  - c) Absolute Stability & Relative Stability
  - d) Tachometers
  - e) Effect of poles and zeros on stability.

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