KADI SARVA VISHWAVIDYALAYA
B.E. SEMESTER IV EXAMINATION OCTOBER – 2015

SUBJECT CODE: EC – 402 **SUBJECT NAME**: CONTROL SYSTEM

DATE: 26/10/2015 **TIME**: 10:30 TO 1:30 **TOTAL MARKS**: 70

Instructions:

1. Answer each section in separate answer sheet.
2. Use of scientific calculator is permitted.
3. All questions are compulsory.
4. Indicate **clearly**, the options you attempted along with its respective question number.
5. Use the last page of main supplementary for rough work.

Section – 1

Que. 1	(All Compulsory.)		
	(A)	Differentiate open loop and closed loop control Systems. state their advantages and disadvantages.	(5)
	(B)	Using block diagram reduction technique find the closed loop transfer Function of the system whose block diagram is given in figure 1 below.	(5)
	(C)	Find-out transfer function for Signal flow diagram as shown in Figure 2 below, using Mason's gains Formula.	(5)

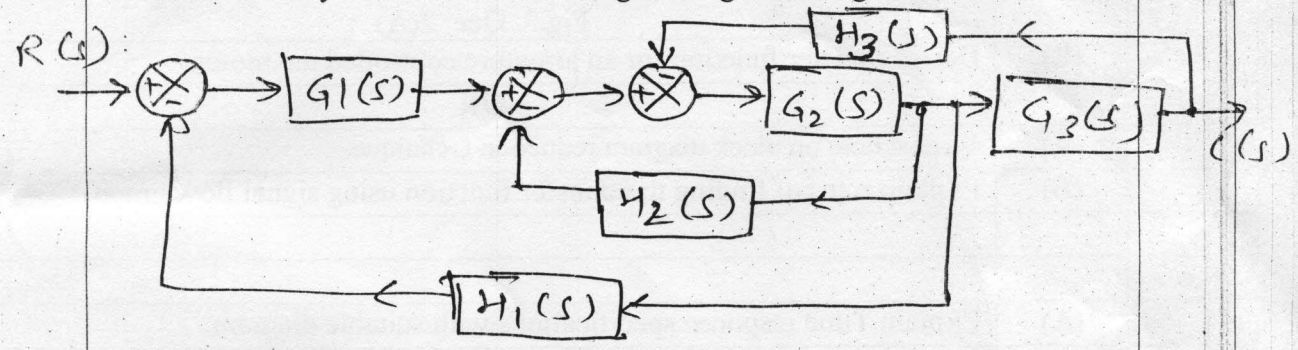


Fig. 1 Que. 1(B)

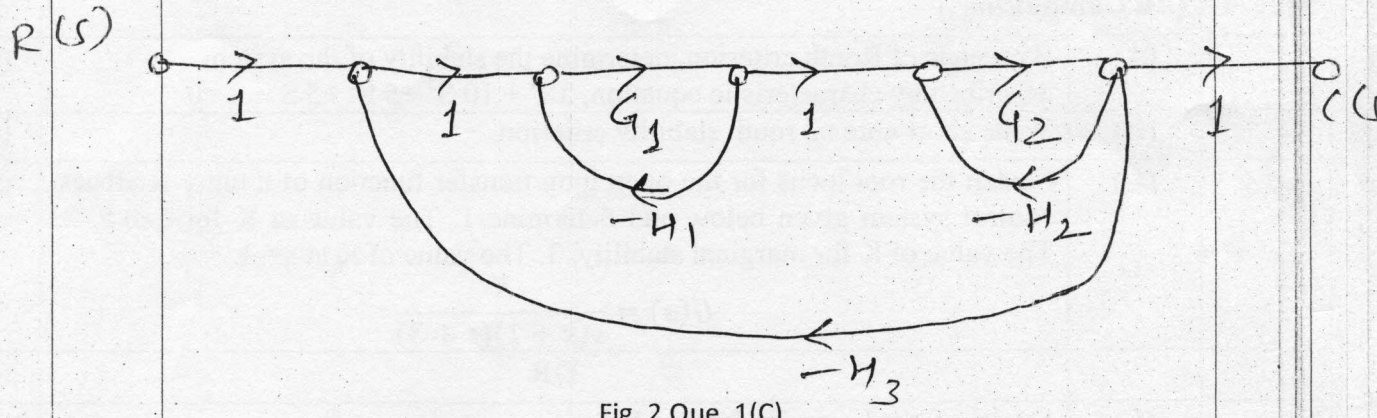
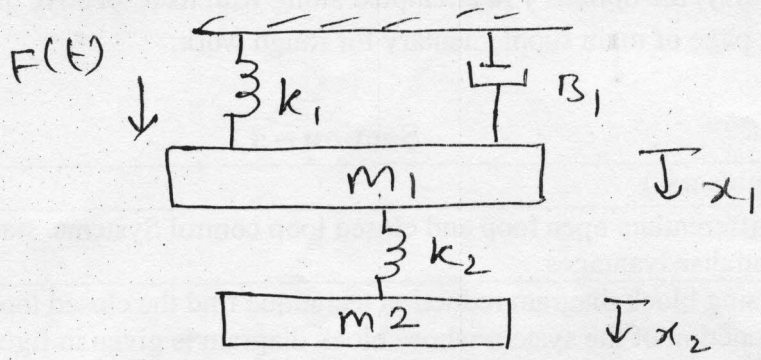


Fig. 2 Que. 1(C)

		OR	
	(C)	Explain force current analogy with suitable example.	**(5)**
Que. 2			
	(A)	Write the differential equations for the mechanical system shown in Fig.3. Also obtain an analogous electrical circuit based on force-current analogy.	**(5)**
		 Fig.3. Que. 2(A)	
	(B)	Derive transfer function for an armature controlled d.c.motor.	**(5)**
		OR	
	(A)	Write a note on block diagram reduction technique.	**(5)**
	(B)	Explain rules of finding the transfer function using signal flow graph.	**(5)**
Que. 3			
	(A)	Explain Time response specifications with suitable diagram.	**(5)**
	(B)	Write note on steady state error and error constants.	**(5)**
		OR	
	(A)	Find out the output response c(t) of the transfer function shown below for the step input. $\frac{C(S)}{R(S)} = \frac{5}{(S+1)}$ Plot the step response on a graph paper.	**(5)**
	(B)	Write note on standard test signals.	**(5)**

Section – 2

Que. 4	**(All Compulsory.)**		
	(A)	By means of Routh criterion, determine the stability of the system described by characteristic equation, $3S^4 + 10\ S^3 + 5\ S^2 + 5\ S + 2 = 0$	**(5)**
	(B)	Write short note on routh stability criterion.	**(5)**
	(C)	Sketch the root locus for the open loop transfer function of a unity feedback control system given below and determine 1. The value of K for ξ=0.5. 2. The value of K for marginal stability. 3. The value of K at s=-4. $$G(s) = \frac{K}{s(s+1)(s+3)}$$	**(5)**
		OR	
	(C)	Explain Root Locus Technique Rules.	**(5)**

Que. 5	**Answer the following questions.**		
	(A)	Sketch the bode plot for the open loop transfer function for the unity feedback system given below and access stability. $$G(S) = \frac{50}{(S+1)(S+2)}$$	**(5)**
	(B)	Write a note on Nyquist's stability criterion.	**(5)**
		OR	
	(A)	Explain: (I) Gain Margin (II) Phase Margin (III) Gain crossover frequency (IV) Phase crossover frequency.	**(5)**
	(B)	Draw the nyquist's plot for, $G(S)H(S) = \frac{2500}{(S+300)}$	**(5)**
Que. 6	**Answer the following questions.**		
	(A)	Explain The advantages of state space approach over classical methods and also obtain state variable equation with necessary block diagram and derivations.	**(5)**
	(B)	Write a short note on integral control.	**(5)**
		OR	
	(A)	Write a short note on error detectors.	**(5)**
	(B)	Write a short note on tachogenerator.	**(5)**

ALL THE BEST

Kadi Sarva Vishwavidyalaya

BE SEMESTER IV

Subject Code: EE402/EC402 **Subject: CONTROL SYSTEM**

Date: 12/05/2014 **Time: 10:30 To 1:30** **Max. Marks: 70**

Instruction: (1) Attempt all questions.

(2) Figures to the right indicate full marks.

(3) Answer each section in separate answer sheet.

(4)Use the scientific calculator is permitted.

Section - I

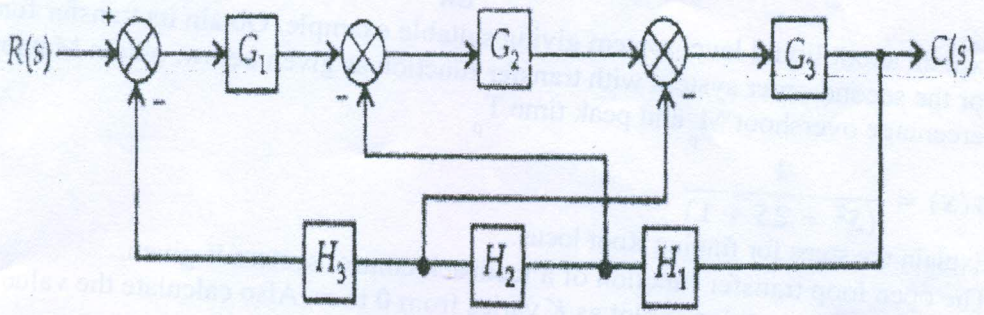
Q.1 [A] Define Following Terms [5]
(1) Self Loop (2) Source Node (3) Rise Time (4) Settling Time (5) Peak Time

[B] Explain force-voltage analogy with suitable example. [5]

[C] Discuss the limitations of transfer functions and advantages of analysis of control systems using state space. [5]

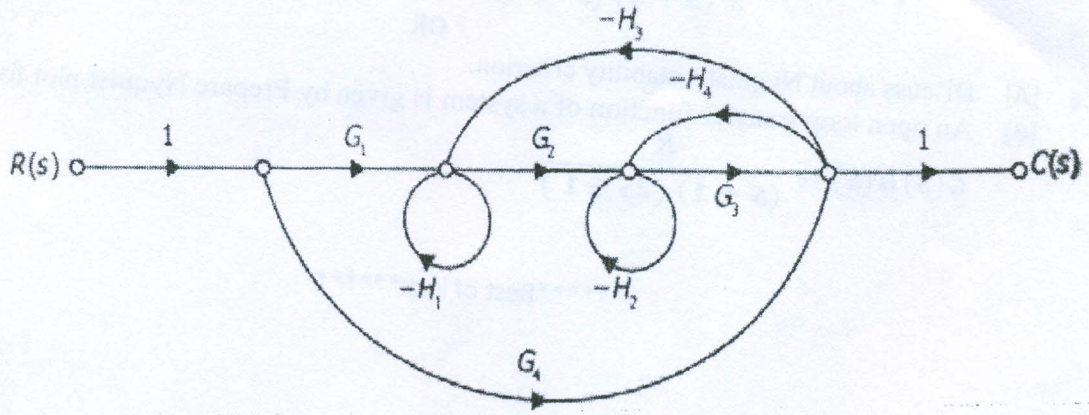
OR

[C] Determine close loop transfer function of the system shown below using block diagram reduction techniques. [5]



Q.2 [A] Explain Mason's gain formula to determine transfer function . [5]

[B] Determine the transfer function of the system with signal flow graph shown in below figure. [5]



OR

Q.2 [A] A second order control system is subjected to unit step input. Draw response curves for underdamped, over damped and critically damped system. [5]

[B] Derive transfer function for an armature controlled d.c.motor. [5]

Q.3 [A] Explain any three rules to find stability in Routh's criterion method. [5]

[B] Using Routh's criterion check the stability of a system whose characteristic equation is given by $S^4 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ [5]

OR

Q.3 [A] Explain about thermal system giving suitable example. Obtain its transfer function. [5]

[B] Explain about time constant of first order and second order system. [5]

Section – II

Q.4 [A] (1)State (2) State vector (3) Transfer function (4) Type "0" system (5) Time response [5]

[B] Give one example of an open loop stable system and open loop unstable system. Explain about stability of the system. [5]

[C] Explain about signal flow graph with suitable example [5]

OR

[C] Sketch Bode plot having unity feedback system determine gain margin for the transfer function given below. [5]

$$G(S) = \frac{200\,(S+2)}{S\,(S^2+10S+100)}$$

Q.5 [A] Explain about signal flow graph with suitable example. [5]

[B] Using Routh array Determine the range of K for a unity feedback system whose open loop transfer function is given by [5]

$$G(S) = \frac{K}{S\,(S+1)\,(S+2)}$$

OR

Q.5 [A] Explain about liquid level system giving suitable example. Obtain its transfer function. [5]

[B] For the second order system with transfer function as given below, obtain Maximum percentage overshoot M_p and peak time T_p. [5]

$$G(S) = \frac{4}{(S^2+2S+1)}$$

Q.6 [A] Explain the steps for finding Root locus. [5]

[B] The open loop transfer function of a feedback control system is given. Draw complete root locus plot as K varies from 0 to ∞. Also calculate the value of K for which the system becomes oscillatory. [5]

$$G(S)H(S) = \frac{K}{S\,(S+3)\,(S^2+2S+1)}$$

OR

Q.6 [A] Discuss about Nyquist's stability criterion. [5]

[B] An open loop transfer function of a system is given by Prepare Nyquist plot for it. [5]

$$G(S)H(S) = \frac{K}{(S+1)\,(2S+1)}$$

******Best of luck******

Kadi Sarva Vishwavidyalaya

BE Sem-4

Subject: CONTROL SYSTEM (EE/EC-402)

Date: 3/11/2014 **Max. Marks: 70**

Time: 3 Hrs

Instruction: (1) Attempt all questions.
(2) Figures to the right indicate full marks.
(3) Answer each section in separate answer sheet.
(4)Use the scientific calculator is permitted.

Section - I

Q.1 [A] Compare Open Loop versus Closed Loop control systems. **[5]**

[B] Explain Standard Test Signals used in control system. **[5]**

[C] Derive the closed loop transfer function using block diagram reduction technique for the below fig. **[5]**

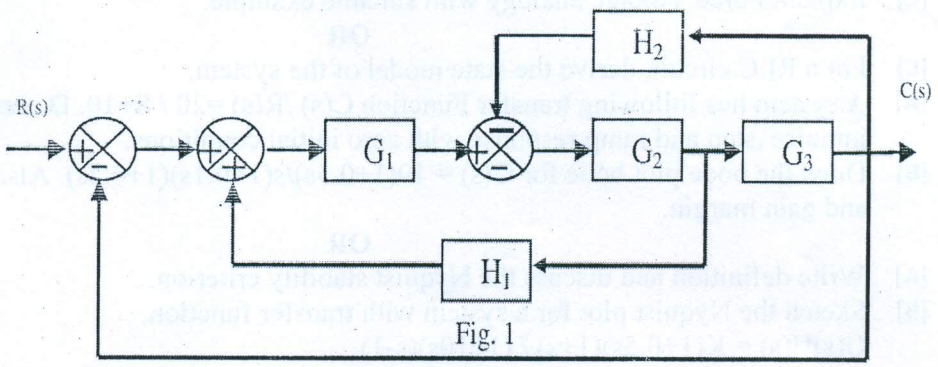
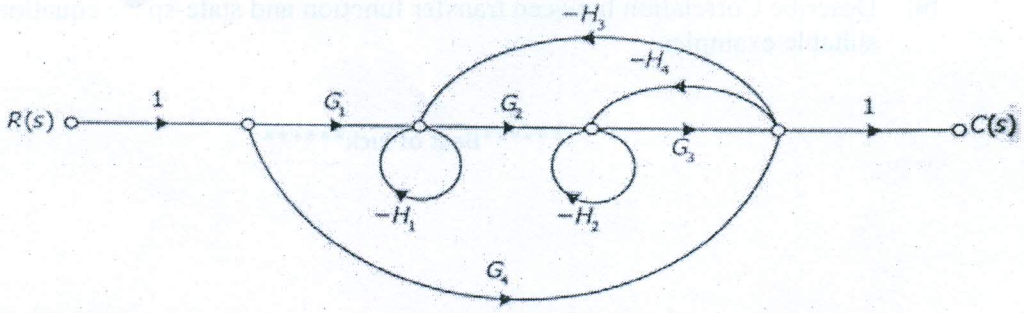


Fig. 1

OR

[C] Derive the transfer function for armature controlled DC motor. **[5]**

Q.2 [A] Determine the transfer function of the system with signal flow graph shown in below fig. **[5]**



[B] Explain Force current analogy with suitable example. **[5]**

OR

Q.2 [A] Explain types of the system and steady state error constants for the same. **[5]**

[B] Explain first order system with appropriate example. **[5]**

Q.3 [A] Define following terms. **[5]**
1) State variable 2) State trajectory 3) State vector 4) Transfer function 5) Source Node

[B] By means of Routh criterion, determine the stability of the system described by characteristic equation, $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$ **[5]**

OR

Q.3 [A] By means of Routh criterion, determine the range of K for stability of the system described by characteristic equation, $S^3 + 8S^2 + 2S + 4K = 0$ [5]

[B] Explain the effect of derivative control action on system performance. [5]

Section – II

Q.4 [A] Explain following terms with necessary diagrams. [5]
1)Delay Time 2)Rise Time 3)Peak Time 4)Steady state error 5)Settling Time

[B] Compare root locus technique and Bode plots for control system analysis purpose. [5]

[C] Explain Force Voltage analogy with suitable example. [5]

OR

[C] For a RLC circuit, derive the state model of the system. [5]

Q.5 [A] A system has following transfer Function C(s) /R(s) =20 / S+10. Determine its unit impulse ,step and ramp response with zero initial conditions. [5]

[B] Draw the bode plot bode for G(s) = 10(1+0.5s)/s(1+0.1s)(1+0.2s). Also find phase and gain margin. [5]

OR

Q.5 [A] Write definition and discuss the Nyquist stability criterion. [5]

[B] Sketch the Nyquist plot for a system with transfer function, [5]
G(s)H(s) = K(1+0.5s)(1+s) / (1+10s)(s-1)

Q.6 [A] Explain Root Locus Technique Rules. [5]

[B] Plot the root locus for given transfer function. [5]
G(s) = K/s(s+1)(s+4).

OR

Q.6 [A] Explain the frequency response, state its applications with possible limitations. [5]

[B] Describe Correlation between transfer function and state-space equations with suitable examples [5]

******Best of luck******

KADI SARVA VISHVAVIDYALAYA

B.E. SEMESTER IV EXAMINATION (APRIL/2015)

SUBJECT CODE: EE/EC-402 **SUBJECT NAME:** CONTROL SYSTEMS

DATE: 30/4/2015 **TIME:** 10: 30 a.m. to 1:30 p.m. **TOTAL MARKS:** 70

Instructions:

1. Answer each section in separate answer sheets.
2. Use of scientific Calculator is permitted.
3. All questions are compulsory.
4. Indicate clearly the options you attempted along with the respective question number.
5. Use the last page of your supplementary for rough work.

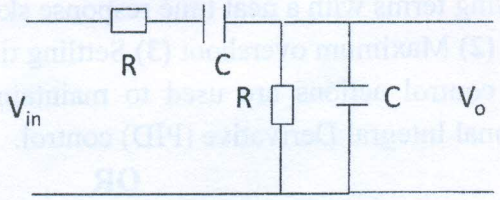
Section – I

Q-1

A Explain a Control system with a block diagram & differentiate between open loop and close loop system. **5**

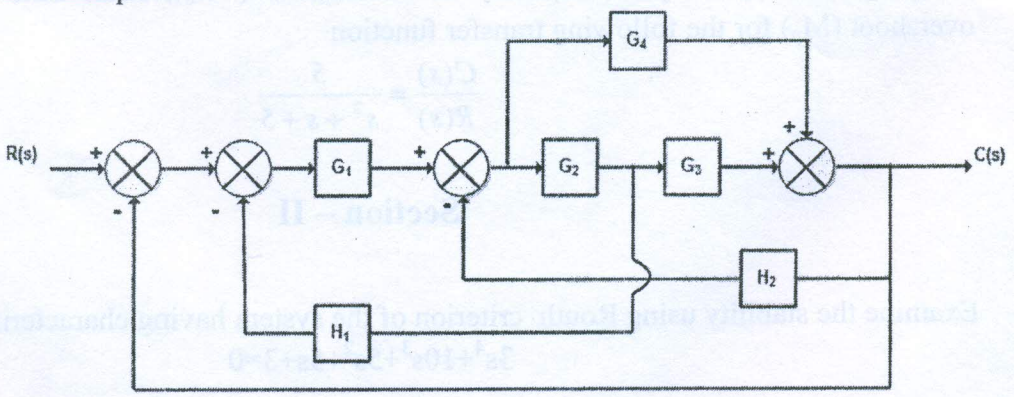
B Name the analogous electrical elements in force-current and force-voltage analogy for the elements of mechanical translational and rotational systems. **5**

C For the given circuit plot the pole zero plot. Assume initial conditions zero. Take R=C=1 for plotting the pole zero plot. **5**



OR

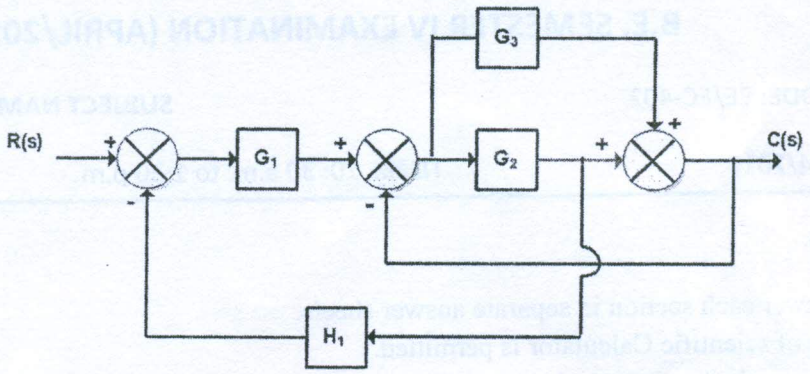
C Find the closed loop transfer function of the system shown below using block diagram reduction techniques. **5**



Q-2

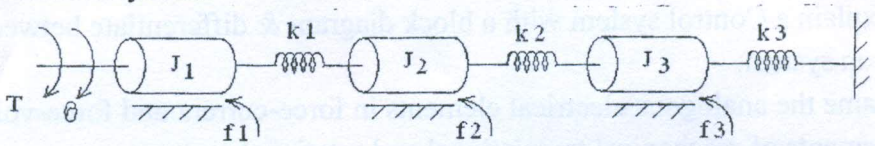
A Define **(1)** State **(2)** State Vector **(3)** State Variable **(4)** State Trajectory **(5)** Transfer function. **5**

B Draw the signal flow graph for the given block diagram and explain Mason's Gain Formula. 5



OR

A Draw free body diagram and analogous electrical circuit based on force – voltage analogy for the given mechanical system. 5



B Discuss the limitations of transfer function approach and hence give the advantages of state space approach. 5

Q-3

A Define the following terms with a neat time response sketch. 5

(1) Rise time **(2)** Maximum overshoot **(3)** Settling time **(4)** Peak Time.

B Which different control actions are used to maintain the output within desirable limits? Explain Proportional Integral Derivative (PID) control. 5

OR

A What is Steady State Error? Explain type of system and its relation with steady state error. 5

B Determine the characteristic equation of the system, natural frequency of oscillations (ω_n) , damping ratio (ζ),damped frequency of oscillations (ω_d), Peak time (t_p), Maximum overshoot (M_p) for the following transfer function 5

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

Section – II

Q-4

A Examine the stability using Routh criterion of the system having characteristic equation : 5

$$3s^4+10s^3+5s^2+5s+3=0$$

B Sketch the Root locus for the following transfer function and determine the range of values of K for which the system is stable. 5

$$G(s)\,H(s) = \frac{K}{s(s+4)(s^2+4s+13)}$$

C Sketch the Nyquist plot for a certain unity feedback system having an open -loop transfer function given by 5

$$G(s)\,H(s) = \frac{K}{s(1+s)(1+2s)(1+3s)}$$

OR

C Explain the rules to sketch Root locus. 5

Q-5

A Sketch the Bode Plot for the open loop transfer function (Use Semi-log graph paper). 5

$$G(s) = \frac{100}{s(s+1)(s+2)}$$

B For the Bode plot drawn in Q-5(A) Determine the Gain margin, Phase Margin, Gain cross over frequency and Phase cross over frequency. Also state the advantages of Bode plot over other stability analysis techniques. 5

OR

A The open loop transfer function of a unity feedback control system is given by, 5

$$G(s) = \frac{K}{(s+2)(s+4)(s^2+6s+25)}$$

By applying Routh criterion, discuss the stability of the closed loop system as a function of K. Determine the value of K which will cause sustained oscillations in the closed-loop system. What is the corresponding oscillation frequency?

B What do you understand by poles and zeroes of a transfer function? Relate it to stability. 5

Q-6

A With a circuit diagram explain the use of potentiometer as an error detector. 5

B Explain types of Time response and standard test signals used as an input for analysis. 5

OR

A Derive expression of response, c(t), of first order unity feedback system whose closed-loop transfer function is given below, for unit step and unit impulse input as a function of time. 5

$$\frac{C(s)}{R(s)} = \frac{1}{1+Ts}$$

B Write a short note on Stepper motor. 5

*********ALL THE BEST************