08.801 ADVANCED CONTROL THEORY

Time: 3 hours Max. Marks 100

Answer all questions from Part A and Any One full question from each Module of Part B

PART A

1. Differentiate between Classical Control Theory and Modern Control Theory ?
2. Explain State Transition Matrix? Mention its Properties ?
3. Differentiate between Phase Variable & Canonical forms of State representation ?
4. Explain Pole Placement techniques ?
5. What is Region of Convergence ?
6. Determine the Z-Transform of the following discrete sequence ?
   (a) $f(k) = (1/2)^k u(k)$ (b) $f(k) = \alpha^k u(-k-1)$
7. Differentiate between incidental and intentional non-linearities ?
8. What is the difference between Phase Plane and Describing function methods of analysis ?
9. Explain Asymptotic Stability and Instability ?
10. Explain Jump resonance ?

(10 x 4 = 40 Marks)

PART B

Module - I

11. (a) A Feedback system has a closed loop transfer function
    $Y(s)/U(s) = 10(S+4) / S(S+1)(S+3)$
    Construct the Canonical state of the System ? (10 Marks)

    (b). A LTI System is characterized by homogenous state equation

$$\begin{bmatrix} X_1' \\ X_2' \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$$

Compute the solution of the homogeneous state model of the equation where

$$X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

(10 Marks)

OR

12. (a) Briefly explain the concept of Controllability & Observability ? (10 Marks)

(b) Examine the controllability and observability of the given system.

$$\begin{bmatrix} X_1' \\ X_2' \\ X_3' \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} u$$

$$Y = \begin{bmatrix} 3 & 4 & 1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$

(10 Marks)

Module – II

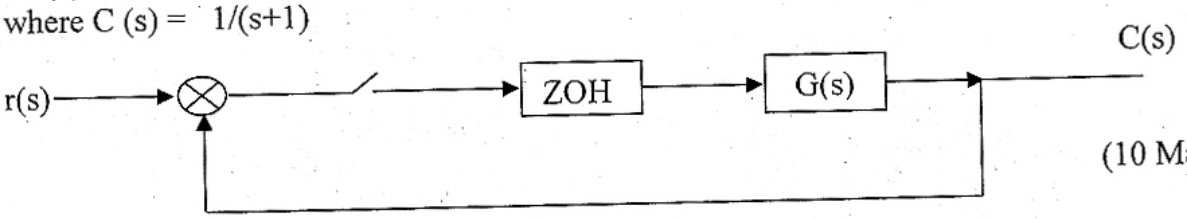
13.(a) (i) State and explain Shanon's sampling theorem?

(ii) Solve the difference equation

$C(k+2) + 3C(k+1) + 2C(k) = U(k)$ given that $C(0) = 1$, $C(1) = -3$, $C(k) = 0$ for $k<0$

(10 Marks)

(b) For the sampled data control system shown in fig find the response to unit step input where $C(s) = 1/(s+1)$



(10 Marks)

OR

14(a) Explain Jury's test of stability? Derive the transfer function of ZOH (10 Marks)

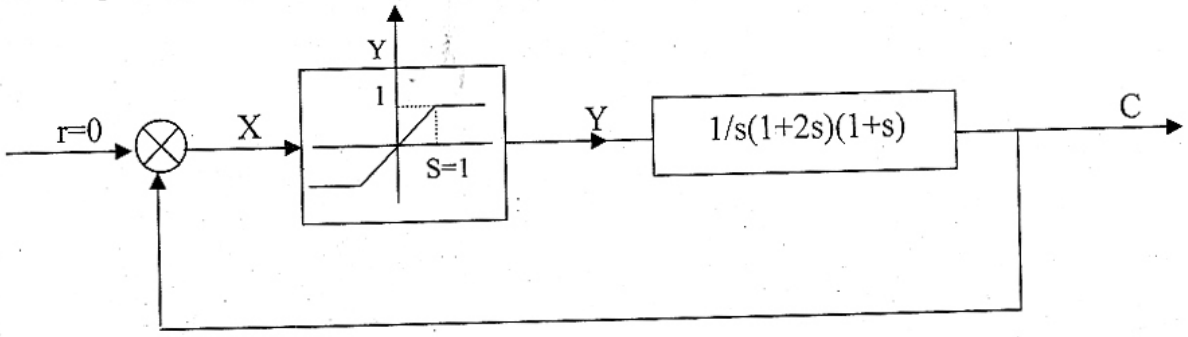
(b). Check the stability of the sampled data control systems

$Z^4 - 1.7Z^3 + 1.04Z^2 - 0.268Z + 0.024 = 0$ (10 Marks)

Module III

15(a) Derive the Describing function for a Saturation Non linearity ? Explain the different types of non- linearities? (10 Marks)

(b) Consider a third order system with a Saturating amplifier having gain in its linear region. Determine the largest value of gain k for the system to stay stable. What would be the frequency, amplitude and nature of the limit cycle for a gain k=3. (10 Marks)



OR

16(a). Explain how to analyze a non- linear system using phase trajectories. (10 Marks)

(b) (i)Briefly explain the terms

(i) Singular points (ii) Focus (iii) Centre (iv) Node (v) Saddle

(ii) Analyze the stability of the following systems using direct method of Liapnnov.

$X' = AX$ Where $A = \begin{bmatrix} -1 & -2 \\ 1 & -4 \end{bmatrix}$ (10 Marks)

MODEL QUESTION PAPER

VIII Semester B.Tech. Degree Examination(2008 Scheme)

ELECTRICAL

08.802: ELECTRICAL MACHINE DESIGN(E)

Time : 3 hrs. **Max. marks:100**

Instruction: *Answer all questions from* ***Part A*** *and one full question from each module of* ***Part B***

Part A

1. Discuss the various types of insulating materials used in electrical machines.
2. What are the factors which affect the selection of flux density in the design of transformers.
3. What is short time rating of an electrical machine?
4. Calculate the apparent flux density at a section of the teeth of an armature of a d.c. machine from the following data: slot pitch=24mm,slot width=tooth width=12 mm, length of armature core including 5 ducts of 10mm each =0.38m, stacking factor=0.92, true flux density and corresponding 'H' are 2.2 wb/m^2 and 70,000AT/m.
5. Explain the factors to be considered for the selection of number of slots in a D.C. machine.
6. Explain how the mmf requirement of the air gap is calculated in a rotating electrical machine.
7. Discuss the procedure for the design of interpole winding in a d.c. machine.
8. What is Short Circuit Ratio(SCR)? What are the affects of SCR in the design of a synchronous machine?
9. Derive the output equation of a three phase induction motor.
10. Compare analysis and synthesis method of CAD of electrical machines.

(10X4=40)

Part B

Module I

11(a) Derive the output equation of a three phase transformer . **(10)**

(b) A 500 kVA transformer has a total loss of 7.5 kW at full load. The rate of heat dissipation from the tank walls is 300W/°C rise and the heat energy required to raise its temperature by 1 °C is 0.45kWh. Calculate the final steady temperature rise and thermal time constant of the transformer (ii) the half hour rating of the transformer to give the same temperature rise as in (i) if the copper loss at full load is twice that of iron loss. **(10)**

OR

12(a) What is Hydrogen cooling? Discuss the merits of this type of cooling. **(5)**

(b) Design a 100 kVA, 2200/480V ,single phase core type transformer to operate at a frequency of 50 Hz. assuming the following data:
volt/turn =7.5V, maximum flux density=1.2 wb/m^2 , window space factor=0.28,
(height of window/width of window)=2, current density=2.5A/mm^2
(effective cross-sectional area of core/square of diameter of circumscribing circle)=0.6 **(15)**

Module II

13(a) Explain the factors to be considered for the selection of specific electric loading of a D.C. machine. **(8)**

(b) A cylindrical magnet coil provides a mmf of 5500A with 55 V across its terminals. The heat dissipation from its external surface is 1000W/m^2. The inside diameter of the coil is 0.1 m and the length of mean turn is 0.43m. If the Cu. space factor is 0.6, calculate (i)the cross-section of the conductor (ii)the height of the coil (iii)no. of turns in the coil. **(12)**

OR

14. A 100 kW, 500V, 6 pole, 450 rpm d.c. shunt motor has an armature diameter of 0.54m and a core length of 0.245m. The average flux density in the air gap is 0.55 wb/m^2. Find the number of armature slots and the details of a suitable armature winding. Assume full load efficiency of 0.89, an armature voltage drop of 5% of the rated voltage and a field current of 1% line current. The current density is 4.7 A/mm^2 and the ratio of pole arc to pole pitch is 0.66. Check for the following: (i) The slot loading should not exceed 1500A (ii) the pitch of the commutator should not be less than 4mm and the diameter of the commutator is 0.65 times the armature diameter.(iii)the voltage between adjacent commutator segments should not exceed 15 V at no load. **(20)**

Module III

15(a) Explain the procedure for the design of rotor in a salient pole synchronous alternator. **(8)**

(b) A 500kVA, 3.3 kV, 50 Hz, 600 rpm, 3-Φ salient pole alternator has 180 turns/phase. Estimate the length of air gap if the average flux density is 0.54 wb/m^2 , the ratio of pole arc to pole pitch is 0.66, SCR =1.2 ,Kw = 0.955, gap contraction factor = 1.15 and mmf required for the air gap is 80% of no load field mmf. **(12)**

OR

16. Determine the main dimensions of a 70 HP,415V, 3-Ø, 50 Hz., star connected 6 pole induction motor for which the specific magnetic loading = 0.51 wb/m^2 and specific electric loading is 30,000 ampere conductors/m. Take efficiency as 90%, power factor as 0.91 and L/T =1. Estimate the number of stator conductors for a winding in which the conductors are connected in parallel paths. Choose a suitable number of conductors/slot so that the slot loading does not exceed 750 ampere conductors. Find the size of the conductors if the current density is 4 A/mm^2 .

(20)

Model Question

Eighth Semester B.Tech. Degree Examination

(2008 Scheme)

Electrical & Electronics Engineering

08:803 ELECTRICAL SYSTEM DESIGN

Time: 3 Hours Max. Marks: 100

Instruction: Answer all questions in PART A and One questions from each module in PART B.

PART – A

1. Explain the different acts & rules that governs the electrical industry in India.
2. Draw the standard symbols of i) Signal lamp, ii) Fuse, iii) Induction motor with wound rotor and iv) Fault.
3. Mention the standard values of voltages and the permitted tolerances specified as per NEC.
4. Write the important safety aspects of electrical system design.
5. What are the factors to be considered for the selection of cables?
6. Explain the method of selection of starters for 3-phase induction motors.
7. Draw the schematic diagram for the installation of 320 kVA diesel - generator with all the protective and measuring devices.
8. Explain the procedures followed by the designing of energy efficient lighting system.
9. Write the different factors to be considered for selection of flood lighting.
10. Explain the necessity of earthing in an electrical system. (10x4=40)

PART – B

Module I

11. (a) Write the scope of NEC in electrical system design. (5)

    (b) Briefly explain the electrical services in building. (7)

    (c) Explain the different pre- commissioning tests for domestic installation. (8)

12. A two bedroom domestic building has the following loads.

Sl. No.	Location	Light load	Fan load	5 A Socket	15 A Socket
1	Bed rooms	60 W incandescent lamp= 3nos./each room	1 no./each room	3nos./each room.	1 no./each room
2	Hall	20 W CFL =6nos.	2 nos.	5 nos.	
3	Kitchen	20 W CFL =3 nos.	Exhaust fan=1 no.	3 nos.	1 no.
4	Work Area/ Toilet/ Verandah etc	20 W CFL=10 nos.	1 no.	4 nos.	1 no

Determine the total connected load, suggest the type of supply and determine number of sub circuits required for the installation. Write the specifications of Main switch, Distribution board and draw the schematic diagram. (20)

Module II

13. (a) Discuss the conventional methods of laying underground cables. (5)

(b) What are the factors to be considered for selecting motors to a crushing metal unit. (5)

(c) Draw and Explain plate earthing. (5)

(d) Expalin the pre-commissioning tests of tansformer. (5)

14. (a) A factory of 100mx50m sized floor is equipped with a total installed power load of 125kW consisting of the following:

i) Line shafting of two 25 kW, 415 V, 3-phase, 50 Hz slipring induction motors.

ii) Individual machine drives of four 15 kW, 415 V, 3-phase, 50 Hz squirrel cage induction motors and two 5 kW, 415 V, 3-phase, 50 Hz quirrel cage induction motors.

iii) Light load of 5 kW.

Assume power factor and efficiency of motors are 0.8 and 80%. Design the Electrical system for this indusry including the selection of switchgears, cables and starters. Also draw the detailed schematic diagram. (16)

(b) For problem 14 (a), suggest the type of sub station and select a suitable transformer. (4)

Module III

15. (a) Briefly expalin the requirements of good lighting scheme. (5)

(b) What are the design criteria for selecting the flood lighting of an open stadium. (7)

(c) Write short notes on the basis of electrical installation on i) Lifts and ii) Escalators. (8)

16. An assembly building has a seating capacity of 800 people. Design the electrical installation including the preperation of installation plan, selection of all the electrical fittings, sizes of cables, switchgears and draw the detailed schematic diagram. (20)

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Eighth Semester B.Tech Degree Examination

(2008scheme)

Electrical & Electronics Engineering

08. 804 Power Semi Conductor Drives

Model Question paper

Answer all questions from Part A and one question from each module from Part B

Part A

1. Differentiate between active and passive torque
2. Derive the fundamental equations of motor load system
3. Describe the frequency and voltage control of cycloconverter
4. Describe the armature control for speed of dc motors
5. Explain the working of a single quadrant chopper
6. Derive the expression for output voltage of a step up chopper
7. Explain the operation of stator frequency control
8. What is meant by slip power recovery scheme? What are its advantages ?
9. Discuss the operation of voltage source inverter drive.
10. What are the advantages of v/f control of induction motors. (10 x 4 = 40)

Part B

11. a) Explain the four quadrant operation with respect to a motor driving a hoist load (10)
    b) Discuss the torque characteristics of different types of load (10)

OR

12. a) Draw and explain the principle of operation of 3 – phase to 1-phase cycloconverter (10)
    b) Draw the block diagram of an electric drive system. Explain the functions of each block (10)

13. a) Explain the working of a chopper circuit employed for a dc series motor control (10)
    b) Explain different methods for electric braking used in dc series motor and draw its characteristics (10)

OR

14. a) Derive the expression for I_{max} and I_{min} for first quadrant chopper fed dc motor (10)
    b) A 220V . 1000rpm, 10A separately excited dc motor has an armature resistance of 1ohm It is fed from a single phase fully controlled bridge rectifier with an ac supply of 230V , 50Hz . Assuming continuous load current. Compute:
    i) motor speed at firing angle 30^0 and torque of 5 N-m
    ii) Developed torque at firing angle of 45^0 and speed of 1000rpm. (10)

15. a) Explain the different methods of speed control available for induction motor drives (10)

b) Explain the operation of current source inverter fed synchronous motor drive (10)

OR

16. a) Explain the static Scherbius drive for the speed control of 3 phase slip ring induction motor . What are the advantages and limitations? (10)

b) Explain closed loop control scheme for a three phase induction motor by V/F control (10)

Eighth Semester B. Tech Degree Examination

(2008 Scheme)

08.805 Elective IV ROBOTICS AND INDUSTRIAL AUTOMATION

(Model Question Paper)

Time: 3 Hours Max. Marks: 100

PART A

Answer all questions

1. Draw the workspace of a typical 2DOF planar manipulator ($L_2<L_1$)
2. Define reach, stroke and tool orientation of a robotic manipulator.
3. Explain why homogeneous coordinates are required for modelling robotic manipulators.
4. What do you mean by Tool Configuration Jacobian and Manipulator Jacobian.
5. What are the advantages and disadvantages of computed torque control strategy over other robot control strategies?
6. What is a perspective transformation matrix?
7. What are the characteristics of a spot welding manipulator?
8. Name the basic elements of an automation system
9. Differentiate between PLC and DCS.
10. Explain any two applications where SCADA system is being used.

(10×4=40 marks)

PART B

Answer any one question from each module

Module I

11. (a) How the frames can be assigned to an industrial robot based on DH convention

(5 marks)

(b) A simple robot has the link parameter table as shown below

axis	a_i	α_i	d_i	θ_i
1	0	0	0	θ_1
2	0	-90^0	d_2	0
3	0	0	d_3	0

Given $\theta_1=0$, $d_2=10$, and $d_3=10$. Determine the location of the end effector with respect to base.

(8 marks)

(c) Given the transformation between Tool to Base of a 3 axis robot as

$T_B^T = \begin{bmatrix} C_{123} & -S_{123} & 0 & L_1C_1 + L_2C_{12} \\ S_{123} & C_{123} & 0 & L_1S_1 + L_2S_{12} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$. Given L_1=0.2, L_2=0.3 and L_3=0.1.

Determine θ_1, θ_2, θ_3 if $T_B^T = \begin{bmatrix} 0.866 & -0.5 & 0 & 0.25 \\ 0.5 & 0.866 & 0 & 0.35 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

(7 marks)

12. (a) Differentiate between reachable workspace and dexterous workspace.

(4 marks)

(b) A one DOF manipulator with rotary joint has to move from 30^0 to 105^0 in 7 seconds. If the joint has initial and final velocity of 1deg/sec and 1.2deg/sec respectively, determine the cubic polynomial to interpolate a smooth trajectory.

(6 marks)

(c) Obtain the dynamic model of a single axis robot. (10 marks)

Module II

13. (a) Explain different linear control schemes for robots. (10 marks)

(b) With the help of a block schematic explain the computed torque control of a single axis robot. (10 marks)

14. (a) What is a robotic work cell? Mention the functions of robot in a work cell.

(10 marks)

(b) Discuss various applications of robots in manufacturing industry.

(10 marks)

Module III

15. (a) What is the role of automation in industries? (10 marks)

(b) What are the benefits of automation? (10 marks)

16. Write notes on

(a) PLC

(b) DCS

(c) SCADA

(d) Hybrid DCS/PLC (5×4=20 marks)

MODEL QUESTION PAPER

Eighth Semester B.Tech. Degree Examination

08.806 3 (Elective IV) HIGH VOLTAGE ENGINEERING (E)

Time : 3 hrs **Max marks:100**

PART A

Answer **all** questions

1. Explain the features of rectifier valves used generating high voltages of 50kV and above.
2. Explain the basic principle of resonant transformers.
3. How are damped high frequency oscillations are obtained from Tesla coil.
4. Name the main components of a multi-stage impulse generator.
5. Explain the insulation requirements of an EHV line
6. Explain how rod gap provide protection against lightning overvoltages.
7. Define BIL of a power system.
8. Draw the equivalent circuit of insulating material during partial discharges.
9. Define normal system voltage and the highest system voltage as referred to high voltage testing.
10. What are the biological aspects in UHV line design.

PART B

(Answer any **one** question from each module)

(MODULE I)

11. a. Explain the working of Van-de-Graaff generator with a neat circuit diagram. What are its advantages and disadvantages? (10)

b. Derive the expression for the ripple and regulation in voltage multiplier circuits. (10)

OR

12. a. Give the Marx circuit arrangement for multistage impulse generator. How is the basic circuit modified to accommodate the wave time control resistances. (12)

b. An impulse current generator has a total capacitance of 15 μF, the charging voltage is 125 kV, the circuit inductance 2 mH and the dynamic resistance is 1 Ω. Determine the peak current and wave shape of the wave. (8)

(MODULE II)

13. a. Define an overvoltage. What are the causes of switching overvoltages? (10)

b. What are the different methods to control switching overvoltages (10)

OR

14. a. Explain how the insulation of protective device is correlated with the insulation of equipments with the help of volt-time curves (10)

b. What is a surge arrester? Explain the working of any one type of surge arrester with the help of a neat sketch (10)

(MODULE III)

15.a.Explain the method of impulse testing of high voltage transformers. (10)

b. Explain with neat diagram how partial discharges are located using straight detectors . (10)

OR

16. a. Explain how high voltage testing is done in surge arresters (10)

b. Explain how tan delta and capacitance of bushings are measured using a high voltage Schering bridge (10)

EIGHT SEMESTER B.TECH DEGREE EXAMINATION

MODEL QUESTION PAPER (2008 SCHEME)

S8 E

08.806 ELECTIVE V(d) OBJECT ORIENTED PROGRAMMING

Time : 3hrs **Max. Marks: 100**

PART –A

Answer all Questions

1. Write about data encapsulation.
2. Explain the use of array of pointers
3. What are inline functions? What is their advantage?
4. Write a C++ program to evaluate the cosine function to 0.0001% accuracy?
5. What is the use of a static function? Give an example.
6. Illustrate the use of "this "pointer.
7. With the help of an example explain the importance of proteced variables.
8. Write a short note on file handling in C++.
9. How exception handling is implemented in C++
10. What is MFC? Exaplain its advantageous.

PART –B

Answer any one question from each module.Each question carries 20 Marks

Module 1

11. a) What are the basic principles of object oriented programming language? Explain with examples, how they are implemented in C++?

    b) Write a C++ program to read the elements of a 2D Matrix and display it. Dynamically allocate space for the matrix. Write a program to test the functions.

12. a) What is meant by storage class ? Explain

b)Write a C++ program to extarct a substring from a given string using functions and pointers

Module 2

13. a) Explain constructors, destructors and copy constructor with an example

b) Write a C++ program to implement a complex class to add to complex numbers

14. a) What is meant by data hiding? Explain with suitable examples.

b) Write a C++ program to implement a string class to concantenate two strings using operator overloading.

Module 3

15. With the help of suitable examples explain how various types of inheritence is implemented in C++.

16. a)Exaplin the concept of polymorphism and virtual functions

b) Write a C++ program to implement class hierarchy shape, circle and reactangle and from recatngle square. Use virtual functions.

Eighth semester **B.Tech.** Degree Examination Modal Question Paper.

Time: 3hrs S8 E Max. marks:100

Design of Digital Control Systems (ELECTIVE)

Answer **All** questions from **Part A**.

Part A

1. What are the advantages of digital control over analog control?
2. What is pulse transfer function?
3. Derive the transfer function for first order hold.
4. Define final value theorem and initial value theorem for discrete time system.
5. Explain the application of multi-rate sampling.
6. Obtain the root locus and critical gain for the first order system with loop transfer function $L(z)=\frac{1}{z-1}$.
7. Realize the digital filter defined by $G(z)=\frac{2+2.2z^{-1}+0.2z^{-2}}{1+0.4z^{-1}-0.12z^{-2}}$.
8. Define Controllability.
9. Write the state-space equation in the controllable canonical form for the transfer function $G(z)=\frac{0.5(z-0.1)}{z^3+0.5z^2+0.4z-0.8}$.
10. Determine the state transition matrix for the state equation $x(k+1)=Ax(k)+bu(k)$.

Answer any **one** question from each module in **Part B**

Part B

Module I

11. a)With a neat block diagram explain the functions of the different components of digital control system. (12)

    b) Show that every horizontal strip of width ω_s to the left of the imaginary axis in s-plane maps to the inside of the unit circle in z-plane. (8)

OR

12. a) Obtain the unit step response of the system with transfer function $H(z)=\frac{z}{z-1}$. (6)

    b) Define type of a discrete-time system and the different error constants. (8)

    c) Evaluate the different error constants for the unity feedback system with forward transfer function $G(z)=\frac{0.4(z+0.2)}{(z-1)(z-0.1)}$. (6)

Module II

13. Consider the unity feedback system with forward transfer function $G(z)=\dfrac{K(0..01873z+0.01752)}{z^2-1.8187z+0.8187}$. Design a controller for the system such that the *w*-plane phase margin is 50°, gain margin is 10dB, and the static velocity error constant is 2 sec^{-1}. Assume a sampling period of 0.2sec. (20)

OR

14. Design a digital controller for the unity feedback system with forward transfer function $G(z)=\dfrac{K(0.01873z+0.01752)}{z^2-1.8187z+0.8187}$ such that the dominant closed loop poles of the system have a damping of 0.5. Assume a sampling period of 0.2s and it is required to have 8 samples per cycle of damped sinusoidal oscillation. Determine the pulse transfer function of the digital controller using root-locus method and determine the velocity error constant. (20)

15. a) Show that the system $x(k+1)=Ax(k)+C^*u(k),\ y(k)=Cx(k),$

$$A=\begin{bmatrix}0&1&0&0\\0&0&1&0\\0&0&0&1\\1&0&0&0\end{bmatrix} \text{ and } C=\begin{bmatrix}1&0&0&0\end{bmatrix}$$

(C^* is the conjugate transpose of C) is completely controllable and observable. (8)

b) For the open-loop system $x(k+1)=Ax(k)+Bu(k)$

$$A=\begin{bmatrix}1&1\\0&1\end{bmatrix}, B=\begin{bmatrix}½\\1\end{bmatrix}$$

Compute feedback gain K so that the poles of the closed loop system with full state feedback are at z=0.9±j.1. (12)

OR

16. a) Find the transfer function $Y(z)/U(z)$ for the system described by

$$x(k+1)=\begin{bmatrix}0&1\\0&3\end{bmatrix}x(k)+\begin{bmatrix}1\\1\end{bmatrix}u(k),\ y(k)=\begin{bmatrix}-2&1\end{bmatrix}x(k).$$ (8)

b) Find the output *y(k)* for the system described by the equations

$$x(k+1)=\begin{bmatrix}1&0\\0&0.5\end{bmatrix}x(k)+\begin{bmatrix}2\\1\end{bmatrix}u(k),\ y(k)=\begin{bmatrix}1&2\end{bmatrix}x(k)$$

when excited by the initial condition $x(0)=[1\quad 2]^T$ and input $u(k)=0$ for all k. (12)