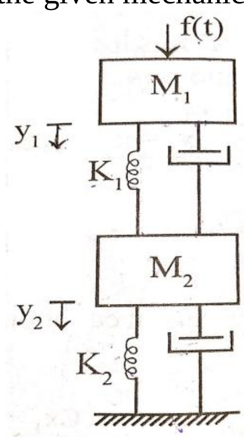
Reg.No. ____________

Karunya UNIVERSITY
(Karunya Institute of Technology & Sciences)
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – Nov/Dec – 2016

		Semester :	**2016-17 ODD**
Code :	**14EI3006**	**Duration :**	**3hrs**
Sub. Name :	**DISCRETE CONTROL SYSTEMS**	**Max. marks :**	**100**

ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	State and prove the any five properties of z-Transform.	CO1	5
	b.	Determine the Initial Value and Final value of the given z-domain signal $X(z)=\dfrac{1-3z^{-1}}{1-3.6z^{-1}+1.8z^{-2}}$	CO1	5
	c.	Find out the one-sided z-transform for the given continuous time function. $x(t)=e^{-at}Cos\omega t$	CO1	10
(OR)				
2.	a.	Using Bilinear Transformation, find whether the given characteristic polynomial is stable or not. $z^3-0.2z^2-0.25z+0.05=0$	CO1	10
	b.	Using Jury's Stability test, check for stability of the sampled data control system represented by the following Characteristic equation: $z^4-1.7z^3+1.04z^2-0.268z+0.024=0$	CO1	10
3.	a.	Determine the state model of the system in Jordan Canonical form for the given discrete-time system transfer function. $\dfrac{Y(z)}{U(z)}=\dfrac{4z^3-12z^2+13z-7}{(z-1)^2(z-2)}$	CO1	10
	b.	Construct the state model of the given mechanical translational system. 	CO1	10
(OR)				
4.	a.	Determine the State model in Canonical form and also for input u(k)=1; k≥1; find the output y(k) for the given discrete time system which is described by the difference equation, $y(k+2)+5y(k+1)+6y(k)=u(k); y(0)=y(1)=0; T=1\text{sec}$.	CO2	13
	b.	Describe the State space representations of discrete time systems.	CO1	7
5.	a.	Consider the system x(k+1)=Gx(k)+Hu(k),	CO3	15

		$G = \begin{bmatrix} -1 & 0 & 0 \\ 1 & -2 & 0 \\ 2 & 1 & -3 \end{bmatrix} H = \begin{bmatrix} 10 \\ 1 \\ 0 \end{bmatrix}$ Determine the suitable state feedback gain matrix K using Ackermann's formula, such that the system will have the closed loop poles at z = -1+j2,-1-j2,-6.		
	b.	Check whether the given system is observable or not. $G = \begin{bmatrix} -1 & 0 & 0 \\ 1 & -2 & 0 \\ 2 & 1 & -3 \end{bmatrix}; H = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}; C = \begin{bmatrix} 4 & 5 & 1 \end{bmatrix}$	CO3	**5**
(OR)				
6.	a.	Describe about the Full order State Observer with the block diagram.	CO3	**6**
	b.	Design a full-order state observer for the given system x(k+1)=Gx(k)+Hu(k); y(k)=Cx(k); where $G = \begin{bmatrix} 0 & -0.16 \\ 1 & -1 \end{bmatrix}; H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}; C = \begin{bmatrix} 0 & 1 \end{bmatrix}$ and the desired eigen values of the observer matrix are 0.5±j0.5.	CO3	**10**
	c.	Check for Controllability for the given discrete time system, x(k+1)=Gx(k)+Hu(k); y(k)=Cx(k); where, $G = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}; H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$	CO3	**4**
7.		With necessary block diagrams, describe the various configurations of control systems design based on polynomial equations approach in detail.	CO2	**20**
(OR)				
8.	a.	Write brief notes on Diophantine Equation.	CO2	**5**
	b.	Solve the Diophantine equation for the given Polynomial. $A(z)=z^2+z+0.5$; $B(z)=z+2$; $D(z)=z^3$	CO2	**15**
		Compulsory:		
9.		Describe the hardware features of the design of a microprocessor based controller for a Position Control system.	CO3	**20**

ALL THE BEST

Course Outcome:

CO1: Appreciate the need for discrete time control systems

CO2: Design control system using polynomial equations approach.

CO3: Develop different types of digital control algorithm for a system.