University Question Bank

Unit 1: Introduction

1. Determine and sketch the even and odd components of, [June/July08, 8 marks]
   i) \( X(n) = e^{-n/4} u(n) \)
   ii) \( X(t) = \{ t, 0 \leq t \leq 1 \text{ and } 2-t, 1 \leq t \leq 2 \} \)

2. Distinguish between power and energy signals. Categories each of the following signals as power or energy signals and find the energy or power of the signal. [June/July08, 6 marks]
   i) \( X(n) = (1/2)^n u(n) \)
   ii) \( X(t) = \cos^2 w_0 t \)

3. Perform the following operations (addition & multiplication) on given signals. Fig.1 (b).
   (i) \( Y_1(t) = X_1(t) + X_2(t) \) (ii) \( Y_2(t) = X_1(t) \cdot X_2(t) \) [June/July09, 4 marks]

4. Distinguish between i) Energy signal & power signal ii) Even & odd signal. [June/July09, 6 marks]

5. Explain the following properties of systems with suitable example:
   i) Time invariance ii) Stability iii) Linearity. [June/July09, 6 marks]

6. Distinguish between:
   i) Continuous time and discrete time signals
   ii) Even and odd signals
   iii) Periodic and non-periodic signals
   iii) Energy and power signals. [Dec 09, 8 marks]

7. Find the even and odd parts of the following signals: [Dec 09, 4 marks]
   i) \( X(t) = [\sin(\pi t) + \cos(\pi t)]^2 \)
   ii) \( X(t) = \{ 1 + t^3 \cos^3(10t) \} \)
8. Find the average power and energy of the following signals. Determine whether they are power / energy signals.
   [Dec 09, 8 marks]
   i) \( x[n] = \{ \sin(\pi n), \text{ for } -4 \leq n \leq 4; 0, \text{ otherwise} \} \)
   ii) \( x[n] = \{ \cos(\pi n), \text{ for } -4 \leq n \leq 4; 0, \text{ otherwise} \} \)
   iii) \( x[n] = \{ \cos(\pi n), \text{ for } n \geq 0; 0, \text{ otherwise} \} \)

9. Write the formal definition of a signal and a system. With neat sketches for illustration, briefly describe the five commonly used methods of classifying signals based on different features. [July10, 12 marks]

10. Determine if the following systems are time-invariant or time variant:
    i) \( y(n) = x(n) + x(n-1) \), ii) \( y(n) = x(-n) \) [July10, 8 marks]

11. Determine if the system described by the following equations are causal or non-causal:
    i) \( Y(n) = x(n) + 1/x(n-1) \)
    ii) \( Y(n) = x(n^2) \) [July10, 4 marks]

12. Sketch the following signals and determine their even and odd components and sketch them.
    i) \( r(t+2) - r(t+1) - r(t-2) - r(t-3) \)
    ii) \( u(n+2) - 3u(n-1) - 2u(n-5) \) [Jan/Feb 05, 12 marks]

13. Given the signal \( x(t) \) as shown in fig 1.b, sketch the following: [Jan/Feb 05, 4 marks]
    i) \( X(-2t+3) \)
    ii) \( X(t/2 - 2) \)

14. Find the even and odd components of the following signal [June 12, 4 marks]

15. Determine if the following signals are energy or power signals [June 12, 6 marks]
    i) \( x(t) = A; -T/2 \leq t \leq T/2 \)
    \( = 0; \text{ elsewhere} \)
    \( x[n] = [\frac{1}{4}]^n u[n] \)
16. The input output relationship in a system is given by $y[n]= x[n-5]+x[n-7]$, where $x[n]$ is the input and $y[n]$ is the output. Determine the properties of the system.

17. Determine whether the following systems are: i) Memoryless, ii) Stable iii) Causal iv) Linear and v) Time-invariant.
   i) $y(n)= nx(n)$
   ii) $y(t)= e^{x(t)}$  
   [Dec 12, 10 marks]

   [Dec 12, 6 marks]

19. For any arbitrary signal $x(t)$ which is an even signal, show that
   \[ \int_{-\infty}^{\infty} x(t) \, dt = 2 \int_{0}^{\infty} x(t) \, dt. \]  
   [June 12, 6 marks]
Unit 2: Time-domain representations for LTI systems – 1

1. Prove that if the impulse response \( h(t) \) and the input \( x(t) \) are unit step functions the output is a ramp. [June 12, 5 marks]

2. If \( h(t) = u(t) - u(t-3) \) and \( x(t) = u(t) - u(t-1) \), Determine the output \( y(t) \). [June 12, 8marks]

3. If the input of a LTI system is \( x[n] = [1, 3, 2, 2] \) and the impulse response is \( h[n] = [1, 4, 2, 1] \). Find the output. [June 12, 7marks]

4. Explain the difference between the following relationships: \( x(n) \cdot \delta(n-no) = x(no) \) and \( x(n) \ast \delta(n-no) = x(n-no) \). [Jun/July 8, 6marks]

5. Given the impulse response of the system as \( h(t) = e^{-t} \cdot u(t) \) and input to the system as \( x(t) = e^{-3t} (u(t) - u(t-2)) \) determine the output of the system. Sketch the various cases. [Jun/July 8, 6marks]

6. Explain any four properties of continuous and / or discrete time systems. Illustrate with suitable examples. [June 7, 8marks]

7. What do you mean by impulse response of an LTI system? How can the above be interpreted? Starting from fundamentals, deduce the equation for the response of an LTI system, if the input sequence \( x(n) \) and the impulse response are given. [June 7, 7marks]

8. Determine \( y(n) \) if \( x(n) = n+2 \) for \( 0 < n < 3 \) and \( h(n) = a^n u(n) \) for all \( n \). [June 7, 7marks]

9. Check whether the following signals are periodic or not. If periodic, determine their fundamental period. [June 5, 6marks]
   i) \( X(n) = \cos(\pi n/7) \cdot \sin(\pi n/5) \)
   ii) \( X(t) = \{ 2 \cos^2((\pi t/2) - 1) \} \cdot \sin(\pi t) \cdot \cos(\pi t) \)

10. Determine the power in the following signal shown in Fig 2(b). [June 5, 4marks]

11. Determine the output \( y(t) \) of a LTI system with impulse response \( h(t) = u(t+1)-2u(t)+u(t-1) \). [Jan/Feb 4, 10marks]
12. Given the impulse response of system \( h[n] \) as \( \beta^n u[-n] \beta > 1 \), find the response of the system for the input \( u[-n] \) \[Jan/Feb 4, 7marks\]

13. The impulse response of a system is \( h(t) = e^{2t} u(t - 1) \). Check whether the system is stable, causal and memory less system. \[Jan/Feb 4, 7marks\]

14. Find the overall impulse response of a cascade of two systems having identical impulse responses \( h[t] = 2\{u(t) - u(t - 1)\} \). \[Jan/Feb 4, 6marks\]

15. Find the convolution integral of \( x(t) \) & \( h(t) \) and sketch the convolved signal: \( x(t) = \delta(t) + \delta(t - 1) + \delta(t - 2), h(t) = 3, (-3 < t < 2) \). \[Jun/July 9, 8marks\]

16. Determine the convolution sum of the given sequence \( x(n) = \{3, 5, -2, 4\} \) and \( h(n) = \{3, 1, 3\} \) \[Jun/July 9, 6marks\]

17. Find the convolution integral of \( x(t) \) and \( h(t) \), and sketch the convolved signal, 
\[ x(t) = (t - 1)\{u(t - 1) + u(t - 3)\} \text{ and } h(t) = [u(t + 1) - 2u(t - 2)] \]. \[Dec 12, 12marks\]

18. Determine the discrete-time convolution sum of the given sequences. \( x(n) = \{1, 2, 3, 4\} \) and \( h(n) = \{1, 5, 1\} \) \[Dec 12, 8marks\]
Unit 3: Time-domain representations for LTI systems – 2

1. Given the impulse response of a system as \( h(n) = n(1/2)^n u(n) \). Determine if the system is causal and stable. [Jun/July 8, 4marks]

2. Determine the complete response of a system described by the following differential equation:
\[
\frac{d^2 y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}; \quad y(0)=0, \quad \frac{dy(t)}{dt} = 1
\]
[Jun/July 8, 12marks]

3. Draw the Form - 1 and Form - II structures for a system described by the following difference equation:
\[
y(n) - 3/4y(n-1) + 1/4y(n-3) = x(n) + 2/3x(n-2)
\]
[Jun/July 8, 4marks]

4. Obtain the convolution of the given two signals. Also sketch the result. [June 7, 8marks]

5. The impulse' response of a LTI system is given by \( h[n] = \{1, 2, 1, -1\} \). Determine the impulse response of the system for the input and \( x[n] = \{1, 2, 3, 1\} \) and sketch the output. [June 7, 6marks]

6. Solve the difference equation of a system defined by:
\[
y(n) - 1/4y(n-1) - 1/8y(n-2) = x(n) + x(n-1) \quad \text{given that} \quad x(n) = 2n u(n); \quad y(-1)=2, \quad y(-2)=-1.
\]
[June 7, 6marks]

7. Discuss briefly the block diagram description for LTI systems by difference equations. [July 06, 6marks]

8. What do you mean by natural response of a system? Determine the natural response for the system described by the following difference equations: [July 06, 9marks]
   i) \( y(n) - 9/16y(n-2) = x(n-1); \quad y(-1)=1, \quad y(-2)=-1 \).
   ii) \( y(n) + 9/16y(n-2) = x(n-1); \quad y(-1)=1, \quad y(-2)=-1 \).

9. Find difference-equation descriptions for the two systems depicted in figure Q3 (c). [July 06, 5marks]
10. Obtain the block diagram representation (direct from I and II) for a system modeled by
the equation
\[ 4 \frac{d^3y(t)}{dt^3} + 3 \frac{dy(t)}{dt} + y(t) = x(t) + \frac{dx(t)}{dt} \]  
[Jan/Feb 04, 7marks]

11. Find the total response of an LTI system described by the equation \[4y[n] + 4y[n + 1] + y[n + 2] = x[n]\] with input \[x[n] = 4^n u[n]\], initial conditions being \[y[-1] = 0, y[-2] = 1\].
[Jan/Feb 04, 7marks]

12. Find the natural response for the system described by the equation
\[ \frac{d^2y(t)}{dt^2} + 2 \frac{dy(t)}{dt} + 2y(t) = 4e^{-3t} \] for \(t > 0\). Also \[y(0) = 3, y'(0) = 4\].
[Jan/Feb 04, 6marks]

13. The impulse response of the system is \[h(t) = e^{-4t}u(t - 2)\]. Check whether the system is
stable, causal and memory less. [Jun/July 09, 6marks]

Draw the direct form-I & direct form-II implementation of the following difference
equation \[y(n) - \frac{1}{4} y(n-1) + y(n-2) = 5x(n) - 5x(n-2)\].
[Jun/July 09, 6marks]

14. The output of an LTI system is given by \[y[n] = x[n+1] + 2x[n] - x[n-1]\]. Find the impulse
response if \(x[n]\) is the input. Is the system stable? [June 12, 4marks]

15. Obtain the natural response of the system described by the difference equation
\[ \frac{dy(t)}{dt} + 2 \frac{dy(t)}{dt} + y(t) = \frac{dx(t)}{dt}; \quad y(0) = 1, \frac{dy(t)}{dt} = 0 \]  
[June 12, 6marks]

16. Determine the impulse response of the LTI system described by the difference equation
\[y[n] - 0.6y[n-1] + 0.08y[n-2] = x[n]\]  
[June 12, 4marks]

17. Draw the direct form I and II representations for a system described by the equation
\[ \frac{dy(t)}{dt} + 5y(t) = x(t) \]  
[June 12, 6marks]

18. Determine the condition of the impulse response of the system if system is, i) Memory
less ii) Stable. [Dec12, 6marks]
Unit 4: Fourier representation for signals – 1

1. Find \( x(t) \) if the Fourier series coefficients are shown in fig. The phase spectrum is a null spectrum.  
   \[ \text{June 12, 6marks} \]

2. Determine the Fourier series of the signal \( x(t)=3 \cos(\pi t/2 + \pi/3) \). Plot the magnitude and phase spectra.  
   \[ \text{June 12, 7marks} \]

3. Show that if \( x[n] \) is even and real. Its Fourier coefficients are real. Hence fins the DTFS of the signal \( x[n] = \sum_{p=-\infty}^\infty \delta[n-2p] \).  
   \[ \text{June 12, 7marks} \]

4. State the condition for the Fourier series to exist. Also prove the convergence condition.  
   \[ \text{June 09, 7marks} \]

5. Prove the following properties of Fourier series. i) Convolution property ii) Parsevals relationship.  
   \[ \text{June 09, 6marks} \]

6. Find the DTFS harmonic function of \( x(n) = A \cos (\frac{2\pi n}{N_0}) \). Plot the magnitude and phase spectra.  
   \[ \text{June 09, 8marks} \]

7. Determine the complex Fourier coefficients for the signal.  
   \[ \text{Jan/Feb 04, 10marks} \]
   \[ X(t)= \{ t+1 \text{ for } -1 < t < 0; \text{ for } 0 < t < 1 \text{ which repeats periodically with } T=2 \text{ units. Plot the amplitude and phase spectra of the signal.} \]

8. State and prove the following of Fourier transform.  
   i) Time shifting property  
   ii) Time differentiation property  
   iii) Parseval's theorem.  
   \[ \text{Jan/Feb 04, 10marks} \]

9. Derive the DTFS representation for C1 discrete time periodic signal \( x(n) \) using the mean square error (MSE) criterion.  
   \[ \text{Jan/Feb 05, 10marks} \]

10. Starting from signal \( x(t) \) defined as \( x(t)=1 \) for \( t\leq 1 \) and \( 0 \) for \( t>1 \). Determine Fourier transform of signal \( g(t) \) shown fig 4(c). Express \( g(t) \) in term of \( x(t) \).  
    \[ \text{Jan/Feb 05, 5marks} \]
11. Write the equation which describes the discrete-time periodic sequence $x(n)$ in terms of the discrete-time Fourier series (DTFS) coefficients. Explain quantitatively, the computation of the DTFS coefficients.  

[July 06, 6marks]

12. State and prove the time shift and periodic time convolution properties of DTFS.  

[May/June 10, 6marks]

13. Use the defining equation for the DTFS coefficients to evaluate the DTFS representation for the signal $x(n)$ defined as,  

$X(n) = \cos(\frac{6\pi n}{13} + \frac{\pi}{6})$  

Sketch the magnitude and phase spectra.  

[July 06, 7marks]

14. Determine the FS representation for the signal $x(t)$ of fundamental period $T$ given by,  

$X(t) = 3\cos[\frac{\pi t}{2} + \frac{\pi}{4}]$ Sketch the magnitude and phase of $X(K)$.  

[July 06, 7marks]

15. Evaluate the DTFS representation for the signal, $x[n] = \sin(\frac{4\pi n}{21}) + \cos(\frac{10\pi n}{21}) + 1$. Sketch the magnitude and phase spectra.  

[July 07, 8marks]

16. State and prove the following Fourier transform: i) Time shifting property ii) Time differentiation property.  

[July 07, 6marks]

17. Find the DTFT for the following signal $x[n]$ and draw its amplitude spectrum:  

Given: i) $x[n] = a^n u[n]$; $|a| < 1$ ii) $x[n] = \delta(n)$ unit impulse (delta).  

[July 07, 6marks]

18. One period of the DTFS coefficients of a signal is given by $x(k) = (1/2)^k$ on $0 \leq K \leq 9$. Find the time-domain signal $x(n)$ assuming $N = 10$.  

[Dec 12, 6marks]


[Dec 14, 6marks]
UNIT 5: Fourier representation for signals

1. Obtain the Fourier transform of the signal $e^{-at} \cdot u(t)$ and plot spectrum. [June/July 08, 14marks]

2. Determine the DTFT of unit step sequence $x(n) = u(n)$ its magnitude and phase. [June/July 08, 6marks]

3. The system produces the output of $y(t) = e^{t} \cdot u(t)$, for an input of $x(t) = e^{-2t} \cdot u(t)$. Determine impulse response and frequency response of the system. [July 07, 10marks]

4. The input and the output of a causal LTI system are related by differential equation
   \[ \frac{d^2 y(t)}{dt^2} + \frac{6dy(t)}{dt} + 8y(t) = 2x(t) \]
   i) Find the impulse response of this system [July 07, 10marks]
   ii) What is the response of this system if $x(t) = te^{-at} \cdot u(t)$?

5. Discuss the effects of a time shift and a frequency shift on the Fourier representation. [July 06, 6marks]

6. Use the equation describing the DTFT representation to determine the time-domain signals corresponding to the following DTFTs:
   i) $X(e^{j\Omega}) = \cos(\Omega) + j\sin(\Omega)$
   ii) $X(e^{j\Omega}) = \{1, \text{ for } \pi/2 < \Omega < \pi; 0 \text{ otherwise} \}$ and $X(e^{j\Omega}) = -4\Omega$
   [July 06, 8marks]

7. Use the defining equation for the FT to evaluate the frequency-domain representations for the following signals:
   i) $X(t) = e^{2t} \cdot u(t-3)$
   ii) $X(t) = e^{-4t}$ Sketch the magnitude and phase spectra. [July 06, 6marks]

8. Show that the real and odd continuous time non periodic signal has purely imaginary Fourier transform. (4 Marks) [Jan/Feb 05, 4marks]

9. Explain the reconstruction of CT signals implemented with zero-order device. [Jan/Feb 05, 4marks]

10. Using convolution theorem, find inverse Fourier transform of
    $X(w) = \frac{1}{(a+jw)^2}$ [Jan/Feb 04, 6marks]

11. The transfer function of a system is $H(w) = 16/(4+jw)$. Find time domain response $y(t)$ for input $x(t) = u(t)$. [Jan/Feb 04, 7marks]

12. Define the DTFT of a signal. Establish the relation between DTFT and Z transform of a signal. [Jan/Feb 04, 7marks]
13. State and prove the following properties of Fourier transform. i) Time shifting property
   ii) Differentiation in time property iii) Frequency shifting property:

   \[ \text{July 09, 9marks} \]

14. Plot the Magnitude and phase spectrum of \( x(t) = e^{-t} \)

   \[ \text{July 09, 6marks} \]

15. Determine the time domain expression for \( X(jw) = \frac{2jw + 1}{(jw + 2)^2} \)

   \[ \text{July 09, 5marks} \]
UNIT 6: Applications of Fourier representations

1. Find the frequency response of the RLC circuit shown in the figure. Also find the impulse response of the circuit.

[July 12, 10marks]

2. The input and output of causal LTI system are described by the differential equation.
\[
\frac{d^2 y(t)}{dt^2} + 3 \frac{dy(t)}{dt} + 2 y(t) = x(t)
\]
   i) Find the frequency response of the system
   ii) Find impulse response of the system
   iii) What is the response of the system if \( x(t) = te^{-t} u(t) \).

(10 Marks)

3. If \( x(t) \leftrightarrow X(f) \). Show that \( x(t)\cos w_0 t \leftrightarrow \frac{1}{2} [ X(f-w_0) + X(f+w_0) ] \) where \( w_0 = 2\pi f_0 \)

[Dec09/Jan10, 7marks]

4. The input \( x(t) = e^{3t} u(t) \) when applied to a system, results in an output \( y(t) = e^t u(t) \). Find the frequency response and impulse response of the system.

(07 Marks)

5. Find the DTFS co-efficients of the signal shown in figure Q4 (b).

[Dec09/Jan10, 6marks]

6. Find the FT pair corresponding to the discrete time periodic signal: \( x[n] = \cos \left( \frac{2\pi}{N} n \right) \).

[June09, 12marks]
The spectrum $X(j\omega)$ of signal is shown in Fig.6(a). Draw the spectrum of the sampled signal at i) half the Nyquist rate ii) Nyquist rate and iii) Twice the Nyquist rate. Mark the frequency values clearly in the figure.

8. State sampling theorem. Explain sampling of continuous time signals with relevant expressions and figures. [Dec 12, 6 marks]

9. Find the Nyquist rate for each of the following signals: [Dec 12, 8 marks]
   i) $x(t) = \text{sinc}(200t)$
   ii) $x(t) = \text{sinc}^2(500t)$

10. Use the defining equation for the DTFT to evaluate the frequency-domain representations or the following signals. Sketch the magnitude and phase spectra.
    
    
    $x[n] = \left(\frac{3}{4}\right)^n u[n - 4]$ [July 07, 8 marks]

11. Use the defining equation for the FT to evaluate the frequency-domain representations for the following signals: [July 06, 6 marks]
    
    iii) $X(t) = e^{-2t}u(t-3)$
    iv) $X(t) = e^{-4t}$ Sketch the magnitude and phase spectra.

12. Find the DTFT of the sequence $x(n) = (1/3)n u(n+2)$ and determine magnitude and phase spectrum. [July 08, 6 marks]
UNIT 7: Z-Transforms – 1

1. Using appropriate properties find the Z-transform of \( x(n)=n^2(1/3)^n u(n-2) \)  
   [July 12, 6 marks]

2. Determine the inverse Z-transform of \( X(z)=1/(2-z^{-1} + 2z^{-2}) \) by long division method  
   [July 12, 4 marks]

3. Determine all possible signals of \( x(n) \) associated with Z-transform  
   \[ X(z)= (1/4) z^{-1} / [1-(1/2) z^{-1}] [1-(1/4) z^{-1}] \]  
   [July 12, 10 marks]

4. State and prove time reversal property. Find value theorem of Z-transform. Using suitable properties, find the Z-transform of the sequences  
   [May/June 10, 10 marks]
   i) \((n-2)(1/3)^n u(n-2)\)
   ii) \((n+1)(1/2)^{n+1} \cos \omega(n+1) u(n+1)\)

5. Consider a system whose difference equation is \( y(n-1) + 2y(n) = x(n) \)  
   i) Determine the zero-input response of this system, if \( y(-1) = 2 \).  
   ii) Determine the zero state response of the system to the input \( x(n)=(114t u(n) \).  
   iii) What is the frequency response of this system?  
   iv) Find the unit impulse response of this system.  
   [May/June 10, 10 marks]

6. Find Z-transform and ROC of \( x[n]= \alpha^n \). what is the constraint on \( \alpha \).  
   [Dec09/Jan10, 7 marks]

7. Using properties of Z-transform find convolution of \( x[n]=[1,2,-1,0,3] \) and \( y[n]=[1,2,-1] \)  
   [Dec09/Jan10, 6 marks]

8. Determine \( x(n) \) if  
   \[ x(z) = \frac{1-z^{-1} + z^{-2}}{(1-1/2 z^{-1})(1-2 z^{-1})(1-z^{-1})} \]  
   For i) ROC of \(|z|<0.5\) ii) ROC of \(1 < |z| < 2\).  
   [June09, 8 marks]

9. Describe the properties of ROC and sketch the ROC of two sided sequences, right sided sequence and left sided sequence.  
   [June09, 10 marks]

10. Find the inverse Z-transform of \( X(z) \) using partial fraction method.  
    \[ X(z) = \frac{1}{(z^2-2z+1)(z^2-z+1/2)} \]  
    [June09, 10 marks]
11. Determine Z-transform of \( x(n) = \cos(\Omega_0 n)u(n) \). \[ \text{Dec08/Jan9, 8 marks} \]

12. State and prove initial value theorem for Z-transform. \[ \text{Dec08/Jan9, 8 marks} \]

13. Determine using partial fraction expansion, inverse Z-transform of \( X(z) = \frac{1}{(1-1.5z^{-1} +0.5z^{-2})} \), ROC \( |z| < 0.5 \). \[ \text{Dec08/Jan9, 8 marks} \]

14. A system is described by the difference equation \( y(n) = 0.7y(n-1) - 0.12y(n-2) + x(n-1) + x(n-2) \). What will be the output when excitation is \( x(n) = nu(n) \)? Is the system stable? \[ \text{June/July 08, 14 marks} \]

15. Solve the difference equation \( y(n) - 3y(n-1) - 4y(n-2) = 0 \), \( n > 0 \): Given \( y(-1) = 5 \) and \( y(-2) = 0 \). \[ \text{June/July 08, 6 marks} \]
UNIT 8: Z-transforms – 2

1. An LTI system is described by the equation $y(n)=x(n)+0.81x(n-1)-0.81x(n-2)-0.45y(n-2)$. Determine the T/F of the system. Sketch the poles and zeros on the Z-plane. Assess the stability.  
   \[July 12, 5\text{marks}\]

2. A system has impulse response $h(n) = (1/3)^nu(n)$. Determine the transfer function. Also determine the input to the system if the output is given by: $y(n)=1/2 u(n)+1/4 (-1/3)^n u(n)$.  
   \[July 12, 5\text{marks}\]

3. A linear shift invariant system is described by the difference equation $y(n)-3/4y(n-1)+1/8y(n-2)=x(n)+x(n-1)$. With $y(-1)=0$ and $y(-2)=-1$. Find i) The natural response of the system. ii) The forced response of the system. iii) The frequency response of the system for a step.  
   \[July 12, 10\text{marks}\]

4. What is region of convergence of $X(z)$, where $X(z)$ is the z-transform of $x(n)$. State all the properties of R.O.C.  
   \[May/June10,10\text{marks}\]

5. Determine the Z-transform of the following sequences including R.O.C  
   i) $\delta(n+5)$  
   ii) $(1/2)^{n+1}u(n+3)$  
   iii) $(1/3)^nu(-n-2)$  
   iv) $2^n u(-n)+ (1/4)^nu(n-1)$  
   v) $a^n$ for $0<\alpha<1$.  
   \[May/June10,10\text{marks}\]

6. Prove the time shift property of unilateral z-transform.  
   \[Dec09/Jan10,7\text{marks}\]

7. Determine the transfer function and difference equation if the impulse response $h(n)=[1/3]^nu(n) +[1/2]^nu(n-1)$.  
   \[Dec09/Jan10,6\text{marks}\]

8. Solve the difference equation $y(n+2)-3/2y(n+1)+1/2y(n)=(1/4)^n$ for $n \geq 0$ with initial conditions $y(0)=10$ and $y(1)=4$. Use z-transform.  
   \[June09,12\text{marks}\]

9. Solve the difference equation $y(n)-3y(n-1)-4y(n-2)=0$. $N > 0$ Given $y(-1)=5$ and $y(-2)=0$.  
   \[Dec08/Jan9,6\text{marks}\]

10. Explain how causality and stability is determined in terms of Z-transform. Explain the procedure to evaluate Fourier transform from pole zero plot of Z-transform  
   \[Dec08/Jan9,10\text{marks}\]