Total Pages: 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EE307

Course Name: SIGNALS AND SYSTEMS (EE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1 Define unit step function and plot x(t) and x(2t), if x(t) = u(t+2) - u(t-2) (5)

2 Find the unilateral Laplace Transform of ramp function $r(t) = t\,u(t)$. Specify the region of convergence (5)

3 Explain the Dirichlet's condition for the existence of Fourier Transform (5)

4 Define and plot the discrete time ramp signal r(n). Also plot r(n-2). (5)

5 Prove that the sequences $x(n) = a^n u(n)$ and $x(n) = -a^n u(-n-1)$have the same X(z) and differ only in ROC (5)

6 State and prove the convolution property of Z- transform (5)

7 Prove that the discrete Fourier series coefficient $C_k = \frac{1}{N}\sum_{n=0}^{(N-1)} x(n)e^{\frac{-j2\pi kn}{N}}$ for k=0,1,2...,N-1 (5)

8 Write the Fourier series representation of a discrete time periodic signal with periodicity N. What is the difference between continuous time and discrete time Fourier series? (5)

PART B

Answer any twofull questions, each carries10 marks.

9 a) Check whether the given signal x(t) is energy or power signal. Find the energy and power of the signal. $x(t) = e^{-5t}u(t)$ (4)

b) The impulse response of a LTI system is $h(t) = (2 + e^{-3t})\,u(t)$.Check whether the system is (i) Stable or unstable (ii) Causal or non causal (iii)Memory or memory less (6)

10 a) Find the response of a LTI system with impulse response $h(t) = e^{-2t}u(t)$ for an input $x(t) = t\,u(t)$. (4)

b) Check whether the system $y(t) = x(t)\,x(t-1)$ is (6)
i) Linear or Non linear ii) Causal or Non causal
iii) Time invariant or Time variant

11 For the following system described by differential equation, find the impulse response, if the system is (i) stable (ii) causal (10)

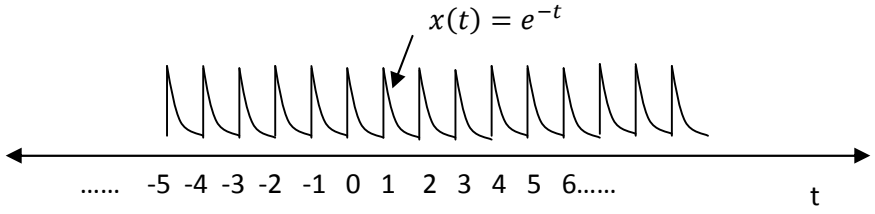
$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = \frac{d^2x(t)}{dt^2} + 8\frac{dx(t)}{dt} + 13x(t)$$

Assume initial conditions as zero.

PART C

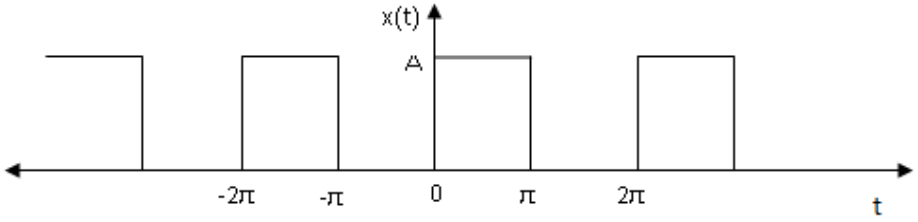
Answer any twofull questions, each carries10 marks.

12 Find the exponential Fourier series of the given signal. Plot the magnitude and phase spectrum. (10)



13 a) Find the Fourier transform of the signal $x(t) = e^{-at}u(t)$ (4)

b) Obtain the trigonometric Fourier series of the following signal (6)



14 a) State and prove Sampling Theorem (5)

b) Using matrixmethod find the convolution of$x[n] = \{1, 4, 3, 1\}$and $h[n] = \{1, 2, 3, 2\}$ (5)

PART D

Answer any twofull questions, each carries 10 marks.

15 a) Find the z-transform and ROC of $x(n) = \left(\frac{1}{3}\right)^n u(n)$ (4)

b) Find the inverse Z-transform of $X(z) = \frac{3z^{-1}}{(1-z^{-1})(1-2z^{-1})}$if (6)

i) ROC is $|z| > 2$ii) ROC is $|z| < 1$

16 An LTI system is described by the difference equation (10)

$$y(n) - \frac{9}{4}y(n-1) + \frac{1}{2}y(n-2) = x(n) - 3x(n-1)$$

Specify the ROC of H(z), and determine h(n) for the following conditions

i) The system is stable ii) The system is causal

17 Determine the Fourier series representation of the following discrete time signal and sketch the frequency spectrum (10)

x(n)={.....1,2,-1,1,2,-1,1,2,-1.....}

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EE307

Course Name: SIGNALS AND SYSTEMS (EE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks Marks

1 Check theLinearity and Time-invariance of the system $y(t)= t^2x(t)$, where y(t) and x(t) are the output and input respectively. (5)

2 Define Laplace transform and show that (5)

$$\mathcal{L}\left(\frac{df(t)}{dt}\right) = s\mathcal{L}(f(t)) - f(0)$$

3 State and prove the following properties of Fourier transform: (5)

i)Time shift ii) Time scaling

4 Find the solution of the difference equation. (5)

$$y(n+1) + 2y(n) = n, y_0 = \frac{8}{9}$$

5 Find Z transform of the sequences: (5)

$$\text{i) } x_1[n] = \{3, -2, 0, 4, 2\}) \text{ii) } x_2[n] = a^{-n}u(-n-2)$$

6 Find inverse Z transform of $X(Z) = \log\left[\frac{1}{1-az^{-1}}\right]$ (5)

7 What is a random signal? Explain with an example. (5)

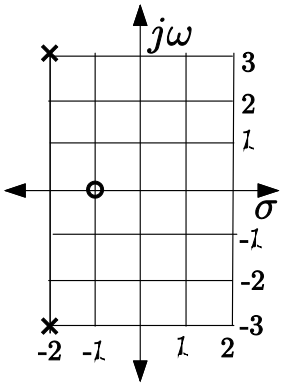
8 State and prove the discrete Fourier transform property phase shifting. (5)

PART B

Answer any two full questions, each carries 10 marks

9 a) The pole-zero plot of a system is shown in Figure 1. Obtain the differential equation model of the system. (3)

Figure 1.



b) Obtain the unit step response of the system represented by Figure 1. (No plot is required). (7)

10 a) Obtain the differential equation representation of the circuit shown in Figure 2. (4)

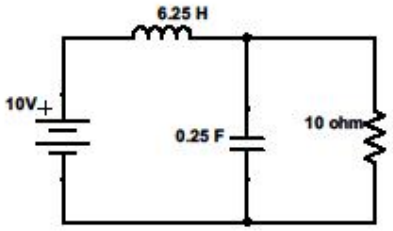


Figure 2.

b) Using Laplace transform, solve the differential equation obtained for Qn. 10(a) and get voltage across the capacitor. (Assume all initial conditions are zeros). (6)

11 a) Find $x(t) * h(t)$ where, $x(t) = u(t) - u(t-2), h(t) = e^{-2t}u(t)$ and $*$ represents the convolution operator. (5)

b) How will you determine the stability of a system from its transfer function? Comment on the stability of the following systems: (5)

i) $G_1(s) = \frac{s-2}{s^2+6s+18}$ ii) $G_1(s) = \frac{s-2}{s^2+18}$

PART C

Answer any two full questions, each carries 10 marks

12 a) Obtain complex exponential Fourier series of the signal x(t) shown in Figure 3. (5)

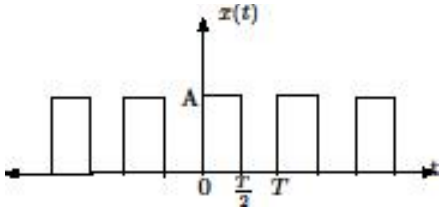


Figure 3.

b) Find the Fourier transform of $e^{-a|t|}$ (5)

13 State and prove sampling theorem. (10)

14 a) The impulse response of a system is given by $h(n) = [2\ 3\ 1]$. Find the response of the system when it is excited by the input $x(n) = u(n-1) - u(n-5)$ (6)

b) Explain energy spectral density and power spectral density. (4)

PART D

Answer any two full questions, each carries 10 marks

15 a) State and prove following properties of Z transform: (6)

i)Multiplication by n ii) Accumulation iii) Convolution

b) Find inverse z transform of (4)

$$X(z) = \frac{z}{2z^2 - 3z + 1}, |z| < \frac{1}{2}$$

16 a) State the properties (atleast eight) of discrete Fourier transform(no proof is required). (6)

b) Obtain Discrete Fouriertransform of the following signals: (4)

i) $x[n] = 0.5^n u[n]$ ii) $x[n] = 0.5^{|n|}$

17 a) Determine the stability of the following discrete transfer function: (5)

i) $H_1(z) = \frac{z}{z^2+0.7z+0.1}$ ii) $H_2(z) = \frac{z}{z^2+2.5z+1}$

b) Give any five properties of nonlinear systems. (5)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

V SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EE307

Course Name: SIGNAL AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1 Check whether the discrete-time system $y[n] = x[n^2]$ is dynamic, causal and time invariant. (5)

2 Solve the differential equation $\dot{x} + 2x = e^{-3t}, x(0) = 0$ using Laplace transform method. (5)

3 Find the Fourier transform of $x(t) = u(t)$ (5)

4 An analog signal is expressed by the equation $x(t) = 15\cos 50\pi t + 15\sin 300\pi t + 10\sin 100\pi t$. Calculate the Nyquist rate (minimum sampling rate) in Hz for this signal. (5)

5 Find the z-transform of $x[n] = \cos(\omega n)u(n)$. (5)

6 State and prove the time shifting property of Z-transform. (5)

7 State and prove time reversal property of discrete time Fourier series (DTFS). (5)

8 Describe random signals with examples. (5)

PART B

Answer any two full questions, each carries 10 marks.

9 a) Check whether the following signals are periodic or not. If periodic, find the period. (5)

i) $x(t) = \sin 0.5\pi t + \cos 0.5t$ ii) $x[n] = e^{j\frac{2\pi}{3}n} + e^{j\frac{2\pi}{5}n}$

b) Find the odd and even parts of the signal $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$ (5)

10 Draw the pole-zero plot of the following function in s-domain and hence find the time domain response. (10)

$$F(s) = \frac{2}{s(s^2 + 2s + 2)}$$

11 a) Determine whether the system $y[n] = n \times x[n]$ is i) linear ii) time invariant iii) dynamic and iv) causal. (5)

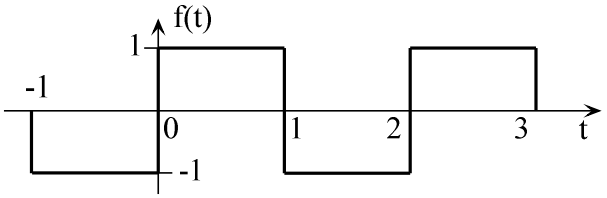
b) Derive the condition for causality and stability in terms of impulse response of (5)

a continuous time linear time invariant system.

PART C

Answer any two full questions, each carries 10 marks.

12 a) Find the exponential Fourier series of the waveform shown in figure. Also plot the magnitude spectrum with n=0,1,2,3,4 and 5. (7)



b) State and prove the time differentiation property of continuous time Fourier transform (CTFT). (3)

13 State and prove sampling theorem. Also, explain aliasing. (10)

14 a) Find the frequency response for the following linear time invariant system and hence find the impulse response. (5)

$\frac{dy(t)}{dt} + 2y(t) = x(t)$. Also find the output y(t) if the input is $x(t) = e^{-t}u(t)$

b) Find the linear convolution $y[n] = x[n] * h[n]$ if $x[n] = \delta(n+1) + \delta(n) + \delta(n-1)$ and $h[n] = 2\delta(n+1) + \delta(n) + 2\delta(n-1)$. (5)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Find Z-transform and ROC of $x[n] = u(-n-1) + \left(\frac{1}{2}\right)^n u(n)$. (6)

b) State and prove the initial value theorem of Z-transforms. (4)

16 a) A causal discrete time system is described by $y[n] = \frac{3}{4}y[n-1] - \frac{1}{8}y[n-2] + x[n]$. Find the frequency response and impulse response. (7)

b) Find the discrete time Fourier series (DTFS) of $x[n] = \{1, -1\}$. (3)

17 a) A causal LTI system is described by the difference equation $y[n] - \frac{1}{2}y[n-1] = 2x[n-1]$. Find the transfer function and impulse response of the system. (5)

b) Classify the various physical non-linearities in systems. (5)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

V SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: EE307

Course Name: SIGNAL AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1 Differentiate between energy and power signals with example. (5)

2 Find the Laplace transform and ROC of the signal $x(t) = e^{-3t}u(t) + e^{-2t}u(t)$. (5)

3 State and prove Parseval's theorem for energy signals. (5)

4 Briefly explain zero order and first order hold circuits. (5)

5 Find the Z transform and ROC of the signal $x(n) = a^n u(n)$. (5)

6 State and prove initial value theorem of Z transform. (5)

7 Find the convolution of the given signals using DTFT. (5)

$x_1(n) = \frac{1}{2}^n u(n) \quad x_2(n) = \frac{1}{3}^n u(n)$

8 Explain different types of nonlinearities present in the system. (5)

PART B

Answer any twofull questions, each carries10 marks.

9 Explain the different types of signals with example. (10)

10 A continuous time LTI system is described by the differential equation $\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 12y(t) = x(t)$. Determine the impulse response and step response given $y(0) = -2, \; y^{|}(0) = 0.$ (10)

11 Define LTI system. Check the causality, time invariance and linearity of the system $y(n) = x(n^2)$. (10)

PART C

Answer any twofull questions, each carries10 marks.

12 Obtain the trigonometric Fourier series representation of a full wave rectifier given $x(t) = \sin t$. (10)

13 a) What is meant by convolution sum? Find the convolution sum given (5)

$x(n) = 2\delta(n+1) - \delta(n) + \delta(n-1) + 3\delta(n-2)$

b) Find the Exponential Fourier Transform of cos ωt (5)

14 State and prove the properties of Fourier transform. (10)

PART D

Answer any twofull questions, each carries 10 marks.

15 Find the inverse z transform using residue method (10)

$X(z) = \frac{1+3z^{-1}}{1+3z^{-1}+2z^{-2}}$; |z|>2

16 a) Determine the DTFT of $x(n) = 2^n u(n)$. (6)

b) Write a note on Random signals and random processes. (4)

17 a) Find the initial and final values of $X(z) = \frac{z-2}{(z-1)(z-3)}$. (5)

b) Define Properties of Fourier Series (any five) representation of Disrete Time Signals (5)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: EE307

Course Name: SIGNALS AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1 Define unit ramp function. Plot $r(t)$ and $x(t) = -4r(t)$ (5)

2 Find the unilateral Laplace transform and ROC of $x(t) = e^{-t}u(t) + e^{4t}u(t)$ (5)

3 If Fourier transform of $x(t)$ is $X(w)$, derive the Fourier transform of $\frac{dx(t)}{dt}$ (5)

4 Plot a) $u[n]$ and b) $x[n] = u[n+2] \times u[-n+2]$ (5)

5 Consider the sequence $x[n] = a^n$, if $x[n]$ is a causal sequence prove that the ROC of X(z) is the exterior of the circle of radius $'a'$, where X(z) is the Z transform of x[n]. (5)

6 State and prove the linearity and time reversal properties of Z-transform (5)

7 Determine whether Fourier series representation is possible for the discrete time signals $a)\ x[n] = 2cos\sqrt{5}\pi n\ and\ b)\ x[n] = 4cos\frac{n\pi}{2}$. If possible find the fundamental period and frequency (5)

8 Find the frequency response $H(w)$ given, $y[n] = \frac{1}{2}\{x[n] + x[n-2]\}$ (5)

PART B

Answer any two full questions, each carries10 marks.

9 a) Find whether the system $y(t) - at^2x(t) + btx(t-4)$ is a) static b) linear c) causal and d) time invariant (6)

b) Given $x(t) = e^{-3t}u(t)$. Find the output of the system if the impulse response of the system is given by $h(t) = u(t+3)$ (4)

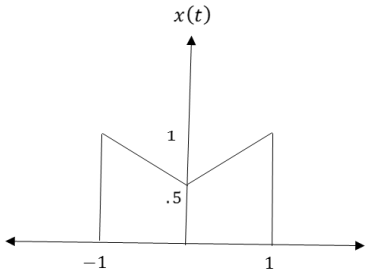
10 a) A $1k\Omega$ resistor is connected in series with $200\mu F$ capacitor. Using Laplace transform find the voltage across the capacitor $y(t)$ if the voltage input is (6)

$x(t) = \frac{3}{5}e^{-2t}u(t)$ with the initial condition $y(0) = -2$

b) Consider and LTI system described by the differential equation (4)
$\frac{dy(t)}{dt} + 5y(t) = \frac{d^2x(t)}{dt^2} + \frac{dx(t)}{dt} - 2x(t)$. Find the transfer function of the inverse system and find out whether a stable and causal inverse system exists.

11 a) Using bilateral Laplace transform find the ROC of the signal $x(t) = e^{-b|t|}$ for a) (6)
b>0 and b) b<0

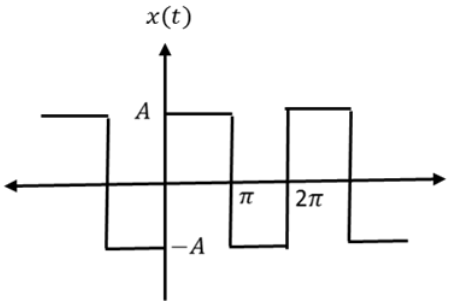
b) For $x(t)$ given below, plot $x(-2t-1)$ (4)



PART C

Answer any two full questions, each carries10 marks.

12 a) Find the exponential Fourier series and plot the magnitude and phase spectrum of (10)
the following waveform.



13 a) Define sampling theorem. With the help of frequency spectrum explain signal (6)
reconstruction is possible only if sampling frequency is $f_s \geq 2f_m$

b) Using Fourier transform property find the Fourier transform of (4)
$x(t) = e^{-3t}u(t-2)$

14 a) Using graphical method find the convolution of $x[n] = \{1,3,3,2\}$ and (6)
$h[n] = u[n] - u[n-4]$

b) The impulse response of a system is given by $h[n] = 3^n u[-n]$. Find whether the system is causal, stable and dynamic (4)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Determine the causal signal $x[n]$, if the Z-transform of the signal is given by (6)

$X(z) - \frac{1}{(1+z^{-1})(1+z^{-1})^2}$

b) An LTI system has the impulse response $h[n] = \left(\frac{1}{2}\right)^n u[n]$. Determine the input of the system if the output is $y[n] = \left(\frac{1}{2}\right)^n u[n] + \left(\frac{-1}{2}\right)^n u[n]$ (4)

16 a) Find the Z-transform and ROC of $x[n] = n\left(\frac{-1}{2}\right)^n u[n] * \left(\frac{1}{4}\right)^{-n} u[-n]$. Symbol * represents convolution (6)

b) If a discrete time periodic signal has periodicity N, write its Fourier series representation. Write down any three differences between continuous time and discrete time Fourier series (4)

17 The impulse response of a discrete time system is given by $h[n] = \frac{1}{2}\delta[n] + \delta[n-1] + \frac{1}{2}\delta[n-2]$. Find the system frequency response $H(w)$ and plot the magnitude and frequency spectra (10)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth semester B.Tech degree examinations (S) September 2020

Course Code: EE307

Course Name: SIGNAL AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1 Check whether the given signal $x(t) = e^{-3t}u(t)$ is an energy or power signal. (5)

2 Find the ROC of the signal $x(t) = e^{-b|t|}$ using Laplace transform. (5)

3 State and prove the convolution property of Fourier transform. (5)

4 Briefly explain sampling process and sampling theorem. (5)

5 Find the initial and final values of $X(z) = \frac{(2z+4)(3z+5)}{(z+2)(4z+5)}$. (5)

6 State and prove time delay theorem of Z transform. (5)

7 Find the DTFT of the sequence $x(n) = 5nu(n)$. (5)

8 Explain different types of nonlinearities present in the system. (5)

PART B

Answer any two full questions, each carries10 marks.

9 Briefly explain the classification of different types of systems with example. (10)

10 a) A continuous time LTI system is described by the differential equation $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$. Find the impulse response using Laplace transform, if the system is stable . Assume zero initial conditions. (5)

b) Find the inverse Laplace transform of $X(s) = \frac{2}{(s+4)(s-1)}$ if ROC is i) Re(s) >1 ii) Re(s) <-4 iii) -4 < Re(s) <1 (5)

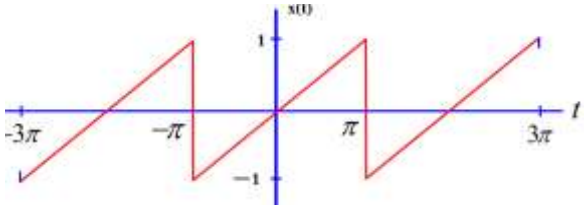
11 a) Determine whether the system $y(t) = t^2x(t-1)$ is linear, time invariant or both. (6)

b) Check whether the given signal $x(t) = 2\cos(10t+1) - \sin(4t-1)$ is periodic or not and find the fundamental period if the signal is periodic. (4)

PART C

Answer any two full questions, each carries 10 marks.

12 Obtain the trigonometric Fourier series representation of the waveform shown below. (10)



13 a) Briefly explain sampling theorem and signal reconstruction. (4)

b) Find the output signal $y(n)$ if the input sequence is $x(n) = \{1,4,3,2\}$ and $h(n) = \{1,3,2,1\}$. (6)

14 The input and output of a causal LTI system is related by the differential equation $\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$. Find the impulse response of the system and also find the unit step response if $x(t) = te^{-2t}u(t)$. (10)

PART D

Answer any two full questions, each carries 10 marks.

15 a) State and prove properties of Z transform. (10)

16 a) Find the DTFS representation for $x(n) = 5 + \sin\frac{n\pi}{2} + \cos\frac{n\pi}{4}$. (5)

b) Evaluate the integral $\int_{-\pi}^{\pi} \left| \frac{1}{1-\frac{e^{-j\omega}}{4}} \right|^2 d\omega$ using Fourier transform (5)

17 a) Find the inverse Z transform $X(z) = \frac{z}{(z-1)(z-2)(z-3)}$ using partial fraction method. (6)

b) Find the Z transform and ROC of the signal $x(n) = a^n u(n)$. (4)

****