KUMARAGURU
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Register Number: …….

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Fourth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U13ECT401**:** Signals and Systems

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If $x[n]$ is a even signal then $\sum_{n=-k}^{k} x[n]$ is equal to

   a) $2\sum_{n=0}^{k} x[n]$ b) $2\sum_{n=1}^{k} x[n]+x[0]$

   c) $x[0]$ d) 0

2. Plot the signal $2u(t-3)+2u(-t-4)$

3. The impulse response of a system is $h[n]=a^n u(n)$. The condition for the system to be BIBO stable is

   a) a is real and positive. b) a is real and negative.

   c) $|a|>1$ d) $|a|<1$

4. Fourier transform of an impulse train is _____.

5. If x(t) is real and odd, the continuous time Fourier series coefficient is

   a) Real and odd b) Imaginary and odd

   c) Real and even d) Imaginary and even

6. The maximum frequency of a band limited signal is 1000Hz. What should be the sampling interval, so that the band limitted signal can be reconstructed from the samples?

7. ROC of a signal contains

   a) Poles b) No Poles

   c) Zeros d) No Zeros

8. Z transform of $x[n-n_0]$=_____.

9. $h[n]*h^{inv}[n]=$_____

   a) 1 b) $\delta[n]$

   c) 0 d) $h[n]$

10. ROC of a infinite causal signal is _____

PART B (10 x 2 = 20 Marks)

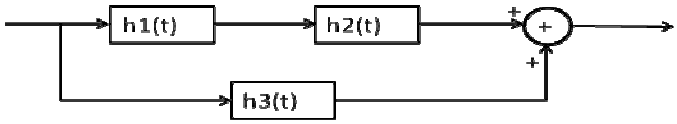
(Not more than 40 words)

11. Is the signal $x[n]=(-1)^n$ periodic? If so find the fundamental period.

12. Find whether the signal $x(t)=tu(t)$ is a power signal or energy signal or neither.

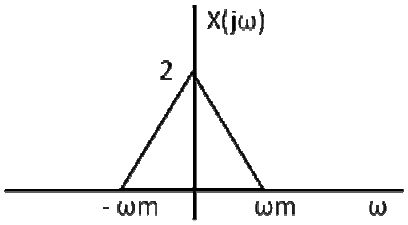
13. Find the Discrete time Fourier series coefficient of $x[n]=1+\cos\left(\frac{2\pi}{6}n\right)$

14. For the System given in Fig $h1(t)=\delta(t)$, $h2(t)=\delta(t)$ *and* $h3(t)=u(t)$. Find the overall impulse response.



15. Find the continuous time Fourier transform of the signal $x(t)=e^{-a|t|}$ $a>0$

16. Draw the spectrum of the sampled signal with $\omega_s=4\omega_m$.



17. The system is described by the equation $y[n]+\frac{1}{4}y[n-1]=x[n]$. Comment on the stability and causality of this system.

18. Given $x[n]\xleftrightarrow{Z}\frac{Z^2}{Z^2-16}$, *ROC* $|Z|<4$, Use Z transform property and find the Z transform of $y[n]=\left(\frac{1}{2}\right)^n x[n]$.

19. Find the Z transform of $x_1[n]=\{1,2,3,4,5\}$. Use Time shifting property to find the Z transform of $x_2[n]=\{1,2,3,4,5\}$ (↑ at 3)

20. What is Gibbs Phenomenon? Explain.

PART C (5 x 14 = 70 Marks)

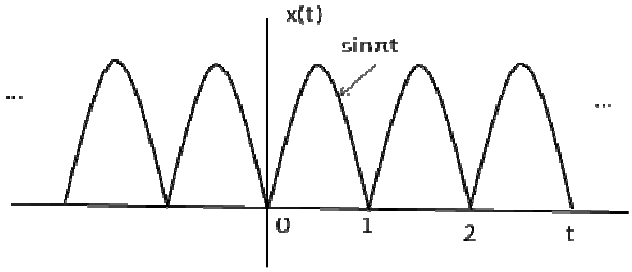
(Not more than 400 words)

Q.No. 21 is Compulsory

21. (i) State and prove Sampling theorem for band limited signals and explain in detail how the signal is reconstructed from the samples. (10)

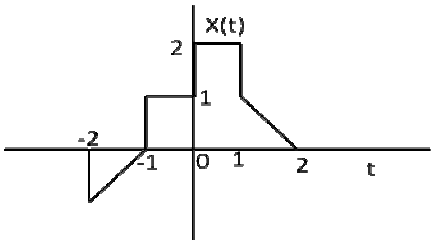
(ii) Explain the steps of converting Continuous time signal to discrete time signal with the corresponding spectrum. (4)

22. a) (i) Find the Fourier Coefficient of the signal x(t) (8)

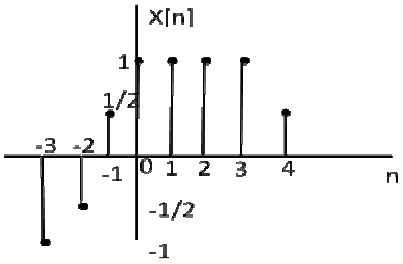


(ii) For the signals given below plot (6)

1. $y(t) = x\left(4 - \frac{t}{2}\right)$



2. $y[n] = \frac{1}{2}x[n] + \frac{1}{2}(-1)^n x[n]$



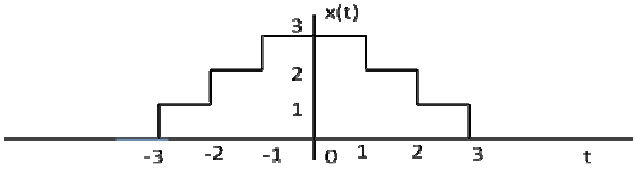
(OR)

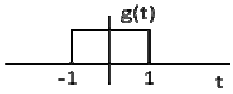
b) (i) A periodic signal has a Fourier series representation (10)

$x(t) \xleftrightarrow{FS,\pi} a_k = -k2^{-|k|}$. Find the Fourier representation of the following signals

1. $y(t) = x(3t)$
2. $y(t) = x(t-1)$
3. $y(t) = \frac{d}{dt}x(t)$
4. $y(t) = \cos(4\pi t)x(t)$

(ii) Express x(t) in terms of g(t) (4)

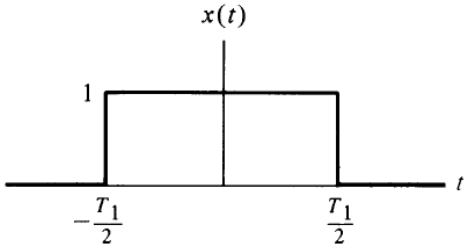




23. a) (i) Find the output of the system with a impulse response h(t) for the input, (7)

$x(t) = e^{|t|}u(t)$ and $h(t) = u(t-3)$ using convolution integral

(ii) Find the continuous time Fourier Transform of the signal given below. (7)



(OR)

b) (i) A continuous time causal LTI system is described by the differential equation (10)

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

1. Find the impulse response of the system
2. Find the output if the system for the input $x(t) = e^{-2t}u(t)$

(ii) Find the Fourier transform of $x(t) = \sum_{k=-\infty}^{\infty}\delta(t-kT)$ (4)

24. a) (i) The impulse response of discrete time LTI system is $h[n]=\left(\frac{1}{2}\right)^n u[n]$. Use Fourier transform to find the output of the system for the input $x[n]=\left(\frac{3}{4}\right)^n u[n]$. (6)

(ii) For the signal $x[n]=-\left(\frac{3}{4}\right)^n u[-n-1]+\left(-\frac{1}{3}\right)^n u[n]$. Find the Z transform. Plot the ROC, poles and zeros in the Z plane. (8)

(OR)

b) (i) Find the time domain signal corresponding to the Z transforms (8)

1. $X(Z)=\frac{(1/4)Z^{-1}}{(1-(1/2)Z^{-1})(1-(1/4)Z^{-1})}$ *with ROC* $1/4<|z|<1/2$

(Use Partial Fraction method)

2. $X(Z)=\frac{16Z^2-2Z+1}{8Z^2+2Z-1}$ *withROC* $|z|>1/2$

(Use Power Series method)

(ii) State and prove the following properties of DTFT. (6)

1. Time Shifting
2. Parseval's theorem
3. Convolution property

25. a) (i) The system function is defined as $H(z)=\frac{1-\frac{7}{4}z^{-1}-\frac{1}{2}z^{-2}}{1+\frac{1}{4}z^{-1}-\frac{1}{8}z^{-2}}$. Draw the direct form , cascade and Parallel realization of the system. (8)

(ii) Find the response of the system for the input and the impulse response given using convolution sum (6)

$x[n]=\begin{cases}\alpha^n & 0\le n\le 4\\ 0 & otherwise\end{cases}$ $h[n]=\begin{cases}1 & 0\le n\le 4\\ 0 & otherwise\end{cases}$

(OR)

A causal LTI system is described by $y[n]-\frac{3}{4}y[n-1]+\frac{1}{8}y[n-2]=x[n]$ (10)

b) (i)
1. Determine the system function H(z)
2. Find the impulse response of the system
3. Find the step response of the system (ie x[n]=u[n])

(ii) The input output relationship of the system is given by $y[n]=2x[2^n]$. Find the properties of the system. (4)

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