Register Number:……………..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: MAY 2018

(Regulation 2015)

Fourth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U15ECT403**:** Signals and Systems

<u>COURSE OUTCOMES</u>

CO1: Categorize different types of signals (K4).

CO2: Distinguish different types of systems (K4).

CO3: Determine the Fourier series representations of periodic signals (K4).

CO4: Examine Continuous Time signals and system by using Fourier Transform (K4).

CO5: Analyze Discrete Time signals and systems by using DTFT and Z Transform (K4).

CO6: Explain sampling of continuous time signals (K2).

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

[K4] 1. If $x(t) \xleftrightarrow{CTFT} X(j\omega)$ then match the following signals with its corresponding spectrum.

List I	List II
A. $x(2t)$	i. $2X(j2\omega)$
B. $x(t/2)$	ii. $\frac{1}{2}X\left(\frac{j\omega}{2}\right)$
C. $x(-2t)$	iii. $\frac{1}{2}X^*\left(\frac{-j\omega}{2}\right)$
D. $x^*(2t)$	iv. $\frac{1}{2}X\left(\frac{j\omega}{2}\right)$

A B C D

a) i iv ii iii

b) ii i iv iii

c) i iv iii ii

d) ii iv iii i

[K2] 2. If x(t) is real and even , then the Fourier series coefficients a_k are

a) Real and Even

b) Real and Odd

c) Imaginary and even

d) Imaginary and odd

[K3] 3. Which of the following signals are periodic with a fundamental period of π

1. $x(t) = 2\cos(10t+1)$
2. $x(t) = 2\cos(10\pi t+\pi)$
3. $x(t) = 5\cos(2t)+2\sin(2t)$
4. $x(t) = 2\sin(\pi t+1)+\cos(t+\frac{\pi}{2})$

a) 1,3 b) 1,4
c) 1,2 d) 2,3

4. The even component of the signal $e^{\alpha t}$ is CO1 [K_2]

a) $\cos \alpha t$ b) $\sin \alpha t$
c) $\cosh \alpha t$ d) $\sinh \alpha t$

5. Assertion (A): All memoryless systems are said to be causal systems. CO2 [K_1]
Reason (R): a causal system is one whose output depends only on present and past input.

a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

6. The Fourier series of a discrete time periodic signal is periodic with a period of CO3 [K_2]

a) π b) 3 π
c) 2π d) 4 π

7. Sequence the steps to evaluate the Fourier transform of $\frac{d}{dt}(u(-2t+3))$. CO4 [K_2]

1. Determine the FT of differentiated signal
2. Determine the FT of time shifted signal
3. Determine the FT of time scaled signal
4. Determine the FT of time reversed signal

The correct sequence of the steps is

a) 2-3-4-1 b) 1-3-2-4
c) 3-4-2-1 d) 4-1-3-2

8. The DTFT of the signal $x\left[\frac{n}{4}\right]$ is CO5 [K_3]

a) $X\left(e^{j4\omega}\right)$ a) $X\left(e^{\frac{-j\omega}{4}}\right)$
c) $X\left(e^{-j4\omega}\right)$ c) $X\left(e^{\frac{j\omega}{4}}\right)$

9. Assertion (A): The ROC of a finite duration signal is the entire Z-plane except z=0, z=∞ CO5 [K_2]
Reason (R): ROC contains poles.

a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

10. Consider the complex exponential signal $e^{\frac{j6\pi}{13}t}$ sampled with sampling interval $T_S = \frac{1}{3\pi}$. The resulting signal is CO6 [K_2]

a) periodic with period n = 13 b) Aperiodic
c) Periodic with period n = 6 d) Periodic with period n=2.

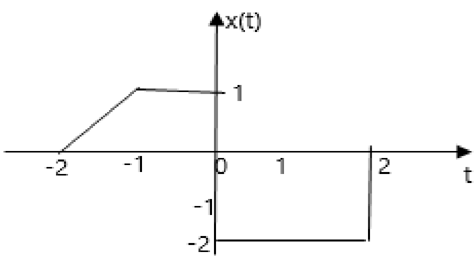
PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11.	Sketch the signal: $x(t) = r(t) - r(t-1) - u(t-2)$	CO1	[K_3]
12.	Is the system $y[n] = nx[n]$ stable?	CO2	[K_3]
13.	The impulse response of a LTI system is $h(t) = te^{-t}u(t)$. Determine whether the system is causal.	CO2	[K_3]
14.	Summarize the Drichlet's condition for the existence of Continuous Time Fourier series.	CO3	[K_2]
15.	A Discrete Time periodic signal with a fundamental period N has a Fourier Coefficients a_K, Compute the Fouriesr series Coefficient of the signal $2x[n-5]$.	CO3	[K_3]
16.	Compute the Fourier transform of the signal $x(t) = \sin \omega_0 t$	CO4	[K_3]
17.	Compute the inverse DTFT of the signal $Y(e^{j\omega}) = e^{j\omega} + e^{-j\omega}$	CO5	[K_3]
18.	Determine the Z- transform of the signal $x[n] = \delta[n-10]$. Also find the ROC of the same.	CO5	[K_3]
19.	Determine the time domain signal corresponding to the transform $X(z) = 1 + z^{-1} + z^{-2}$	CO5	[K_2]
20.	A continuous time signal $x(t) = 2\cos(50\pi t).5\sin(20\pi t)$ is being sampled. Calculate the maximum sampling period T_s that produces no aliasing.	CO6	[K_3]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. a) A continuosus –time signal x(t) is shown below . (6) CO1 [K_3]



Plot the following signals

i. $x(t+2)$

ii. $x\left(4 - \frac{t}{2}\right)$

iii. $x(2-t)$

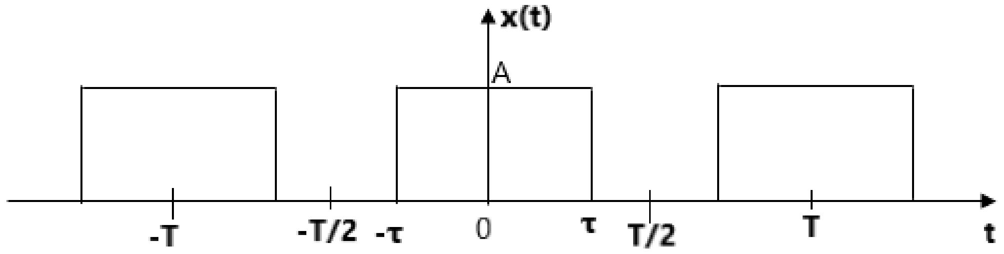
iv. $x(2t)$

b) Classify the following systems in terms of their linearity, time invariance, memory and causality. (8) CO2 [K_3]

i. $y(t) = \int_{-\infty}^{2t} x(\tau)d\tau$

ii. $y[n] = 2\log(x[n+1])$

22.	a) Compute $y[n] = x[n] * h[n]$, where $x[n] = \left(\frac{1}{2}\right)^{-n} u[-n-2]$, $h[n] = u[n-2]$	(10)	CO2	[K_3]
	b) Prove that $x(t) * \delta(t) = x(t)$	(4)	CO2	[K_3]
23.	Determine the Fourier series coefficients of the signal given below. Sketch the magnitude and phase spectrum of the same.		CO3	[K_3]



24.	a) Find the Fourier transform of the signal $x(t) = e^{-a\|t\|}$. Hence plot the magnitude and phase spectrum.	(10)	CO4	[K_3]
	b) State and prove the Time shifting property and Parseval's relation of Continuous Time Fourier Transform.	(4)	CO4	[K_2]
25.	a) Determine the DTFT of the signal $x[n] = \left(\frac{1}{8}\right)^{-n} u[-n]$.	(7)	CO5	[K_3]
	b) Find the inverse Z-transform of the signal $X(z) = \frac{z^2}{(z-0.5)(z-1)^2}$, ROC : $\|z\| > 1$	(7)	CO5	[K_3]
26.	A causal LTI system is described by the following difference equation $y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n]$. Determine i. The System function ii. The impulse response and the frequency response of the system. iii. The response of the system to the input $x[n] = (\frac{1}{3})^n u[n]$		CO5	[K_3]
27.	State Sampling theorem. Explain with necessary diagrams and equations, the process of sampling and reconstruction of the original signal.		CO6	[K_2]

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