KATHMANDU UNIVERSITY
End Semester Examination [C]
April 2022

Marks Scored:

Level: B.E.
Year : III
Course : EEEG 313
Semester : I

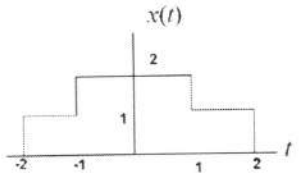
Exam Roll No. :
Time: 30 mins.
F.M. : 10

Registration No.:
Date :

SECTION "A"
[20Q. × 0.5 = 10 marks]

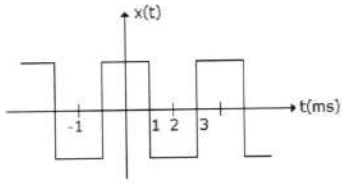
Encircle the most appropriate option.

1. What is the total energy of the signal $x(t)$ shown below?



a. 10 b. 6
c. 12 d. ∞

2. The fundamental frequency of the signal shown below is……..

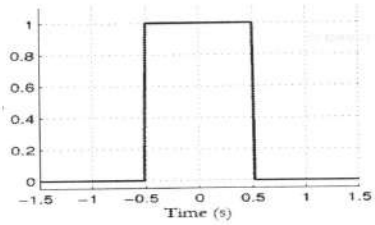


a. 500 Hz b. 1000 Hz
c. 250 Hz d. 0.25 Hz

3. Is the DT cosine signal $x[n] = \cos[5n + \theta]$ periodic?
a. YES, always b. NO, never
c. YES, but only when θ=0 d. Not enough information to determine

4. What is the highest possible frequency for a DT signal?
a. 2π b. π/2 c. π d. π/4

5. Which of the following is the correct expression for the rectangular pulse signal shown in figure below?



a. $u(t) - u(t - 0.5)$
b. $u(t) - u(t + 0.5)$
c. $u(t - 0.5) + u(t + 0.5)$
d. $u(t + 0.5) - u(t - 0.5)$

6. When two LTI systems with impulse responses $h_1[n]$ and $h_2[n]$ are connected in parallel, the impulse response of a single equivalent system is equal to…..
a. $h_1[n]h_2[n]$ b. $h_1[n] * h_2[n]$
c. $h_2[n]h_1[n]$ d. $h_1[n]+h_2[n]$

7. Which of the following is linear system?
a. $y[n] = x[n] + 2$ b. $y[n] = 2x[n]$
c. $y[n] = x[n] + 2x^2[n]$ d. Both a and b

8. Which of the following is a time invariant system?
a. $y(t) = t\,x(t - 1)$ b. $y(t) = 2\,x(t - 1) - 1$
c. $y(t) = \frac{x(t)+x(t-1)}{2}$ d. Both b and c

9. The impulse response of a CT LTI system commonly known by the name "accumulator" is $h(t) = u(t)$. The system is ……..
a. an unstable system b. a stable system
c. a critically stable system d. a memoryless

10. The Fourier series coefficient a_0 of a CT sinusoidal signal $x(t) = 2\sin(2\pi t + \pi) + 1$ will be.....

a. 2 b. 0 c. 1 d. 3

11. The Fourier transform of the CT decaying real exponential signal $x(t) = e^{-at}u(t)$ is.....

a. $\frac{1}{a-j\omega}$ b. $\frac{1}{a+j\omega}$ c. $\frac{2a}{a^2+\omega^2}$ d. 1

12. A LTI system provides a constant time delay to the input. The phase response of the system will be.....

a. constant b. linear c. nonlinear d. zero

13. For a distortionless system, the magnitude response within its specified bandwidth will be.....

a. linear b. nonlinear c. constant d. strictly unity

14. The convolution property of CT Fourier series says that if two periodic signals with fundamental period T,
$x(t)$and $y(t)$ have FS coefficients a_k and b_k , the FS coefficients of the convolution between $x(t)$and $y(t)$ will be.....

a. $c_k = a_k\, b_k$ b. $c_k = a_k + b_k$ c. $c_k = Ta_k\, b_k$ d. $c_k = \frac{1}{T}a_k\, b_k$

15. A bandlimited analog signal has the highest frequency content of 200 KHz. Which of the following sampling frequency satisfies the Nyquist sampling condition for the signal?

a. 500 KHz b. 400 KHz c. 200 KHz d. 100 KHz

16. A CT signal $x(t)$ has Fourier transform $X(j\omega)$. The Fourier transform of the signal $2x(t-1)$ will be.....

a. $2X(j(\omega-1))$ b. $X(j(\omega-2))$ c. $e^{-j\omega}X(j2\omega)$ d. $2e^{-j\omega}X(j\omega)$

17. The total energy of a periodic signal will always be.....

a. finite b. infinite c. zero d. negative

18. Which of the following is not a common application of correlation functions?

a. stability analysis b. feature extraction c. pattern recognition d. spectral estimation

19. The impulse response of a reconstruction system (DT to CT conversion) is rectangular pulse function. The system is ..... reconstruction system.

a. first order b. zero order c. second order d. ideal

20. Butterworth filter are characterized by .....

a. ripples in pass band b. ripples in stop band
c. ripples in both pass band and stop band d. no ripples in pass band or stop band

KATHMANDU UNIVERSITY
End Semester Examination [C]
April 2022

Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

Course : EEEG 313
Semester : I
F.M. : 40

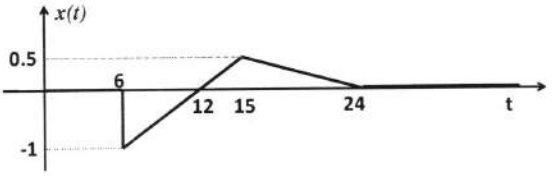
SECTION "B"
[5Q. × 8 = 40 marks]

Attempt ANY FIVE questions.

1. a. Define the terms '*signal energy*' and '*signal power*'. [2]

   b. Check if the system described by the following input output relationship is linear and time invariant or not. [3]
   $$y(t) = 2x(t) + 2$$

   c. For the CT signal shown below, find and sketch: [3]
   i) $x_1(t) = x(2t + 2)$
   ii) $x_2(t) = x(-2t - 1)u(t - 1)$



2. a. Determine and sketch the convolution of the following two signals. Use graphical fold and shift method with all intermediate plots clearly shown. [4]
   $$x(t) = \begin{cases} t, & 0 \le t \le 2 \\ 0, & elsewhere \end{cases}$$
   $$h(t) = \begin{cases} 1, & 0 \le t \le 1 \\ 0, & elsewhere \end{cases}$$

   b. The output of a LTI system is given by the convolution between its input and the impulse response. State and derive the conditions that its impulse response must satisfy for a DT LTI system to be memory less, causal and stable. [4]

3. a. Consider a system whose input and output satisfy following differential equation: [4]
   $$\frac{dy(t)}{dt} + 2y(t) = x(t).$$
   Solve the differential equation to determine the output of the system for the input $x(t) = e^{2t}u(t)$ and the initial condition $y(0)=0$.

   b. Check if the following signal is periodic or not. If periodic, find its fundamental period. [2]
   $$x(t) = \cos(5t + \frac{\pi}{6})$$

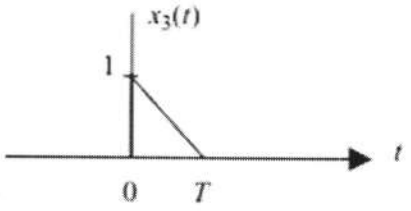
   c. What is the relationship between unit step, unit impulse and unit ramp signals? State for both CT and DT signals. [2]

4. a. A periodic signal $x(t)$ with fundamental period $T = 3$ has one period defined as below: [5]
   $$x(t) = \begin{cases} t, & 0 \le t \le 1 \\ 1, & 1 \le t \le 2 \\ 0, & 2 \le t \le 3 \end{cases}$$

   If the exponential Fourier series coefficients of $x(t)$ is denoted as a_k, by using the analysis equation for exponential Fourier series, obtain the expression to compute a_k. Also compute the values of a_0, a_1 *and* a_{-1}.

b. Derive the forward and inverse transform equations for the continuous time Fourier transform (CTFT). [3]

5. a. Find the Fourier transform of the CT signal shown below. [3]



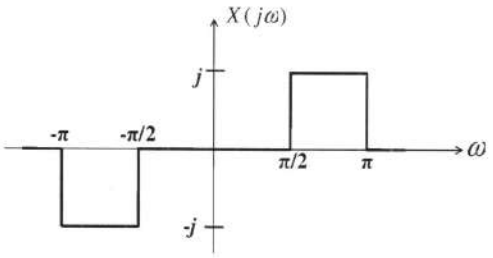
b. A pulse in frequency domain is defined as below: [3]

$$X(j\omega) = \begin{cases} 2, & -\frac{W}{2} < \omega < \frac{W}{2} \\ 0, & elsewhere \end{cases}$$

Using the definition of Fourier transform and inverse Fourier transform, obtain the signal $x(t)$whose Fourier transform is $X(j\omega)$.

c. State and prove the time shifting property for discrete time Fourier transform (DTFT). [2]

6. a. If a CT signal $x(t)$ has Fourier transform $X(j\omega)$ as shown below, obtain and draw the Fourier transform of impulse train sampled version of $x(t)$ for following sampling period $(i)\ T_s = 0.25\ \ (ii)\ T_s = 4$ [3]



b. Explain impulse train sampling and ideal reconstruction in detail. [3]

c. What do you understand by signal mixer? Explain its use in RF transmitter and receiver. [2]

KATHMANDU UNIVERSITY
School of Science / School of Engineering
End-Semester Examinations
May/June, 2022

Examination Time: 11:00 A.M. to 2.00 P.M.

Date/ Day	I–I	I-II	II – II	III – II
May 26, 2022 Thursday	PHYS 104	PHYS 102 PHYS 105 ARCH 112		ETEG 303 ETEG 301 MEEG 306 COMP 302 GEOM 306 CIEG 308 ARCH 319 INAN 301 MGTS 302 BIOT 305 ENVS 303 MATH 327
May 27, 2022 Friday			MATH 208 MATH 207 ENVS 203 PHAR 214 MATH 217 ARCH 215 BIOT 206 BIOT 208	
May 30, 2022 Monday	CHEM 101	MATH 104 MATH 102 MATH 103 MATH 106		EEEG 309 MEEG 308 COMP 314 GEOM 310 CIEG 309 CIEG 341 CHEG 305 ENVS 335 PHAR 311 BIOT 306
May 31, 2022 Tuesday			MCSC 202 ESEE 221 ARCH 216 PHAR 223 BIOT 207	Semi L. graph
June 2, 2022 Thursday	COMP 101 AGRS-116	ENVE 101 CHEM 102 BIOT 102 NEPT 101		GEOM 307 CHEG 314 PHAR 313

SOCA-401

ENVS-402
ARCH-425

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Controller of Examinations

Date/ Day	I–I	I-II	II – II	III – II
June 5, 20222 Sunday		AGRN -111	EEEG 214 MEEG 202 COMP 204 CIEG 206 CIEG 241 CHEG 210 ENVS 202 CHEM 212	
June 6, 2022 Monday	MATH 111	COMP 116 COMP 117 ARCH 161		ETEG 305 COEG 301 MEEG 318 COMP 304 MATH 322 GEOM 315 CIEG 310 CHEG 310 CIEG 342 ENVS 336 BIOT 307
June 7, 2022 Tuesday		AGRS-105 COMP 102		PHAR 316
June 8, 2022 Wednesday			PHAR 221 BIOL 207	
June 9, 2022 Thursday		ENVS 101	EEEG 215 MEEG 206 COMP 231 GEOM 204 CIEG 207 CIEG 242 CHEG 211 BIOT 211 MATH 211	
June 10, 2022 Friday	ENGT 104	ENGT 105 CHEM 103 Arts-117		ETEG 321 EPEG 318 MEEG 317 MEEG 309 COMP 341 GEOM 319 CIEG 318 CIEG 313 CHEG 312 EEEG 331 BIOT 308 ENVS 305 ENVS 345 MATH 325

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Controller of Examinations

Date/ Day	I–I	I-II	II – II	III – II
June 12, 2022 Sunday		ENVS 112	PHAR 224 ENVS 205	PHAR 315
June 13, 2022 Monday	PHAR 112		EEEG 221 MEEG 207 COMP 232 GEOM 206 CIEG 208 CHEG 212 BIOT 210 PHAR 212	GEOM 313
June 14, 2022 Tuesday		BIOT 101		EPEG 301 EPEG 315 MGTS 303 COMP 306 COMP 323 CIEG 312 CHEG 313 BIOT 309 ENVS 337 ENVE 399
June 15, 2022 Wednesday		ENGG 112	PHAR 222 ESEE 201	
June 16, 2022 Thursday				ENVS 306
June 17, 2022 Friday			CEEG 201 CIEG 209 CHEG 213 ENVE 205 MATH 213	
June 19, 2022 Sunday				COMP 307 COMP 342 COMP 409 CIEG 314 CHEG 315 CHEG 322 ENVS 331 ENVE 311

Note:

1. *Examinations will be conducted as per this schedule and under no circumstance the dates and times will be changed unless the University publishes prior notice.*
2. *Practical examinations will be conducted by the schools/ departments.*
3. *The schools/departments should submit the in-semester evaluations and the practical examination evaluations to the Office of the Controller of Examinations by May 19, 2022.*

Controller of Examinations