

410607/410507

Roll No. _____

Total No. of Pages: 3

410607/410507

B. Tech. IV - Sem. (Main / Back) Exam., (Academic Session 2021- 2022)

Electrical Engineering

4EE4 – 07/4EX4 – 07 Signals & Systems

Common to EE & EEE

Time: 2½ Hours

Maximum Marks: 120

Min. Passing Marks:

Instructions to Candidates:

**Part – A: Short answer questions (up to 25 words) 6 × 3 marks = 18 marks.
Candidates have to answer six questions out of ten.**

**Part – B: Analytical/Problem solving questions 3 × 10 marks = 30 marks.
Candidates have to answer three questions out of seven.**

**Part – C: Descriptive/Analytical/Problem Solving questions 3 × 24 marks = 72 marks.
Candidates have to answer three questions out of five.**

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

**Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)**

1. NIL

2. NIL

PART – A

Q.1 What is Nyquist rate?

Q.2 If $x(n) = n \left(\frac{1}{2}\right)^n u(n)$. Find its Z – transform.

Q.3 If Fourier transform of $x(t)$ is $X(w)$. What will be the Fourier transform of $x(bt)$? ($b > 0$)

Q.4 What is aliasing?

Q.5 Define the term system.

[410607/410507]

Page 1 of 3

Q.6 Find Laplace transform of $f(t) = \left(\frac{e^t + e^{-2t}}{t}\right)$.

Q.7 State and prove the convolution theorem in relation of Fourier transform.

Q.8 Find out whether the system $y(t) = x(2t)$ is time-invariant system or not.

Q.9 Distinguish between continuous-time and discrete-time signals.

Q.10 Determine whether the following signals are periodic or not? If periodic find the fundamental period :

(a) $\sin(12\pi t)$

(b) $e^{j4\pi t}$

PART - B

Q.1 Explain in brief the sampling theorem.

Q.2 State and prove any five properties of Z – transform.

Q.3 For each following system, determine, whether it is (i) memoryless (ii) stable and (iii) causal. Where $x(t)$ or $x(n)$ is input and $y(t)$ or $y(n)$ is output.

(a) $y(t) = \cos(x(t))$

(b) $y[n] = 2x[n]u[n]$

(c) $y(t) = x(2 - t)$

(d) $y[n] = 2x[2^n]$

Q.4 Evaluate the step response for the LTI system having impulse response $h(t) = e^{-|t|}$.

Q.5 Find the DTFT of the given signal –

$$x[n] = \begin{cases} 1, & |n| \leq M \\ 0, & |n| > M \end{cases}$$

where M is an integer.

Q.6 Determine the z – transform, the ROC and the locations of poles and zeros of $X(z)$ for the following signal $x[n] = \left(\frac{1}{2}\right)^n u[n] + \left(\frac{-1}{3}\right)^n u[n]$.

Q.7 Find the Fourier transform of the signal $x(t) = \frac{d}{dt} \{(e^{-3t}u(t)) * (e^{-t}u(t - 2))\}$.

PART – C

Q.1 Find the Laplace transform of the following continuous time functions -

(a) $x(t) = 3t^4 + t^3 + 3t^2 + 4t + 10$

(b) $x(t) = \cos^2 2t$

(c) $x(t) = t \sin At + \sin At \cos Bt$

Q.2 (a) Discuss the following properties of continuous-time and discrete-time LTI system with example.

(i) Distributive property

(ii) Commutative property

(b) Explain the following properties of Fourier transform along with proof -

(i) Modulation property

(ii) Duality

Q.3 Write and explain all the properties of continuous-time Fourier series.

Q.4 (a) Explain interpolation with zero-order hold circuit.

(b) State and prove the initial value and final value theorem for Laplace transform.

Q.5 Find state equation of a discrete-time system described by –

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{3}{4}x(n-1)$$
