

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 2 EXAMINATIONS-2022

B.Tech - III Semester (ECE)

COURSE CODE (CREDITS): 18B11EC412 (4)

MAX. MARKS: 25

COURSE NAME: Fundamentals of Signals & Systems

COURSE INSTRUCTORS: Dr. Vikas Baghel

MAX. TIME: 1.5 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

- Q1.** The first-order differential equation $\frac{dy(t)}{dt} + 2y(t) = x(t)$ describes a particular continuous-time system initially at rest. [5] [CO2]
- i. Verify that the impulse response of this system is $h(t) = e^{-2t}u(t)$.
 - ii. Is this system (i) memoryless? (ii) causal? (iii) stable? Clearly state your reasoning.
- Q2.** a) What are the limitations of Fourier series? [1] [CO3]
- b) Prove the time shifting property of continuous-time Fourier series. [2]
- c) State and prove Parseval's relation for discrete-time periodic signal. [2]
- Q3.** a) Find the Fourier transform of given signals and also sketch and label the amplitude and phase spectrums. [5] [CO3]
- i. $\sin\left(2\pi t + \frac{\pi}{4}\right)$
 - ii. $\delta(t + 1) + \delta(t - 1)$
- b) Determine the inverse Fourier transform of: [5]
- i. $X(\omega) = 2\pi\delta(\omega) + \pi\delta(\omega - \pi) + \pi\delta(\omega + 4\pi)$
 - ii. $X(\omega) = 2 \sin \frac{[3(\omega - 2\pi)]}{\omega - 2\pi}$

Q4. a) Consider a causal LTI system with frequency response

[2] [CO3]

$$H(w) = \frac{1}{jw + 3}$$

For a particular input $x(t)$ this system is observed to produce the output

$$y(t) = e^{-3t}u(t) - e^{-4t}u(t)$$

Determine $x(t)$.

b) Compute the convolution between $x[n] = \left(\frac{1}{2}\right)^{n-2} u[n-2]$ and

[3]

$$h[n] = u[n+2].$$