

Printed pages: 2

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B. TECH
(SEM III) THEORY EXAMINATION 2017-18
SIGNALS AND SYSTEMS

Time: 3 Hours

Total Marks: 100

- Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

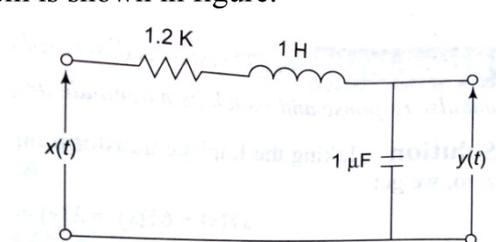
1. Attempt all questions in brief. 2 x 10 = 20

- Draw the signal $x(t) = u(t) - 2u(t-1) + u(t-2)$?
- Define periodic and aperiodic signal with example?
- What are the different types of system?
- What are the dirichlet conditions?
- State Duality property of Fourier Transform?
- What are the drawbacks of transfer function method of representing a system?
- Why is it not possible to construct a germanium P-N-P-N switching diode?
- What is the relationship between Fourier transform and Laplace transform?
- What is BIBO criterion for stability of a system?
- Define the terms-natural response and force response of a system?

SECTION B

2. Attempt any three of the following: 10 x 3 = 30

- Find and sketch the even and odd component of the following-
(i) $tu(t)$ (ii) $\cos(\omega t)u(t)$
- Determine the z-transform and ROC of $x(n) = \left(\frac{2}{3}\right)^n u(n) + \left(-\frac{1}{2}\right)^n u(n)$
- Find the convolution of the signals given using Fourier Transform-
 $x_1(n) = \left(\frac{1}{2}\right)^n u(n)$
 $x_2(n) = \left(\frac{1}{3}\right)^n u(n)$
- Determine the impulse response of the discrete-time system
 $y(n) - 3y(n-1) + 2y(n-2) = x(n) + 3x(n-1) + 2x(n-2)$
- A second order system is shown in figure.



- Determine its (i) Critical resistance (ii) Damping ratio (iii) Undamped natural frequency (iv) impulse response (v) transfer function

SECTION C

3. Attempt any *one* part of the following:

10 x 1 = 10

- a) Sketch and check whether the given signal $x(t) = \sum_{n=-\infty}^{\infty} e^{-(2t-n)} u(2t-n)$ is periodic? If yes compute its average power?
- (b) (i) Draw the signal $r(t) - 2r(t-1) + r(t-2)$?
(ii) Find signal whether the signal is energy signal, power signal or not
 $x(t) = e^{-3t} u(t)$.

4. Attempt any *one* part of the following:

10 x 1 = 10

- a) Prove the time shifting and Time reversal property of Z-transform?
- b) (i) Find the signal whose bilateral transform is
 $X(s) = \frac{1}{(s+5)(s+1)}$; $-5 < \text{Re}(s) < -1$.
(ii) Derive the Initial Value theorem?

5. Attempt any *one* part of the following:

10 x 1 = 10

- a) Verify Parseval's theorem $\sum_{n=-\infty}^{\infty} x(n)x^*(n) = \frac{1}{2\pi} \int_{-\pi}^{\pi} X(e^{j\omega})X^*(e^{j\omega})d\omega$ for the following
sequence $x(n) = \left(\frac{1}{2}\right)^n u(n)$
- b) (i) What is the difference between Fourier Transform and Discrete time Fourier transform?
(ii) Find the DTFT for the following signal $x(n) = (0.5)^n u(n) + 2^{-n} u(-n-1)$?

6. Attempt any *one* part of the following:

10 x 1 = 10

- a) Determine the stability of the system described by difference equation
 $y(n) - \frac{5}{2}y(n-1) + y(n-2) = x(n) - x(n-1)$
- b) (i) Define the power spectral density and their properties?
(ii) Find the cross-correlation of two finite length sequences
 $x(n) = \{1, 2, 1, 1\}$; $y(n) = \{1, 1, 2, 1\}$

7. Attempt any *one* part of the following:

10 x 1 = 10

- a) For the second order system given by
 $y(n) + 0.3y(n-1) - 0.1y(n-2) = x(n) - x(n-1)$ Determine (i) the system function
(ii) transfer function (iii) unit sample response sequence (iv) Unit step response sequence
- b) Using block diagram reduction technique, simplify
(i) The block diagram of the system given
(ii) Find the overall transfer function