

2017

ELECTRONICS

( Major )

Paper : 5.1

( Signals and Systems )

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

1. Answer all questions : 1×7=7

- (a) Give an example of a discrete time signal.
- (b) Define a ramp function.
- (c) What is Nyquist rate?
- (d) Give the expression of correlation.
- (e) Give the expression of z-transform of the signal  $x(n)$ .
- (f) Give an example of a periodic signal.
- (g) What is a power signal?

2. Answer any *four* questions : 2×4=8

- (a) Define and draw a unit step function.
- (b) Give the mathematical description of Fourier transform and inverse Fourier transform.
- (c) Write and prove the shifting theorem of Fourier transform.
- (d) What is the mathematical complexity associated in DFT calculation? Express in terms of number of additions and multiplications.
- (e) What is the difference between DFT and IDFT?

3. Answer any *three* questions : 5×3=15

- (a) Check the linearity of the following system :

$$y(n) = \cos n$$

- (b) Give an example of each of the following :

- (i) Causal system
- (ii) Stable system
- (iii) Time invariant system
- (iv) System with memory
- (v) Reversible system

(c) Two sequences are given as

$$x(n) = [1 \ 2 \ -1 \ -2]$$

$$h(n) = [1 \ -1 \ 2 \ -2]$$

Find  $x(n) * y(-n)$  using z-transform.

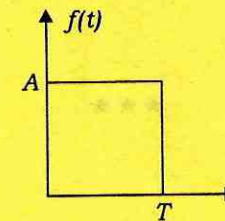
(d) What are the different types of correlation? Name them and give their mathematical steps.

(e) A sequence is given as

$$x(n) = [1 \ -1 \ 2 \ -2]$$

Find its DFT.

(f) For the waveform shown below in figure, determine the Fourier transform :



4. Answer any *three* questions : 10×3=30

(a) A signal is given as

$$x(n) = [1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7]$$

Determine

$$y(n) = 2x(n-1) + 3x(n+1) + x(2n)$$

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- (b) A signal is given as  $x(n] = (1 \ 2 \ 3 \ 4)$  and a system is given as  $h(n] = (1 \ 1 \ 1 \ 1)$ . If the signal is applied to the system, what is the output of the system?
- (c) Prove that convolution in time domain is equivalent to multiplication in frequency domain.
- (d) Write briefly about Decimation-in-Time FFT algorithm. What are its advantages?
- (e) Write short notes on the following :
- (i) Sampling theorem
  - (ii) LTI system and its properties

