367456(28)

BE (4th Semester)
Examination, April - May, 2017

[New Scheme]

Signals and Systems

Time Allowed : 3 hours *Maximum Marks :* 80
Minimum Pass Marks : 28

Note : (*i*) Part (*a*) of each question is compulsory. Attempt any **two** parts from (*b*), (*c*) and (*d*) of each question.

(*ii*) The figures in the right-hand margin indicate marks.

UNIT-I

1. (*a*) Compare causal system and non-causal system. [2]

(*b*) Find which of the following signals are energy and power signals :

(*i*) $\sin\left(\frac{\pi}{3}\right) n$, (*ii*) $x(n) = nu(n)$ [7]

(*c*) Check whether the following systems are (1) dynamic or static, (2) Rime-invariant or time-variant and (3) causal or non-causal : [7]

(*i*) $\frac{d^2 y(t)}{dt^2} + 2y(t)\frac{dy(t)}{dt} + 3ty(t) = x(t)$

(*ii*) $y(n) = a^n u(n)$

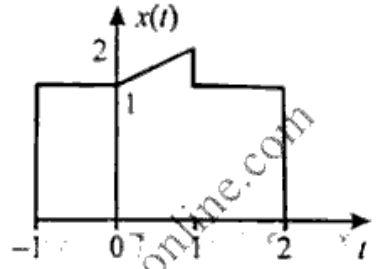
(*iii*) $y(n) = x(n)\, x(n-2)$

(*d*) For the signal $x(t)$ shown figure below find the signals : [7]

(*i*) $x(t-3)$

(*ii*) $x(2t+2)$

(*iii*) $x\left(\frac{5}{3}t\right)$



UNIT-II

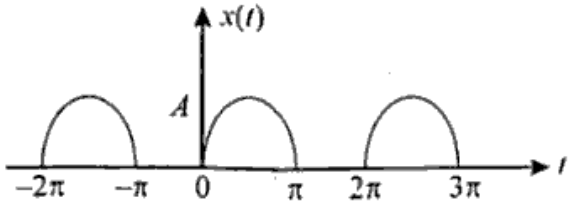
2. (*a*) Write the condition for existence of Fourier Transform. [2]

(*b*) State and prove the properties of Fourior Transform

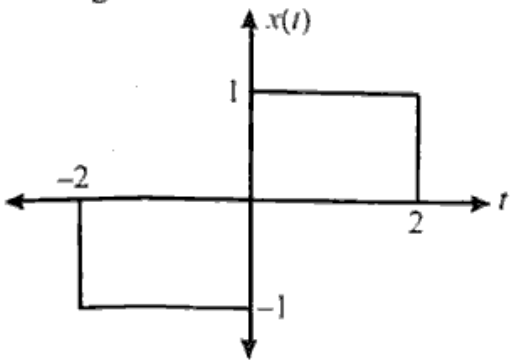
(*i*) Frequency shifting

(*ii*) Differentiation in time domain [7]

(*c*) Find the Fourier series expansion of half-wave rectified sine wave shown in figure : [7]



(*d*) Obtain the Fourier Transform of signal shown in figure : [7]



UNIT-III

3. (*a*) Define impulse response and step response for continuous time system. [2]

(*b*) Find the convolution of the following signals by graphical method :

$x(t) = e^{-3t}u(t)$, $h(t) = u(t+3)$ [7]

(*c*) Find the cross-correlation of two finite length sequences $x(n) = \{1, 2, 1, 1\}$ and $y(n) = \{1, 1, 2, 1\}$. [7]

(*d*) Find the DTFT of the following sequences :

(*i*) $a^n u(n)$, (*ii*) $u(n-m)$, (*iii*) $u(n+3) - u(n-3)$ [7]

UNIT-IV

4. (*a*) Write the criteria for stability and causality of signal in *z*-domain. [2]

(*b*) Find the *Z-X* form of the following sequences : [7]

(*i*) $y(n) = x(n-2)\,u(n)$

(*ii*) $y(n) = x(n+2)\,u(n)$ [7]

(*c*) Using long division method, find the inverse *Z*-transform of $X(z)$

$$X(z) = \frac{z}{2z^2 - 3z + 1} \text{ ; ROC ; } |z| < \frac{1}{2}$$ [7]

(*d*) Plot the pole-zero pattern and determine which of the following systems are stable : [7]

(*i*) $y(n) = y(n-1) - 0.8y(n-2) + x(n) + x(n-2)$

(*ii*) $y(n) = 2y(n-1) - 0.8y(n-2) + x(n) + 0.8x(n-1)$

UNIT - V

5. (*a*) Define system function. [2]

(*b*) Find the state variable matrices *A, B, C & D* for the following equation : [7]

$y(n) - 3y(n-1) - 2y(n-2) = x(n) + 5x(n-1) + 6x(n-2)$

(*c*) Realize the following system in direct form-I and direct form-II : [7]

$$y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n) + 2x(n-1)$$ [7]

(*d*) Obtain the parallel form realization of the discrete time system given below : [2]

$$y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + 3x(n-1) + 2x(n-2)$$ [7]
