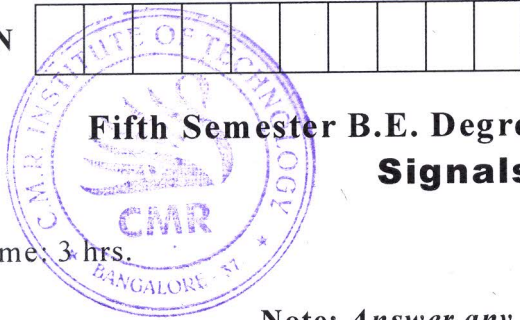


USN

10EE52



Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Signals and Systems

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART - A

- 1 a. Define a signal and a system with examples. (04 Marks)
- b. Sketch the following signal and determine even and odd components.
 $x(n) = (1, 2, 0, 1, 2)$
 \uparrow (06 Marks)
- c. Find the total energy of the signal :
 $x(t) = A ; -\frac{T}{2} \leq t \leq \frac{T}{2}$
 $= 0 ; \text{ otherwise}$ (04 Marks)
- d. Check whether the following signals are periodic or not. If periodic determine their fundamental period.
 (i) $x(t) = \cos t + \sin \sqrt{2} t$
 (ii) $x(n) = \cos (\pi + 0.2n)$ (06 Marks)
- 2 a. Determine whether the system given below is (i) memoryless (ii) Causal (iii) Time invariant (iv) Linear (v) stable
 $y(t) = e^{-x(t)}$ (06 Marks)
- b. Find the response of an L.T.I. system with impulse response $h(n) = \alpha^n u(n)$ for an input signal $x(n) = \beta^n u(n) ; |\alpha| < 1$ and $|\beta| < 1$. When (i) $\alpha \neq \beta$ and (ii) $\alpha = \beta$. (10 Marks)
- c. Find the step response for the system whose impulse response $h(t) = t u(t)$. (04 Marks)
- 3 a. The impulse response of a system is $h(t) = e^{2t} u(t - 1)$. Check whether the system is (i) stable (ii) causal (iii) memoryless. (06 Marks)
- b. The differential equation of the system is given as, $\frac{d^2 y(t)}{dt^2} + \frac{3dy(t)}{dt} + 2y(t) = x(t)$
 with $y(0) = 1, \left. \frac{dy(t)}{dt} \right|_{t=0} = 1$
 Determine total response of the system for an input $x(t) = u(t)$. (08 Marks)
- c. Draw the direct form-I and direct form-II realizations for the system
 $y(n) - \frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) = x(n) + 2x(n-1)$ (06 Marks)
- 4 a. State and prove the following properties of discrete time fourier series:
 (i) Parseval theorem
 (ii) Time shift (10 Marks)
- b. Find the fourier series co-efficients for the periodic signal $x(t)$ with period, 2 sec given by
 $x(t) = e^{-t} ; \text{ for } -1 \leq t \leq 1$. (10 Marks)

PART - B

- 5 a. State and prove the following properties of continuous time fourier transform :
 (i) Convolution (ii) Linearity (10 Marks)
- b. Find the fourier transform of the following :
 $x(t) = \sin(\pi t) e^{-2t} u(t)$ (05 Marks)
- c. Find the inverse fourier transform of $X(w) = \frac{jw + 12}{(jw)^2 + 5jw + 6}$ (05 Marks)
- 6 a. Find the DTFT of the following signals :
 (i) $x(n) = \left(\frac{1}{2}\right)^n u(n-2)$
 (ii) $x(n) = u(n) - u(n-6)$
 (iii) $x(n) = 2^n u(-n)$ (10 Marks)
- b. Obtain the frequency response and impulse response of the system having the output $y(n)$ for the input $x(n)$ as given below:
 $x(n) = \left(\frac{1}{2}\right)^n u(n)$
 $y(n) = \frac{1}{4} \left(\frac{1}{2}\right)^n u(n) + \left(\frac{1}{4}\right)^n u(n)$ (10 Marks)
- 7 a. State and prove the following properties of z-transform:
 (i) Initial value theorem
 (ii) Differentiation in z-domain (08 Marks)
- b. Find the Z.T. of the following and sketch the R.O.C.S.
 (i) $x(n) = a^{n-1} u(n)$
 (ii) $x(n) = \left(\frac{1}{2}\right)^n u(n) + 2^n u(-n-1)$ (06 Marks)
- c. Find the inverse z-transform of $X(z) = \frac{z^2 - 3z}{z^2 + \frac{3}{2}z - 1}$ using partial fraction expansion method,
 ROC : $\frac{1}{2} < |z| < 2$. (06 Marks)
- 8 a. A causal discrete time LTI system is described by
 $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$
 where $x(n)$ and $y(n)$ are the input and output of the system respectively.
 (i) Determine the system function $H(z)$
 (ii) Find the impulse response $h(n)$
 (iii) Find the stability of the system (12 Marks)
- b. Solve the following difference equation for the given initial conditions and input.
 $y(n) - \frac{1}{9}y(n-2) = x(n-1)$
 with $y(-1) = 0$, $y(-2) = 1$ and $x(n) = 3u(n)$. Use unilateral z-transformation. (08 Marks)
