CRASH COURSE

Fifth Semester B.E. Degree Examination, May 2017
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 system.   **(05 Marks)**
    b.   Distinguish between (i) Power and Energy signals and   (ii) Even and Odd signals.   **(05 Marks)**
    c.   Check whether the following signals are periodic or not. If periodic, find their fundamental period.

       (i) $x(n) = \cos\left(\dfrac{4\pi n}{3}\right)$ (ii) $x(t) = 3\cos 4t$ **(05 Marks)**

    d.   For the signal x(t) shown in Fig.Q1(d), plot $x(t-1) + x(-t+3)$ **(05 Marks)**
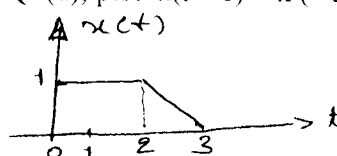

Fig.Q1(d)

2   a.   Find the convolution of the following signals:
       $x(t) = e^{-2t} u(t)$, $h(t) = u(t + 2)$ **(10 Marks)**
    b.   Find the response of the system for input $x(n) = u(n)$ whose impulse response $h(n) = \alpha^n u(n)$; $0 < \alpha < 1$. Also plot the output signal y(n).   **(10 Marks)**

3   a.   Check whether the systems characterized by the following impulse responses are (i) causal (ii) stable and (iii) memory less.
       (a) $h(n) = 3\,\delta(n)$ (b) $h(t) = e^{-2t} u(t-1)$ **(06 Marks)**
    b.   Draw the direct form – I and direct form – II realizations for the system described by the difference equation $y(n) + \frac{1}{2}y(n-1) - y(n-3) = 3x(n-1) + 2x(n-2)$ **(06 Marks)**
    c.   Obtain the output of the system given by the differential equation

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$$

$$y(0) = 0; \quad \left.\frac{dy(t)}{dt}\right|_{t=0} = 1 \quad \text{and} \quad x(t) = e^{-2t} u(t).$$
       (08 Marks)

4   a.   State and prove the following properties of continuous time fourier series
       (i) Linearity   (ii) Convolution   (iii) Frequency shift.   **(12 Marks)**

    b.   Determine D.T.F.S representation for the signal $x(n) = \cos\left(\dfrac{n\pi}{3}\right)$. Plot the spectrum of x(n).
       (08 Marks)

PART – B

5 a. Find the fourier transform for the following :
   (i) $x(t) = \delta(t)$ (ii) $x(t) = e^{-3t} u(t-1)$ (iii) $x(t) = e^{at} u(-t)$ (09 Marks)
  b. Determine the inverse F.T. of the following using partial fraction expansion :
   $$X(jw) = \frac{5jw + 12}{(jw)^2 + 5jw + 6}$$ (05 Marks)
  c. Find the frequency response and impulse response of the system described by the differential equation $\frac{d}{dt}y(t) + 8y(t) = x(t)$ (06 Marks)

6 a. Find the D.T.F.T of the following :
   (i) $x(n) = \left(\frac{1}{2}\right)^n [u(n+3) - u(n-2)]$

   (ii) $x(n) = a^n u(n)$; $|a| < 1$
   (iii) $x(n) = u(n) - u(n-6)$ (09 Marks)
  b. Obtain difference equation description for the system having impulse response
   $h(n) = \delta(n) + 2(\frac{1}{2})^n u(n) + (-\frac{1}{2})^n u(n)$.   (06 Marks)
  c. State and prove Parseval's theorem of D.T.F.T.   (05 Marks)

7 a. What is R.O.C? List the properties of R.O.C.   (06 Marks)
  b. Find the Z-transform of the following :
   (i) $x(n) = n a^{n-1} u(n)$ (ii) $x(n) = (1/2)^n u(n) + (1/3)^n u(n)$
   (iii) $x(n) = (1/2)^n u(n-2)$ (09 Marks)
  c. Find the inverse Z-transform of $x(z) = \dfrac{z^2 - 3z}{z^2 + \frac{3}{2}z - 1}$; ROC $|z| > 2$ (05 Marks)

8 a. Find the transfer function and impulse response of the system described by the difference equation $y(n) - \frac{1}{2} y(n-1) = 2x(n-1)$ (06 Marks)
  b. Determine whether the system described below is causal and stable
   $$H(z) = \frac{2z + 1}{z^2 + z - \frac{5}{16}}$$ (04 Marks)
  c. Solve the following difference equation using unilateral z-transform
   $y(n) - \frac{3}{2} y(n-1) + \frac{1}{2} y(n-2) = x(n)$; $n \geq 0$; with initial conditions $y(-1) = 4$, $y(-2) = 10$

   and $x(n) = \left(\frac{1}{4}\right)^n u(n)$.   (10 Marks)

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