Reg. No. :

Q 2202

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Third Semester

Electronics and Communication Engineering

EC 232 — SIGNALS AND SYSTEMS

(Common to Bio-Medical Engineering)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define step function and rectangular pulse function.
2. Define Linear Time Invariant System.
3. State Parseval's theorem for continuous time aperiodic signal.
4. Find the Laplace transform of $u\,(t-2)$.
5. Define Transfer function.
6. Find the convolution of $x(t) = tu\,(t)$ and $x_2\,(t) = u(t)$.
7. Find the DFT of $x(n) = a^n$.
8. Find the Z transform of $x(n) = u(n) - u(n-3)$.
9. Give any two methods used to find inverse Z-transform.
10. Define system function.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Test whether the following signals are periodic or not and if the signal is periodic, calculate the fundamental period.

(1) $x(t) = 2\,u\,(t) + 2\sin 2t$

(2) $x(t) = 20\cos\left(10\pi t + \frac{\pi}{6}\right)$

(3) $x(n) = \cos\left(\frac{\pi}{2}n\right) + \sin\left(\frac{\pi}{8}n\right) + 3\cos\left(\frac{\pi}{4}n + \frac{\pi}{3}\right)$

(4) $x(n) = e^{j\frac{2\pi}{3}n} + e^{j\frac{3\pi}{4}n}$ (8)

(ii) (1) Find the even and odd components of the signal $x(n) = \{-2, 1, 2, -1, 3\}$. (4)

(2) Determine the power and RMS value of the signals. (4)

$$x_1(t) = 5\cos\left(50t + \frac{\pi}{4}\right) + 16\sin\left(100t + \frac{\pi}{3}\right) \text{ and}$$

$$x_2(t) = 10\cos 5t \quad \cos 10t.$$

Or

(b) (i) Verify whether the systems given are causal, instantaneous, linear and shift in variant. (12)

(1) $y(t) = x(t)\cos wt$

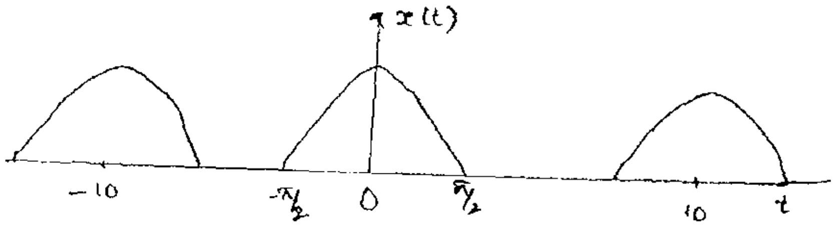
(2) $y(n) = \log_{10} x(n)$

(3) $y(n) = x(n)\,u(n)$

(ii) Determine the energy of the signals (4)

$$x_1(t) = e^{-3t}u(t) \text{ and } x_2(n) = \left(\frac{1}{3}\right)^n u(n)$$

12. (a) (i) Find the exponential Fourier series for the signal shown (10)



(ii) (1) Find the Fourier transform of $x(t) = e^{-at}u(t)$. (3)

(2) State and prove convolution property of Fourier Transform. (3)

Or

(b) (i) Find the inverse Laplace transform of

$$X(s) = \frac{3s^2 + 8s + 6}{(s+2)(s^2 + 2s + 1)} \quad (6)$$

(ii) State and prove any five properties of Laplace transform. (10)

13. (a) (i) Solve $\frac{d^2 y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} + x(t)$ if the initial conditions are $y(0^+) = \frac{9}{4}$; $\frac{dy(0^+)}{dt} = 5$ if the input is $e^{-3t}u(t)$. (12)

(ii) Find the step response of the system whose impulse response is $t\,u(t)$. (4)

Or

(b) (i) Find the convolution of $x(t)$ and $h(t)$ given

$x(t) = \sin t\,u(t)$; $h(t) = u(t)$ and

$x(t) = e^{-at}u(t)$; $h(t) = e^{-bt}u(t)$ (8)

(ii) Realize

$H(s) = \frac{s(s+2)}{(s+1)(s+3)(s+4)}$ in cascade form. (8)

14. (a) (i) Compute the eight-point DFT of the sequence $x(n) = \{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$ using three input radix -2 DIT algorithm. (10)

(ii) Find the Z-transform of $x(n) = \left(\frac{1}{2}\right)^n u(-n)$. (6)

Or

(b) (i) Find the DTFT of the given

$x(n) = (0.5)^n u(n) + 2^{-n} u(-n-1)$ (8)

(ii) Find inverse Z transform of

$X(z) = \frac{z^2}{(1-az)(z-a)}$ (8)

15. (a) (i) Find the linear convolution of (10)

(1) $x(n) = \{1, 2, 3, 4, 5\}$ with $h(n) = \{1, 2, 3, 3, 2, 1\}$

(2) $x(n) = \{1, -1, 2, 3\}$ with $h(n) = \{0, 1, 2, 3\}$

(ii) Find the impulse response of the discrete time system described by the difference equation. (6)

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

Or

(b) (i) Find the state variable matrices A, B, C and D for the equation. (10)

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

(ii) Realize

$y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n) + 2x(n-1)$ in direct form-I. (6)
