B.Tech Odd Semester (CBCS) Exam., December—2016

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

(3rd Semester)

Course No. : ETC–301

(Signal and Systems)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

Note : 1. Attempt **one** question from each Unit.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the margin indicate full marks for the questions.

UNIT—I

1. *(a)* Find the even and odd components of the following signals : 2×4=8

(i) $X(n)$ { 3, 1, 2, 4, 2}

(ii) $X(n)$ { 2, 5, 1, 3}

(iii) $X(n)$ {5, 4, 3, 2, 1}

(iv) $X(n)$ {5, 4, 3, 2, 1}

(b) Define various elementary continuous time signals. Indicate them graphically. 7

2. *(a)* Define a system. How are systems classified? Define each one of them. 10

(b) Examine whether the following signals are periodic or not. If periodic, determine the fundamental period : 1+2+2=5

(i) $\sin 12\ t$

(ii) $X(n) \quad \cos \frac{n}{6} \cos \frac{n}{6}$

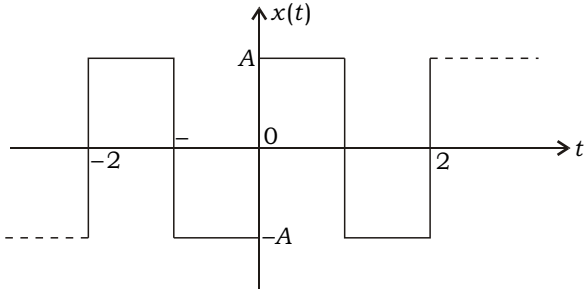
(iii) $3\sin 200\ t \quad 4\cos 100t$

UNIT—II

3. *(a)* Show that the following signals are orthogonal over an interval [0, 1] : 5

$$X_1(t) \quad 2$$
$$X_2(t) \quad \sqrt{3}(1 \quad 2t)$$

(b) Obtain the trigonometric Fourier series for the waveform shown in the figure below : 10



4. *(a)* Find the Fourier transform of the following signals : 2½×2=5

(i) $\cos \ _0 t\, u(t)$

(ii) $e^{\ t} \sin 5t\, u(t)$

(b) Find the Laplace transform and ROC for the following signals : 2+3=5

(i) $X(t) \quad u(\ t)$

(ii) $X(t) \quad e^{\ t} u(t) \quad e^{\ 4t} u(t)$

(c) Find the initial and final values of the following : 2½×2=5

(i) $\dfrac{S \quad 3}{S^2 \quad 5S \quad 4}$

(ii) $\dfrac{S^2 \quad 3S \quad 6}{S^2 \quad 2S \quad 3}$

UNIT—III

5. *(a)* Find the DTFT of the following sequences : 2×3=6

(i) $(n \quad 3) \quad u(n \quad 3)$

(ii) $a^n u(n)$

(iii) $a^n u(\ n \quad 1)$

(b) State and prove the time shifting, time reversal and frequency shifting properties of DTFT. 3×3=9

6. *(a)* Find the DTFT of the following : 2½×2=5

(i) $X(n) \quad \{2, \quad 1, 3, 2\}$

(ii) $X(n) \quad 0 \ 5^n u(n) \quad 2^n u(\ n \quad 1)$

(b) State and prove the time convolution and frequncy convolution properties of DTFT. 10

UNIT—IV

7. *(a)* Discuss the properties of LTI systems. 10

(b) Consider a causal LTI system with frequency response

$$H(\omega) \quad \frac{1}{4 \quad j\omega}$$

For a particular input $X(t)$, the system is observed to produce the output

$$Y(t) \quad e^{\ 2t} u(t) \quad e^{\ 4t} u(t)$$

Find the input $X(t)$. 5

8. *(a)* A system produces an output $Y(t) \quad e^{\ t} u(t)$ for an input of $X(t) \quad e^{\ 2t} u(t)$. Determine the impulse response and frequency response of the system. 7

(b) Consider a stable LTI system that is characterized by the differential equation

$$\frac{d^2y(t)}{dt^2} \quad \frac{dy(t)}{dt} \quad 3y(t) \quad \frac{dx(t)}{dt} \quad 2x(t)$$

Find the response for input $X(t) \quad e^{\ t}u(t)$. 8

UNIT—V

9. *(a)* Define *Z*-transform. What are the advantages and limitations of *Z*-transform? What is the condition for *Z*-transform to exist? 6

(b) State and prove the time shifting, time reversal and time expansion properties of *Z*-transform. 9

10. *(a)* Write the properties of ROC of *Z*-transform. 5

(b) Using the properties of *Z*-transform, find the *Z*-transform of the following : 5

$$X(n) \quad 2^n u(n \quad 2)$$

(c) Find the inverse *Z*-transform of

$$X(z) \quad \frac{2z \quad 7}{z^2 \quad 5z \quad 6}; \text{ ROC; } |Z| \quad 2 \qquad 5$$

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