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

ELECTRONICS AND COMMUNICATION ENGINEERING

(3rd Semester)

Paper No. : EC–CF–01

(Signals and Systems)

Full Marks : 50
Pass Marks : 15
Time : 2 hours

Note :
1. Attempt any **five** questions.
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.

1. *(a)* Find the following summations : 1×5=5

(i) $\sum_{n} e^{3n} \ (n \quad 3)$

(ii) $\sum_{n} (n \quad 3) \cos 3n$

(iii) $\sum_{n} n^2 \ (n \quad 4)$

(iv) $\sum_{n} (n \quad 3) e^{n^2}$

(v) $\sum_{n \ 0} 4^n \ (n \quad 3)$

(b) Sketch the following signals : 3+2=5

(i) $u(n \quad 2) \quad u(\quad n \quad 3)$

(ii) $u(n \quad 4) \quad u(n \quad 2)$

2. *(a)* Determine whether the following discrete-time signals are periodic or not. If periodic, determine the fundamental period : 1×5=5

(i) $\sin \frac{2 \ n}{3} \quad \cos \frac{2 \ n}{5}$

(ii) $\cos \frac{}{2} \quad 0 \ 3n$

(iii) $1 \quad e^{j2 \ n/3} \quad e^{j4 \ n/7}$

(iv) $\sin(0 \ 02 \ n)$

(v) $\cos 4n$

(b) Check whether the following systems are linear or not : 3+2=5

(i) $\frac{dy(t)}{dt} \quad y(t) \quad x(t)\frac{dx(t)}{dt}$

(ii) $y(t) \quad 2x^2(t)$

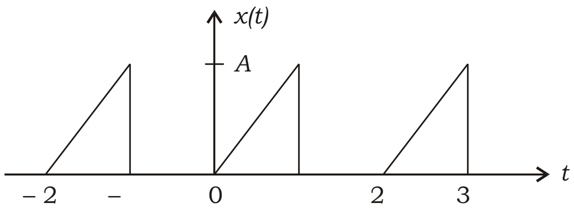
3. (a) Prove that the complex exponential signals are orthogonal functions. 4

(b) A rectangular function $x(t)$ is defined by

$$x(t) \quad \begin{matrix} 1 & \text{for} & 0 & t & \\ 1 & \text{for} & & t & 2 \end{matrix}$$

Approximate the above function by a single sinusoid $\sin(t)$ over the interval $[0, 2\ \ ]$ such that the mean square error is minimum. Evaluate the mean square error in this approximation. 6

4. (a) Obtain the trigonometric Fourier series for the waveform shown in the figure below : 5



(b) Find the Fourier transform of the following signals : 3+2=5

(i) $x(t) \quad \frac{1}{a^2 \quad t^2}$

(ii) $x(t) \quad \frac{1}{t}$

5. Find the Laplace transform and ROC for the following signals : 2×5=10

(a) $x(t) \quad e^{\ 5t}u(t \quad 1)$

(b) $x(t) \quad e^{t}\sin 2t$ for $t \quad 0$

(c) $x(t) \quad e^{2t}u(\ t) \quad e^{3t}u(\ t)$

(d) $x(t) \quad te^{\ 2|t|}$

(e) $x(t) \quad u(\ t)$

6. (a) Find the Z-transform of $x(n) \quad n^2u(n)$. 5

(b) Determine the inverse Z-transform of the following : 5

$$X(z) \quad e^z \quad e^{1/z}$$

7. (a) A causal and stable LTI system has the property that

$$\frac{4}{5}^{n} u(n) \qquad n\ \frac{4}{5}^{n} u(n)$$

(i) Determine the frequency response $H(\ \ )$ for the system.

(ii) Determine a difference equation relating any input $x(n)$ and the corresponding output $y(n)$. 2+2=4

(b) Find the DTFT of following signals : 2×3=6

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

(ii) $x(n)\quad 3^{n}\, u(n)$

(iii) $x(n)\quad a^{|n|}$

8. *(a)* Obtain the transfer function of the system if

$$y(t)\quad u(t)\quad e^{\ \ t}u(t)\quad e^{\ \ 3t}u(t)\quad e^{\ \ 4t}u(t)$$

and

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

(b) Derive the relation between convolution and correlation. 6

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