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Question Paper Code : 27190

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the value of the integral $\int_{-\infty}^{\infty} e^{-2t} f(t+2)dt$.

2. Give the relation between continuous time unit impulse function $f(t)$, step function $u(t)$ and ramp function $r(t)$.

3. State Dirichlets conditions.

4. Give the relation between Fourier transform and laplace transform.

5. What is $u(t-2) * f(t-1)$? Where $*$ represents convolution.

6. Given the differential equation representation of a system, $\frac{d^2}{dt^2} y(t) + 2\frac{d}{dt} y(t) - 3y(t) = 2x(t)$. Find the frequency response $H(jr)$.

7. State the need for sampling.

8. Find the z–transform and its associated ROC for $x[n] = \{1, -1, 2, \underset{\uparrow}{3}, 4\}$.

9. Distinguish between recursive and non-recursive systems.

10. Convolve the following signals, $x[n] = \{1, 1, 3\}$ and $h[n] = \{1, 4, -1\}$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Given $x[n] = \{1, 4, \underset{\uparrow}{3}, -1, 2\}$. Plot the following signals.

(i) $x[-n-1]$ (ii) $x\left[-\frac{n}{2}\right]$

(iii) $x[-2n+1]$ (iv) $x\left[-\frac{n}{2}+2\right]$

Or

(b) Given the input-output relationship of a continuous time system $y(t) = tx(-t)$. Determine whether the system is causal, stable, linear and time invariant.

12. (a) State and prove any four properties of Fourier transform.

Or

(b) Find the Laplace transform and its associated ROC for the signal $x(t) = te^{-2|t|}$.

13. (a) Convolve the following signals :

$x(t) = e^{-2t}u(t-2)$

$h(t) = e^{-3t}u(t)$

Or

(b) The input-output of a causal LTI system are related by the differential equation $\frac{d^2}{dt^2}y(t) + 6\frac{d}{dt}y(t) + 8y(t) = 2x(t)$.

(i) Find the impulse response $h(t)$

(ii) Find the response $y(t)$ of this system if $x(t) = u(t)$.

Hint : Use Fourier transform.

14. (a) State and explain sampling theorem both in time and frequency domains with necessary quantitative analysis and illustrations.

Or

(b) State and prove any two properties of DTFT and any two properties of 2-transform.

15. (a) Convolve the following signals :

$$x[n] = \left(\frac{1}{2}\right)^{n-2} u[n-2]$$

$$h[n] = u[n+2]$$

Or

(b) Consider an LTI system with impulse response $h[n] = \alpha^n u[n]$ and the input to this system is $x(n) = \beta^n u(n)$ with $|\alpha|$ & $|\beta| < 1$. Determine the response $y[n]$.

(i) When $\alpha = \beta$

(ii) When $\alpha \neq \beta$

Using DTFT.
