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Question Paper Code: 54404

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Electronics and Communication Engineering

15UEC404- SIGNALS AND SYSTEMS

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

- The period of the function $\cos \frac{\pi}{4} (t - 1)$ is CO1- R
(a) $\frac{1}{8}s$ (b) $8s$ (c) $4s$ (d) $\frac{1}{4}s$
- The Fourier series of an odd periodic function contains CO2- R
(a) Odd harmonics only (b) Even harmonics only
(c) Sine harmonics only (d) Cosine harmonics only
- The inverse Laplace transform of $\frac{-a}{s(s-a)}$ CO3- R
(a) e^{at} (b) $-e^{at}$ (c) $1 - e^{at}$ (d) $-1 + e^{at}$
- The F.T. of a conjugate symmetric function is always CO4- R
(a) Imaginary (b) Real (c) Conjugate unsymmetric (d) Conjugate symmetric
- The ROC of sequence in the Z.T. of sequence $x[n] = a^n \cup [n]$ is CO5- R
(a) $z > a$ (b) $z < a$ (c) $|z| > a$ (d) $|z| > a$

PART – B (5 x 3= 15 Marks)

- Determine whether the signal, $x(t) = \sin 3t$ is periodic. CO1- R
- What is the difference between tabulation and graphical methods? CO2- R

8. What are the applications of the Laplace transform? CO3- R
9. Differentiate convolution and multiplication property. CO4- R
10. Find the DTFT (Discrete time Fourier transform) of $x[n] = a^n U[n]$ for $-1 < a < +1$ CO5- R

PART – C (5 x 16= 80 Marks)

11. (a) (i) Explain the classification of signals with examples CO1- U (6)
- (ii) Determine whether the systems described by the following input – output equation are linear, dynamic and casual. CO1- App (10)

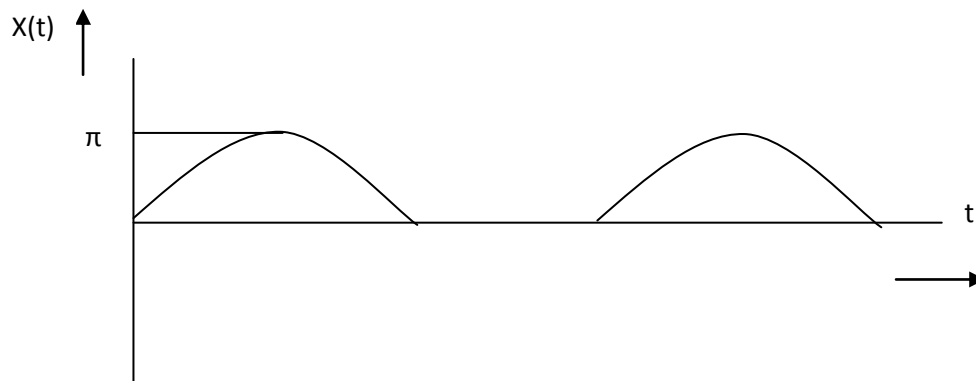
$$y(t) = x(t-3) + (3-t)$$

$$y(n) = nx(n) + bx^2(n)$$

Or

- (b) (i) What are the mathematical operations that can be performed on discrete time signals? CO1 App (8)
- (ii) Determine whether the following systems are time invariant or not. CO1 App (8)
1. $y(t) = 2tx(t)$,
 2. $y(t) = x(t)\sin 20\pi t$

12. (a) (i) Determine the response of the LTI system whose input $x(n)$ and impulse response $h(n)$ are given by $x(n) = \{1, 2, 5, 1\}$ and $h(n) = \{1, 2, 1, -1\}$. CO2- App (8)
- (ii) Determine the Fourier series representation of the half wave rectifier output. CO2- App (8)



Or

- (b) Determine the forced response of the system described by the equation CO2- App (16)

$$5 \frac{dy(t)}{dt} + 10y(t) = 2x(t), \text{ for the input, } x(t) = 2u(t)$$

13. (a) Determine the Laplace transform of CO3- Ana (16)
- (a) $x(t) = e^{-at} \sin t u(t)$
- (b) $x(t) = e^{-3t} u(t)$

Or

- (b) Determine the inverse Laplace transform of CO3- Ana (16)
- (a) $X(s) = \frac{2}{s(s+1)(s+2)}$
- (b) $X(s) = \frac{1}{(s+2)(1+s+s^2)}$

14. (a) State and prove sampling theorem for low pass band limited signal and explain the process of reconstruction of the signal from its samples CO4- U (16)

Or

- (b) (i) State and prove the Parseval's relation for discrete time Fourier transform. CO4- U (8)
- (ii) Find the DTFT of the given periodic signal CO4- U (8)

$$x[n] = \cos \omega_0 n = \frac{1}{2} e^{j\omega_0 n} + \frac{1}{2} e^{-j\omega_0 n}, \text{ with } \omega_0 = \frac{2\pi}{3},$$

15. (a) Determine the Z transform and ROC for the following discrete time signals CO5- Ana (16)
- (i) $x(n) = 0.3^n u(n)$.
- (ii) $x(n) = 0.8^n u(-n-1)$

Or

- (b) (i) Obtain the direct form-I realization for the system described by the difference equation, CO5- Ana (8)

$$\left(y(n) - \frac{1}{2}y(n-1) - \frac{1}{3}y(n-2) + \frac{1}{4}y(n-3)\right) = x(n) + \frac{1}{5}x(n-1) + \frac{1}{6}x(n-2)$$

- (ii) Obtain the direct form-II realization for the system described the difference equation CO5- Ana (8)

$$\left(y(n) - \frac{1}{8}y(n-1) + \frac{1}{7}y(n-2) - \frac{1}{6}y(n-3)\right) = 2x(n) - \frac{1}{2}x(n-1) + \frac{1}{3}x(n-2) - \frac{1}{4}x(n-3)$$