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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Electronics and Communication Engineering

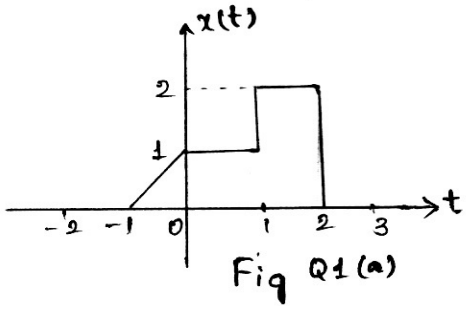
Semester End Examination; Dec.-2019

Signals and Systems

Time: 3 hrs *Max. Marks: 100*

Note: i) PART - A is compulsory. **Two** marks for each question.

ii) PART - B: Answer any **Two** sub questions (from a, b, c) for Maximum of **18 marks** from each unit.

Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	A continuous time signal is shown in Fig. Q1(a). Sketch $x(t)\,[u(t) - u(t-1)]$.  Fig Q1(a)	2
b.	State and prove commutative property.	2
c.	Find the FS coefficients for the periodic signal $x(t)$ with period 2 given by, $x(t) = e^{-t}$; for $-1 < t < 1$.	2
d.	State and prove linearity property of Fourier Transform.	2
e.	If $x(n) = \alpha^n$; $0 \le n \le N-1$ $= 0$; elsewhere Prove that $X(z) = \dfrac{1-\alpha^N z^{-N}}{1-\alpha z^{-1}}$; $ROC\,\lvert z\rvert > 0$.	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	Determine whether or not each of the following signals is periodic or not. If periodic find its fundamental period. i) $x(t) = 10\cos(\pi t)\sin(4\pi t)$ ii) $x(t) = \cos(2\pi t) + \sin(3\pi t) + \cos\left[5\pi t - \dfrac{3\pi}{4}\right]$ iii) $x(t) = e^{-j10t} + e^{j15t}$	9
b.	Find the energy of the signals, i) $x(t) = 2\,rect\,(t)$ ii) $x(t) = rect(t)\cos(4\pi t)$ iii) $x(t) = rect(t)\sin(2\pi t)$	9
c.	For the following systems, determine whether the system is Memory less, Causal, Linear. i) $y(t) = \dfrac{d}{dt}\left[e^{-t}\,x(t)\right]$ ii) $y(n) = 2x(n) + \dfrac{1}{x(n-2)}$ iii) $y(n) = \sum_{k=-\infty}^{n-3} \sin[x(k)]$.	9
	UNIT - II	**18**
2 a.	Consider the input signal $x(n)$ and the impulse response $h(n)$ given below, $X(n) = 1$; $0 \le n \le 4$ $= 0$; otherwise $h(n) = \alpha^n$; $0 \le n \le 6$; $\alpha > 1$ $= 0$; otherwise Compute the output signal $y(n)$. Also plot $y(n)$ for $\alpha = 2$.	9

Contd...2

b. Evaluate the continuous-time convolution integral given below and plot it 9

$Y(t) = \{ u(t+2) - u(t-1)\} * u(-t+2)$

c. Draw the direct form I and direct form II implementations for system described by,

i) $Y(n)+\frac{1}{4}y(n-1)-\frac{1}{8}y(n-2)=x(n)+x(n-1)$ ii) $Y(n)+\frac{1}{2}y(n-1)-y(n-3)=3x(n-1)+2x(n-2)$ 9

UNIT - III

18

3 a. State and prove properties of Continuous Time Fourier Series, 9

i) Linearity ii) Time Reversal iii) Parseval's Theorem

b. State and prove properties of Continuous Time Fourier transform, 9

i) Time shifting ii) Conjugation iii) Duality

c. For the signal *x(t)* shown in Fig. Q3(c), find the FS representation and draw its magnitude and phase spectra. 9

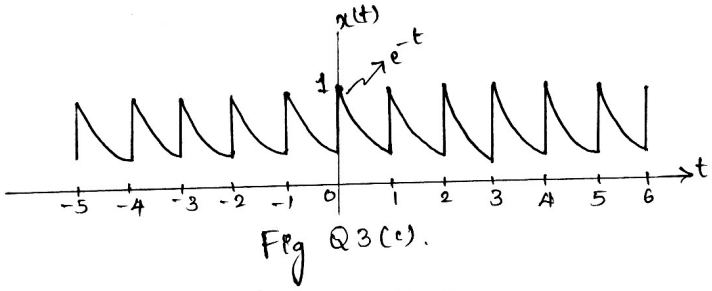


Fig Q3(c).

UNIT - IV

18

4 a. Determine the Nyquist rate corresponding to the following signals: 9

i) $x(t) = cos(150\pi t)\, sin(100\pi t)$ ii) $x(n) = cos^3(200\pi t)$

iii) $x(t) = sinc(200t) + sinc^2(200t)$

b. State and prove properties of the discrete time Fourier Transform, 9

i) Frequency shift ii) Differentiation in Time iii) Time Expansion

c. Using appropriate properties, find the DTFT of the following signals: 9

i) $x(n)=\left(\frac{1}{2}\right)^n u(n-2)$ ii) $x(n)=\sin\left(\frac{\pi}{4}n\right)\left(\frac{1}{4}\right)^n u(n-1)$ iii) $x(n)=n\left(\frac{1}{2}\right)^{|n|}$

UNIT - V

18

5 a. Find Z- transform and ROC of the following signal, 9

i) $x(n) = 7\left(\frac{1}{3}\right)^n u(n) - 6\left(\frac{1}{2}\right)^n u(n)$

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

b. State and prove the properties of Z-transform: 9

i) Linearity ii) Time expansion iii) Final value theorem

c. Find the inverse Z-transform of, 9

$$X(z) = \frac{z^3 + z^2 + \frac{3}{2}z + \frac{1}{2}}{z^3 + \frac{3}{2}z^2 + \frac{1}{2}z} \quad ; ROC: |z| < \frac{1}{2}$$

by partial fraction expansion method.

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