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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; March/April - 2022

Signals and Systems

Time: 3 hrs *Max. Marks: 100*

Course Outcome

The Students will be able to:
CO1: Apply knowledge of basic mathematics to classify different signals and systems
CO2: Analyze signals and systems to determine their properties.
CO3: Analyze LTI/LSI systems in time domain and frequency domain to determine system output and properties
CO4: Analyze CT and DT system and implement using different structures
CO5: Commenting on existing demo, group activity based learning new tools and solving problems using tools

***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	BLs	COs	POs
	I : PART - A	**10**			
I a.	Determine whether the following signals are periodic. Find the periodic, if they are periodic; i) $x(t) = v(t) + v(-t)$ *where* $v(t) = \sin(t).u(t)$ ii) $\cos(\frac{1}{5}\pi n).\sin(\frac{1}{3}\pi n)$	2	L2	CO1	PO1
b.	Check whether the following continuous time systems are time invariant or time variant: *i)* $y(t) = \sin x(t)$ *ii)* $y(t) = t.x(t)$	2	L2	CO2	PO1
c.	Compute the Fourier transform of the signal, $x(t) = e^{-2t}u(t)$	2	L1	CO3	PO1
d.	Define frequency shift property with respect to DTFT.	2	L1	CO3	PO1
e.	Determine the Z-transform of the following: *i)* $\delta(u)$ *ii)* $u(n)$	2	L2	CO3	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Determine whether the following signals are energy signals or power signals and calculate their energy or power: *i)* $x(n) = \left(\frac{1}{2}\right)^n u(n)$ *ii)* $x(t) = \cos^2(w_0 t)$ *iii)* $x(n) = u(n)$	9	L3	CO2	PO1

Contd... 2

b. For each of the systems, determine whether the system is linear or non linear, causal or non causal, stable or unstable.

i) $y(n) = \cos[x(n)]$

ii) $y(n) = x(n).u(n)$

iii) $y(n) = Sgn[x(n)]$ — 9 L2 CO2 PO1

c. Find and sketch the Even and Odd components of the following:

i) $x(t) = e^{jt}$

ii) $x(t) = \begin{cases} t & ; \quad 0 \le t \le 1 \\ 2t & ; \quad 1 \le t \le 2 \end{cases}$

iii) $x(t) = \cos^2\left(\frac{\pi t}{2}\right)$ — 9 L2 CO1 PO1

UNIT - II **18**

2 a. Obtain $x(t) * y(t)$ for the signals,

$x(t) = u(t) - u(t-2)$, $y(t) = t[u(t) - u(t-1)]$. Sketch the convolved signal $x(t) * y(t)$. — 9 L3 CO3 PO2

b. Determine the complete response of the system;

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4 \quad y(t) = \frac{dx(t)}{dt}$$

With $y(0) = 0, \left.\frac{dx(t)}{dt}\right| = 1$ *and* $x(t) = e^{-2t}.u(t)$ — 9 L3 CO3 PO2

c. Draw the direct form-I and form-II realizations for the following systems:

i) $y(u) - \frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) = x(n) + 2.x(n-1)$

ii) $\frac{2.d^3y(t)}{dt^3} + \frac{dy(t)}{dt^2} + 3y(t) = x(t)$ — 9 L2 CO4 PO2

UNIT - III **18**

3 a. State and prove the following properties of FS:

i) Linearity

ii) Convolution in time

iii) Modulation theorem — 9 L1 CO3 PO1

b. Find the exponential Fourier series and plot the magnitude and phase spectrum for the saw tooth wave form of Fig.Q3(b)

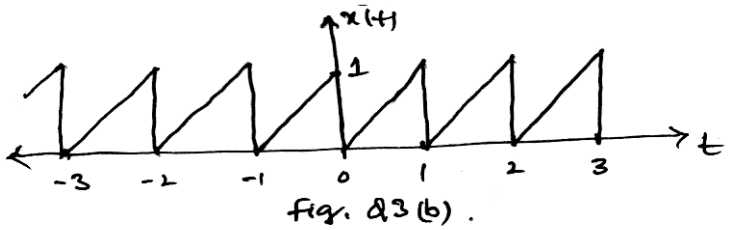

fig. Q3 (b).

9 L3 CO3 PO2

Contd... 3

c. Obtain the Fourier transforms of the following signals:

i) $x(t) = e^{at}\ u(-t)$

ii) $x(t) = e^{-a|t|}$

iii) $x(t) = e^{-a|t|}\sin(t)$

9 L3 CO3 PO2

UNIT - IV **18**

4 a. State and prove the following properties of DTFT:

i) Time shift

ii) Parseval's theorem

iii) Duality

9 L1 CO3 PO1

b. Determine the Nyquist rate for the following signals:

i) x(t) = sinc(200t)+sinc²(200t)

ii) x(t) = cos(10Πt)+3cos(20Πt)

iii) x(t) = 1+cos(200Πt)+sin(400Πt)

9 L3 CO3 PO2

c. Obtain the DTFS of the following DT a periodic sequences:

i) $x(n) = \delta(u) - 3\delta(u-3) + 2\delta(u-4)$

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

iii) $x(n) = \left(\frac{1}{2}\right)^n u(n-4)$

9 L3 CO3 PO2

UNIT - V **18**

5 a. Determine the ZT of following sequences:

i) $(0.2)n\ \langle u(n) - u(n-4)\rangle$

ii) $\alpha^{|n|}, 0 < |\alpha| < 1$

iii) $n^2u(n)$

9 L2 CO3 PO1

b. State and prove the following properties of ZT

i) Translation

ii) Initial value theorem

iii) Multiplication by a Ramp

9 L2 CO3 PO1

c. Determine the inverse Z-transform of

$$x(Z) = \frac{1}{1 - 1.5Z^{-1} + 0.5Z^{-2}} \quad for$$

i) $RoC\ |Z| > 1$

ii) $RoC\ |Z| < 0.5$

iii) $RoC < |Z| < 1$

9 L2 CO3 PO2

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