

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

Q.1 Solve Any Two of the following.

12

A) Sketch the following signal

CO 01

6

i) $x(t) = 3r(t) - 3u(t-3)$

ii) $x[n] = \delta[n] + \frac{1}{2}\delta[n-1] + (\frac{1}{2})^2\delta[n-2] + (\frac{1}{2})^3\delta[n-3]$

B) Derive the expression for relationship between input and output of LTI system in time domain

CO 02

6

C) Determine if the following systems are time-invariant, linear, causal

CO 01

6

i) $Y(t) = t * (X(t))$

ii) $Y[n] = X[n] + n * X[n+1]$

Q.2 Solve Any Two of the following.

12

A) Explain the Even and odd signal with example. Also show that sum of even part and odd part of signal is equal to original signal.

CO 01

6

B) Prove the following statements :

CO 02

6

i) The convolution of an odd and even function is odd.

ii) The convolution of an even and even function is even.

iii) The convolution of an odd and odd function is odd.

C) Find the Fourier series coefficients C_k for the signal

CO 03,04

6

$x(t) = (1/2) + (1/3) * \cos(t) + (1/2) * \cos(2t)$

Also find the FSC of following i) $X(-t)$ ii) $X(t/2)$ iii) $x(t-2)$

Q.3 Solve Any Two of the following.

12

A) Let $x(n) = \delta(n+2) - \delta(n+1) + 2\delta(n) + \delta(n-1) - \delta(n-2)$ with discrete time Fourier transform $X(e^{j\omega})$. Evaluate the following functions of $X(e^{j\omega})$ without computing the transform itself:

CO 03

6

(i) $X(e^{j0})$ (ii) $X(e^{j\pi})$ (iii) $\int_{-\pi}^{\pi} X(e^{j\omega}) d\omega$

(iv) $X(e^{j\omega})$ (v) Magnitude and phase of $X(e^{j\omega})$

B)	If $X(e^{j\omega})$ is the Fourier Transform of a real sequence $x[n]$ then, show the following: (i) $X(e^{j\omega})$ is conjugate symmetric (ii) phase of $X(e^{j\omega})$ is anti-symmetric and Phase Spectrum is odd function (iii) magnitude of $X(e^{j\omega})$ is symmetric and Magnitude Spectrum is even function	CO 03	6
C)	Find Laplace transform of function: $f(t) = 4t^2 - 3\cos t + 5e^{-t}$ with $0 \leq t < \infty$:	CO 04	6
Q.4	Solve Any Two of the following.		12
A)	Perform the inverse Laplace transform of the following expression: $F(s) = (3s + 7) / (s^2 - 2s - 3)$	CO 04	6
B)	Determine the z transform and ROC for the signal $x[n] = [3(2^n) - 4(3^n)].u(n)$	CO 04	
C)	Find Fourier transform of signal $x(t) = e^{at}.u(-t)$ Also draw Amplitude and Phase Spectrum .	CO 03	6
Q. 5	Solve Any Two of the following.		12
A)	Prove that energy in Continuous Domain and Energy in Fourier Domain remains Unchanged	CO 03	6
B)	Compute the inverse z-transform of signal $x(z) = (z+2)/(2z^2-7z+3)$ if ROCs are i) $ z > 3$ ii) $ z < 1/2$ iii) $1/2 < z < 3$	CO 04	6
C)	Determine the DTFS of $x[n] = \{1, 2, 1, 0\}$ with period $N=4$.	CO 03,04	6

***** End *****