

SE (ELEX) Sem IV R'20 c'-scheme

23.05.2025

Time: 3 Hours

Max. Marks: 80

- Note: -1. Question no. 1 is compulsory.
 2. Answer any three out of remaining questions.
 3. Figures to right indicate full marks.
 4. Assume suitable data wherever necessary.



Q.1 Attempt any 4 questions

20 marks

- Sketch the following signals
 - $X_1(t) = u(t) - u(t-2)$
 - $X_2(t) = r(t)u(2-t)$
- Find whether the following signals are periodic or aperiodic. If periodic find fundamental period?
 - $X(t) = \cos(60\pi t) + \sin(50\pi t)$
 - $X(n) = 12 \cos(20n)$
- State and prove time shifting property of Laplace transform.
- Find the fourier transform of $X(t) = \sin(\Omega_0 t)$.
- State Dirichlet conditions for existence of Fourier series.

Q.2 a) classify whether the following systems are linear/nonlinear, causal/non causal 10 Marks

- $y(t) = x^2(t)$
- $y(n) = n x(n)$

b) Find the inverse Laplace transform of

10 Marks

$$X(S) = \frac{2}{(s^2 + 3s - 4)} \text{ for all possible ROCs.}$$

Q.3 a) Find inverse Z transform of

10 Marks

$$X(Z) = \frac{0.25 Z}{(z-0.5)(z-0.25)} \text{ for ROC } |Z| > 0.5$$

b) Find the trigonometric Fourier series of the periodic signal $x(t)$.

10 Marks

$$x(t) = 1 \text{ for } -1 \leq t \leq 1 \\ = -1 \text{ for } 1 \leq t \leq 3 \text{ for one cycle. } T = 4\text{sec.}$$

Q.4 a) What is the overall impulse response $h(t)$, when two systems are connected in series and in parallel? 10 Marks

Find overall impulse response of cascade system for given $h_1(t)$ and $h_2(t)$ using Laplace transform.

$$h_1(t) = e^{-3t} u(t)$$

$$h_2(t) = e^{-2t} u(t)$$

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Page 1 of 2

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- b) Find Z transform and ROC of the following signal. 10 Marks
- (i) $x(n) = [3(3)^n - 4(2)^n] u(n)$
- (ii) $x(n) = 2^n u(n) + (-1)^n u(n)$
- Q.5. a) Find the total response for the following system 10 Marks
- $y(n) + y(n-1) - 2y(n-2) = u(n-1) + 2u(n-2)$
- where $y(-1) = 0.5$, $y(-2) = 0.25$
- b) State and prove convolution property of DTFT. Find the convolution of the signals given below using Fourier transform. 10 Marks
- $X_1(n) = \left(\frac{1}{2}\right)^n u(n)$ & $X_2(n) = \left(\frac{1}{3}\right)^n u(n)$
- Q.6 a) Write short note on 10 Marks
- (I) Correlation
- (II) Convolution
- b) A system is designed by the following differential equation 10 Marks
- $\frac{d^2 y(t)}{dt^2} + 7 \frac{dy(t)}{dt} + 12y(t) = x(t)$
- determine the response of the system to a unit step input applied at $t=0$. The initial conditions are $y(0^-) = -2$, $\frac{dy(t)}{dt}(0^-) = 0$

