BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

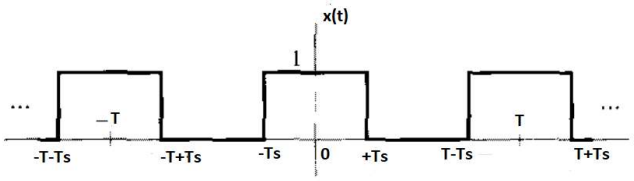
CLASS: BTECH **SEMESTER : IV**
BRANCH: ECE **SESSION : SP/2024**

SUBJECT: EC251 SIGNALS AND SYSTEMS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Define the energy signals, power signals and even, odd signals with mathematical equations.	[5]	1	1
Q.1(b)	The input x(t) and output y(t) of a system is related as $y(t) = \int_{-\infty}^{t} x(\tau)\cos(3\tau)\,d\tau$. Find whether it is time invariant and stable.	[5]	1	2
Q.2(a)	What will be the condition of impulse response for a causal LTI system? Determine the conditions on 'a' such that the continuous-time system with impulse response $h(t)=e^{at}u(t)$ is stable and causal.	[5]	2	1
Q.2(b)	Find the convolution between x(t) and h(t), where $x(t)=e^{-at}u(t)$ and $h(t)= e^{at}u(-t)$.	[5]	2	2
Q.3(a)	Find the Fourier series representation for the square wave x(t), depicted in figure, for $T_s/T=1/4$.	[5]	3	2



Q.3(b)	i) Mention the advantages of Laplace transform over Fourier transform. ii) Find the inverse Laplace transform of $X(s) = \frac{3s+4}{(s+1)(s+3)^2}$, assuming x(t) is a causal signal.	[2+3]	3	3
Q.4(a)	i) Outline the mapping between Laplace transform and z-transform. ii) Determine the z-transform of the signal $x[n]=\alpha^n u[n]$. Depict the ROC and pole and zero locations of X(z) in the z-plane.	[2+3]	4	2
Q.4(b)	Find the inverse z-transform of $X(z) = \frac{z^3-10z^2-4z+4}{z^2-2z-4}$ with ROC $\|z\|<1$.	[5]	4	3
Q.5(a)	i) State and prove the sampling theorem. Draw spectrum of the sampled signal. ii) What is the Nyquist rate for the signal $x(t)=3\cos 50\pi t+10\sin 300\pi t-\cos 100\pi t$.	[3+2]	5	2
Q.5(b)	Describe the zero-order hold reconstruction method.	[5]	5	3

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