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

CLASS: BTECH **SEMESTER: V**
BRANCH: EEE **SESSION: MO/2022**

SUBJECT: EE305 DIGITAL SIGNAL PROCESSING

TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. **The total marks of the questions are 25.**
2. **Candidates attempt for all 25 marks.**
3. **Before attempting the question paper, be sure that you have got the correct question paper.**
4. **The missing data, if any, may be assumed suitably.**
5. **Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.**

				CO	BL
Q1	(a)	A continuous time signal is represented as $x(t)$= 15 + Sin [($\frac{\pi}{3}$)t] Cos [($\frac{\pi}{6}$)t]. What is the fundamental period of signal $y(t) = x(-t+2) + x(2t+3)$?	[2]	1	2
Q1	(b)	The impulse response of discrete LTI system is *h*(n) = (-1/2) ^{n} u(n) + (1.01) ^{n} u(n-1). Determine this system is causal and /or stable. Justify your answer.	[3]	2	6
Q2	(a)	The discrete time signals $\boldsymbol{x(n)}$ = 1 + Cos ($\frac{2\pi}{6}\boldsymbol{n}$) and $\boldsymbol{y(n)}$ = Sin ($\frac{2\pi}{6}\boldsymbol{n} + \frac{\pi}{4}$) with fundamental period of N = 6. Determine the Fourier series coefficients of $\boldsymbol{x(n)}$ and $\boldsymbol{y(n)}$.	[2]	3	3
Q2	(b)	Find the Laplace transform of $x(t)$ = t $\frac{d}{dt}\{e^{-t}$Cos(t) u(t)}? The Laplace transform of $\boldsymbol{x(t)}$ is X(s) = $\frac{4s+5}{(s+2)(s-1)}$. If the Fourier transform of $\boldsymbol{x(t)}$) is exist, then find out the inverse Laplace transform of X(s)?	[3]	3	3
Q3	(a)	If $y(t) = x(t) * h(t)$ and $g(t) = x(3t) * h(3t)$ and given that $x(t)$ has Fourier transform $X(\omega)$ and $h(t)$ has Fourier transform $H(\omega)$. If $g(t)\ has\ the\ form\quad g(t) = A\,y(Bt)$. Determine the values of A and B.	[2]	3	4
Q3	(b)	These are the following information about a continuous-time periodic signal with period 3 and Fourier coefficients $\boldsymbol{X_n}$: (a) $\boldsymbol{X_n} = \boldsymbol{X_{n+2}}$. (b) $\boldsymbol{X_n} = \boldsymbol{X_{-n}}$. (c) $\int_{-0.5}^{0.5} \boldsymbol{x(t)dt}$ = 1 (d) $\int_{0.5}^{1.5} \boldsymbol{x(t)dt}$ = 2. Determine $\boldsymbol{x(t)}$	[3]	3	3
Q4	(a)	(i)For an input x[n], output y[n] of a system is related as y[n] = x[n] + n. Determine whether it is stable/unstable, linear/nonlinear and time-variant/ non time-invariant.(ii)Consider a discrete time signal $x(n) = a^n u(n)$. What are the conditions for the x[n] to be energy signal and power signals are respectively?	[2]	2	3
Q4	(b)	Let $X(e^{j\omega})$ denote the Fourier transform of the signal $x(n)$ = {-1, 0, 1, 2, 1, 0, 1, 2, 1 0, -1}, $-3 \le n \le 7$. Perform the following calculations (a) Find $X(e^{j\pi})$ (b) Evaluate $\int_{-\pi}^{\pi} \left\lvert \frac{dX(e^{j\omega})}{d\omega} \right\rvert^2 d\omega$ (c) Find $\boldsymbol{X(e^{j0})}$	[3]	3	6
Q5	(a)	Determine the inverse z-transform of $\boldsymbol{X(z) = \frac{1}{1024}\left[\frac{1024 - z^{-10}}{1 - o.5z^{-1}}\right], \lvert z \rvert > 0}$.	[2]	3	3
Q5	(b)	If x_1(n)= {1, 2, 3, 4} and x_2(n)= {1, -1, 2, 1}. Find the linear and circular convolution of x_1(n) and x_2(n).	[3]	3	3

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