BTECH
(SEM III) THEORY EXAMINATION 2021-22
BASIC SIGNALS & SYSTEMS

Time: 3 Hours ***Total Marks: 100***

Notes:

- *Attempt all Sections and Assume any missing data.*
- *Appropriate marks are allotted to each question, answer accordingly.*

SECTION-A	Attempt **All** of the following Questions in brief	Marks **(10X2=20)**	**CO**
Q1(a)	Define CT signals.		
Q1(b)	Define unit step, ramp and delta functions for CT		
Q1(c)	Define odd and even signal		
Q1(d)	Define linear and non-linear systems		
Q1(e)	Define time invariant and time varying systems		
Q1(f)	Define Static and Dynamic system		
Q1(g)	Check whether the given system is causal and stable $y(n) = 3x(n-2) + 3x(n+2)$		
Q1(h)	What is the Laplace transform of (a) e^{-at} sin ωt u(t)		
Q1(i)	A signal $x(t) = \cos 2\pi$ ft is passed through a device whose input –output is related by $y(t) = x^2(t)$. What are the frequency components in the output		
Q1(j)	Define the Fourier transform pair for continuous time signal.		

SECTION-B	Attempt **ANY THREE** of the following Questions	Marks **(3X10=30)**	**CO**
Q2(a)	(i) Obtain the Fourier transform of $x(t) = e^{-at}u(t)$, a> 0. (ii) Find the Laplace transform of signal u(t). (iii) Find the Laplace transform of the signal. $x(t) = -te^{-2t}\,u(t)$ (iv) List some properties of continuous-time Fourier transform		
Q2(b)	(i) What are the properties of convolution (ii) Find the unit step response of the system given by $h(t) = (1/RC).e^{-t/RC}\,u(t)$		
Q2(c)	(i) What is the transfer function of a system whose poles are at -0.3±j 0.4 and a zero at -0.2 (ii) Give the Existence of DTFT		
Q2(d)	Calculate the initial and final values of the functions $x_1(t)$, $x_2(t)$, whose Laplace transforms are specified below: (i) $X_1(s) = \dfrac{s+3}{s(s+1)(s+2)}$ with ROC R_1: $\mathrm{Re}\{s\} > 0$; (ii) $X_2(s) = \dfrac{s+5}{s^3+5s^2+17s+13}$ with ROC R_2: $\mathrm{Re}\{s\} > -1$;		
Q2(e)	(i) What do you mean by state transition matrix? State and prove its properties (ii) State and prove time shifting and differentiation properties of Z transform.		

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q3(a)	Determine if systems with the following impulse responses: (i) $h(t) = \delta(t-2)$, (ii) $h(t) = \delta(t) - \delta(t-2)$, are invertible.		
Q3(b)	Calculate the inverse Laplace transform of right-sided sequences with the following transfer functions: $X_1(s) = \dfrac{s+3}{s(s+1)(s+2)}$		

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**

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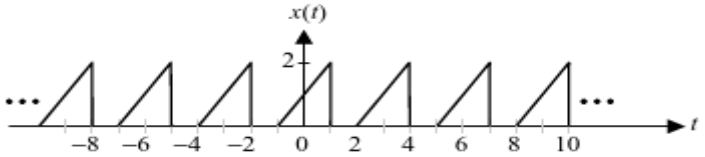
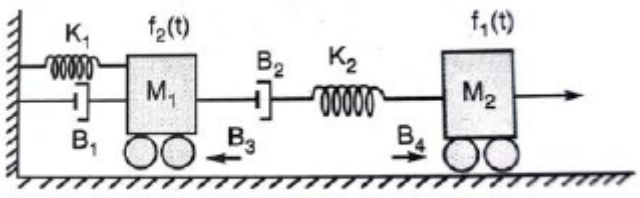
Q4(a)	Calculate the unilateral Laplace transform for the following functions: (i) unit impulse function, $x_1(t) = \delta(t)$; (ii) unit step function, $x_2(t) = u(t)$	
Q4(b)	Calculate the Fourier transform of the following functions: (i) unit impulse sequence, $x_1[k] = \delta[k]$; (ii) decaying exponential sequence, $x_3[k] = p^k u[k]$ with $\lvert p \rvert < 1$.	

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q5(a)	Calculate the trigonometric CTFS coefficients of the periodic signal x(t) defined over one period $T_0 = 3$ as follows: $x(t) = \begin{cases} t+1 & -1 \le t \le 1 \\ 0 & 1 < t < 2. \end{cases}$ 		
Q5(b)	Calculate the CTFS coefficients for the following signal $x(t) = 3 + \cos\left(4t + \frac{\pi}{4}\right) + \sin\left(10t + \frac{\pi}{3}\right)$		

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q6(a)	Consider the system $H(z) = \frac{z^{-1} + \frac{1}{2}z^{-2}}{1 - \frac{3}{5}z^{-1} + \frac{2}{25}z^{-2}}$ Determine (i) the impulse response (ii) the zero-state step response		
Q6(b)	A signal has Laplace transform $X(s) = \frac{(s+2)}{(s^2+4s+5)}$ Find the Laplace transform Y(s), of the following signals (i) $y(t) = t\,x(t)$ (ii) $y(t) = e^{-t}x(t)$		

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q7(a)	For the given mechanical system draw the equivalent circuit using F-V and F-I analogy 		
Q7(b)	What do you mean by the existence of Fourier series? And explain properties of Fourier series.		