PAPER ID-411707

Roll No: ☐☐☐☐☐☐☐☐☐☐☐☐☐

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

Time: 3 Hours   *Total Marks: 70*

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 **(7X2=14)**
Q1(a)	Explain how aperiodic signals can be represented by Fourier transform.	
Q1(b)	What are the major classifications of the signal	
Q1(c)	What are the Conditions for a System to be LTI System?	
Q1(d)	Find the Fourier transform of x(t)=sin(wt)	
Q1(e)	Define time invariant and time varying systems.	
Q1(f)	What are the properties of convolution?	
Q1(g)	What is the use of Laplace transform	

SECTION-B	Attempt **ANY THREE** of the following Questions	Marks **(3X7=21)**
Q2(a)	(i) What is the periodicity of $x(t) = e^{j100\Pi t} + 30°$ (ii) Find the fundamental period of the signal $x(n) = 3\ e^{j3\Pi(n+1/2)}$ (iii) Is the system describe by the equation y(t) = x(2t) Time invariant or not? Why (iv) What is the period T of the signal x(t) = 2cos (n/4)?	
Q2(b)	Find the Fourier coefficients of $x(t)=1+\sin 2\omega t+2\cos 2\omega t+\cos[3\omega t+\pi/3]$.	
Q2(c)	Explain Modelling of mechanical system and electrical system and then give the analogy between electrical and mechanical system.	
Q2(d)	State and prove convolution property of Laplace transform and then using this property find Laplace transform of $$\frac{s}{(s+1)(s+2)}$$	
Q2(e)	For the circuit given below, Initially switch is closed for a long time and steady state condition has reached. At t =0 switch is opened. Find the expression of current through inductor	
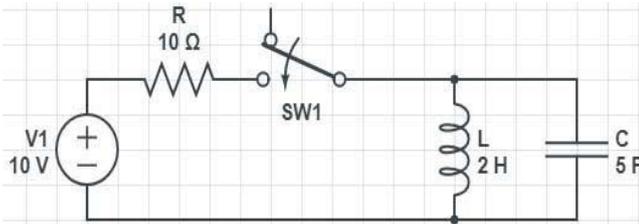
SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X7=7)**
Q3(a)	State and prove time shifting and differentiation properties of Z transform.	
Q3(b)	A signal has Laplace transform $$X(s) = \frac{(s+2)}{(s^2+4s+5)}$$ Find the Laplace transform Y(s), of the following signals (i) $y(t) = t\ x(t)$ (ii) $y(t) = e^{-t}x(t)$	

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SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X7=7)**
Q4(a)	Obtain the state model for the given transfer function $T(s) = Y(s) / U(s) = K (b_1s+b_2) / (s^3+a_1s^2+a_2s+a_3)$	
Q4(b)	Obtain the state transition matrix of a system given by. $$A=\begin{bmatrix} -1/2 & -5/2 \\ 1/2 & -7/2 \end{bmatrix}$$	

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X7=7)**
Q5(a)	Find even and odd component of the following signals (i) $x(t)= \cos t + \sin t + \cos t \sin t$ (ii) $x(n) = \{1,2,1,4,5,0,3\}$	
Q5(b)	State and prove the time delay theorem and Parsavel's theorem of Z-transform.	

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X7=7)**
Q6(a)	Obtain the trigonometric Fourier series for the half wave rectified sinewave.	
Q6(b)	State and prove duality property of Fourier transform. Find the inverse Fourier transform of, $$X(j\omega) = \begin{cases} 2\cos\omega, & |\omega| < \pi \\ 0, & |\omega| > \pi \end{cases}$$	

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X7=7)**
Q7(a)	Find the inverse Laplace transform of given function by using convolution theorem (i) $x(s)= 1/(s^2+a^2)^2$ (ii) $x(s)= s/(s+1)(s+2)$	
Q7(b)	Explain state transition matrix, its physical significance and properties.	