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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING  
DCET END TERM EXAMINATION- AUGUST 2024**

<b>Semester : 4<sup>th</sup></b>	<b>Date : 6/08/2024</b>
<b>Course Code :EEE2001 v02</b>	<b>Time :9:30 am to 12:30 pm</b>
<b>Course Name :Signals &amp; Systems</b>	<b>Max Marks :100</b>
<b>Program : B.Tech &amp; 4<sup>th</sup> Sem</b>	<b>Weightage :50%</b>

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

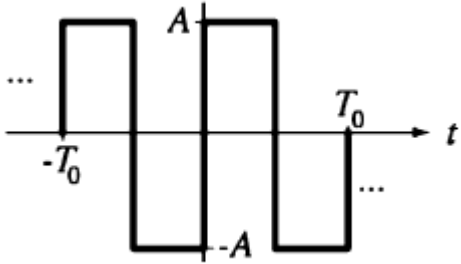
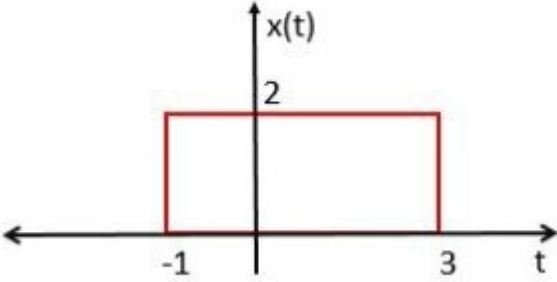
<b>PART A</b>			
<b>ANSWER ANY 5 QUESTIONS</b>		<b>5Q X 2M=10M</b>	
1	Explain the concept of impulse response in the context of continuous-time LTI systems. How does the impulse response provide insights into the system's behavior?	(CO1)	[Knowledge]
2	Explain the concept of Fourier series and its role in representing continuous-time periodic signals. Provide the formula for the Fourier series coefficients and mention a key property.	(CO1)	[Knowledge]
3	Define the Sampling Theorem and explain its significance in the context of signal processing.	(CO1)	[Knowledge]
4	Describe the process of mapping from the s-plane to the z-plane in the context of signal processing. How is the stability of a system in the s-plane related to its counterpart in the z-plane?	(CO1)	[Knowledge]
5	Compare and contrast the Laplace Transform and Z-Transform in terms of their domains, applications, and mathematical representations. Discuss situations where using one transform might be more advantageous than the other, and highlight any limitations or challenges associated with each	(CO2)	[Knowledge]
6	Explain the significance of mapping the s-plane to the z-plane in the context of signal processing. Discuss how this transformation is employed in practical applications, and analyze its impact on stability and causality	(CO2)	[Knowledge]
7	Discuss about the classification of signals based on magnitude and duration.	(CO2)	[Knowledge]

**PART B****ANSWER ANY 5 QUESTIONS****5Q X 10M=50M**

8	Fourier series are the ones that are used in applied mathematics, and especially in the field of physics and electronics, to express periodic functions such as those that comprise communications signal waveforms. It is used to represent non-sinusoidal periodic signals into harmonic components of sinusoidal signals. Referring to the above statements, state the special conditions where fourier series may not exist.	(CO2)	[Understand]
9	A DC voltage of 5 Volts was applied to an electrical circuit using a Battery comprising a Resistor, capacitor and a switch. All the elements are connected in series The value of Resistor is 1000 Ohms and capacitance is 3 micro-farads.The switched was initially open but at $t=0$ the switch has been closed and a transient response was observed. The battery was charging the capacitor to a steady state value. The voltage source in series with the switch gives rise to a type of Signal. After drawing the source signal, explain what will happen to the source signal if the switch is closed at $t=t_0$ instead of $t=0$ with the help of conceptual explanations. Also compute the value of the signal at $t=0$ .	(CO2)	[Understand]
10	An odd square Signal with time period T can be represented by fourier series expansion a) Identify the fourier coefficients that will be existing b) Compute the fourier coefficients .	(CO3)	[Understand]
11	An Even + Half wave symmetric square Signal with time period T can be represented by fourier series expansion a) Identify the fourier coefficients that will be existing b) Compute the fourier coefficients	(CO2)	[Understand]
12	Compare and contrast the Laplace Transform and Z-Transform in terms of their domains, applications, and mathematical representations. Discuss situations where using one transform might be more advantageous than the other, and highlight any limitations or challenges associated with each	(CO3)	[Understand]
13	Explain the significance of mapping the s-plane to the z-plane in the context of signal processing. Discuss how this transformation is employed in practical applications, and analyze its impact on stability and causality	(CO2)	[Understand]
14	A voltage having the Laplace transform $(4s^2 + 3s + 2) / (7s^2 + 6s + 5)$ is applied across a 2H inductor having zero initial current. It is desired to compute the current flowing through the inductor at steady state. Utilizing the Final value theorem compute the current flowing through the inductor at steady state.	(CO3)	[Understand]

**PART C****ANSWER ANY 2 QUESTIONS****2Q X 20M=40M**

14	A mathematician was plotting the Region of Convergence (ROC) of a given signal $x(t)$ . Region of Convergence (ROC) is defined as the set of points in s-plane for which the Laplace transform of a function $x(t)$ converges. In other words, the range of $\text{Re}(s)$ (i.e. $\sigma$ ) for which the function $X(s)$ converges is called the region of convergence. The signal $x(t)$ is an addition of two different signals and it was observed that the ROC is $\sigma < -2$ for one signal and $\sigma > 4$ for the other signal. By referring to the above statements, express the final equation of $x(t)$	(CO4)	[Understand]
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	in terms of $t$ and also comment on the stability of the signal. (Hint-The Signal $x(t)$ is a combination of exponential one sided signals).		
15	<p>Fourier Series is very useful for circuit analysis, electronics, signal processing etc. The study of Fourier series is the backbone of Harmonic analysis. Harmonic analysis is used for filter design, noise and signal analysis. Harmonic analysis is also very important in power system and power electronics studies. In power network, harmonics are mainly generated by non-linear elements and switching equipment. The output waveform of an inverter circuit is given below.</p> 	(CO3)	[Understand]
16	<p>For applications like digital signal processing operations like time shifting, amplification and scaling are performed. Referring to the above statements, Explain the concept of time shifting, scaling and reversal by drawing the updated signal <math>x(-3t+8)</math> for the signal <math>x(t)</math> given in Fig below</p> 	(CO2)	[Understand]