Roll No: ☐☐☐☐☐☐☐☐☐☐☐☐☐

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

Time: 3 Hours   *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt** *all* **questions in brief.**   **2 x 7 = 14**

a.	Write down the properties of STM.
b.	Define Periodic and Aperiodic signals.
c.	State and prove the Duality theorem.
d.	State the conditions for the existence of Fourier series.
e.	Find the impulse response of the system y(t)=x(t-t0) using Laplace transform.
f.	State Initial and Final value theorem.
g.	Find Z transform of x(n)={1,2,3,4}

SECTION B

2. **Attempt any** *three* **of the following:**   **7 x 3 = 21**

a.	A rectangular pulse is given as A rect $(^t/_\tau)$. Determine whether it is a energy or power signal. Also, find out its energy and power.
b.	Find the Fourier transform of a rectangular pulse of duration T and amplitude A.
c.	Find the convolution of the two signals x(t)= e $^{-2t}$ u(t) & h(t)= u(t+2).
d.	Find the state model of the differential equation is: $$\dddot{y}+2\ddot{y}+3\dot{y}+4y=u$$
e.	Find the Z transform of $\frac{1}{n(n+1)}$.

SECTION C

3. **Attempt any** *one* **part of the following:**   **7 x 1 = 7**

(a)	Obtain the Force-Voltage analogy of the given mechanical system:
(b)	Determine whether the following systems are linear, time invariant, causal, stable. (i)y(n) = log[x(n)] (ii)y(n) = $\sum_0^\infty$ x(n)

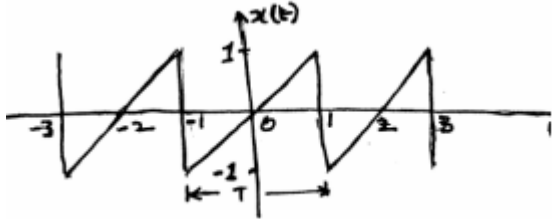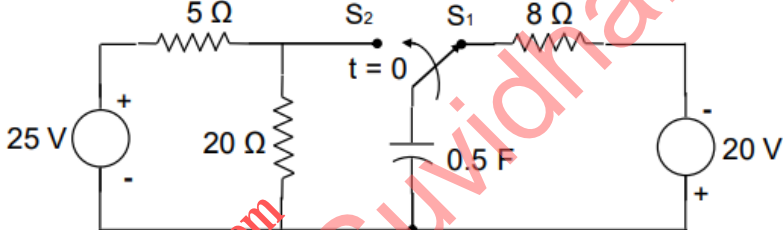PAPER ID-411930

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4. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	Find the trigonometric Fourier series for the periodic signal shown below:
(b)	State and prove the Parseval's Energy Identity.

5. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	Solve the given differential equation using Laplace Transform: $y'' - 3y' - 10y = 1$ Given that $y(0) = -1$ & $y'(0) = 2$
(b)	Consider the circuit shown below. The switch was in position S1 for a long time. It is operated as shown. Compute and plot the capacitor voltage for $t > 0$. Also find the time at which the capacitor voltage becomes zero.

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	A system is characterized by the following state space equations: $\dot{X}_1 = -3 x_1 + x_2$; $\dot{X}_2 = -2 x_1 + u$; $Y = x_1$ (i) Find the transfer function of the system and comment on the stability of the system. (ii) Compute the STM.
(b)	Obtain a state model for the system whose Transfer function is given by: $G(s)H(s) = \dfrac{(7S^2 + 12S + 8)}{(S^3 + 6S^2 + 11S + 9)}$

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	Determine the unit step response of the system whose difference equation is given by: $y(n) - 0.7y(n-1) + 0.12y(n-2) = x(n-1) + x(n-2)$ if $y(-1) = y(-2) = 1$
(b)	Find the inverse z-transform of $x(z) = (z^2 + z) / (z-1)(z-3)$, for all the possible ROCs.