

MID TERM EXAMINATION

B.TECH PROGRAMMES (UNDER THE AEGIS OF USICT)

IV Semester, May, 2023

Paper Code: EEC- 203/208

Subject: CIRCUIT AND SYSTEM

Time: 1½ Hrs.

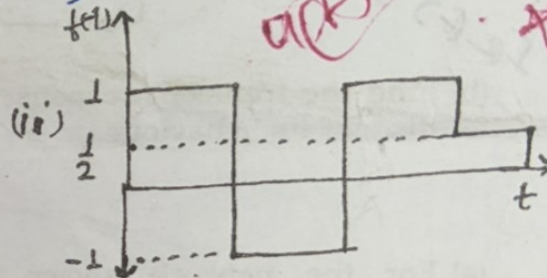
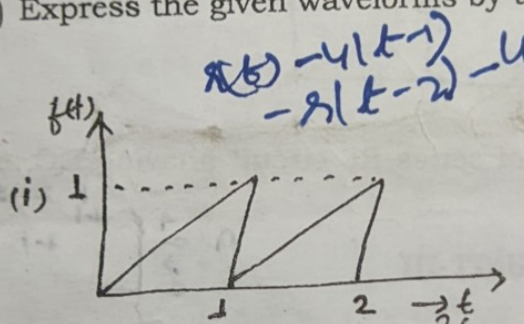
Max. Marks: 30

Note: Attempt Q. No. 1 which is compulsory and any two more questions from remaining.

Q. No.	Question	Max. Marks	CO(s)
1 (a)	What is an LTI system?	2	CO 1
(b)	Derive relationship between z and Laplace Transform	2	CO 1
(c)	Differentiate between Linear and Non-linear system?	2	CO 1
(d)	Differentiate between Time variance and Time invariance systems?	2	CO 1
(e)	Write the properties of Impulse function.	2	CO 1
2 (a)	What do you mean by z – transform ? Find the Z-transform of $x(n) = \cos(n\omega)u(n)$.	2	CO 1
(b)	Synthesis the given waveform	5	CO1
3 (a)	What do you mean by Laplace transform Find the Laplace transform of the function $f(t) = \sin \omega t$ for $0 < t < T/2$	5	CO1
(b)	Consider a RC circuit as shown below. The switch S is closed at time $t=0$. Find the current $i(t)$ through and voltage across the resistor and capacitor	5	CO2
4 (a)	At $t=0$, S is closed in the circuit of figure below find $V_c(t)$ and $I_c(t)$. All initial condition are zero.	5	CO3
(b)	In the series RLC circuit shown below. There is no initial charge on the capacitor. If the switch S is closed at $t=0$. Determine the resulting current.	5	CO3

- (a) Express the standard signal (or singularity functions) in mathematical and graphical forms. (5)
- (b) What do you mean by LTI system. Write its properties. (5)
- (b) What do you mean by LTI system. Write its properties. (5)

Q2 (a) Express the given waveforms by the standard signals. (6.5)



(b) For the current $I(t) = 5U(t-5) - 3e^{-2t}$, find $I(s)$ and hence to determine the value of $I(0^+)$ and $I(\infty)$. (6)

OR

Q3 (a) Find the Laplace Transform of the following signals: (6)

(i) $f(t) = 10U(t) - 5e^{-t} - 5e^{-t-4}$ (ii) $f(t) = e^{-at}t^2$

(b) Define GATE Signal and sketch the given signals using GATE signal: (6.5)

(i) $f(t) = (t-4)[u(t-1) - u(t-4)]$

(ii) $f(t) = Ktu(t) - K(t-1)u(t-1) - Ku(t-4)$

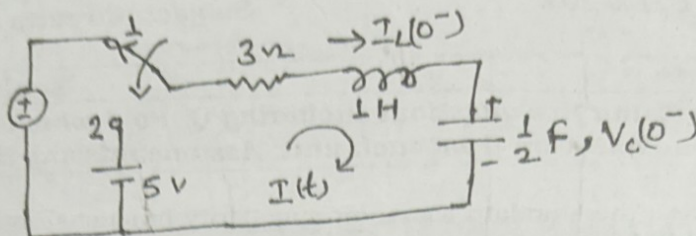
Q4 (a) Consider the differential equation $\frac{d^2y(t)}{dt^2} + \frac{3dy(t)}{dt} + 2y(t) = 5U(t)$

Where $U(t)$ is unit step function. The initial conditions are $y(0^+) = -1$ and

$\frac{dy(0^+)}{dt} = 2$. Determine $y(t)$ for $t \geq 0$. (6.5)

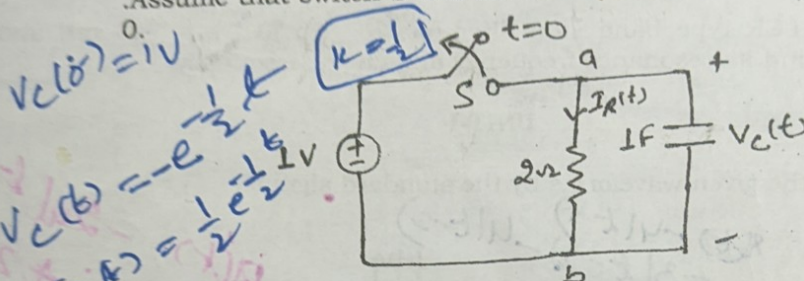
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(b) In the circuit shown in the figure switch K is moved from position 1 to position 2 at $t=0$. Find $i(t)$, if $I_L(0^-) = 2A$ and $V_C(0^-) = 2V$. (6)



OR

Q5 (a) Calculate the voltage, $V_C(t)$ and current $I_R(t)$ for $t \geq 0$ for figure shown. Assume that switch S was closed for a long time before being opened at $t=0$. (6.5)



Q.1 (a) What are even and odd signals? Explain with example. (2)

(b) What is LTI system. Describe its properties. (2)

(d) Find the Laplace Transform of the following functions: (2)

(i) $e^{-at} \cos \omega t$

(ii) $10U(t) - \delta(t) - 5\delta(t-4)$

$\frac{10}{s} - 1 - 5e^{-4s}$

Q.2 (a) Synthesize the given waveforms (fig.1 & fig.2) and find its Laplace Transform. (6)

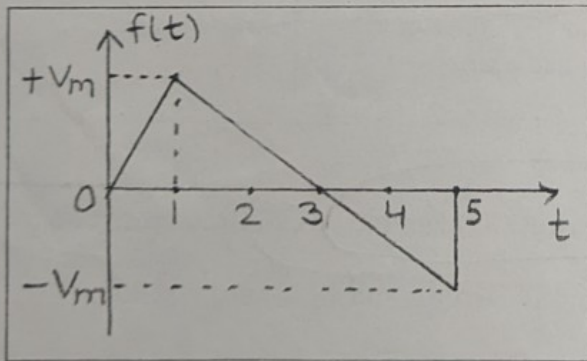


Fig.1

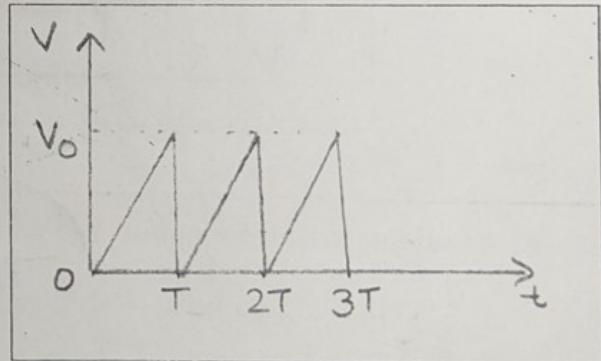


Fig.2

(b) Find $i(t)$ for $t > 0$ in the circuit of fig.4. switch is opened at $t=0$. (5)

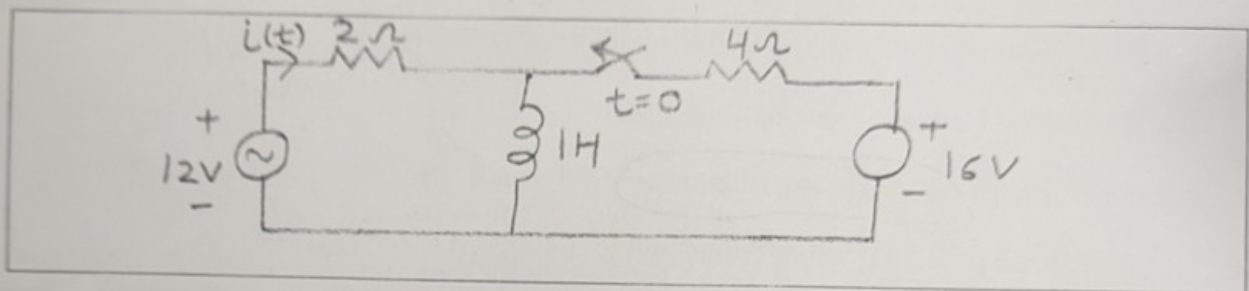


Fig.4

Q.4.(a) Synthesize the given waveform(fig.5) using standard signals. (5)

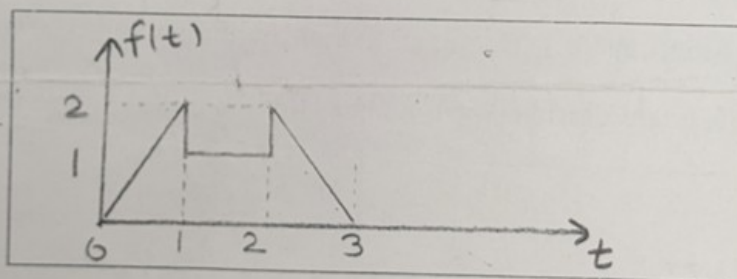
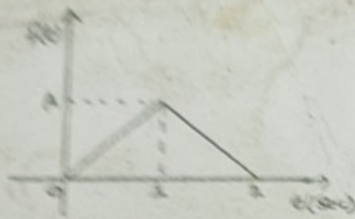


Fig 5

(b) A voltage pulse of magnitude 5V and duration of 3 seconds extending from $t=2$ to $t=5$ is applied to a series R-L circuit having $R=1$ ohm and $L=2$ henry. Find $i(t)$. Initially inductor is de-energized. (5)

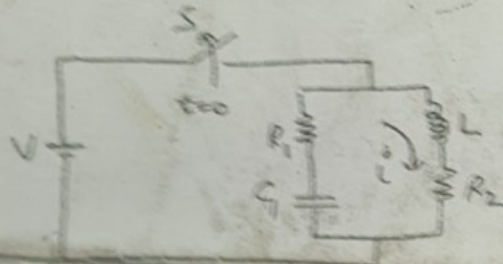
- Q1 (a) Obtain the Laplace transformation of $e^{-\alpha} \sin(\alpha t)$ and $1 - e^{-\alpha}$ where α is a constant. (5)

- (b) Synthesize the waveform (3)



And also draw its three waveform components.

- (c) The switch of the circuit is opened at $t=0$. Determine the current i' and its derivative at $t=0^+$. (5)



UNIT-I

- Q2 (a) Solve the differential equation $2\ddot{x} + 7\dot{x} + 6x = 1$ when $x(0) = 0$ and $\dot{x}(0) = 1$ (6)

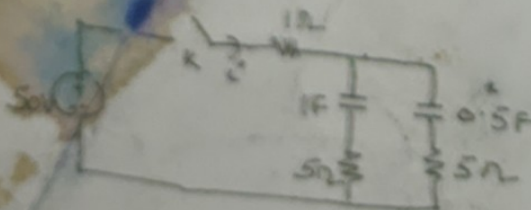
- (b) A function in Laplace domain is given by

$$I(s) = \frac{(s+1)}{s(s^2+4s+4)}$$

Obtain its inverse form.

(6.5)

- Q3 (a) Assume no initial charge on either of the capacitors and switch is closed at $t=0$, find $i(t)$. (6)



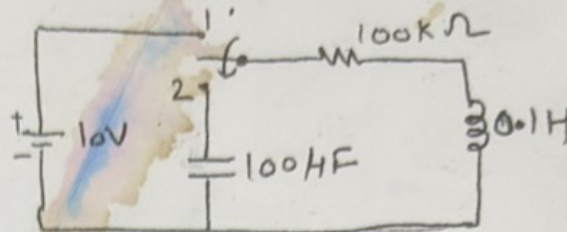
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(b) In the circuit, the switch is moved from position 1 to 2 at $t=0$.

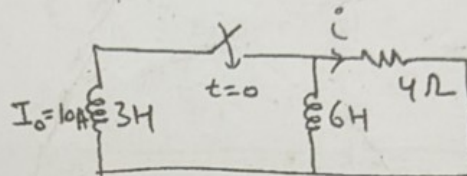
Determine i , $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t=0^+$

(6.5)



UNIT-II

Q4 (a) A 3-H inductor in the circuit of figure carries a 10-A initial current. The switch is closed at $t = 0$. Obtain the expression for i . (6)



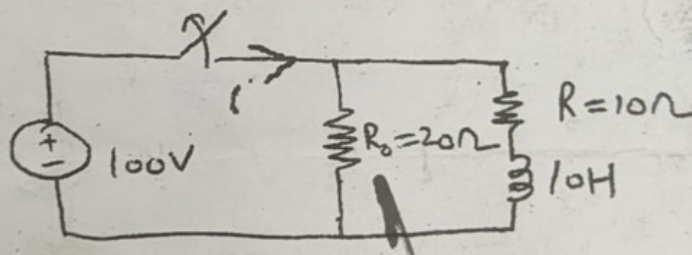
(b) For the network, find

(6.5)

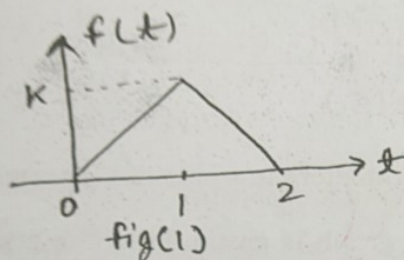
(i) Initial rate of current i just after switching.

(ii) Initial voltage across R_0 .

(iii) Voltage across the switch at the instant of separation.

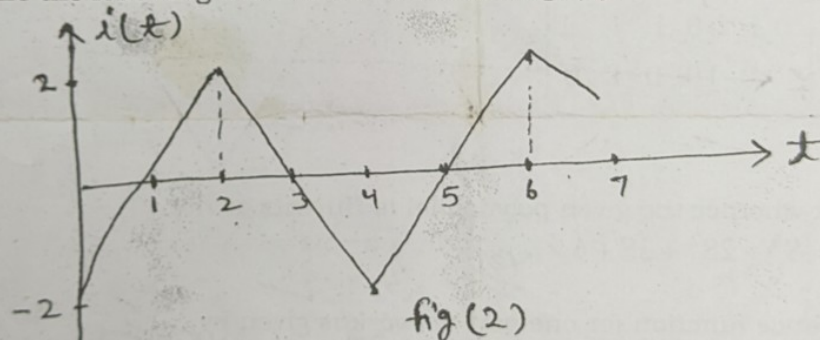


- (c) Explain mathematically convolution in time domain for Laplace Transform. (5)
 (d) Explain mathematically convolution in time domain for Laplace Transform. (5)
 (e) Synthesize the following waveform as shown in fig. (1) Using gate function.



42
57

Q2 (a) Synthesize the following waveform as shown in fig. (2). (6.5)



(b) Calculate the Laplace Transform of the periodic waveform as shown in above fig. (2) (6)

Q3 (a) Find the Laplace Transform of the given function, $f(t) = e^{-a(t+b)} U(t-b)$ (4.5)

(b) Determine whether or not each of the following signals is periodic. If a signal is periodic, specify its fundamental period. (8)

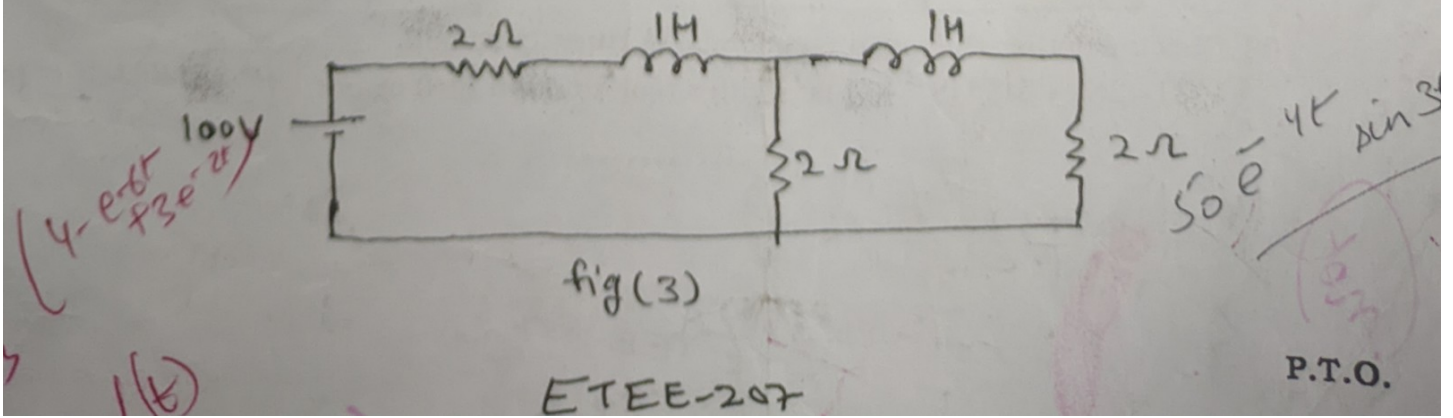
- (i) $x_1(n) = e^{j7\pi n}$ (ii) $x_2(n) = 3e^{j(3/5)(n+1/2)}$

150 (4) 2+9

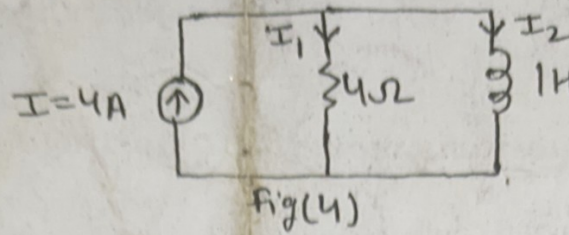
-4t cos(3/4t)

(b) In the given network as shown in fig (3), find the current.

(6.5)



- Q5 (a) Find the value of current in Series R-L-C Circuit with unit step response for over damped, critically damped, and under damped conditions. (6.5)
- (b) In parallel circuit as shown in fig.(4) Calculate the branch current. (6)



(a) LTI System and its properties

(6)