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ESC201 | **Mini-Quiz III** | **04/02/2025**

Total Marks: 5 | **Time: 10 minutes**

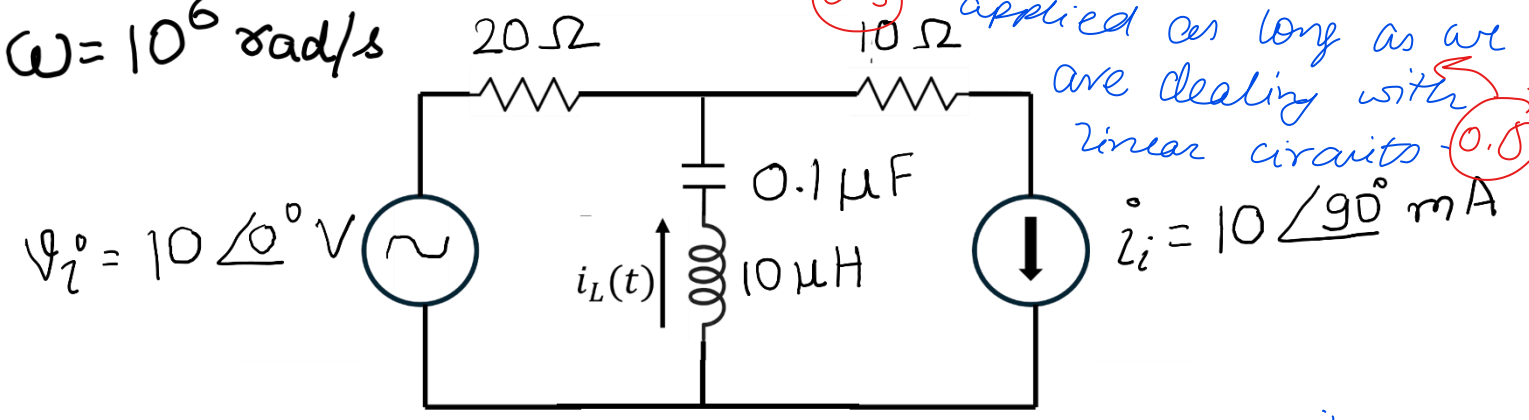
Instructions

- **Please write your name and roll number first.**
- **Read the question carefully and answer it in the question paper itself.**

1) For sinusoidal input sources, use the superposition principle and find the current through the inductor in the steady state. **(4 marks)**

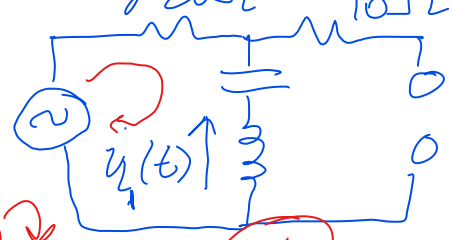
2) Can you still apply the superposition principle if the inputs are no longer sinusoidal but replaced by triangular pulses? If yes, why? If not, why? **(1 mark)**

→ Yes, Superposition can be applied as long as we are dealing with linear circuits (0.5) (0.5)



→ Considering only v_i ; i_i can be open circuited.

Eq. ckt. ⇒ (0.5)

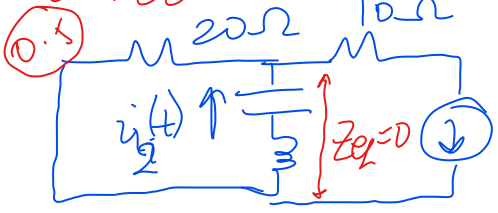


$Z_C = \frac{-j}{\omega C} = -j10$ (0.5)

$Z_L = j\omega L = j10$

$i_{L_1}(t) = \frac{-V_i}{Z_{eq}}$ (1) (0.5) $= \frac{-10\angle 0^\circ}{j10 + 20\,\Omega - j10} = -0.5\angle 0^\circ$ A

This -ve sign is important since it tells about initial phase of current through inductor in the given direction. → Eq. ckt only considering i_i (Shorting V_i)



(0.5) → "0" impedance means a short circuit ∴ i_i flows entirely through inductor ⇒ $i_{L_2}(t) = i_i = 10\angle 90^\circ$ mA (0.5)

∴ $i_L(t) = i_{L_1} + i_{L_2} = -0.5\angle 0^\circ + 0.01\angle 90^\circ$ A (0.5)