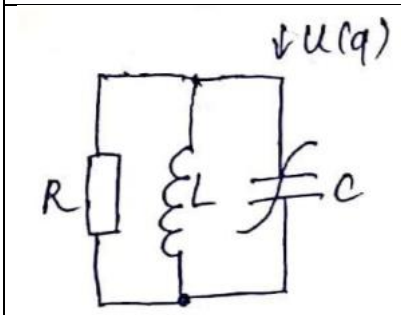
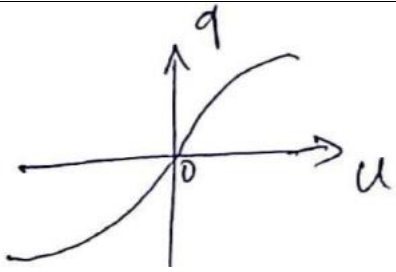
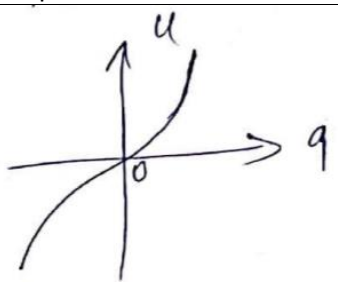
help for solving the problem…

case A

circuit	q(U) dependence	U(q) dependence
		

$$I_C = \frac{dq}{dt} \; ;$$

$$I_R = \frac{U(q)}{R} \; ;$$

$$U_R = U_L = U_C = U(q)$$

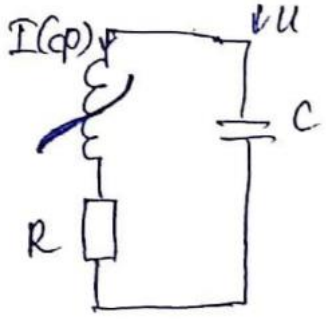
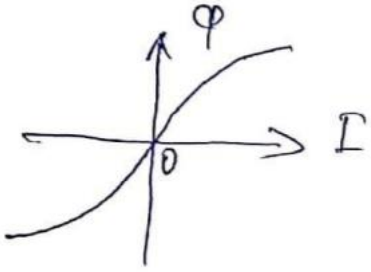
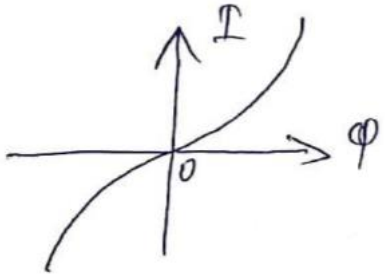
$$U(q) = U_L = L \cdot \frac{dI_L}{dt} \rightarrow \frac{dI_L}{dt} = \frac{U(q)}{L}$$

$$I_R + I_L + I_C = 0$$

$$\frac{U(q)}{R} + I_L + \frac{dq}{dt} = 0$$

→ Further, it is easy to obtain a differential equation in the known form of a nonlinear oscillator

case B

circuit	Φ(I) dependence	I(Φ) dependence
		

$$I(\varphi) = I_C = C \cdot \frac{du_c}{dt} \rightarrow \frac{du_c}{dt} = \frac{I(\varphi)}{C}$$

$$u_L + u_R + u_C = 0 \rightarrow \frac{d\varphi}{dt} + I(\varphi) \cdot R + u_C = 0$$

→ Further, it is easy to obtain a differential equation in the known form of a nonlinear oscillator