

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT
EE-201 ELECTRIC CIRCUITS
Dr. Ibrahim O. Habiballah

Design of A Flashing Light

Flashing lights are used in many practical applications such as the flashing light in a still camera or as a warning for hazards in tall antenna towers, construction sites, and secure areas. In order to design a circuit that produces a flashing light, electrical engineers must know the requirements of the application.

A flash light typical circuit is shown in Fig. 1. The lamp in this circuit starts to conduct whenever the lamp voltage reaches a value V_{max} . During the time the lamp conducts, it can be modeled as a resistor whose resistance is R_L . The lamp will continue to conduct until the lamp voltage drops to the value V_{min} . When the lamp is not conducting, it behaves as an open circuit

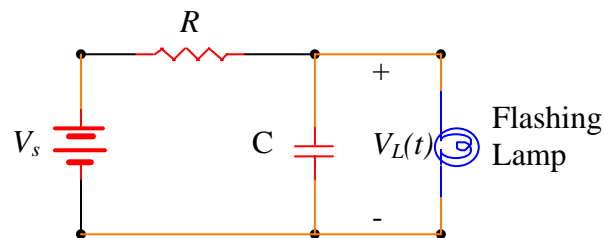


Fig. 1 Typical flashing light circuit

When the lamp behaves as an open circuit, the dc voltage source V_s will charge the capacitor via the resistor R toward a value of V_s volts. However, once the lamp voltage reaches V_{max} , it starts conducting and the capacitor will start to discharge toward the Thevenin voltage seen from the terminals of the capacitor. But once the capacitor voltage reaches the cutoff voltage of the lamp V_{min} , the lamp will act as an open circuit and the capacitor will start to recharge. This cycle of charging and discharging the capacitor is summarized in the sketch shown in Fig. 2.

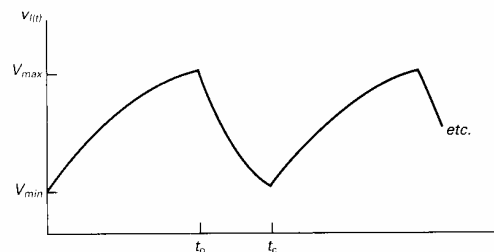


Fig. 2 Charging and discharging of the capacitor C

In Fig. 2, let $t = 0$ at the instant the capacitor starts to charge. The time t_o represents the instant the lamp starts to conduct, and t_c is the end of a complete cycle. It should be noticed that in constructing Fig. 2, it is assumed that the circuit has reached the repetitive stage of its operation. The design of the flashing light circuit requires developing the equation for $V_L(t)$ as a function of V_{\max} , V_{\min} , V_s , R , C , and R_L for the intervals 0 to t_o and t_o to t_c .

In this design problem, it is required to design a flashing light by selecting the proper components to meet the specific requirements listed below.

Component	Size	Cost for Each (SR)
R	1 KOhm	0.50
R	100 Ohm	0.25
C	50 μ F	2.50
C	10 μ F	1.50
DC Battery	250 V / 250 KWh	500.00
DC Battery	100 V / 80 KWh	200.00

The flashing lamp can be modeled as 1.3 Kohm resistor when it is conducting. Assume that the source voltage V_s is 1000 V, $V_{\max} = 900$ V, $V_{\min} = 300$ V.

Design a flashing lamp that flashes (15 + serial no.) times per minute. Calculate the annual cost of the flashing lamp and show all the required calculations in detail.

Due Date January 3rd 2004.