Answer on Question #40692, Physics, Electrodynamics

There are two capacitors A and B of capacitance 4μF and 6μF respectively. Their breakdown voltages are 300 V and 250 V respectively. If they are connected in series, the maximum potential difference which can be applied on their combination will be :-

(1)400 V (2)450 V (3)500 V (4)550 V

Solution

The maximum charge that can be in the capacitor A:

$$Q_{AMAX} = C_A V_{AMAX} = 4 \cdot 10^{-6}\text{F} \cdot 300\text{ V} = 1.2\text{ mC}.$$

The maximum charge that can be in the capacitor B:

$$Q_{BMAX} = C_B V_{BMAX} = 6 \cdot 10^{-6}\text{F} \cdot 250\text{ V} = 1.5\text{ mC}.$$

When capacitors are connected in series their charges are equal. The maximum charge that can be in any capacitor is

$$Q_{MAX} = Q_{AMAX} = 1.2\text{ mC}.$$

The maximum potential difference which can be applied on the capacitor A:

$$V_A = \frac{Q_{AMAX}}{C_A} = 300\text{ V}.$$

The maximum potential difference which can be applied on the capacitor B:

$$V_B = \frac{Q_{AMAX}}{C_B} = \frac{1.2\text{ mC}}{6 \cdot 10^{-6}\text{F}} = 200\text{ V}.$$

The maximum potential difference which can be applied on their combination will be

$$V = V_A + V_B = 300\text{ V} + 200\text{ V} = 500\text{V}.$$

Answer: (3) 500 V.