

Capacitors and Capacitance Assignment 2

Question 1

A parallel plate air capacitor has plate area 0.2 m^2 and has separation distance 5.5 mm . Find

- (a) Its capacitance when capacitor is charged to a potential difference of 500 volts
- (b) Its charge
- (c) Energy stored in it
- (d) Force of attraction between the plates

Question 2

Consider a system of capacitors where two parallel plate air capacitors each of capacitance C are connected in series to a battery of EMF ξ . Now one of the capacitor is filled uniformly with a dielectric of dielectric constant K . What would happen to electric field strength of that capacitor and what would be the change in electric field strength? Calculate the amount of charge that flows through the battery?

Question 3

A spherical capacitor has charges $+Q$ and $-Q$ on its inner and outer conductors. Find the electric potential energy stored in the capacitor?

Question 4

Find the capacitance of an isolated spherical conductor of radius r_1 surrounded by an adjacent concentric layer of dielectric with dielectric constant K and outside radius r_2 .

Question 5

In a parallel plate air capacitor having plate separation 0.05 mm , an electric field of $4 \times 10^4 \text{ V/m}$ is established between the plates. After the removal of the battery a metal plate of thickness $t = 0.02 \text{ mm}$ is inserted between the plates of the capacitor. Find

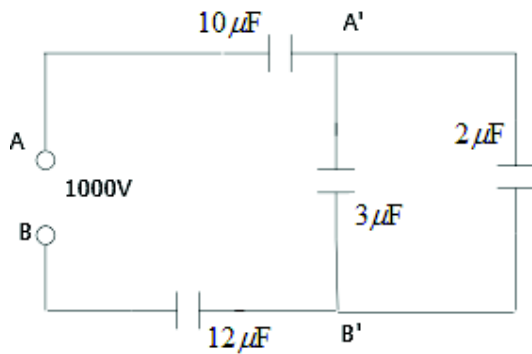
- (a) Potential difference across capacitor before the introduction of metal plates.
- (b) Potential difference across capacitor after the introduction of metal plates.
- (c) Potential difference across capacitor if dielectric slab with dielectric constant $K=3$ and same thickness were inserted in place of metal plate.

Question 6

Find the capacitance of four parallel plates each of area $A \text{ m}^2$ and separated by a distance d_1 , d_2 , and d_3 . The space between them is filled with dielectrics of relative permittivity ϵ_1 , ϵ_2 and ϵ_3 . Permittivity of free space is ϵ_0 .

Question 7

Consider the figure given below



- (1) Find the equivalent capacitance between A and B
- (2) Find the potential difference between 3 μF capacitor
- (3) Find the amount of charge on 2 μF capacitor
- (4) Find the energy stored on 12 μF capacitor

Question 8

Two parallel plate condensers A and B having capacities 2 μF and 10 μF are charged separately to the same potential of 200V. Now, positive plate of A is connected to negative plate of B and the negative plate of A is connected to positive plate of B.

- (1) Calculate the equivalent capacitance and the common voltage of combination A-B.
- (2) Find the loss in electrical energy in each condenser.

Question 9

The plates of a parallel plate capacitor are separated by a dielectric whose relative permittivity varies according to following relation

$$\epsilon_r = \frac{1}{1 + \frac{x^2}{d^2}}$$

Find the capacitance of the capacitor.

