The value of a capacitor

Science, Physics

A capacitor is constructed as two plane parallel square plates with an area of 20cm* 20cm and a 5. 0mm separation. It is mounted in a vertical plane (with the top plate edges horizontal) and used to measure the depth of liquid in a tank, which is allowed to fill the space between the plates to a variable extent, the rest being filled with air.

If the liquid is methanol with a relative permittivity of 33, calculate the maximum and minimum values of the capacitance, corresponding to the extreme liquid levels, and the value when the gap is half-full.

C= ἐA/d

C- Capacitance in Farads

Ἑ= permittivity of dielectric (absolute, not relative)

A= Area of plate overlap in square meters

D= distance between plates in meters

A= 20*20= 400cm2/10000= 0. 04

D= 5mm

Ἑ= 33

C= 33* (0. 04)/(5/1000)

= 33*0. 04*1000/5

= 33*40/5

C= 264

(c). To avoid rapid indicator fluctuations if the liquid is agitated when half-full, a time constant for charge/discharge of about 10s is required. What should be the series resistance of the electrical supply to the capacitor?

C= 264

V= 10s

= 264/10

= 26. 4m/s

9. State Faraday’s laws of electromagnetic induction. A flux of 30mwb links with a 1200 turn coil when a current of 5. 0 A is passing through the coil. Calculate:

Faraday’s law of induction is a law of electromagnetism which predicts how a magnetic field interacts with electric circuits to generate an electromotive force.

(a) The inductance of the coil:

Magnetic flux, = 30mWb= 30*10-6Wb

A= 30

= 30/5

= 30/5

= 6mT

(b) The energy stored in the magnetic field;

I= 5. 0A N= 1200 l= 30mwb

H= NI/l= 5*1200/30

= 6000/30= 200

H= 200AT/m

(c) The average e. m. f if the current is reduced to zero in 0. 20s.

E= Blv= (1. 25)(300/1000)4

= 1. 5

= 1. 5/0. 2

= 7. 5V

10. (a). Explain the basic operating principle of a generator. With the aid of a

sketch, describe what is meant by a shunt-wound generator.

A generator is basically a machine that has the ability to convert mechanical energy into electrical energy. We have two types of generators depending on the types of electric current they produce. We have either direct current (DC) or alternating current (AC) generators. These two types of generators have differing construction details but the basic principle on the way they work is similar.

Shunt-wound generator or Penjana Piran is a type of generator where field winding is connected parallel to the armature thus creating a relatively high resistance making the current carried to be only a fraction of the armature current.

(b). A 250 V d. c. the shunt-wound generator has an armature resistance of 0. 10Ω. Determine the e. m. f generated for a power output of 50KW, neglecting the field current of the generator.

Load current, I= 50000watts/250= 200A

V= 250 volts

I= 250/0. 10= 2500

Generated e. m. f E= V+IR

= 250+2500(0. 10)

= 250+250

= 500V