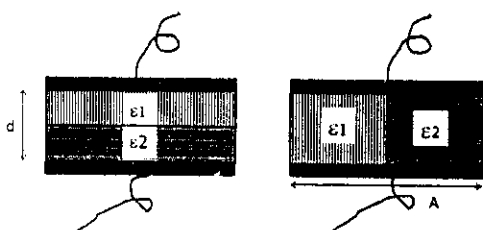


BACHELOR OF SCIENCE EXAMINATION, 2018

(2nd year, 1st semester)

PHYSICS(subsidiary) ---- Paper - SO5**Time : TWO Hours****ANSWER ANY FIVE QUESTIONS****Full Marks : 50**

1. (a). What is a 'polar' molecule? Give examples. What happens when it is placed in an electric field?
 (b). Write Gauss's law for dielectric materials.
 (c). A parallel plate capacitor, with distance between plates 'd' and area of each plate 'A' is filled with 2 dielectrics of dielectric constant ϵ_1 and ϵ_2 as shown in figure below. Calculate the capacitance in each case. (3+2+5)



2. (a) Is there a relation between dielectric constant and electronic polarizability? Explain why?
 (b) Write the essential difference between a conductor, an insulator and a dielectric material.
 (c) Calculate the electronic polarizability of a mica atom if the relative permittivity of mica at NTP is 6.0. (3+3+4)
3. (a) Determine the self inductance of a coaxial cable of inner radius 'a' and outer radius 'b'.
 (b) What is meant by self inductance? What is the unit of inductance? (3+7)
4. (a) Explain how an L-C circuit produces oscillations. What is the frequency of oscillation?
 (b) A $1.5 \mu\text{F}$ capacitor is charged to 57 V, the battery is then disconnected and a 12 mH coil is connected in series with the capacitor so that LC oscillations occur. Assuming the resistance to be negligible, what is the maximum current in the coil? (5+5)
5. (a) Draw a schematic diagram showing propagation of an electromagnetic wave.
 (b) Find an expression for the velocity of electromagnetic waves using Maxwell's equations.
 (c) Write down Maxwell's equations in free space. (2+6+2)
6. (a) An inductor of very low resistance is suddenly connected, in parallel, to a fully charged capacitor. Show that the charge on the capacitor will decay in an oscillatory manner. Find out the frequency of this oscillation.
 (b) Find out the value of that frequency at $R=0$. (7+3)
7. Write notes on (any 2):
 i) Mutual inductance
 ii) Parallel resonant circuit
 iii) Forced oscillations (5+5)