PH 202 Course coordinator/ Instructor**: Alika Khare**

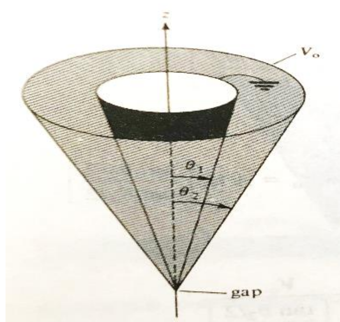
Problem Set no. II **Due date: Monday, Jan 25, 2024**

Note: Please submit the solutions of at least two of the problems, on Thursday, Jan 25, 2024, during the class. The solutions can be submitted in a group of maximum of four students. Name and Roll no. of all the group members should be written clearly on the top. If solutions are found to be reasonably correct then 10 marks (five marks each) will be awarded and in case of non submission/wrong solution zero marks.

1. A rectangular pipe, running parallel to the z-axis (from $-\infty$ to $+\infty$), has three grounded metal sides, at $x = 0$, $x = b$, and $y = 0$. The potential on the fourth side, at $y = a$, is given by $V_o(x,a) = 2sin\left(\frac{\pi x}{b}\right) + \frac{1}{10} sin\frac{5\pi x}{b}$, for $0 \leq x \leq b$.
   i. State all the boundary conditions clearly.
   ii. Starting form Laplace's equation, work out the potential inside the pipe.
   iii. Workout the electric field on all the four surfaces of the pipe.

2. Two concentric spherical shells of radii of curvature 10 cm and 30 cm are maintained at a potential difference of 100V. The outer shell is gounded and inner shell is maintained at a potential of 100 V. Find the potential and the electric field in between the shells.

3. Two conducting cones at $\theta_1 = \pi/10$ and $\theta_2 = \pi/6$ having an infinitesimally small hole at r=0 as shown below in the figure such that these are insulated with each other. The inner cone is maintained at 0 potential whereas the outer one at 50 V. Find V and **E** in between the cones.



4. The surface of the spherical shell of radius R carries a surface charge density $\sigma(\theta)$, dependent on θ only. Work out the expression for potential inside as well as outside the sphere.

5. A spherical shell of radius R carries a uniform surface charge density σ_o on the northern hemisphere and that of $-\sigma_o$ on the southern hemisphere. Find the potential inside as well as outside the shell.

6. A metallic sphere of radius R is maintained at a constant potential of V_o. calculate the potential outside the sphere.