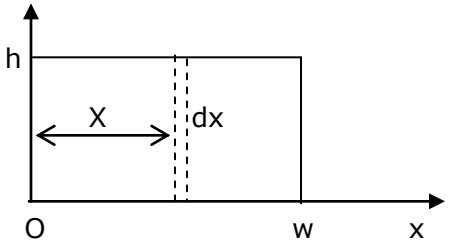
Q- A non uniform electric field is given by the expression E = *ayi* + *bzj* + *cxk,* where *a, b,* and *c* are constants. Determine the electric flux through a rectangular surface in the *xy* plane, extending from *x* = 0 to *x* = w and from *y=0 to y=h.*

The flux through a surface is given by the scalar product of the field strength and the area of the surface.

As the rectangular surface is in xy plane the flux corresponding to x and y component of field will be zero (parallel to the surface) and the flux through the surface is only due to z component of the field. The z component of the field is varying with x only and directly proportional to x coordinate.

Consider an infinitely thin strip of the surface at a distance x from y axis of thickness dx as in figure. Field at this strip will have magnitude c*x and will be normal to the surface hence the flux through this strip will be given by

$d\phi$ = field*area
or $d\phi$ = (c*x)(h*dx) = c h x*dx



Hence flux through the whole rectangle will be

$$\phi = \int d\phi = \int_0^w chx * dx = ch\int_0^w x * dx = \frac{c * h * w^2}{2}$$