Question 11

Q: How to calculate the charge accumulating on the electrodes?

A: Using the equation, Q=CV, the charge, Q, can be obtained by multiplying the calculated capacitance, C, by a difference of electric potential, V.
Alternatively, integrating electric flux density over the area will give a charge.

Please refer to the next slide for more information.

Additional Information

・Apply as follows:

    Boundary conditions: 1 [V] and 0 [V],

    Relative permittivity, ε_r: 10,

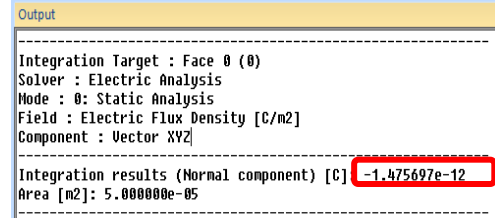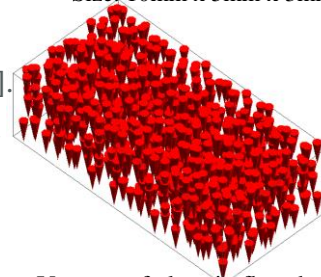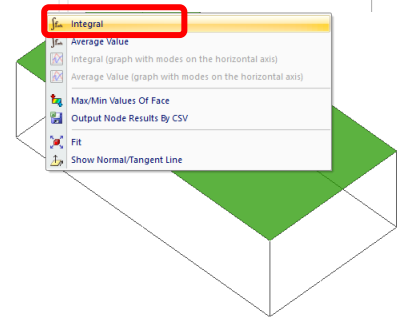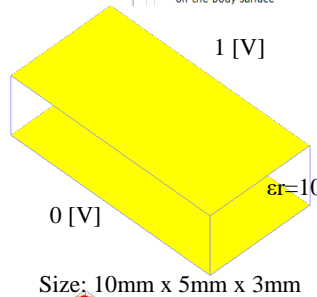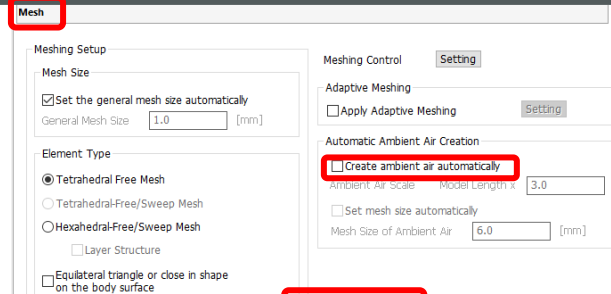   Size of capacitor: 10 mm x 5 mm x 3 mm.

・Deselect [Create ambient air automatically].

・Femtet's solver calculates to give C of 1.476 [pF].

・The charge accumulated on one electrode is calculated as follows.

    Q=CV=1.475e-13*1=1.476 [pC]

・Alternatively, the charge on the electrode can be calculated by integrating electric flux on the electrode by area. In this example, select the surface of one electrode and the integration will give the value of 1.476 [pC]. This is consistent with the theoretical value.

1 [V]

$\varepsilon_r=10$

0 [V]

Size: 10mm x 5mm x 3mm

Vectors of electric flux density

Mesh

Meshing Setup

Mesh Size

☑ Set the general mesh size automatically

General Mesh Size   1.0   [mm]

Element Type

◉ Tetrahedral Free Mesh

○ Tetrahedral-Free/Sweep Mesh

○ Hexahedral-Free/Sweep Mesh

  ☐ Layer Structure

☐ Equilateral triangle or close in shape on the body surface

Meshing Control   [Setting]

Adaptive Meshing

☐ Apply Adaptive Meshing   [Setting]

Automatic Ambient Air Creation

☐ Create ambient air automatically

Ambient Air Scale   Model Length X   3.0

☐ Set mesh size automatically

Mesh Size of Ambient Air   6.0   [mm]

f_x **Integral**

f_x Average Value

Integral (graph with modes on the horizontal axis)

Average Value (graph with modes on the horizontal axis)

Max/Min Values Of Face

Output Node Results By CSV

Fit

Show Normal/Tangent Line

Output

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------------------------------------------------------------
Integration Target : Face 0 (0)
Solver : Electric Analysis
Mode : 0: Static Analysis
Field : Electric Flux Density [C/m2]
Component : Vector XYZ
------------------------------------------------------------
Integration results (Normal component) [C]  -1.475697e-12
Area [m2]: 5.000000e-05
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