# Vamos estudar a Lei de Coulomb

Instruções:

a) Execute cada bloco de codigo e entenda cada linha de comando.

b) Realize as atividades ao final.

Aluno :

In [1]:
```
import numpy as np  # Para mais detalhes https://numpy.org/
import matplotlib.pyplot as plt # Para mais detalhes https://matplotlib.o
```

In [2]:
```
ri = 0.
rf = 5.
dr = 0.1
r = np.arange(ri,rf,dr)
print(r)
```

```
[0.  0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.  1.1 1.2 1.3 1.4 1.5 1.6 1.
7
 1.8 1.9 2.  2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.  3.1 3.2 3.3 3.4 3.
5
 3.6 3.7 3.8 3.9 4.  4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9]
```

In [3]:
```
r = np.arange(ri,rf+dr,dr)
print(r)
```

```
[0.  0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.  1.1 1.2 1.3 1.4 1.5 1.6 1.
7
 1.8 1.9 2.  2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.  3.1 3.2 3.3 3.4 3.
5
 3.6 3.7 3.8 3.9 4.  4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5. ]
```

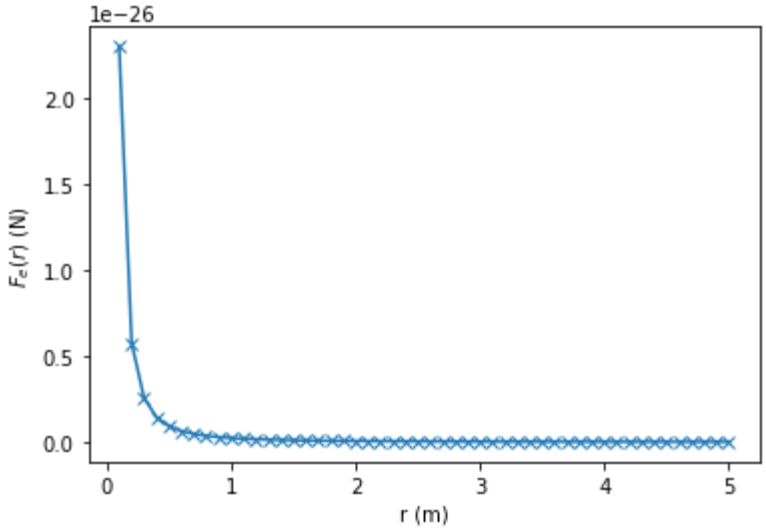
In [4]:
```
def F_e(r,q1,q2):
    k = 9*10**9
    e2= (1.6*10**(-19.))**2
    return k*q1*q2*e2/(r**2)
```

In [5]:
```
q1 = -1. # carga q_1
q2 = -1. # carga q_2

plt.plot(r,F_e(r,q1,q2),'-x')
plt.xlabel(r'r (m)')
plt.ylabel(r'$F_{e}(r)$ (N)')

plt.show()
```

```
/tmp/ipykernel_46355/2413256222.py:4: RuntimeWarning: divide by zero en
countered in true_divide
  return k*q1*q2*e2/(r**2)
```

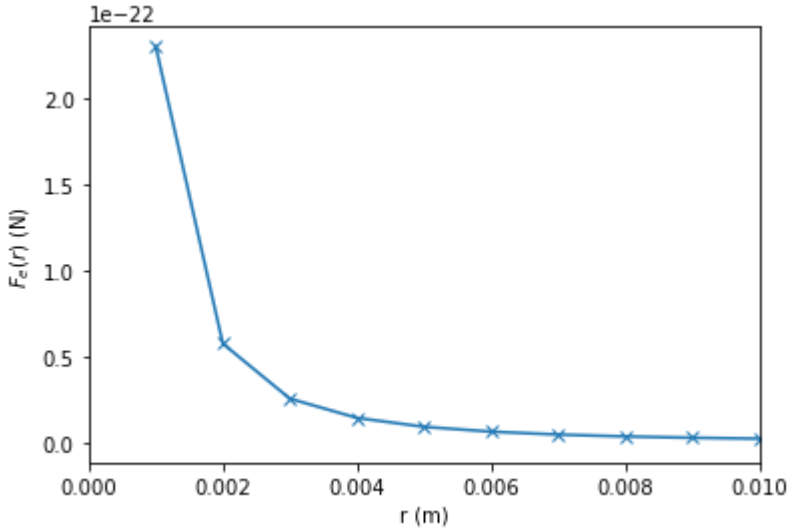



In [6]:
```
# Corrija o erro da divisao por zero:
ri = 0.001
dr = 0.001
rf = 5.
r = np.arange(ri,rf+dr,dr)
print(r)
```

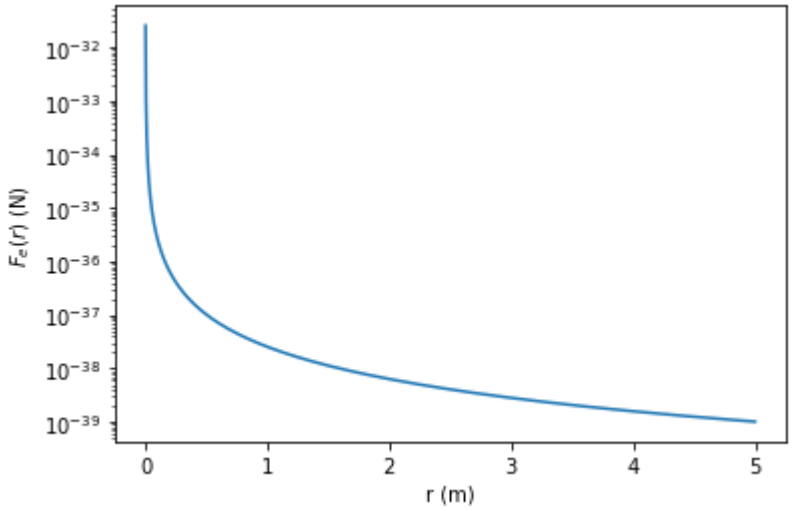
```
[1.000e-03 2.000e-03 3.000e-03 ... 4.998e+00 4.999e+00 5.000e+00]
```

In [7]:
```
q1 = -1. # carga q_1
q2 = -1. # carga q_2

plt.plot(r,F_e(r,q1,q2),'-x')
plt.xlabel(r'r (m)')
plt.ylabel(r'$F_{e}(r)$ (N)')
plt.xlim(0,0.01)
plt.show()
```




In [8]:
```
plt.plot(r,F_e(r,q1,q2)/(9*10**9),'-')
plt.xlabel(r'r (m)')
plt.ylabel(r'$F_{e}(r)$ (N)')
plt.yscale('log')
plt.show()
```




# Copie e cole o necessario dos codigos acima e gere os graficos para responder as perguntas

1) Varie o sinal das cargas q1 e q2 e analize o resultado na figura

R:

In [ ]:

2) Imagine uma carga dez vezes maior q1=10*q2 e gere um novo grafico. Analize o resultado

R:

In [ ]:

Type *Markdown* and LaTeX: $\alpha^2$

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In [ ]: