

# ELEC 4705 - Test 3

Nov. 9th 2018

Student Name:

Student Number:

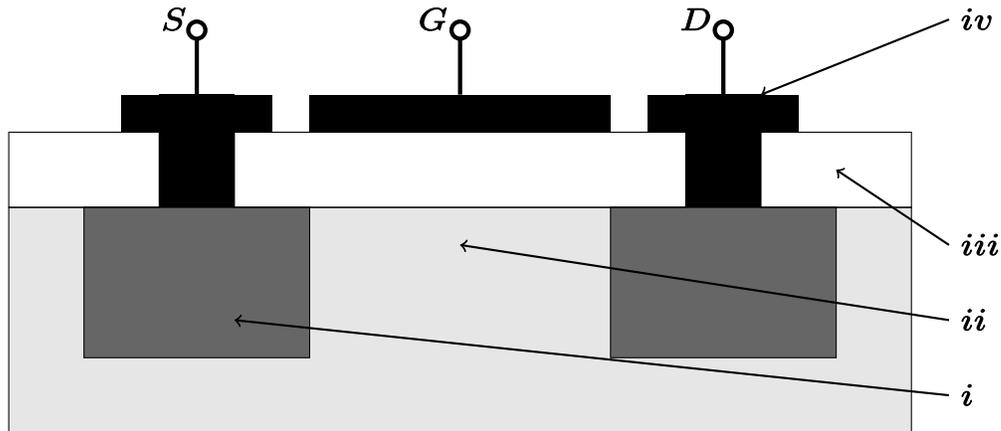
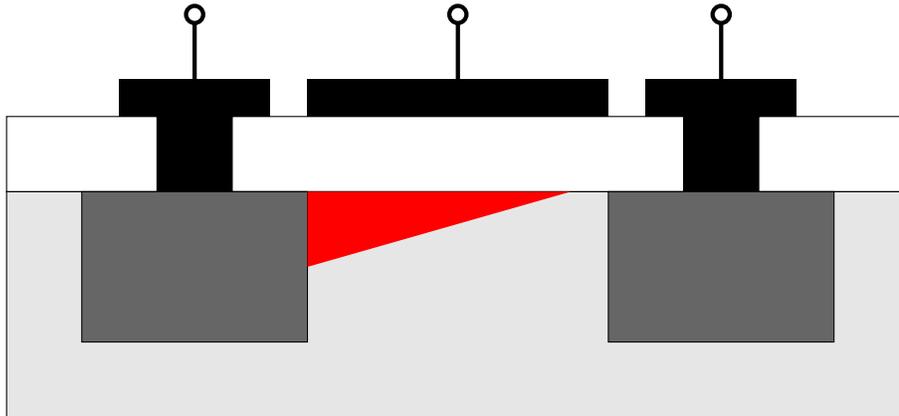


Figure 1 An off MOSFET

1) (6 points) Figure 1 shows an NPN MOSFET in the "off" mode. Describe what the dark gray (*i*), gray (*ii*), white (*iii*), and black (*iv*) components are.

- i. Heavily doped N region
- ii. Doped P region
- iii. Oxide insulation
- iv. Metal contacts for gate, source, and drain

2) (6 points) Redraw the mosfet shown in Question 1 operating in saturation mode. Describe what is happening and why it is called saturation.



The channel has formed underneath the gate, and pinch-off has occurred, limiting the current, thus putting it in saturation mode.

3) (4 points) What enables optical fibers to confine light? Describe the structure, and explain how a monomode fiber might be made.

Light is confined by the difference in the index of refraction of the core compared to the cladding.  $n_{core} > n_{clad}$ . A monomode fiber is then made by using a cladding that is much thicker than the diameter of the core.

4) (3 points) Give 3 examples of ways in which fiber optics are superior to copper.

Fiber optics are 1) lighter, 2) cheaper, 3) have less attenuation over greater distances, 4) are EMI impervious, and 5) are much faster (speed of light vs speed of electron in metal)

5) (2 points) In a laser, what type of emission provides the photon amplification?

Amplification is a result of stimulated emission

6) (6 points) In a semi-conductor laser, special doping is done to make the type of emission described in Question 5 possible. What is this doping doing? Describe it and show how it might look on a band diagram.

The doping is done to provide traps that inhibit spontaneous emission, thereby making pumping possible. This looks as follows on a band diagram.

