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|  | **PHYS 102 General Physics II – Midterm II****April 18, 2016 Wednesday 19:00 -20:30** |  |

**Please read!**

* Count to make sure that there are 5pages in the question booklet
* Check your name and surname on front page, and student ID number on each page, and sign each page.
* This examination is conducted with closed books and notes.
* Put all your personal belongings underneath your seat and make sure that pages of books or notebooks are not open.
* Absolutely no talking or exchanging anything (like rulers, erasers) during the exam.
* You must show all your work to get credit; you will not be given any points unless you show the details of your work (this applies even if your final answer is correct!).
* Write neatly and clearly; unreadable answers will not be given any credit.
* If you need more writing space, use the backs of the question pages and put down the appropriate pointer marks.
* Make sure that you include units in your results.
* Make sure that you label the axis and have units in your plots.
* You are not allowed to use calculators during this exam.
* Only the answers in the boxes will be graded and NO partial credit will be given. No points will be given to unjustified answers. Incomplete calculations will not be graded.

**P102\_Index:**

**1- (25 pts)** Consider the DC circuit shown in the figure. Determine the final value of the charges in each capacitor separately for the case when

(a) the switch *S* is open (as in the figure) and a long time passed, and

(b) the switch *S* is now closed and a long time has passed in this setting.

Note: *micro* means *1/1000000* and *kilo* means *1000*; give numerical values, do not forget to include the units.

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|  (a)  = =(b)  = =  |

**2- (25 pts)** At the instant shown in the figure, an electron and a proton are moving in perpendicular paths with the same speed *v*. Find the total electric and magnetic force (vector) the electron exerts on the proton at this instant. Denote the charge for electron and proton by *-e* and *e*, respectively.

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Only the answers in the boxes will be graded and NO partial credit will be given. No points will be given to unjustified answers. Incomplete calculations will not be graded.



**3- (25 pts)** Consider a wire segment of length , which carries a steady current , as shown in the figure. For the coordinate system given in the figure answer the following questions:

(i) Express the length element at point in terms of the unit vectors and the differential displacements of the coordinate system.

(ii) Express the vector from point to point in terms of the unit vectors and the coordinates of and . Calculate the magnitude of .

(iii) Calculate the cross product .

 (iv) Calculate the magnetic field at point using the law of Biot-Savart. You may use the following indefinite integral in your calculation:

(v) Using your answer to (iv), calculate the magnetic field at the center of a ring of radius carrying a steady current . (Hint: A circle can be obtained from an -sided regular polygon as .)

**4- (25 pts)** Four very long current-carrying wires (I=3 A) in the same plane intersect to form a square, as shown in the Figure. Find the magnitude and the direction of the net magnetic fields at points A, B, C and D.

 Magnitude Direction

Point A:

Point B:

Point C:

Point D