Physics 2220
Spring 2006
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SECOND MIDTERM

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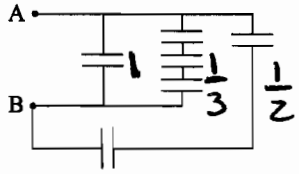
Name: Solution Student ID #:

Discussion Instructor (circle): Barcikowski El-Gendy Johnson Rodriguez

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES! 5 Points Each
Use the conversion constants and data given on the front page.

(a) Calculate the equivalent capacitance between A and B if all capacitors have the same value, C.

$$1 + \frac{1}{2} + \frac{1}{3} = \frac{11}{6}C = \boxed{1.833C}$$



(b) Calculate the term involving x^6 using the binomial expansion for the expression $(1-x^2)^{5/2}$. Calculate a number or fraction for the coefficient. third term because x^2 is inside Parentheses

$$(1-x^2)^{5/2} = \frac{\frac{5}{2}\left(\frac{5}{2}-1\right)\left(\frac{5}{2}-2\right)(x^2)^3}{3!} = \frac{5\cdot 3\cdot 1}{2\cdot 2\cdot 2\cdot 2}x^6 = \boxed{\frac{5}{16}}x^6$$

(c) Calculate the current density in a copper wire with a total current of 110 Amp if the wire is circular with a diameter of 2.25 mm.

$$A = \pi r^2 = \pi(.001125)^2 = 3.976\times10^{-6}\ m^2$$

$$J = \frac{I}{A} = \frac{110}{3.976\times10^{-6}} = \boxed{27.7\ \frac{MA}{m^2}}$$

(d) An electric potential has the form $V = Ax^4y^2z^3$, where A is a constant. Calculate the x-component of the electric field.

$$E_x = \frac{\partial}{\partial x}V = \boxed{-4Ax^3y^2z^3}$$

(e) Two capacitors of values 2.00 μF and 4.00 μF, are in series as shown. The battery is 155 V. What is the energy stored in the combination of capacitors?

$$U = \frac{1}{2}CV^2 = \frac{1}{2}\left(1.33\times10^{-6}\text{F}\right)(155\text{V})^2 = \boxed{1.60\times10^{-2}\text{ J}}$$