فيزياء هندسيه (١)
العام الدراسى ٢٠١٥ / ٢٠١٦
الفصل الدراسى الاول

جامعة كفر الشيخ
كليه الهندسة
قسم الفيزيقا و الرياضيات الهندسية
الفرقة الاعدادية

يناير 2016
امتحان نهاية الفصل الدراسى الاول
الزمن: 3 ساعات

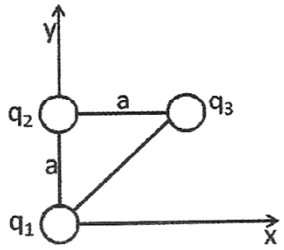
فيزياء هندسيه (1)

$(\epsilon_0 = 8.8 * 10^{-12}\ C^2/Nm^2)$ $(Y_{steel} = 20 * 10^{10}\ N/m)$ $(P_{atm} = 1.01 * 10^5\ Pa)$ $(\rho_{water} = 1000\ Kg/m^3)$

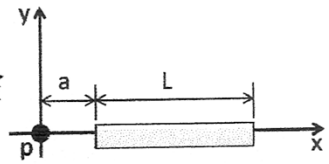
(20 درجه)

(1) (أ) اوجد القوه المحصله التى تؤثر على الشحنه q_3 كما فى الشكل:

$q_1 = q_3 = 5\ \mu c$, $q_2 = -2\ \mu c$, $a = 0.1\ m$



(ب) اوجد المجال الكهربى عند النقطه P تبعد مسافه a عن قضيب مشحون بشحنه Q و طول القضيب L كما فى الشكل التالى:



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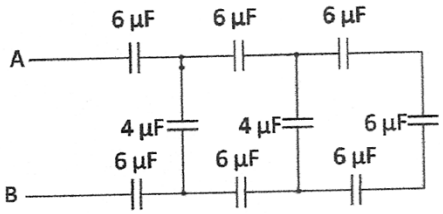
(2) (أ) مكعب طول ضلعه 80 cm مركزه نقطه الاصل. اوجه المكعب توازى المستويات الاساسيه . شحنه قيمتها 170 μC موضوعه فى مركز المكعب . احسب الفيض خلال وجه واحد من اوجه المكعب.

(ب) شحنه $q_1 = 2\ \mu C$ تقع فى نقطه الاصل، و شحنه $q_2 = -6\ \mu C$ تقع على محور y فى نقطه احداثياتها (0,3) اوجد الجهد الكهربى عن نقطه P احداثياتها (4,0)

(25 درجه)

(ج) اوجد السعه المكافئه بين النقطتين A , B لمجموعه المكثفات الموضحه بالشكل التالى :



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(3) (أ) بندول بسيط يتحرك حركه توافقيه بسيطه حسب العلاقه $X(t) = 15 \cos(6t)$

(20 درجه)

حيث الازاحه بالسنتيمتر و الزمن بالثانيه. اوجد ازاحه الجسم و سرعه الجسم عند زمن قدره 25 S

(ب) مصدر تردده 500 Hz يصدر موجات بطول موجى 0.2 m احسب الزمن الذى تحتاجه هذه الموجات لتقطع مسافه 300 m

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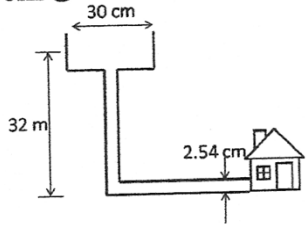
(4) (أ) ارسم (منحنى الاجهاد – الانفعال) مبينا اهم النقاط عليه

(25 درجه)

(ب) كابل من الصلب طوله 10 m يتعرض لقوه شد 940 N احسب قطر الكابل اذا اريد الاتزيد الاستطاله عن 0.5 cm

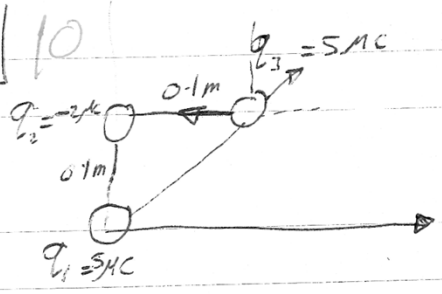
(ج) برج لتخزين المياه ارتفاعه 32 m و قطره 30 cm يزود المنزل بالماء عن طريق انبوب افقى فى الاسفل له قطر 2.54 cm معدل تدفق الماء الى المنزل 2500 cm^3/S ما هى قيمه الضغط فى الانبوب الافقى ؟



Dr. Demyana Adel Abdel Masieh

Best Wishes

1-P | 10



2

$$\vec{F_3} = \vec{F_{13}} + \vec{F_{23}} \qquad \text{If } k = k_c \frac{qq}{r^2}$$ 2

$$F_{13} = k \frac{5*10^{-6} * 5*10^{-6}}{(\sqrt{2}*0.1)^2} = 11\ N$$

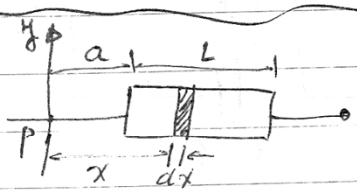
$$F_{23} = 9.9*10^{9} \frac{(5*10^{-6}) * (2*10^{-6})}{(0.1)^2} = 9\ N$$

$$\vec{F_{13}} = 11\cos 45\, \hat{i} + 11 \sin 45\, \hat{j} = \frac{11}{\sqrt{2}}\hat{i} + \frac{11}{\sqrt{2}}\hat{j} = 7.8\hat{i} + 7.8\hat{j}$$ 2

$$\vec{F_{23}} = -9\hat{i}$$ 2

$$\vec{F_3} = -9\hat{i} + 7.8\hat{i} + 7.8\hat{j} = -1.2\hat{i} + 7.8\hat{j}\ N$$

1-b | 10



$dq = \lambda\, dx$

$$dE = k\frac{dq}{r^2} = k\frac{\lambda\, dx}{x^2}$$

$$E = \int_a^{a+\ell} dE$$ 2

$$= \int_a^{a+\ell} \frac{k\lambda\, dx}{x^2} = k\lambda\left[\frac{-1}{x}\right]_a^{a+\ell} = k\lambda\left[\frac{1}{a} - \frac{1}{a+\ell}\right]$$ 2

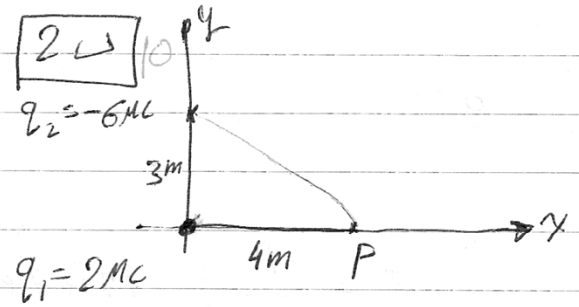
$$E = k\lambda \frac{\ell}{a(a+\ell)} \qquad \boxed{\lambda \ell = Q}$$

$$\boxed{E = \frac{kQ}{a(a+\ell)}}$$

2ف 5

$$\Phi = \frac{q_{in}}{6\epsilon_0} = \frac{170 \times 10^{-6}}{6 \times 8.8 \times 10^{-12}} = 3.2 \times 10^{6} \ Nm^2/C$$

2ب 10

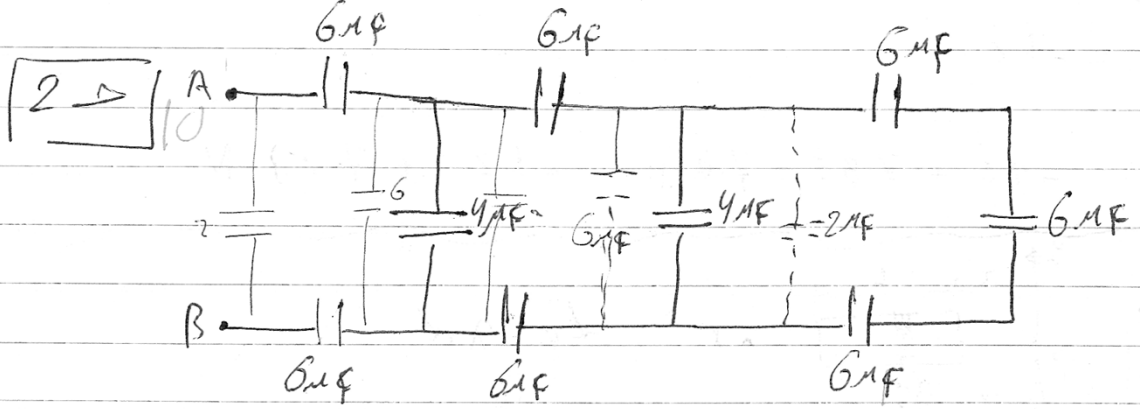


$$V_P = k\frac{q_1}{r_1} + k\frac{q_2}{r_2}$$

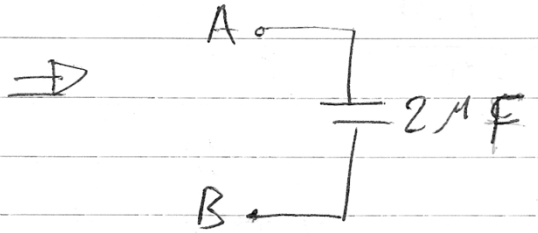
$$= 8.9 \times 10^{9}\left(\frac{2 \times 10^{-6}}{4} + \frac{-6 \times 10^{-6}}{5}\right)$$

$$= -6.2 \times 10^{3} \ V$$

2ج 10



$\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$



3 أ $x(t) = 15 \cos(6t)$ cm

$x(2s) = 15 \cos(6 * 2s) = 10.3$ cm

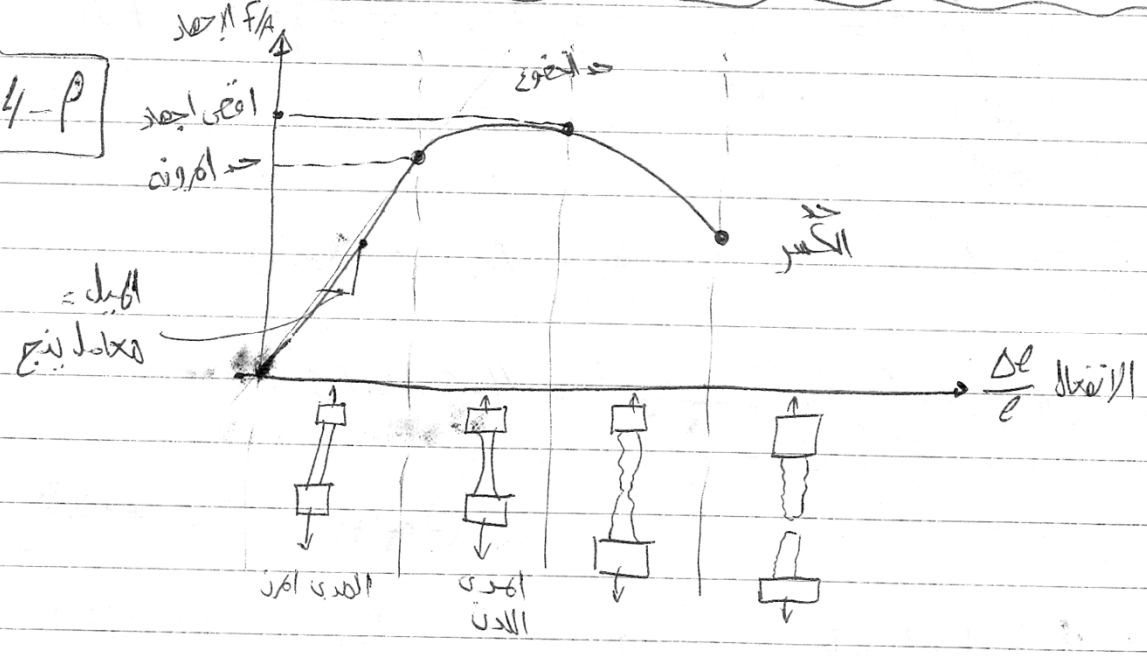
$v(2s) = -(15 * 6) \sin(6 * 2s) = 157.5$ cm/s

3 ب $f = 500$ Hz $\quad \lambda = 0.2$ m $\quad t = ?$ at $\ell = 300$ m

$v = \lambda f = 500 * 0.2 = 100$ m/s

$v = \frac{\ell}{t} \Rightarrow t = \frac{\ell}{v} = \frac{300}{100} = 3$ s

4 - أ



4 - ب

$$Y = \frac{F/A}{\Delta l / l}$$

$$20 * 10^{10} = \frac{940/A}{0.5 * 10^{-2}/10} \Rightarrow A = 9.4 * 10^{-6}\ m^2$$

$$A = \pi r^2 \Rightarrow r = 1.7 * 10^{-3}\ m$$

$$D = 2r = 3.4\ mm$$ قطر الكابل

4 - د

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2$$

P_1: الضغط الجوي — $v_1 \to 0$ — y_1: 32 m — P_2: ? — v_2: $A_2 \cdot v_2 = 0.0025$ — $y_2 \to 0$

$$A_1 v_1 = A_2 v_2 \quad \because A_1 >> A_2 \quad \therefore v_1 \simeq 0$$

$$v_2 = \frac{0.0025}{\pi\left(\frac{2.54}{2} * 10^{-2}\right)^2} = 4.9\ m/s$$

بالتعويض في معادلة برنولي

$$(1.01 * 10^5) + (10^3 * 9.8 * 32) = P_2 + \left(\frac{1}{2} * 10^3 * 4.9^2\right)$$

$$P_2 = 4.02 * 10^5\ Pa$$

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العام الدراسى ٢٠١٥ / ٢٠١٦
الفصل الدراسى الثانى

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كليه الهندسة
قسم الفيزيقا و الرياضيات الهندسية
الفرقة الاعدادية

يونيو 2016
امتحان نهاية الفصل الدراسى الثانى
الزمن: 3 ساعات

فيزياء هندسيه (1)

$\mu_0= 4\pi*10^{-7}$T.m/A , q= $1.6*10^{-19}$ C	c_{water}=4186 J/kg.c^o ,c_{vapor}=2010 J/kg.c^o , c_{glass}=837 J/kg.c^o
$m_p=1.67*10^{-27}$ Kg , $m_e= 9.1*10^{-31}$ Kg	$L_v=2.26*10^6$ J/kg , $K_B=1.38*10^{-23}$ J/K , k_{Ag}= 427

السؤال الاول :
(20 درجه)

(1) باستخدام قانون امبير استنتج معادله المجال المغناطيسى داخل ملف حلقى عدد لفاته(N) ويمر به تيار(I)و نصف قطر الحلقه (r) . احسب قيمه المجال عند (N=100 , I= 30 mA, r = 2 cm)

(2)شريحه مستطيله من معدن طولها (L=2 cm) و عرضها (W=1.5 cm) و سمكها (t = 0.1 cm) يمر بها تيار (I=0.1 mA). عند تسليط مجال مغناطيسى (B=1.2 T) عمودى على الشريحه كان جهد هول (V_H=7.5 mv) . استنتج معادله حساب (V_H) . اوجد قيمه معامل هول للشريحه .

السؤال الثانى :
(25 درجه)

(1) يتحرك بروتون فى منطقه مجال مغناطيسى (B = i+2j-3k T) بسرعه (v= 4 m/s) فى اتجاه محور (y) احسب القوه المغناطيسيه التى تؤثر على الالكترون.

(2) احسب القوه الدافعه الكهربيه المتولده فى ملف على هيئه مربع طول ضلعه (L= 0.2 m) موضوع فى منطقه مجال مغناطيسى عمودى على مستوى المربع. المجال متغير مع الزمن وفقا للمعادله (B= 0.03 t + 1.4 T)

(3) اوجد النسبه بين نصف قطر مسار الكترون الى نصف قطر مسار بروتون لهما نفس السرعه فى منطقه مجال مغناطيسى منتظم قيمته (B=0.35 T) عمودى على السرعه.

(4)اذا كانت عناصر الدائره الكهربائيه(ε=10v,R=6Ω,L=30mH)احسب ثابت الزمن للدائره. وقيمه التيار عندt=2ms

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السؤال الثالث :
(20 درجه)

(1) احسب كتله البخار التى درجه حرارتها (110^{o}C) و المطلوبه لرفع درجه حراره (200 g) من الماء موضوعه فى وعاء زجاجى كتلته (100 g) من (20^{o}C) الى (60^{o}C)

(2) شريحتان فى تلامس حرارى،سمك كل منهما L_1,L_2 ، التوصيليه الحراريه لكل منهما k_1,k_2 درجه الحراره عند سطوحهما الخارجيه T_h,T_cاحسب درجه الحراره T عند الحد الفاصل بينهما فى حاله الاستقرار. اذا كانت الشريحتان من الفضه (Ag)ولهما نفس السمك و نفس المساحه، درجه الحراره عند سطوحهما الخارجيه (80^{o}C, 30^{o}C) اوجد T

السؤال الرابع :
(25 درجه)

(1) وضح فكره عمل الترمومترات

(2) عينه من غاز مثالى حجمها ($V=1m^3$) عند ضغط ($p=1.01*10^6$ V^2 Pa) تمددت الى ضعف حجمها الاصلى فى عمليه شبه استاتيكيه، احسب الشغل المبذول.

(3) خزان حجمه (0.3 m^3) يحتوى على (2 mol) من غاز الهليوم عند درجه حراره (20^{o}C) بفرض ان الهليوم يسلك كغاز مثالى احسب متوسط طاقه الحركه لكل جزئ

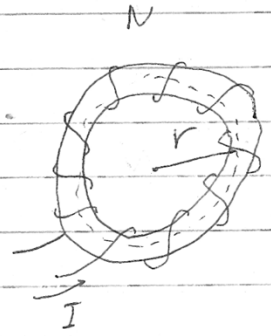
(4) اسطوانه من معدن تم رفع درجه حرارتها ببطء من (20^{o}C) الى (80^{o}C) فكانت الزياده فى حجم الاسطوانه بالنسبه للحجم الاصلى (0.432 %). اوجد معامل التمدد الحجمى و معامل التمدد الطولى للماده المصنوع منها الاسطوانه.

Dr. Demyana Adel Abdel Masieh

Best Wishes

اعدادى - ترم ثانى - 2016

السؤال الاول:



$$\oint B \cdot dS = \mu_0 I \qquad (1)$$

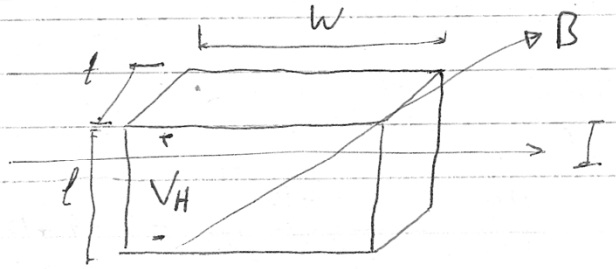
$$B \oint dS = N \mu_0 I$$

$$B\, 2\pi r = N \mu_0 I$$

$$B = \frac{N \mu_0 I}{2\pi r} \qquad 5$$

$$B = \frac{100 * 4\pi * 10^{-7} * 30 * 10^{-3}}{2\pi * 2 * 10^{-2}} = 100 * 10^{-7} * 30 * 10^{-3} * 10^{+2}$$

$$= 30 * 10^{-6}\ T \qquad 5$$



(2)

$$F_E = F_B$$

$$qE = q v B$$

$$\frac{V_H}{l} = v B$$

$$V_H = l v B$$

$$I = nqAv$$

$$v_d = \frac{I}{nqA}, \quad A = l \cdot t$$

$$V_H = l \frac{I}{nq(lt)} B$$

$$V_H = \frac{I}{nqt} B \qquad 5$$

$$R_H = \frac{1}{nq} = \frac{1}{\frac{C \cdot elec}{m^3}} = \frac{m^3}{C \cdot elec}$$

$$V_H = R_H \frac{IB}{t}$$

$$7.5 * 10^{-3} = R_H \frac{0.1 * 10^{-3} * 1.2}{0.1 * 10^{-2}} \Rightarrow R_H = \frac{0.1 * 10^{-2} * 7.5 * 10^{-3}}{0.1 * 10^{-3} * 1.2}$$

$$= 6.25 * 10^{-2} \ \frac{m^3}{electron \cdot C} \qquad 5$$

السؤال الثاني:

$$-\left(\begin{vmatrix} i & j \\ k & j \end{vmatrix}\right) *$$

(1)

$$v = 4j \qquad B = i + 2j - 3k$$

$$F = q\, v \times B = 1.6 * 10^{-19} * (4j) \times (i + 2j - 3k)$$

$$= 1.6 * 10^{-19} (-4k + 0 - 12\, i)$$

$$= -6.4 * 10^{-19} k - 4.8 * 10^{-19} i \quad N$$

5

(2)

$$\mathcal{E} = -N \frac{d\Phi}{dt}$$

$$= -N \frac{d A \cdot B}{dt} = -N A \frac{dB}{dt}$$

$$\mathcal{E} = -1 * l^2 * \frac{d}{dt}\left[0.03 t^3 + 1.4\right]$$

5

$$= -1 * (0.2)^2 (0.03) = -1.2 \text{ mV}$$

(3)

$$r_e = \frac{m_e v}{qB} \qquad r_p = \frac{m_p v}{qB}$$

5

$$\frac{r_e}{r_p} = \frac{m_e v}{qB} \Big/ \frac{m_p v}{qB} = \frac{m_e}{m_p} = \frac{9.1 * 10^{-31}}{1.67 * 10^{-27}} = 5.44 * 10^{-4}$$

$\frac{1}{5.44 * 10^{-4}} = 0.1838 * 10^{4}$

(4)

$$\tau = \frac{L}{R} = \frac{30 * 10^{-3}}{6} = 5 \text{ ms}$$

5

$$I = \frac{\mathcal{E}}{R}\left(1 - e^{-t/\tau}\right)$$

5

$$I = \frac{10}{6}\left(1 - e^{-2/5}\right) = \frac{10}{6}\left[0.329\right]$$

$$= 0.549 \text{ A}$$

السؤال الثالث :

السؤال الرابع (1)

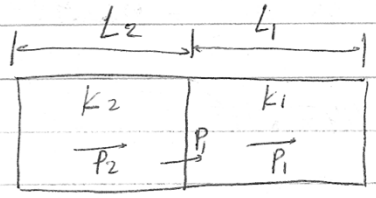
(1) فكره عمل الترمومترات :

تعتمد فكره الترمومترات على تغير بعض الخواص الفيزيائيه لاى نظام بتغيير درجه حرارته . بعض الخواص الفيزيائيه التى تتغير بتغير درجه الحراره هى :
(1) حجم السائل (2) ابعاد الجسم الصلب (3) ضغط الغاز عند ثبوت الحجم
(4) حجم الغاز عند ثبوت الضغط (5) المقاومه الكهربيه لموصل
(6) لون الجسم

المعادله :

كميه الطاقه اللازمه لرفع درجه حراره جرام واحد من الماء بمقدار درجه مئويه واحده من 14.5°C الى 15.5°C

(2)



فى حاله الاستقرار معدل انتقال الطاقه متساوى عند جميع الاجزاء

$$P_1 = P_2$$

$$\frac{k_1 A_1 (T - T_c)}{L_1} = \frac{k_2 A_2 (T_h - T)}{L_2}$$

$$\frac{k_1 (T - T_c)}{L_1} = \frac{k_2 (T_h - T)}{L_2}$$

$$\frac{k_1}{L_1} T - \frac{k_1}{L_1} T_c = \frac{k_2}{L_2} T_h - \frac{k_2}{L_2} T \quad (* L_1 L_2)$$

$$L_2 k_1 T - L_2 k_1 T_c = L_1 k_2 T_h - L_1 k_2 T$$

$$T = \frac{L_1 k_2 T_h + L_2 k_1 T_c}{L_1 k_2 + L_2 k_1}$$

$$T = \frac{L k T_h + L k T_c}{L k + L k} = \frac{T_h + T_c}{2} = \frac{80 + 30}{2} = \frac{110}{2} = 55\ ^\circ C$$

السؤال الرابع:

(1)

ماء 200g 20°C → 60°C ← زجاج 100g 20°C → 60°C

m = ? 110°C → 60°C

$Q_{cold} = -Q_{hot}$

$m_w c_w \Delta T + m_g c_g \Delta T = -[m c \Delta T + m L_v + m c \Delta T]$

(110→100) (100→60)

$Q_{cold} = 0.2 * 4186 * 40 + 0.1 * 837 * 40 =$

$= 33488 + 3348 = 36.83 * 10^3$ J

$Q_{hot} = m C_v \Delta T + m L_v + m C_w \Delta T$

$= m [2010 * 10 + 2.26 * 10^6 + 4186 * 40]$

$= m [20.100 * 10^3 + 2260 * 10^3 + 167.44 * 10^3] = m\, 2.447 * 10^6$

$36.83 * 10^3 = m * 2.447 * 10^6$

$m = \frac{36.83 * 10^3}{2.447 * 10^6} = 15$ g

السؤال الثالث (1)

(2)

$W = -\int P dV = -\int_1^2 1.01 * 10^6 V^2 dV$

$= \frac{1.01 * 10^6}{3} [V^3]_1^2 = \frac{1.01 * 10^6}{3} [8 - 1] = -2.35 * 10^6$ J

(3)

$\frac{1}{2} m v^2 = \frac{3}{2} k_B T = \frac{3}{2} * 1.38 * 10^{-23} * (20 + 273)$

$= 606.5 * 10^{-23}$ J

(4)

$\Delta V = \beta V_i \Delta T$

$\beta = \frac{1}{\Delta T} \frac{\Delta V}{V_i} = \frac{1}{60} * \frac{0.432}{100} = 72 * 10^{-6}$ °C^{-1}

$\beta = 3\alpha \therefore \alpha = \frac{\beta}{3} = 24 * 10^{-6}$ °C^{-1}

فيزياء هندسيه (١)
العام الدراسى ٢٠١٦ / ٢٠١٧
الفصل الدراسى الاول

Kafr Elshiekh University
Faculty of Engineering
Department of
Physical and Mathematical Engineering
Preparatory Year

22 January 2017
3 hours
90 Marks
Final exam

Engineering physics (1)

$q_e=1.6*10^{-19}C$	$K_e=8.9*10^9 Nm^2/C^2$	1mile =1.609km	$g=9.8m/s^2$

Question(1) : ***(15 Marks)***

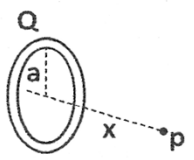
(a) Two electrons are separated by a distance of ($6*10^{-11}m$). Find the electric force exerted by one electron on the other.

(b) What is the meaning of "*Equipotential surface*"?

(c) The potential difference between two parallel sheets distance (*1.5cm*) apart is (*2500V*). Calculate the electric field between the sheets.

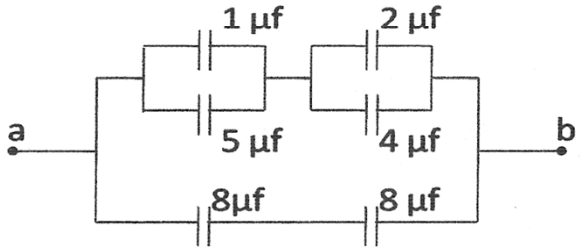
Question(2) : ***(30 Marks)***

(a) A uniform charged ring of radius (a) has a total charge of (Q). Derive the equation of the electric field at a point (P) as shown in figure.



(b) Consider a thin spherical shell of radius (14cm) with a total charge (32μC) distributed uniformly on its surface. Find the electric field at (10cm) and (20cm) from the center of the charged shell.

(c) Find the equivalent capacitance between a and b for the combination of capacitors shown in figure.



Question(3) : ***(15 Marks)***

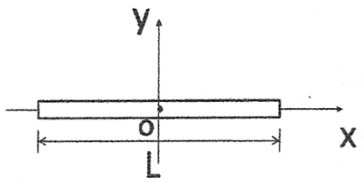
(a) A car is traveling at a speed of (*32m/s*). Is the driver exceeding the speed limit of (*75 mile/h*)?

(b) What are the different types of "*Elastic Modulus*" of solids?

(c) What is the centripetal acceleration of the Earth as it moves in its orbit around the sun? (*radius of orbit (r)= 1.496*10^{11}m*).

Question(4) : ***(30 Marks)***

(a) Calculate the moment of inertia of a uniform rigid rod of length (*L*) and mass (*M*) about an axis perpendicular to the rod and passing through its center of mass as shown in figure.



(b) A (*200g*) block connected to a light spring for which the force constant (*5N/m*) is free to oscillate on a horizontal frictionless surface. The block is displaced (*5cm*) from equilibrium and released from rest:

- Find the period of its motion, maximum speed and maximum acceleration.
- Calculate the total energy of the system.

(c) The mattress of a water bed is (*2m*) long by (*2m*) wide and (*25cm*) deep. It supported by four legs, each leg has a circular cross section of radius (*2cm*): (ρ=1000kg/m^3)

- Find the weight of the water in the mattress
- What pressure does this bed exert on the floor?

Best Wishes **Dr. Demyana Adel Abdel Masieh**

اعدادى - Final 2017_1_22 فصل دراسى اول

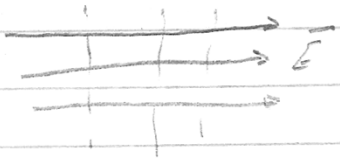
Question 1: (15 Marks)

(a) Two electrons are separated by a distance of $(6 * 10^{-11} m)$. Find the electric force exerted by one electron to other.

$$F_e = k_e \frac{qq}{r^2} = 8.9 * 10^9 \frac{(1.6 * 10^{-19})^2}{(6 * 10^{-11})^2} = 0.632 * 10^{-7} = 6.3 * 10^{-8} \ N$$

(b) What is the meaning of "Equipotential Surface"?

سطح تساوى الجهد : سطح تكون قيمه الجهد متساويه عند جميع نقاطه . وهو السطح العمودى على خطوط المجال

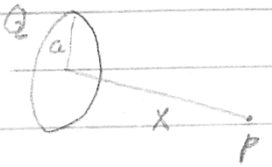


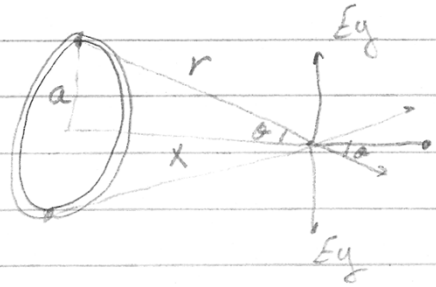
(C) The potential difference between two parallel sheets distance (1.5 cm) apart is (2500V). Calculate the uniform electric field between the sheets.

$$\Delta V = -E \cdot d \Rightarrow E = -\frac{\Delta V}{d} = \frac{2500}{1.5 * 10^{-2}} = 1.6 * 10^5 \ N/C$$

Question 2: (30 Marks)

(a) A uniform charged ring of radius (a) has a total charge of (Q). Derive the equation that calculates the electric field at a point (P) as shown in figure





$\Sigma E_y = 0$

$E = \Sigma E_x$

$$dE = k_e \frac{dq}{r^2} \Rightarrow dE_x = k_e \frac{dq}{r^2} \cos\theta$$

$$dE_x = k_e \frac{dq}{r^2} \frac{x}{r} \Rightarrow dE_x = k_e \frac{x}{r^3} dq$$

$$E = \int dE_x = k_e \frac{x}{r^3} \int dq = k_e \frac{x}{r^3} q$$

$$r = \sqrt{x^2 + a^2} \Rightarrow \boxed{E = k_e \frac{x q}{(x^2 + a^2)^{3/2}}}$$

(b) Consider a thin spherical shell of radius (14 cm) with a total charge (32 μC) distributed uniformly on its surface. Find the electric field at (10 cm) and (20 cm) from the center of the charge distribution.

at 10 cm

$E = 0$ because $q = 0$

at 20 cm

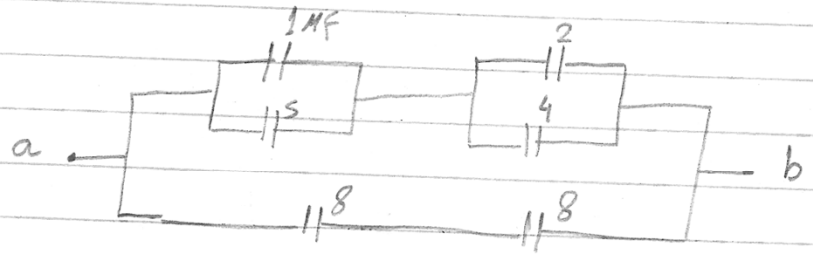
$$\oint E \cdot dA = \frac{q_{in}}{\epsilon_0}$$

$$E \cdot A = \frac{q_{in}}{\epsilon_0} \Rightarrow E\, 4\pi r^2 = \frac{q_{in}}{\epsilon_0} \Rightarrow E = \frac{q_{in}}{4\pi r^2 \epsilon_0}$$

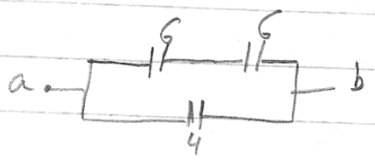
$$E = k_e \frac{q_{in}}{r^2} \Rightarrow 8.9 * 10^9 \frac{32 * 10^{-6}}{(0.2)^2} = 7120 * 10^3$$

$$= 7.12 * 10^6 \text{ N/C} \text{ or } \text{V/m}$$

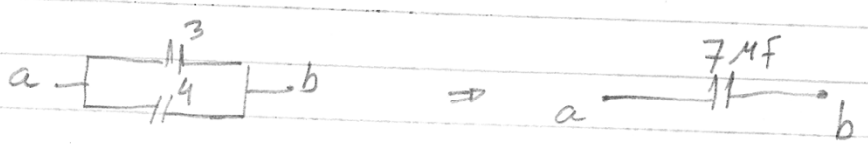
(C) find the equivalent capacitance between a and b for the combination of capacitors shown in figure.



$1+5=6$ $\quad 2+4=6$ $\quad \frac{1}{8}+\frac{1}{8}=\frac{1}{4} \Rightarrow C_t=4$



$\frac{1}{6}+\frac{1}{6}=\frac{2}{6}=\frac{1}{3} \Rightarrow C_t=3$



Question (3): (15 Marks)

(a) A car is traveling at a speed of (32 m/s). Is the driver exceed the speed limit of (75 mil/h)

$$32\ \frac{m}{s}=\frac{32}{1.609*10^3}\ \frac{mil}{s}=\frac{32}{1.609*10^3}*60*60\ \frac{mil}{h}$$

* $1\ mil = 1.609\ km \Rightarrow 1\ mil = 1.609*10^3\ m = 1\ m = \frac{1}{1.609*10^3}\ mil$

- $1\ h = 60*60\ s \Rightarrow s = \frac{1}{60*60}\ h$

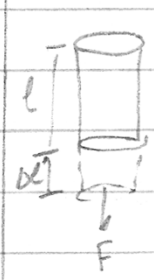
$32\ \frac{m}{s} = 71.5\ \frac{mil}{h} < 75\ mil/h$ لم يتجاوز السرعة المقررة

$$75\ \frac{mil}{h}=75*\frac{1.609*10^3}{60*60}=33.5\ \frac{m}{s}$$

$$32\ \frac{m}{s} < 33.5\ \frac{m}{s}$$

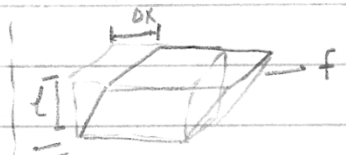
(b) What are the different types of "Elastic Modulus"

Young's Modulus



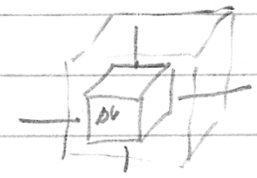
$$Y = \frac{F/A}{\Delta l / l} \qquad \left[\frac{N}{m^2}\right]$$

Shear Modulus



$$S = \frac{f/A}{\Delta x / l} \qquad \frac{N}{m^2}$$

Bulk Modulus



$$\beta = -\frac{\Delta P}{\Delta V / V} \qquad \frac{N}{m^2}$$

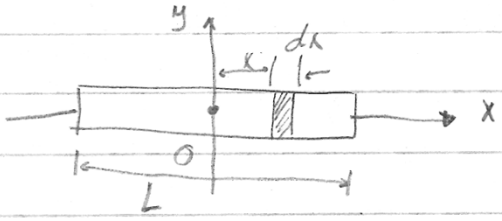
(c) What is the centripetal acceleration of the Earth as it moves in its orbit around the sun? ($r = 1.496 * 10^{11}$ m)

$$a_c = \frac{v^2}{r} = \frac{(2\pi r/T)^2}{r} = \frac{4\pi^2 r}{T^2}$$

$$= \frac{4\pi^2 * 1.496 * 10^{11}}{(365 * 24 * 60 * 60)^2} = 5.9 * 10^{-3} \ m/s^2$$

Question 4 : (30 Marks)

(a) Calculate the moment of inertia of a uniform rigid rod of length (L) and mass (M) about an axis perpendicular to the rod passing through its center of mass. as shown in figure.



$$I = \int r^2 \, dm$$

$$\rho = \frac{m}{L} \Rightarrow dm = \rho \, dx$$

$$r = x$$

$$I = \int_{-L/2}^{L/2} \rho x^2 \, dx = \rho \left[\frac{x^3}{3}\right]_{-L/2}^{L/2} = \frac{\rho}{3}\left[\left(\frac{L}{2}\right)^3 - \left(-\frac{L}{2}\right)^3\right]$$

$$= \frac{2}{3}\frac{\rho L^3}{8} = \frac{1}{12}\rho L^3 = \frac{ML^2}{12}$$

(b) A (200 g) block connected to a light spring for which the force constant is (5 N/m) is free to oscillate on a horizontal frictionless surface. The block is displaced (5 cm) from equilibrium and released from rest:

- Find the period of its motion, maximum speed, and maximum acceleration.
- Calculate the total Energy of the system

$m = 200\,g \quad k = 5\ N/m \quad A = 5\ cm$

$$w = \sqrt{\frac{k}{m}} = \sqrt{\frac{5}{0.2}} = 5\ rad/s^{-1}$$

$$w = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi}{w} = 1.2\ s^{-1}$$

$$v_{max} = wA = 5 * 0.05 = 0.25\ m/s^{-1}$$

$$a_{max} = w^2 A = 5^2 * 0.05 = 1.25\ m/s^{-2}$$

$$E_T = \frac{1}{2} k A^2 = \frac{1}{2} * 5 * (0.05)^2 = 6.25 * 10^{-3}\ J$$

(C) The mattress of a water bed is (2m) long by (2m) wide and (25 cm) deep. It supported by four legs, each leg has a circular cross section of radius (2 cm):

- Find the weight of the water in the mattress.
- what pressure does this bed exert on the floor?

$$V = 2 * 2 * 0.25 = 1\ m^3$$

$$m = \rho V = 10^3\ kg$$

$$F = mg = 10^3 * 9.8 = 9800\ N$$

$$\text{Pressure} = \frac{f}{A} = \frac{f}{4 * \pi r^2}$$

$$= \frac{9800}{4 * \pi (0.02)^2}$$

$$= 1949.648 * 10^3\ Pa$$

فيزياء هندسيه (١)
العام الدراسى ٢٠١٦ / ٢٠١٧
الفصل الدراسى الثانى

Kafr Elshiekh University
Faculty of Engineering
Department of
Engineering Physics and Mathematics
Preparatory Year

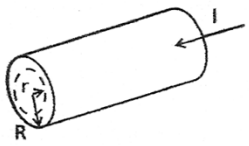
Engineering physics (1)

7 - 6 - 2017
3 Hours
90 Marks
Final Exam

Part One : Question(1) : ***(20 Marks)***

(a) A straight wire of length ($L=3m$) carries a current ($I= 4A$) toward the positive *x-axis*. A ($0.2\ T$) uniform magnetic field is directed along a positive *y- axis* .Find the magnitude and direction of the magnetic force acting on the wire.

(b) Use the *Ampere's law* to calculate the magnetic field a distance r from the center of the wire in the region $r < R$.

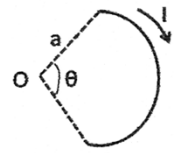


(c) A square coil of side ($d=18cm$) consists of (25) turns of wire and carries a current of ($15\ mA$). A ($0.35\ T$) magnetic field is applied parallel to the plane of the coil.

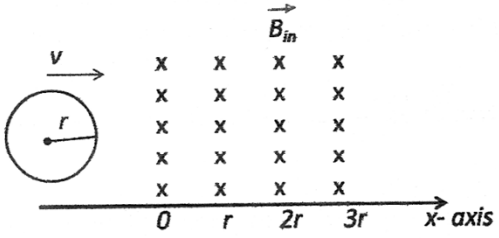
- Calculate the magnitude of the magnetic dipole moment of the coil.
- What is the magnitude of the torque acting on the loop?

Question(2) : ***(25 Marks)***

(a) Use the *Biot- Savart law* to calculate the magnetic field at a point O for the circular arc of radius a and angel θ carrying a constant current I.



(b) Plot as a function of x the magnetic flux through the area enclosed by the loop.



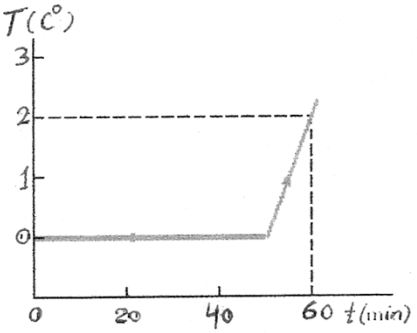
(c) A solenoid with ($68\ turns$) in ($8\ cm$) length and has a diameter of ($1.2\ cm$):

- Calculate the inductance of the solenoid.
- How much energy is stored in its magnetic field when it carries a current of $0.9\ A$?
- Calculate the self-induced emf in the solenoid if the current decreases at the rate of (0.5A/s). ($\mu_0=4\pi*10^{-7}$T.m/A)

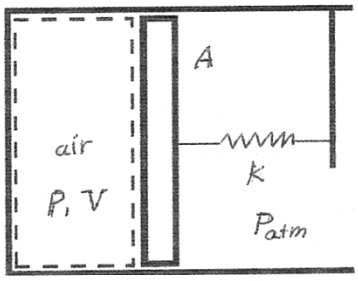
Part Two : Question(1) : ***(15 Marks)***

(a) State the assumptions of the kinetic theory of gases and find its mathematical expression.

(b) A cooking vessel on a slow burner contains 10 kg of water and an unknown mass of ice in equilibrium at 0°C at time t = 0. The temperature of the mixture is measured at various times, and the result is plotted in the Figure. During the first 50 min, the mixture remains at 0°C. From 50 min to 60 min, the temperature increases to 2°C. Ignoring the heat capacity of the vessel, determine the initial mass of ice.



(c) We are given air in the spring-restrained piston-cylinder arrangement of the Figure with P_1 = 100 kPa, V_1 = 0.002 m^3, x_1 = 0 m, no force on the piston at state 1, P_{atm} = 100 kPa, and A = 0.018 m^2. The air expands until V_2 = 0.003 m^3. We know the spring is linear with F_{spring} = kx with k = 16.2 kN/m. Find the final pressure of the air and the work done by the air on the piston.



Question(2) : ***(15 Marks)***

(a) Prove that violation of the Kelvin-Planck Statement leads to a violation of the Clausius Statement and vice versa.

(b) Discuss Carnot engine using its P-V diagram and T-S diagram.

(c) A multicylinder gasoline engine in an airplane, operating at 2500 rev/min, takes in energy 7.89 * 103 J and exhausts 4.58 * 103 J for each revolution of the crankshaft.

(i) How many liters of fuel does it consume in 1h of operation if the heat of combustion is 4.03* 107 J/L? (ii) What is the mechanical power output of the engine? Ignore friction and express the answer in horsepower. (iii) What is the torque exerted by the crankshaft on the load? (iv)What power must the exhaust and cooling system transfer out of the engine?

Question(3) : ***(15 Marks)***

(a) State the general law of mirrors and prove it.

(b) State the lens aberrations.

(c) A converging lens of focal length 20 cm is placed to the right of a diverging lens of focal length 10 cm are separated by 20 cm. An object is placed 10 cm to the left of the diverging lens. Find the position and the magnification of the final image.

Useful data: For water $L_f = 3.33 * 10^5$ J/Kg, $L_v = 2.26 * 10^6$ J/Kg , C_w = 4186 J/Kg. °C

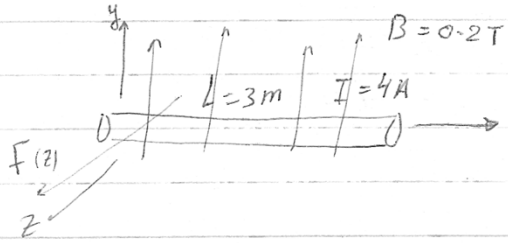
Best Wishes

Dr. Ahmed Saeed **Dr. Demyana Adel Abdel Masieh**

45 مغناطيسية 2017-2016 إعدادي - ترم ثاني - final

Question (1) [20]

* (a) A straight wire of length ($L = 3\ m$) carries a current ($I = 4A$) toward the positive x-axis. A ($0.2\ T$) uniform magnetic field is directed along a positive y-axis. Find the magnitude and direction of the magnetic force acting on the wire.



$\vec{F} = I\,\vec{L} \times \vec{B}$

$F = 4(3\hat{i}) \times (0.2\hat{j})$ (5)

$= 2.4\ \hat{k}\ N$

* (b) Use the Ampere's law to calculate the magnetic field a distance r from the center of the wire in the region $r < R$

$\oint B \cdot ds = \mu_0 I$

$B \oint ds = \mu_0 I'$

$B\ S = \mu_0 I'$

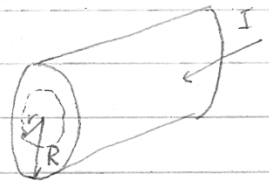
$B\ (2\pi r) = \mu_0 I \frac{r^2}{R^2}$

$\boxed{B = \frac{\mu_0 I\ r}{2\pi R^2}}$

$\boxed{S = 2\pi r}$

$\frac{I}{I'} = \frac{\pi R^2}{\pi r^2}$

$\boxed{I' = I \frac{r^2}{R^2}}$



(5)

* (C) A square coil of side ($d = 18\ cm$) consists of (25) turns of wire and carries a current of ($15\ mA$). A ($0.35\ T$) magnetic field is applied parallel to the plane of the coil.

- Calculate the magnitude of the magnetic dipole moment of the coil

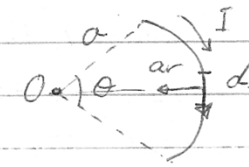
$\mu = NIA = 25 * 15 * 10^{-3} * (0.18)^2 = 12.15 * 10^{-3}\ A \cdot m^2$ (5)

- What is the magnitude of the torque acting on the loop?

$\tau = \mu \times B = 12.15 * 10^{-3} * 0.35 = 4.25 * 10^{-3}\ N.m$ (5)

Question (2) [25]

* (a) Use the Biot-Savart law to calculate the magnetic field at a point O for the circular arc of radius a and angel θ carrying a constant current I



$$dB = \frac{\mu_0 I}{4\pi} \frac{\vec{ds} \times a\hat{r}}{r^2}$$

$ds \perp ar$

$\boxed{ds \times ar = \vec{ds}}$

$$dB = \frac{\mu_0 I}{4\pi} \frac{a\,d\theta}{a^2}$$

$s = a\theta$

$\boxed{ds = a\,d\theta}$

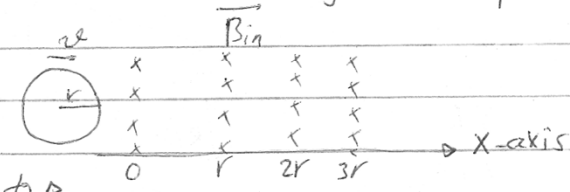
$$dB = \frac{\mu_0 I}{4\pi a} d\theta$$

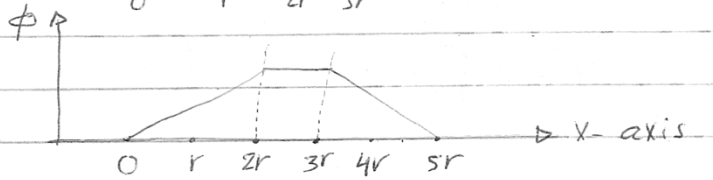
$\boxed{r^2 = a^2}$

$$\boxed{B = \frac{\mu_0 I}{4\pi a}\theta}$$

(5)

* (b) plot as a function of x the magnetic flux through the area enclosed by the loop





(5)

* (C) A solenoid with (68 turns) in (8 cm) length and has a diameter of (1.2 cm):

- Calculate the inductance of the solenoid

$N = 68 \quad \ell = 0.08\ m \quad d = 1.2\ cm \quad r = 0.6\ cm$

or $L = (\mu n^2 \ell A)$

$V = L * \pi r^2 = 0.08 * \pi (0.6 * 10^{-2})^2 =$ (5)

$L = \mu_0 n^2 V = 4\pi * 10^{-7} * \left(\frac{68}{0.08}\right)^2 (0.08 * \pi * (0.06)^2) = 8.215\ \mu H$

- ~~Cal~~ How much energy is stored in its magnetic field when it carries a current of 0.9A?

$U = \frac{1}{2} L I^2 = \frac{1}{2} * 8.215 * 10^{-6} * 0.9^2 = 3.327\ \mu J$ (5)

- Calculate the self Induced emf in the solenoid if the current decreases at the rate of (0.5 A/s)

$\mathcal{E}_L = -L \frac{dI}{dt} = -(8.215 * 10^{-6}) * (-0.5) = 4.1075\ \mu V$ (5)

فيزياء هندسيه (١)
العام الدراسى ٢٠١٧ / ٢٠١٨
الفصل الدراسى الاول

Kafr Elshiekh University
Faculty of Engineering
Department of
Physical and Mathematical Engineering
Preparatory Year

Engineering physics (1)

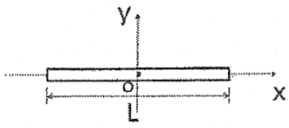
2- 01- 2018
3 hours
90 Marks
Final exam: 3 pages

Answer the following questions:

Question(1) : (ILOs: a1) ***(15 Marks)***

(a) Suppose that the acceleration (a) of a particle moving with uniform speed (v) in a circle of radius (r), is proportional to (r^n) and (v^m). Determine the values of n and m and write the simplest form of an equation for the acceleration.

(b) Calculate the moment of inertia of a uniform rigid rod of length (L) and mass (M) about an axis perpendicular to the rod and passing through its center of mass.



(c) The position versus time for an object in simple harmonic motion is given by [$x(t) = 0.05 \cos(5t+0.127\pi)$ m]. What is the velocity and acceleration of this object?

Question(2) : (ILOs: b1) ***(15 Marks)***

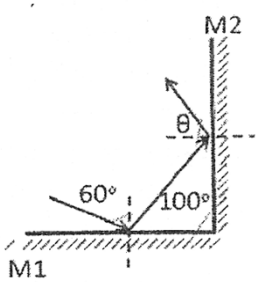
(a)A solid steel sphere is initially surrounded by air ($P_o=10^5$ N/m^2). The sphere is lowered into the ocean to a depth where the pressure is ($2*10^7$N/m^2). The volume of the sphere in air is (0.5 m^3). By how much does this volume change once the sphere is submerged?($\beta=20*10^{10}$N/m^2)

(b) The pressure experienced at a point on the bottom of a swimming pool (9 m) in depth is (189.5 k Pa). What is the density of water? ($P_o=10^5$ Pa), ($g= 9.8$ m/s^2).

(c) What is the main assumptions of the *Ideal fluid flow* ?

Question(3) : (ILOs: c1) ***(15 Marks)***

(a) Two mirrors make an angle of (100°) with each other, A ray is incident on mirror M_1 at an angle of (60°). Find the direction of the ray after it is reflected from mirror M_2.



(b) Draw a sketch showing the path of light rays from a point on the bottom of a swimming pool to the eye of an observer.

(c) An object is placed (15 cm) away from a lens. A virtual image is formed (5 cm) from the lens. Determine the focal length of lens, and the type of lens.

Question(4) : (ILOs: a1) ***(15 Marks)***

(a) Choose the best answer:

1-A total charge of 6.3×10^{-8} C is distributed uniformly throughout a 2.7-cm radius sphere. The volume charge density is:

a. $3.7 \times 10{-}7$ C/m^3. b. $6.9 \times 10{-}6$ C/m^3. c. $6.9 \times 10{-}6$ C/m^2.

d. $2.5 \times 10{-}4$ C/m^3. e. $7.6 \times 10{-}4$ C/m^3.

2- Each plate of a capacitor stores a charge of magnitude 1mC when a 100-V potential difference is applied. The capacitance is:

a. 5 μF. b. 10 μF. c. 50 μF. d. 100 μF. e. none of these.

3- The capacitance of a parallel-plate capacitor is: a. proportional to the plate area.

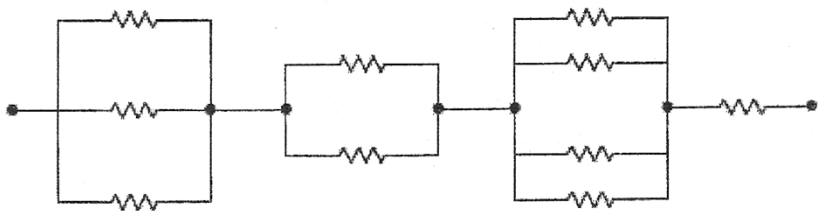
b. proportional to the charge stored. c. independent of any material inserted between the plates.

d. proportional to the potential difference of the plates. e. proportional to the plate separation.

4- The units of resistivity are: a. ohm. b. ohm·meter. c. ohm/meter

d. ohm/meter^2 e. none of these.

5- Each of the resistors in the diagram has a resistance of 12 Ω. The resistance of the entire circuit is:



a. 5.76 Ω. b. 25 Ω. c. 48 Ω. d. 120 Ω. e. none of these.

6-A farad is the same as a:

(a) J/V. (b) V/J. (c) C/V. (d) V/C. (e) N/C.

7- If the plate area of an isolated charged parallel-plate capacitor is doubled:

(a) the electric field is doubled. (b) the potential difference is halved.

(c) the charge on each plate is halved. (d) the surface charge density on each plate is doubled. (e) none of the above.

(b) Define the Electric Dipole and discuss the effect of electric Field on it.

Question(5) : (ILOs: b1) ***(15 Marks)***

(a) A sphere made of insulating material of radius R has a charge density $\rho = ar$ where a is a constant. Let r be the distance from the center of the sphere.

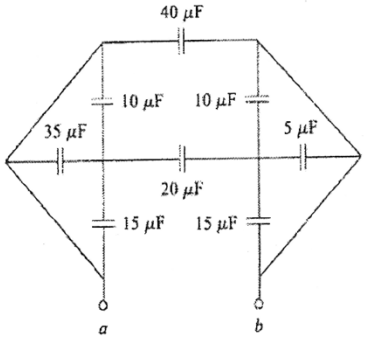
1) Find the electric field everywhere, both inside and outside the sphere.
2) Find the electric potential everywhere, both inside and outside the sphere. Be sure to

indicate where you have chosen your zero potential.

3) How much energy does it take to assemble this configuration of charge?

(b) Start from Gauss's law find the capacitance per unit length for infinite cylindrical capacitor.

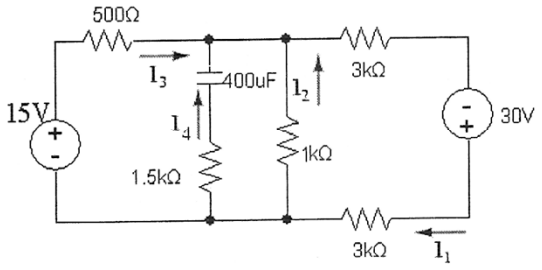
(c) For the following figure find the equivalent capacitance and if the potential between a and b is 30V find the potential difference for each one.



Question(6) : (ILOs: c2) ***(15 Marks)***

(a) The resistivity of Sodium sulfate (Na_2SO_4) solution is about 20 Ω·cm. The charge carriers are chiefly Na^+ and SO_4^{-2} ions, and of each there are about 3×10^{20}/ cm. If we fill a plastic tube 2 meters long with Sodium sulfate solution and connect a 12-volt battery to the electrodes at each end, what is the resulting average drift velocity of the each ion, in cm/s?

(b) Find the current in each branch of the following circuit and the charge on the capacitor and the energy stored in it.



(c) State the properties of conductors.

Useful data: $q_e = 1.6022 \times 10^{-19}$ C, $m_e = 9.1 \times 10^{-31}$ kg, $K_e = 9 \times 10^9$ N.m^2/C^2

Best Wishes

Dr. Ahmed Saeed **Dr. Demyana Adel Abdel Masieh**

45

2018 - 2017 Final إعدادي تيرم اول
خولة ماهر

Question (1) 15

(a) Suppose that the acceleration (a) of a particle moving with uniform speed (v) in a circle of radius (r), is proportional to (r^n) and (v^m). Determine the values of n and m and write the simplest form of an equation for the acceleration.

$a \propto r^n v^m$

$\frac{L}{T^2} \propto (L)^n \left(\frac{L}{T}\right)^m$

$L T^{-2} \propto L^{n+m} T^{-m}$

$-m = -2 \quad \boxed{m = 2}$

$n + m = 1$

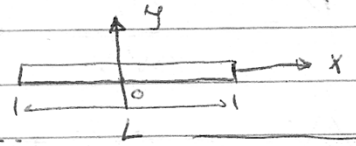
$n + 2 = 1 \quad \boxed{n = -1}$

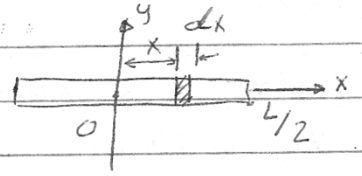
5

$a \propto r^{-1} v^2$

$a = k \frac{v^2}{r}$ $\quad k$: dimensionless constant

(b) Calculate the moment of inertia of a uniform rigid rod of length (L) and mass (M) about an axis ~~pre~~ perpendicular to the rod and passing through its center of mass





$\rho = \frac{M}{L}$

$dm = \rho \, dl$

$dm = \frac{M}{L} dl$

$\boxed{dm = \frac{M}{L} dx}$

$r^2 = x^2$

$I = \int r^2 \, dm$

$I = \int_{-L/2}^{L/2} \frac{M}{L} x^2 \, dx$

$= \frac{M}{L} \left[\frac{x^3}{3}\right]_{-L/2}^{L/2}$

$= \frac{M}{3L} \left[\left(\frac{L}{2}\right)^3 - \left(\frac{-L}{2}\right)^3\right]$

$= \frac{M}{3L} \cdot 2 \left[\frac{L^3}{8}\right]$

$\boxed{I = \frac{1}{12} M L^2}$

5

(C) The position versus time for an object is simple harmonic motion is given by $\{x(t) = 0.05 \cos(5t + 0.127\pi)\ m\}$. What is the velocity and acceleration of this object?

$$x(t) = 0.05 \cos(5t + 0.127\pi) \quad m$$

5

$$v(t) = \frac{dx}{dt} = 0.25 \sin(5t + 0.127\pi) \quad m/s$$

$$a(t) = \frac{d^2x}{dt^2} = -1.25 \cos(5t + 0.127\pi) \quad m/s^2$$

Question (2) 15

(a) A solid steel sphere is initially surrounded by air ($P_0 = 10^5\ N/m^2$). The sphere is lowered into the ocean to a depth where the pressure is ($2 * 10^7\ N/m^2$). The volume of the sphere in air is ($0.5\ m^3$). By how much does this volume change once the sphere is submerged? ($\beta = 20 * 10^{10}\ N/m^2$)

$$\beta = -\frac{\Delta P}{\Delta V/V} \Rightarrow 20 * 10^{10} = -\frac{2 * 10^7 - 10^5}{\Delta V / 0.5}$$

5

$$\Delta V = -0.5 * \frac{(200 * 10^5 - 10^5)}{20 * 10^{10}} = -\frac{0.5 * 199 * 10^5}{20 * 10^{10}} = -5 * 10^{-5}\ m^3$$

(b) The pressure experienced at a point on the bottom of swimming pool (9m) in depth is (189.5 kpa). What is the density of water? ($P_0 = 10^5\ Pa$), ($g = 9.8\ m/s^2$)

$$P = P_0 + \rho h g$$

5

$$189.5 * 10^3 = 10^5 + \rho * 9 * 9.8$$

$$\rho = \frac{189.5 * 10^3 - 100 * 10^3}{9 * 9.8} = \frac{89.5 * 10^3}{88.2} = 1014 * 10^3\ kg/m^3$$

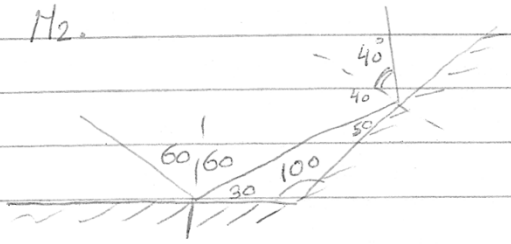
(c) What is the main assumption of the Ideal fluid flow?

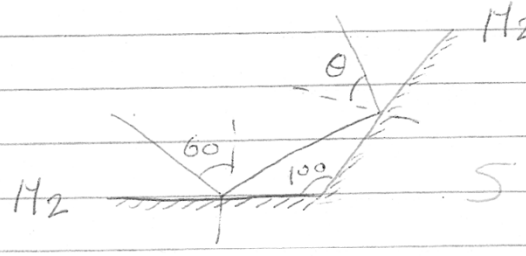
1- non-Viscous غير لزج
2- steady flow تدفق مستمر
3- in compressible غير قابل للانضغاط
4- irrotational ليس به حركات دورانيه

5

Question (3) 15

(a) Two mirrors make an angle of (100°) with each other, A ray is incident on mirror M_1 at an angle of (60°). Find the direction of the ray after it is reflected from mirror M_2.





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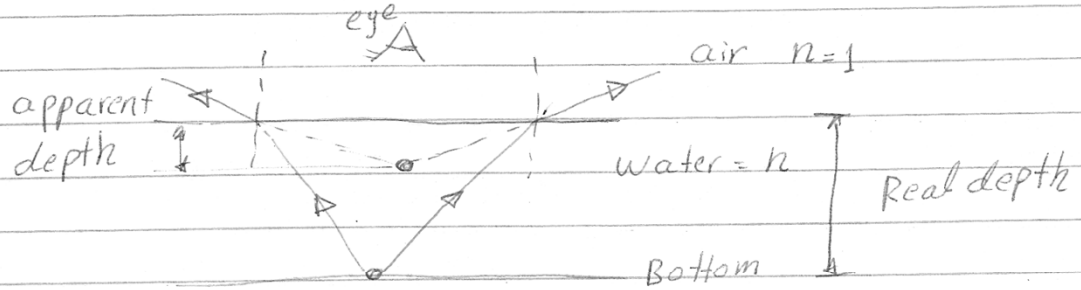
(b) Draw a sketch showing the path of light rays from a point on the bottom of a swimming pool to the eye of an observer.



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(c) An object is placed (15 cm) away from a lens. A virtual image is formed (5 cm) from the lens. Determine the focal length of lens, and the type of lens.

5

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{1}{15} - \frac{1}{5} = \frac{1}{15} - \frac{3}{15} = \frac{-2}{15}$$

$f = -7.5$ cm concave