8.	For a rotating system with uniform air gap, electromechanical energy conversion is possible if: A) only stator winding is excited. B) only rotor winding is excited. C) both stator and rotor windings are excited. D) either stator or rotor winding is excited.
9.	For a rotating system with a cylindrical stator and salient rotor: A) only stator self inductance is a function of rotor position B) rotor self inductance is a function of rotor position C) both stator self inductance and mutual inductance are functions of rotor position D) all inductances (self and mutual) are functions of rotor position
10.	A rotating system with ac excitation for stator and dc excitation for the rotor is called a A) reluctance machine B) synchronous machine C) induction machine D) dc machine

The second question (10 marks)

Which of the following statements is correct? You can write down in your answer sheet the question number followed by either ✓ or X mark.

1.	To reduce leakage flux in a magnetic circuit, air gaps are to be increased
2.	For non-magnetic materials, the B-H relation is linear.
3.	Motional (speed) voltage increases with increasing supply frequency
4.	Mutual inductance between two coils depends on their self inductances
5.	For linear magnetic system stored energy equals co-energy.
6.	Direction of electromagnetic torque is to increase inductance
7.	Transformer voltage depends on coil inductance variation with position.
8.	The mutual inductance between two magnetically coupled coils *may be* lower than the smaller self inductance of each coils
9.	For doubly excited rotating system, it is necessary to have some saliency for possible electromechanical energy conversion.
10.	Distributed winding provides more sinusoidal mmf space variation

The third question (20 marks)

1.	Discuss what is meant by magnetic flux fringing in the magnetic circuits; then show how to minimize it. (4 marks)
2.	With the aid of BH curve of a permanent magnet material show the effect of air gap length on the position of the operation point (5 marks)

Please Turn Over

3. For two magnetically-coupled coils, show that the total stored energy W_t is given by:

$$W_t = \tfrac{1}{2} L_{11} I_1^2 + \tfrac{1}{2} L_{22} I_2^2 \pm M\, I_1 I_2$$

where I_1 and I_2 are the currents in the two coils.

L_{11} and L_{22} are the self-inductances of the two coils.

M is the mutual inductance between the two coils. (5 mark)

4. A magnetic circuit has three parts in series. The first part has a length of 10 cm and 2 cm^2 cross section area and made of a magnetic material of infinite permeability. The second part is an air gap of 2.5 cm^2 cross section area and 4 mm length. The third part is made of a permanent magnet material having the following BH curve data:

H (kAT/m)	-55	-50	-45	-40	-30	0
B (T)	0	0.35	0.8	1.0	1.1	1.25

It is required to establish a flux density of 0.8 T in the air gap. Determine the dimensions of the permanent magnet of minimum volume. (6 marks)

The fourth question (25 marks)

1. For a singly-excited rotating electromechanical energy converter, derive a relation for the developed torque in terms of both stored energy and co-energy. (5 mark)

2. With the aids of current-flux linkage curves, derive how to determine energy converted into mechanical motion from a certain position to another. (5 marks)

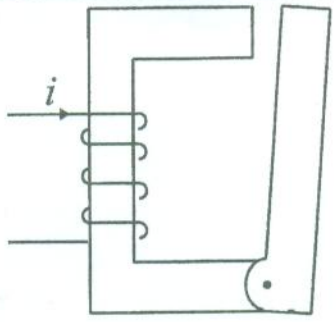
3. Sketch the space variation of self and mutual inductances for a doubly-excited electromechanical energy conversion device having saliency in both stator and rotor. (5 marks)

4. The electromagnet relay shown in figure has 1000 turns. The reluctance of the iron parts can be neglected.

a) If the air-gap length is 1 mm, what is the current required to develop a force of 30 Newton? (3 marks)

b) If the air-gap length is 2 mm, what is the current required to develop the same force of 30 Newton? (3 marks)

c) What is the energy stored in the air-gap volume for the conditions in part a and part b? (4 marks)



The fifth question (20 marks)

1. For a doubly-excited electromechanical energy conversion device of cylindrical stator and rotor:

a) Derive a general expression for the electromagnetic torque acting on the rotor. (8 marks)

b) Show all the possible electrical machines can be obtained. (4 marks)

2. Show the MMF space distribution a dc-excited coil of uniform air gap, if the conductors are
a) concentrated b) distributed in 8 slots (4 in each side).
Which of the two cases are preferred? Why ? (8 marks)

Good Luck and best wishes

Prof. Essam Eddin M. Rashad and Exam Committee

TANTA UNIVERSITY

Electrical Power and Machines Department

Faculty of Engineering

Final EXAM 2011/2012 - First Term

Course	Energy Conversion (EPM2106)	Time Allowed	3 hours
Students	2nd Year (Electrical Power and Machines)	Total Mark	90
Date	Sat. 16th January, 2012	Number of pages	3

Attempt ALL the following questions and problems:

- ***Clarify your answer with the suitable sketches as you can.***
- ***Assume any missed data reasonably.***

The first question (15 marks)

Choose the correct answer/answers for the following statements. It is sufficient to write down the question number followed by your choice/choices in your answer sheet:

1. Self inductance of a coil depends on
   A) Number of coil turns B) Core material
   C) Coil current D) All the above

2. Iron losses depend on
   A) electric supply frequency only B) flux level only
   C) area of hysteresis loop of the material only D) all the above choices

3. Compared with magnetic materials, permanent magnetic material has higher values of
   A) magnetic field intensity (H) B) flux density (B)
   C) relative permeability (μ_r) D) current

4. For dc excitation, induced emf is
   A) always zero B) only transformer voltage
   C) both speed and transformer voltages D) only speed voltage

5. Mutual inductance between two coils increases with increase of:
   A) angle between their axes B) distance between them
   C) their currents D) none of the above choices

6. For mutually coupled coils, if currents are both entering at the dot-marked terminals, coil fluxes
   A) are additive B) are subtractive
   C) increase D) cancel each other

7. For ideally coupled coils, coupling coefficient is
   A) zero. B) unity C) infinity D) between zero and unity

Please Turn Over

Problem number (4) (16 Marks)

(a) The conservation of heat can be used to develop a heat balance for a long thin rod. If the rod is not insulated along its length and the system is at steady state. The equation that results is :

$T'' + \eta(T_a - T) = 0 \quad , T(0) = T_1 \ \ and \ \ T(L) = T_2$

For L = 10 m rod with $T_a = 20$, $T(0) = 40$, $T(10) = 100$, $\eta = 0.01$ use finite difference method to solve this problem numerically by dividing the rod into five equal parts.

(b) Use the linear shooting method to get the solution of the BVP (by applying Euler's method).

$y'' = y - x\,y' + 2x + 2/x \quad y(1) = 0 \ , \ y(2) = 4\ln 2 \ , \quad h = 1/2$

Problem number (5) (16 Marks)

(a) Approximate the solution of the one-dimensional parabolic PDE

$U_{xx}(x,t) = U_t(x,t) \quad 0 \le x \le 1 \quad \text{and} \quad 0 \le t \le 0.15$, where

$U(0,t) = U(1,t) = 10 \quad \text{and} \quad 0 \le t \le 0.15$

$U(x,0) = 10 + 10x(x-1) \qquad 0 \le x \le 1$, use $h = 0.25$, $k = 0.05$

(b) Determine the vertical displacement $U(x, t)$ of a uniform perfectly flexible string of a constant density that is lightly stretched between two fixed points 0, L. Consider the wave equation given by

$U_{xx}(x,t) = U_{tt}(x,t) \ , \ 0 \le x \le 2 \ , \ 0 \le t \le 1$

subject to $U(0,t) = U(2,t) = 0, \quad U_t(x,0) = 0$

$U(x,0) = 16x^2(2-x)^2 \qquad 0 \le x \le 2 \qquad \text{with} \quad h = 0.5 \ , \ k = 0.25$

Good luck

Dr. Manal Mohamed Hekal

Dr. Waheed Kamal Zahra

Course Title: Engineering Mathematics (3) a Year: 2nd Electrical Power and Machines Engineering.
Course Code: PME2109 Date: 20 / 1 / 2012 (First term) Allowed time: 3 hrs No. of Pages: (2)

Remarks: (Answer the following questions. Assume any missing data…)

Problem number (1) (19 Marks)

(a) Consider $f(x) = 2x^2 e^x + 1$, $x = 1, 1.5, 2.5$. Determine the coefficients of Lagrange interpolation to evaluate approximate value of $f(2)$.

(b) Determine the polynomial of degree ≤ 4 using Newton's divided differences that interpolate the data in the following table:

x	1.0	2.0	3.0	5.0	7.0
$f(x)$	14.5	19.5	29	87.5	161

(c) In a biology study, the growth of a bacteria culture recorded the following data:

t	2.0	5.0	8.0
$b(t)$	5.0	9.0	18.0

Where $b(t)$ denotes the number of bacteria at time t (hours). Use natural cubic spline to estimate the number of bacteria at $t = 4$ and $t = 6$.

Problem number (2) (18 Marks)

(a) Let $f(x) = x\cos x - 3x^2$. Approximate $f'(1.2)$, $f''(1.2)$ using h = 0.1 with errors of the order h^4 and h^2 respectively.

(b) By applying Richardson extrapolation technique, we can reduce the truncation error to approximate the first derivative of a function. Derive Richardson formula and the bound of error that is of order h^4.

(c) Determine the number of subintervals n required to approximate the integral $\int_0^2 (\cos x + x^4)\,dx$, with an error E_T less than 10^{-4} using the Simpson's composite rule.

Problem number (3) (16 Marks)

(a) Euler's method is the simplest method of all the numerical techniques for solving IVPs. Derive formulas for local and global truncation errors of this method.

(b) Use the Adams third–order predictor–corrector method to obtain an approximation to the solution of the IVP: $y' = y x^{-2}$, $x \in [1, 2]$, $y(1) = 2$ *with* $h = 0.25$. Obtain the starting values using second-order Runge-Kutta method.

P.T.O.

Q3: **(20 Marks)**

A. Find and plot the electric field intensity and potential everywhere due to a point charge Q which located at the center of a spherical conducting shell of radii a and b. **(5 Marks)**

B. The plane z = 0 is a perfectly conducting surface. A point charge of 5 nC is located at A(2, -3, 6), and a point charge of – 8 nC is located at B(4, 3, 1).

i- Determine V at a point midway between the two charges.

ii- Find y if V=0 at C (5, y, 1). **(8 Marks)**

C. Evaluate the force produced on a square loop connecting points A(1,0,0), B(3,0,0), C(3,2,0) and D(1, 2, 0) which carries a current of 2 mA in counterclockwise direction due to a current carrying conductor of 15 A in the y-axis. **(7 Marks)**

Q4: **(25 Marks)**

A. Drive an expression for the magnetic field strength due to an infinite line carries current I directed in positive z-axis direction. **(7 Marks)**

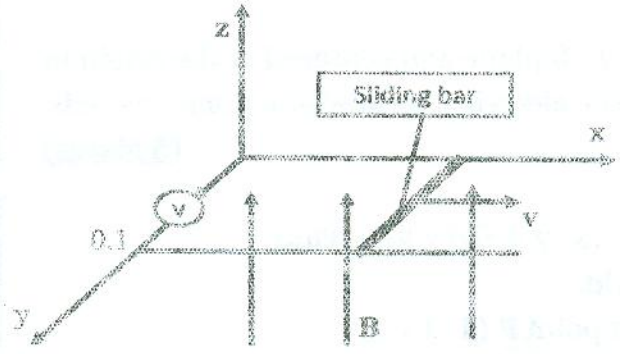
B. Evaluate the magnetic field strength at the point P(2, 2, 0) at the center of square loop of 2 meter length located at z = 0 plane and carries current 5 A in counterclockwise direction as shown in the figure. **(8 Marks)**

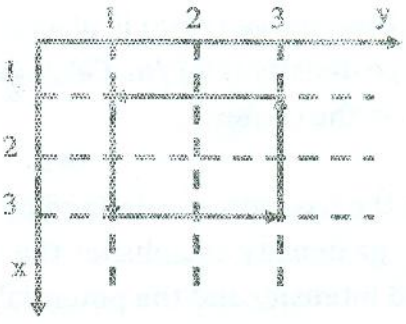
C. Let a magnetic flux density $B = (0.5\,x)\,a_z$ Tesla as in the figure. The position of the sliding bar is given by $x = 4t - 2t^2$ meter. If the separation of the rails is 10 cm.

i- Calculate the voltmeter reading at t =0.5 second

ii- Calculate the voltmeter reading when x=1 meter

iii- Plot the voltmeter reading for $0 < t < 3$ second **(10 Marks)**





WISH YOU ALL THE BEST Dr. Ayman Hoballah

انتهت الأسئلة

TANTA UNIVERSITY
Faculty of ENGINEERING
DEPARTMENT OF ELECTRICAL POWER AND MACHINES ENGINEERING
EXAMINATION (SECOND YEAR) STUDENTS OF ELECTRICAL ENGINEERING

COURSE TITLE: ELECTROMAGNETIC FIELDS			COURSE CODE: EPM2104/EPM2142
DATE: 09/01/2012	TERM: FIRST	TOTAL ASSESSMENT MARKS: 85	TIME ALLOWED: 3 HOURS

Notes:
Systematic arrangement of calculations and clear neat drawings are essential.
Any data not given is to be assumed – Answer as many questions as you can.
Answer as brief as possible

الإمتحان مكون من 4 اسئلة في ورقتين

Q1: **(20 Marks)**

A. Using Gauss's law, derive an expression for the electric field intensity **E** at a point P a radial distance *a* meter from a uniformly charged infinite line by ρ_l C/m. **(5 Marks)**

B. Let a point charge Q1 = 25 nC be located at point P_1 (4, -2, 7) and a charge Q_2 = 60 nC at P_2 (-3, 4, -2) in free space.
   i. Find **E** at P_3 (1, 2, 3).
   ii. Specify at what point on the y-axis is E_x =0.
   iii. Determine the location of a point charge Q_3 = -30 nC to cancel the field at the origin.
   iv. How much electric flux leaves the surface of a sphere of radius 10 m centered at the origin?
   (10 Marks)

C. A volume charge is distributed throughout a sphere of radius *a* meter and centered at the origin with uniform density ρ C/m³. Evaluate the electric field and total energy stored due to this charge distribution. **(5 Marks)**

Q2: **(20 Marks)**

A. Find the work done in moving a 5 μC charge from the P1(1,8 ,5)to P(2, 18 , 6) through electric field $\mathbf{E} = (-8xy)\bar{a}_x - (4x^2)\bar{a}_y + \bar{a}_z\ V/m$ along the path: $y = 3x^2 + z,\ z = x + 4$ **(5 Marks)**

B. Consider a circular line charge (ring) is placed in z=0 plane and centered at the origin in which the line charge density is k c/m. Calculate the electric potential at a point at z-axis away distance *h* from the center. **(5 Marks)**

C. A potential field in the free space is defined by $V = x^2 y + 5y^2 z$ Volt. Find: -
   i- The volume charge density establishes this field.
   ii- The electric field intensity and the potential at point P (1, 3, 2).
   iii- The potential difference between A (1, 2, 3) and B (2, 3, 1).
   iv- The total charge inside cube defined by $0 < x, y, z < 3$. **(10 Marks)**

Question (4) **(18 Marks)**

a) Derive an expression for the sag in transmission lines between supports at the same level. (6 Marks)

b) An overhead line with copper conductors is supported on two towers 200 m apart having a difference in level of 10 m. The conductor diameter is 2 cm and weighs 2.3 kg/m. Calculate the sag at the lower support under the conditions if wind provides a pressure of 57.5/m^2 of the projected area and a factor of safety is 4. The maximum tensile strength of copper is 4220 kg/cm^2. (12 Marks)

Question (5) **(18 Marks)**

a) Compare between the weight of copper used in 3-wire and 2-wire DC distribution system. (6 Marks)

b) A distributor AB of 600 m is fed from both the ends at 250 V and is loaded with loads of 100 A, 50 A and 80 A at distances of 200, 300 and 500 m respectively from the feeding end A. If the maximum allowed voltage drop is 5 V, find the resistance in ohm/m of the conductor. (12 Marks)

With my Best Wishes

Dr. Doaa Mokhtar
and **Examination Committee**

Tanta University

Department: Elec. Power and Machines Engineering
Total Marks: 90 Marks

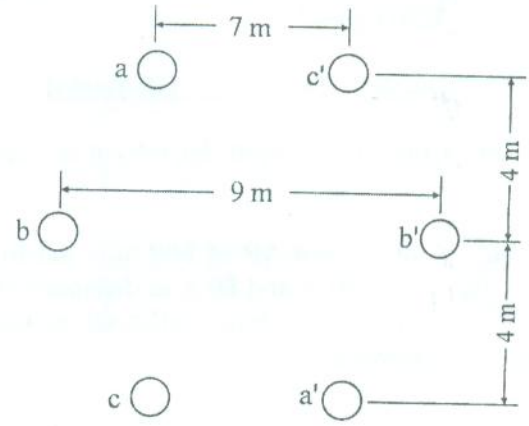
Faculty of Engineering

Course Title: Electrical Power Engineering (1) | Course Code: EPM2105 | Year: Second year
Date: Jan 23rd 2012 (First term) | Allowed time: 3 hrs | No. of Pages: (2)

Answer all the following questions:

Question (1) **(12 Marks)**

The six conductors of a double circuit transmission line are arranged as shown in the figure. The diameter of each conductor is 2.5 cm. Find the capacitive reactance to neutral and the charging current per Km per phase at 132 kV and 50 Hz, assuming that the line is regularly transposed.



Question (2) **(24 Marks)**

a) Explain using phasor diagram the Ferranti effect. (4 Marks)

b) Derive an expression for A, B, C, D constants for two networks in series having constants A_1, B_1, C_1, D_1 and A_2, B_2, C_2, D_2. (4 Marks)

c) A 3-phase transmission line of length 150 km delivers a load of 50 MW at 110 kV and 0.8 lagging power factor. The line has a resistance, inductive reactance and capacitive shunt admittance of 0.1 Ω/phase/km, 0.5 Ω/phase/km and 3×10^{-6} mho/phase/km, respectively. Using nominal-T method, determine: (16 Marks)

1. The efficiency.
2. The regulation of the line.
3. The charging current.

Question (3) **(18 Marks)**

a) Mention the different types of insulators used in transmission lines. (4 Marks)

b) What is the reason of unequal voltage distribution over suspension insulators? Mention three methods to improve this voltage distribution. (5 Marks)

c) The self capacitance of each unit in a string of three suspension insulators is C. The shunting capacitance of each insulator to earth is 0.15 C while the capacitance between the pin and the guard ring is 0.1 C. Calculate:

i. The voltage across each insulator as a percentage of the line voltage to earth.
ii. String efficiency.

(9 Marks)

P.T.O.

وكان الميزان قد نقل بعد **القراءات الرابعة والسادسة والعاشرة والرابعة عشر**. عين في جدول ميزانية مناسيب النقط مع عمل كل التحقيقات اللازمة إذا كان **منسوب النقطة الخامسة هو متران تحت سطح البحر**. وإذا أريد تسوية هذا القطاع بحيث **يميل ٠,٥% إلي أسفل مع ثبات منسوب النقطة الرابعة في** الميزانية فعين في نفس الجدول **ارتفاع الحفر والردم** إذا كانت نقط القطاع تتباعد **٤٠ متر** بعضها البعض. **(١٢ درجة)**

السـؤال الرابع - (٦ درجات)

وضح بالرسومات المتقنة وكافة البيانات على الرسم كلا مما ياتي:

أ- كيفية انتقال الأحمال من المنشآت الى التربة.
ب-التوزيع المثلثى لكل من : التربة الجافة – التربة المشبعة جزئيا– التربة المشبعة كليا.
ت-شكل توزيع الاجهادات الرأسية داخل التربة الناتجة عن كلا من وزن التربة والأحمال الخارجية وذلك خلال مستوى رأسى يمر بمنتصف الأساس.
ث-بعض الأسباب التى تؤدى لحدوث ظاهرة الهبوط النسبى فى المنشآت.

السـؤال الخامس:- (١٠ درجات)

أ- ماهى التربة، وكيف تكونت؟
ب-ماهى أهم الفروق بين التربة المتماسكة والتربة الغير متماسكة؟
ت-أذكر أمثلة على بعض أنواع التربة ذات المشاكل موضحا الأضرار التى تسببها للمنشآت.
ث-كيف يمكن تصنيف التربة طبقا لقطر حبيباتها؟
ج- وضح لماذا يعتبر الهبوط النسبى أكثر خطورة على المنشأ من الهبوط الكلى، وما هى قيم كلا من الهبوط الكلى والهبوط النسبى المسموح بها للأساسات طبقا للكود المصرى لتصميم الاساسات.

السـؤال السادس:- (٩ درجات)

أ- ما المقصود بفقاعة الضغط داخل التربة، وكيف يمكن أن يؤثر أبعاد الأساس على حجمها.
ب-أذكر مع التوضيح بالرسم الأنواع المختلفة للأساسات السطحية.
ت-متى يتم اللجوء لاستخدام الأساسات العميقة بدلا من الأساسات السطحية؟
ث- أذكر أنواع الخوازيق المستخدمة فى الأساسات العميقة وذلك تبعا لطريقة تنفيذها.
ج- المطلوب حساب قيمة الاجهادات الكلية المتولدة فى كابل كهربائى نتيجة لحمل موزع مقداره ٨.٠ طن/م^2 يؤثر بمنتصف قاعدة أبعادها ١.٠ x ١.٠ متر تقع على سطح الأرض، اذا علمت أن السطح العلوى للكابل يقع على عمق ٢ متر أسفل الأساس وأن وزن وحدة الحجوم للتربة الموجود بها الكابل هو ١.٩ طن / م^3

ملحوظة: استخدم الطريقة التقريبية لحساب الاجهادات الناتجة عن الحمل المركز.

With the best of wishes.....

examiners: Dr. Ahmed Farouk, Dr. Sobhy A. Younes

2/2

Tanta University	Department: Electrical Engineering Total Marks: 70 Marks	Faculty of Engineering
Course title: Civil Engineering	Course code: 21H3	Second Year : First term
Date: January 23, 2012	Allowed time: 3 hours	No. of pages : (2)

السؤال الأول (١٥ درجة):

أ. أذكر بالتفصيل الخطوات العملية اللازمة لقياس طول خط أ ب بالطرق المختلفة إذا علمت أنه:

- **يمكن رؤية** كل من نهايتي الخط أ ب من الأخرى ويصعب التوجيه بسبب وجود بحيرة بينهما.
- **لا يمكن رؤية** أي من نهاية الخط أ ب من الأخرى بسبب وجود عائق (مبني مرتفع) بينهما يعوق الرؤية والتوجيه معا.
- نقطة أ تقع علي الجانب الأيمن لترعة القاصد ويمكن أن يحتلها الراصد أما نقطة ب فتقع علي الجانب الأخر من الترعة ولا يمكن الوصول إليها. (٦ درجات)

ب. حول المقاييس الآتية إلي مقاييس عددية:

١٦/١ من البوصة للميل – ٢,٥ بوصة لكل ٥ كيلو متر –
٢.٥ سم لكل ٢٠ ميل – ١٢,٥ مم لكل ٢٥٠٠ ذراع . (٣ درجات)

ت. المطلوب تصميم ورسم مقياس رسم تخطيطي ١ : ٢٠٠ يقرأ مباشرة إلي أقرب ٠,١ **من القصبة** ثم استعمل المقياس لرسم قطعة أرض رباعية الشكل حيث **أ ب = ٨,٣ قصبة ، ب حـ = ٥,٤ قصبة ، حـ د = ٧,٧ قصبة ، د أ = ٥,٧ قصبة ، د ب = ٨,٢ قصبة ،**
ثم استنتج طول القطر أ حـ. (٦ درجات)

السؤال الثاني (١٥ درجة):

أ- اشرح بإيجاز خطوات الرفع المساحي باستخدام الشريط مع شرح طريقتين للتحشية موضحا إجابتك بالرسم. (٣ درجات)

ب- قيس خط بين نقطتين علي مستوي انحداره ١ : ٥ فوجد أن طوله ١٠٩,٢٥ متر. وبعد إتمام القياس أختبر الشريط فوجد أن طوله **ينقص بمقدار** ١١ سم عن طوله الاسمي وهو ٢٠ **متر فما هو الطول الذي يعين به هذا الخط علي خريطة مرسومة بمقياس ١ : ٥٠٠ .** (٦ درجات)

ت- منطقة مائية في الميناء مربعة الشكل ومحاطة علي أضلاعها بأسلاك يتدلي منها ألغام وكان طول كل سلك **نصف كيلو متر** ونتيجة لثقل الألغام حدث ترخيم في السلك بلغ مداه في المنتصف من كل سلك قدره ٢٠ مترا. ما هي **مساحة قطعة الأرض بالمتر المربع وبالفدان وما هو الخطأ النسبي في حساب المساحة؟** (٦ درجات)

السؤال الثالث (١٥ درجة):

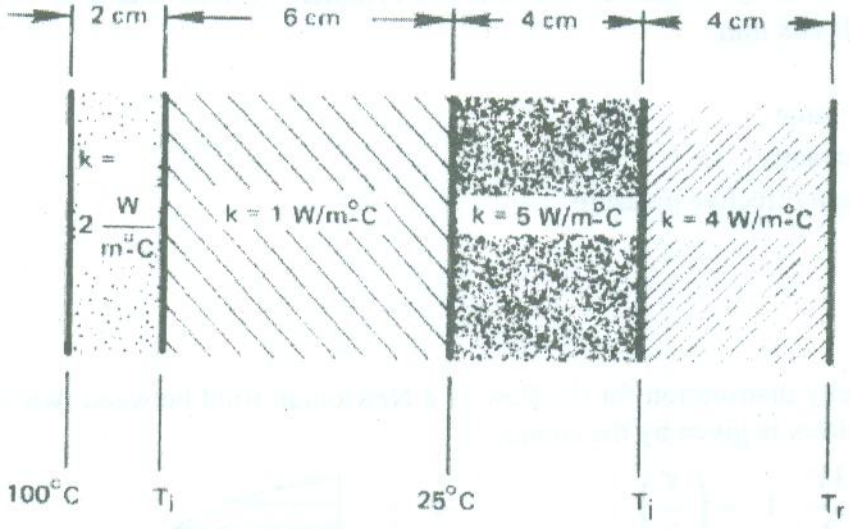
أ- اشرح الخطوات العملية اللازمة لإيجاد **الزاوية المحصورة بين ضلعي مبني مقام** إذا علمت أن إمكانية **القياس من الخارج** فقط وباستخدام القياسات الطولية. (٣ درجات)

ب- عند إجراء ميزانية طولية علي قطاع طولي كانت قراءات القامة:

٣,١١ – ٢,٥٨ – ١,٩٧ – ٢,٠٨ – ٢,٨٥ – ١,٥٩ – ١,١٢ – ٢,٩٥ – ٠,٨٤ – صفر – صفر –
١,١٨ – ١,٢٤ – ٠,٤٤ – ٠,٢٣ – ١,١٣ – ١,٨٧

and delivery pipe is 20 cm and length of suction pipe 5.5 m and length of delivery pipe is 20 m. the friction factor of pipe material 0.04 m. Determine the shaft power input to the pump. Given pump efficiency 0.86.

5-What are Ti, Tj, and Tr in the wall shown in the following Figure



6-Determine the value of maximum temperature and its position of the wall with the uniform distributed heat source having volumetric rate of heat generation $q_v = 8*10^6$ w/m^3, the plate thickness 10 mm and thermal conductivity of the plate material K=20 w/m.°c, the surface temperature of the plate are $T_{w1} = 80°C$, $T_{w2} = 80\ °C$

With my best wishes

Tanta university
Faculty of Engineering **Engineering Mechanics**
Elect. Power Depart. **Time allowed: 3 hr**

Final Exam 2011-2012

1- Autombile engine that operates on four-stroke engine produced brake power 94 kw at speed 2000 rpm, number of cylinder 6 cylinder, cylinder diameter 80 mm, stroke length 108 mm.

Calculate:

a- Stroke volume

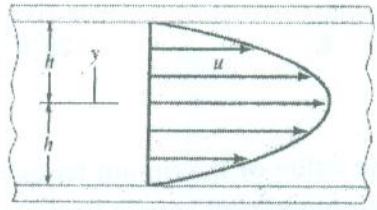
b- Engine capacity

c- Brake mean effective pressure

d- Torque.

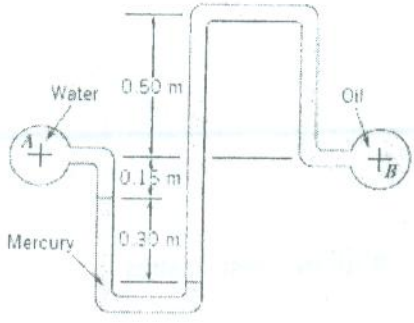
2- The velocity distribution for the flow of a Newtonian fluid between two wide, parallel plates is given by the equation

$$u = \frac{3V}{2}\left[1 - \left(\frac{y}{h}\right)^2\right]$$



Where V is the mean velocity. The fluid has a viscosity of 0.04 pa. s. When V= 2 m/s and h = 0.1 m determine: (a) the shearing stress acting on the bottom wall, and (b) the shearing stress acting on a plane parallel to the walls and passing through the centerline (midplane).

3- The mercury manometer of Fig. indicates a differential reading of 0.30 m when the pressure in pipe A is 30-mm Hg vacuum. Determine the pressure in pipe B.



4- A centrifugal pump deliver 0.2 m^3/s discharge of the water from suction reservoir in to delivery reservoir. The static suction head 5 m blow the atmospheric pressure and static delivery head 18 m above the atmospheric pressure. Diameter of suction