Course title: **Furnaces and Heat Treatment**	Date: 26 May 2018
Course code: MPD 2213	Total marks: 75
Year: 2nd – Production Engineering and Mechanical Design	Time allowed: 3 hrs
2nd Term – Final Exam	No. of pages: 2

Answer all the following questions. The neat sketches are considered a part of your answer

Q1: Choose the most correct answer [23 marks]

1. Electric-resistance heating elements for steel melting furnaces are normally made of (80Ni-20Cr || 80Ni-20Cr+Al || 54Ni-46Cu || platinum || silicon carbide).

2. The basic lining of electric arc furnace walls is made of (magnesite || silica || clay || dolomite). It helps in reduction of sulfur content (True || False).

3. The holding period for austenitizing a 50 mm diameter steel bar is about (0.5 || 1 || 2 || 5) hr.

4. Induction hardening is conducted to low carbon steels (True || False). The induction coil with frequency (10 || 200 || 350 || 400) kHz provides the thinnest hardened case.

5. Stress relief is achieved by annealing when the residual stress > yield strength (True || False). The recommended heating temperature for this treatment is about (250 || 500 || 750 || 810)°C for low carbon steel.

6. Isothermally annealed structure have the following characteristics except formation of (textured ferrite and perlite || short pearlite lamella || coarse grained ferrite || high ferrite portion).

7. Nucleation of new crystals occurs during (recovery || stress relief || recrystallization || grain growth) annealing.

8. Quenching is an important stage in age hardening to (increase the strength || form the coherent precipitates || non-coherent precipitates || form supersaturated solution). Heating after this stage at high temperature for very long time causes overaging (True || False).

9. The age hardenable alloy (Dural || 2%Be-bronze || Cu-0.5%Cr || Mg-5%Zn) is commercially used for aircraft applications, whereas the resistance welding electrodes are made of (Dural || 2%Be-bronze || Cu-0.5%Cr || Mg-5%Zn) alloy.

10. If the diffusion coefficient of carbon in a steel sleeve is $1.51*10^{-5}$ cm^2/s at the carburizing temperature, the calculated case depth after 15 min is then (0.21 || 1.17 || 1.65 || 0.27) mm.

11. A 80 mm diameter and 30 kg steel bar is to be austenitized by heating to 850°C. Given the heat content of steel at room temperature and at 850°C is 40 and 720 kJ/kg, respectively, find the heat required to heat up the bar (1200 || 54400 || 578000 || 20400 || 21600) kJ. If the furnace efficiency is 85, what would be the heat to be by the fuel (1411.7 || 24000 || 64000 || 491300 || 17340) kJ.

12. Eutectoid steel contains about (6.67% || 4.30% % || 2.00% || 0.79) of carbon.

13. Temperature control fuels is less accurate in industrial furnaces operated with (liquid || oil || gaseous || solid). However, heavy oils are to be preheated before atomization to (save energy || reduce heat losses || reduce their viscosity || avoid air contamination).

14. Absence of recirculation is a positive indication for complete fuel/air mixing. (True || False)

15. Temperature uniformity inside furnace load is **not** affected by the (thermal conductivity || density || thermal expansion coefficient || specific heat || thermal diffusivity) of the load material.

16. Sponge iron is produced from (iron ore || pig iron & scrap || steel scrap || limestone & scrap).

Q2:   [3+7+6+4+6=**26 marks**]

1) Why the flue gas exit temperature is always higher than the furnace temperature?

2) Draw schematic of the construction of the arc furnace used in steel making. List the operating procedure.

3) What are the characteristics of the rimmed steel ingots? State briefly how the riming action occurs (the stages of rimming)?

4) Compare between the composition and role of the electrolyte used in the electrolysis cells for production of; (a) Aluminum, (b) Magnesium

5) How aluminum content affects (a) killing steel ingots, (b) martensite transformation temperature on TTT diagram, and (c) nitriding case hardening of steel

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Q3:   [6+4+5+5+3+3=**26 marks**]

1) With the help of TTT diagram explain the procedure of austempering and list its advantages and limitations.

2) High hardenability and high %C are not desirable for successful welding. Why?

3) "Spalling may occur for case hardened components. While nitriding increases the possibility of spalling, flame/induction hardening reduces this risk".

   What is meant here by spalling? Explain why nitriding and flame/induction hardening have contradicting متعارضة effects on spalling?

4) What are the causes and the consequences of the residual stresses? Is the recrystallization annealing sufficient to release such residual stresses?

5) With only sketches show how annealing temperature of a cold worked structure can influence the grain structure, tensile strength, and ductility.

6) Explain why the finer-grained metals exhibit higher strength compared to coarser-grained ones.

Best wishes,
Assoc. Prof. Mahmoud Ahmadein

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TANTA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF MECHANICAL POWER ENGINEERING
SECOND YEAR STUDENTS OF PRODUCTION ENGINEERING & MACHINE DESIGN
COURSE TITLE: HEAT TRANSFER   COURSE CODE: MEP2251

DATE: MAY,30-2018   SECOND TERM   TOTAL ASSESSMENT MARKS: 70   TIME ALLOWED : 3 HOURS

> **Remarks:** (answer the following questions; assume any missing data, steam and heat tables and charts are allowed)

Problem number (1)   (14 Marks)

(a) What is the thermal contact resistance, how it can be reduced?   **(3 Marks)**

(b) How does forced convection differ from natural convection?   **(3 Marks)**

(c) Steam at 320°C flows in a stainless steel pipe (k = 15 W/m·K) whose inner and outer diameters are 5 cm and 5.5 cm, respectively. The pipe is covered with 3-cm-thick glass wool insulation (k = 0.038 W/m·K). Heat is lost to the surroundings at 5°C by natural convection and radiation, with a combined natural convection and radiation heat transfer coefficient of 15 W/m²·K. Taking the heat transfer coefficient inside the pipe to be 80 W/m²·K, determine the rate of heat loss from the steam per unit length of the pipe. Also determine the temperature drops across the pipe shell and the insulation.   **(8 Marks)**

Problem number (2)   (14 Marks)

a) Hot water is to be cooled as it flows through the tubes exposed to atmospheric air. Fins are to be attached in order to enhance heat transfer. Would you recommend attaching the fins inside or outside the tubes? Why?   **(3 Marks)**

b) Does the (a) efficiency and (b) effectiveness of a fin increase or decrease as the fin length is increased?   **(3 Marks)**

c) A metallic electrical wire of diameter d = 5 mm is to be coated with insulation of thermal conductivity k = 0.35 W/m.K. It is expected that, for the typical installation, the coated wire will be exposed to conditions for which the total coefficient associated with convection and radiation is h = 15 W/m².K. To minimize the temperature rise of the wire due to ohmic heating, the insulation thickness is specified so that the critical insulation radius is achieved. During the wire coating process, however, the insulation thickness sometimes varies around the periphery of the wire, resulting in eccentricity of the wire relative to the coating. Determine the change in the thermal resistance of the insulation due to an eccentricity that is 50% of the critical insulation thickness.   **(8 Marks)**

Problem number (3)   (14 Marks)

a) Physically, what does the Grashof number represent? How does the Grashof number differ from the Reynolds number? **(3 Marks)**

b) Will a hot horizontal plate whose back side is insulated cool faster or slower when its hot surface is facing down instead of up? **(3 Marks)**

c) Aluminum fins of triangular profile are attached to a plane wall whose surface temperature is 250°C. The fin base thickness is 2 mm, and its length is 6 mm. The system is in ambient air at a temperature of 20°C, and the surface convection coefficient is 40 W/m^2.K.

 (a) What are the fin efficiency and effectiveness? (b) What is the heat dissipated per unit width by a single fin? **(8 Marks)**

Problem number (4)   **(14 Marks)**

a) Steel balls 12 mm in diameter are annealed by heating to 1150 K and then slowly cooling to 400 K in an air environment for which T_∞= 325 K and h = 20 W/m^2 .K. Assuming the properties of the steel to be k = 40 W/m.K, ρ = 7800 kg/m^3, and c = 600 J/kg .K, estimate the time required for the cooling process. **(6 Marks)**

b) Consider a cubic block whose sides are 5 cm long and a cylindrical block whose height and diameter are also 5 cm. Both blocks are initially at 20°C and are made of granite (k = 2.5 W/m·K and α = 1.15 x 10^{-6} m^2/s). Now both blocks are exposed to hot gases at 500°C in a furnace on all of their surfaces with a heat transfer coefficient of 40 W/m^2·K. Determine the center temperature of each geometry after 10 min. **(8 Marks)**

Problem number (5)   **(14 Marks)**

a) How does radiation influence the temperature measurements? **(3 Marks)**

b) What is the radiation shields? **(3 Marks)**

c) A cubical furnace 2 m on a side is used for heat treating steel plate. The top surface of the furnace consists of electrical radiant heaters that have an emissivity of 0.8 and a power input of 1.5 x 10^5 W. The sidewalls consist of a well-insulated refractory material, while the bottom consists of the steel plate, which has an emissivity of 0.4. Assume diffuse, gray surface behavior for the heater and the plate, and consider conditions for which the plate is at 300 K. What are the corresponding temperatures of the heater surface and the sidewalls? **(8 Marks)**

With my best wishes

EXAMINER   DR. ELSAYED ELSAID

Tanta University
Engineering Faculty
2nd Year Prodution

Course Code
MPD 2210

Machine design
Mai 2018
Time : 4 hours

Answer all the following questions :

(1)- Two parallel shafts whose centre lines are 4.8 m apart, are connected by an open belt drive. The diameter of the larger pulley is 1.5 m and that of smaller pulley 1.05 m. The initial tension in the belt when stationary is 3 KN. The mass of the belt is 1.5 Kg/m length. The coefficient of friction between the belt and the pulley is 0.3. Taking centrifugal tension into account, calculate the horse power transmitted , when the smaller pulley rotates at 400 r.p.m. .

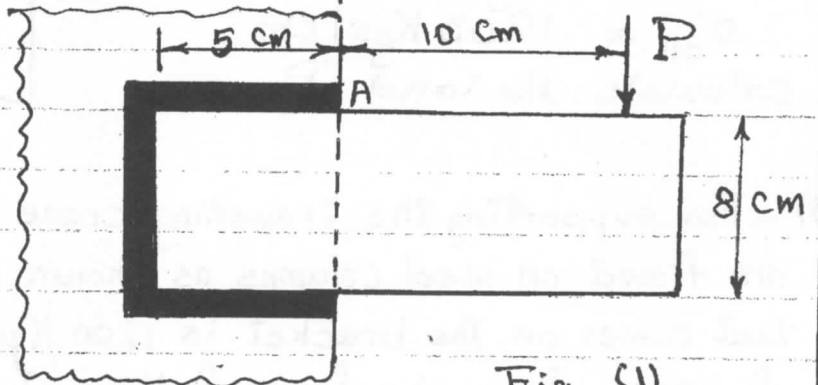(2) - A bracket carring a load P is to be welded as shown in Fig. (1). Calculate the value of the load P if the size of the weld is 8.5 mm and the working shear stress is not To exceed 800 Kgs/cm².

Fig. (1)

(3)- A beam ABCD is subjected To loads 50 KN (25 KN as shown in Fig. (2). Determine the deflection at point D and determine the value of maximum deflection of the beam between point B and point C.
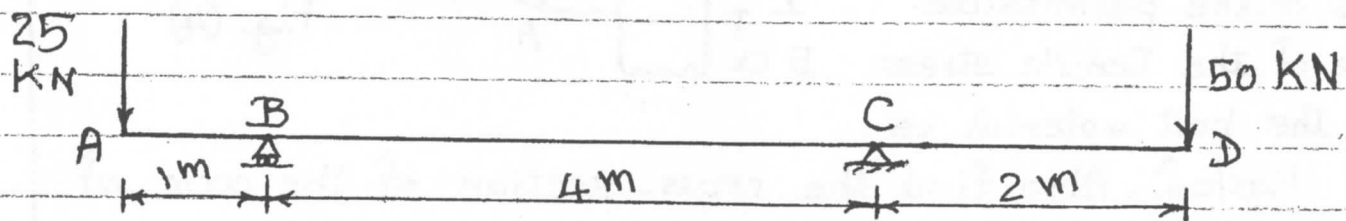

Fig. (2)

(4)_ An eccentrically loaded lap riveted joint is to be designed for a steel bracket as shown in Fig. (3). The bracket plate is 25 mm thick. All rivets are to be of the same size.

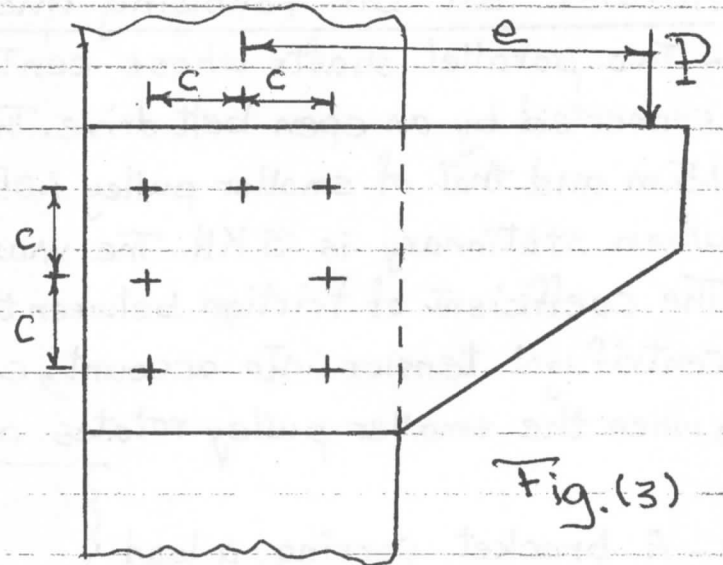rivet spacing, $C = 10$ cms, load arm, $e = 40$ cm, rivets size, $d = 25.5$ mm and the permissible shear stress is $\tau_{all} = 650$ Kgs/cm^2 and crushing stress is $\sigma_{all} = 1200$ Kgs/cm^2. Calculate the load P.

Fig. (3)

(5) _ For supporting the travelling crane in a workshop, the brackets are fixed on steel columns as shown in Fig. (4). The maximum load that comes on the bracket is 1200 Kgs, acting vertically at a distance of 40 cms from the face of the column. The vertical face of the bracket is secured to a column by 4 bolts, in two rows (two in each row) at a distance of 5 cm from the lower edge of the bracket.

Determine the size of the bolts if the permissible value of the tensile stress for the bolt material is 840 Kgs/cm^2, Also find the cross_section of the arm of the bracket which is rectangular.

Fig. (4)
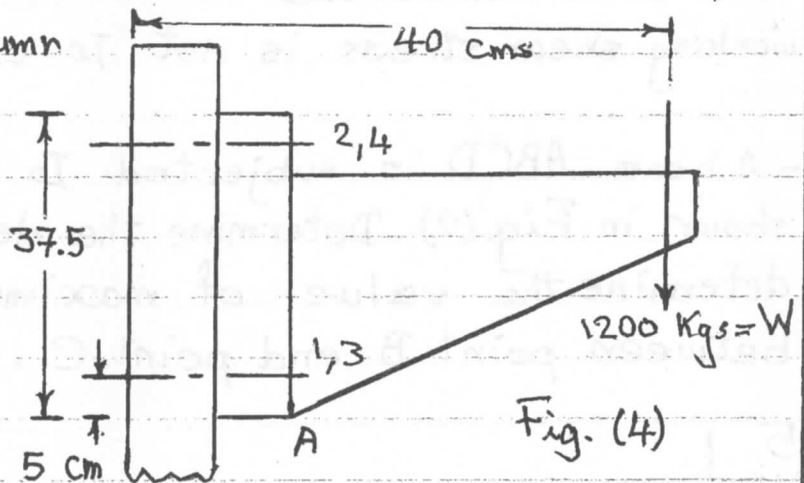
End of questions   Good Luck   Dr. H. Hendawy

Final EXAM 2017/2018 - Second Term

Course	Electrical Machines(EPM2245)	Time Allowed	3 hours
Students	2nd Year (Mechanical Power Engineering)	Total Mark	85
Date	6/ 6/2018	Number of page	1

Answer ALL the following questions:

The first question (17 marks)

A	Explain the load characteristic of D.C compound generator.
B	A 4 pole, lap wound 750 r.p.m. d.c. shunt generator has an armature resistance of 0.4 ohm and field resistance of 200 ohm. The armature has 720 conductors and the flux per pole is 30 mWb. If the load resistance is 15 ohm, determine the terminal voltage.

The second question (17 marks)

A	Explain the characteristic of d.c shunt motor.
B	A DC series motor has the following data: Armature resistance = 1.5 ohm, series field resistance = 2.5 ohm, supply voltage = 300 Volt, mechanical losses =300 W, if the input power is 6 KW at 3000 R.P.M, find the motor's efficiency.

The third question (17 marks)

A	What is the difference between ideal transformer and practical transformer?
B	A 5KVA, 500/250 V, 50 Hz, single-phase transformer gave the following readings, Open circuit test : 500 V, 1 A, 50 W (L.V. side open) Short circuit test : 25 V, 10 A, 60 W (L.V. side shorted)Determine. a- The efficiency on full load, 0.8 lagging power factor. b- The voltage regulation on full load, 0.8 leading power factor. c- The efficiency on 60% full load, 0.8 leading power factor. d- Draw the equivalent circuit referred to primary and insert all the values in it.

The fourth question (17 marks)

A	Write the various methods used for starting of three-phase induction motor.
B	A 480 V three-phase induction motor is drawing 60 A line current at 0.85 power factor lagging. The stator copper losses are 2000 W, the core losses are 1800 W, the rotor copper losses are 700 W and the friction and windage losses are 600 W. draw a power flow diagram of the motor and calculate the quantities: a- The air gap power d- The developed (converted) power b- The output power (shaft power)e-The efficiency of the motor c- The slip

The fifth question (17 marks)

A	Discuss the methods used for starting single-phase induction motors.
.B	A three-phase, 11 KV, 1MVA, 60 Hz, two-pole, star-connected, synchronous generator has Xs = 3 ohm per phase and Rs =.0.4 ohm per phase. The generator operates at full load with 0.8 lagging power factor. Determine. a- The excitation voltage. Draw the phasor diagram for this condition. b- The torque angle.c- The voltage regulation.

Good Luck and best wishes   Dr. Abdelwahab Hassan

Course Title: **Materials Joining** Date: 09-06- 2018	Course code: MPD4234 Allowed time: **3 Hr**	Year: 2ⁿᵈMech.Prod. Dept No. of Pages: (1)

أجب عن الأسئلة التالية موضحا اجابتك بالرسم كلما امكنك ذلك ... (درجات الأسئلة متساوية)

السؤال الأول:-

ا- تكلم باختصار عن عمليات وصل المواد؟ وأذكر خطوات عملية البرشمة؟ وما هي المواصفات الواجب توافرها فى مسمار البرشام

ب- عرف عملية اللحام؟ وأذكر شروط اللحام الجيد؟ وأذكر مزاياه؟وماهى عيوب اللحام؟.

ج- صنف عمليات اللحام؟ وما هي العوامل التى تحدد طريقة التجهيز المناسبة ونوع الوصلة المفضلة؟.

السؤال الثاني:-

ا- تكلم باختصار عن اللحام الغازى؟ وما هي الغازات المستعملة فى عملية اللحام الغازى الشائعة ؟ وما هي خواص غاز الأستيلين؟

ب- بين كيف يتم تصنيف محضرات الأستيلين؟ وما هي الشروط والمواصفات القياسية لمحضرات الأستيلين؟.

ج- ما هي احتياطات الأمن الصناعى : ا- عند اللحام وتداول الأسطوانات الصلب؟.

ب- عند تخزين الأسطوانات؟ .

السؤال الثالث :-

ا- اشرح تكوين بورى اللحام؟ وما شروط البورى لنجاح عمليات اللحام؟ وما أنواعه؟ وفرق بينه و بين بورى القطع؟ .

ب- عرف شعلة اللحام؟ وبين طريقة ضبط شعلة اللحام؟ وما هي أنواع اللهب؟.

ج- ما هي الشروط الواجب توافرها فى سلك اللحام؟ وصنفها؟ وعرف مساعدات الصهر وما وظائفها؟ .

السؤال الرابع:-.

ا- أذكر خلاصة القوس الكهربى؟ وما هي ادواره الرئيسيةفى تكوين القوس؟ وما العلاقة بين الجهد والتيار ودرجة حرارة القوس؟

ب- ما العلاقة بين الطاقة والجهد والتيار وطول القوس؟ وتكلم عن قابلية المعادن والسبائك للحام؟ ..

ج- عرف عيوب اللحام؟ وما طرق الكشف عنها؟ وما أنواعها؟ وما أسبابها؟ وما طرق معالجتها؟ .

السؤال الخامس:-

ا- ما هي مصادر التغذية لقوس اللحام؟ و قارن بين خطى اللحام بالتيار المتردد و التيار المستمر؟.

ب- ما هي العوامل المؤثرة على جودة وصلات اللحام وسلامتها؟ وما هي اختبارات جودة وصلات اللحام؟.

ج- تكلم باختصار عن ميتالورجية عملية اللحام بالصهر الهادئ والصهر الساخن؟ وما هي دورة اللحام؟.

السؤال السادس:-

ا- قارن بين اللحام الكهربائى و اللحام الغازى؟ وما هي مزايا وعيوب كل منهما؟ .

ب- ما هي احتياطات السلامة فى:- (١) لحام القوس الكهربائى.

(٢) لحام الأوكسى اسيتيلين.

ج- أذكر سبب ما يأتى:-

١ - ضعف جودة لحام الأوكسى أسيتيلين عن اللحام بالقوس الكهربائى.

٢ - يكثر التشوه فى الشغلة الملحومة عن طريق لحام الأوكسى أسيتيلين.

٣ - تفادى السحب البطئ لغاز الأسيتيلين عند اللحام.

٤ - كبر منطقة التأثر الحرارى بلحام الأوكسى اسيتيلين.

السؤال السابع:-

ا- أذكر أنواع أسياخ اللحام؟ وأيها أصلح فى لحام القوس الكهربائى؟ وأذكر المواد المستخدمة فى تغليف أسياخ اللحام بالقوس الكهربائى بطريقة البثق؟ وما فائدة مواد التغليف؟.

ب- ما هي مساعدات الصهر الجيدة التى تضاف لمواد خلطة التغليف لأسياخ اللحام بالقوس الكهربائى؟ وما هي فوائد مساعدات الصهر فى لحام القوس الكهربائى؟ وما هي الأشتراطات الواجب توافرها لمساعدات الصهر؟.

ج- أذكر العوامل التى تؤثر فى الفقد فى الالكترود واحتمال انحباسه فى اللحام مع شرح عنصرين منهما؟.

(((مع أجمل التمنيات بالتوفيق والنجاح))).........

(((الممتحن: ا.د./ علاء الدين الحمادى واللجنة)))

Tanta University		Department: Production Engineering & Mechanical Design Total marks: 60 Marks		Faculty of Engineering
Course Title: Metrology Measurement Equipment **Course Code:** MPD2212 **Year:** 2nd Year Production				**Date:** 11- 6- 2018 **Allowed time:** 3 hrs. **No. of pages:** 2
		Final term Exam		

Answer all the following questions:

Q1. (15 marks)

a. Define measurement? And mention the basic information about measurement?

b. What are the factors that influence the choice of measurement devices? With a brief mention of both of them?

c. What are the different types of calipers in the industry? Please identify your answer with help of sketch?

d. Discuss the elements of measuring systems? Please identify your answer with help of sketch?

Q2. (20 marks)

1- How to measure the following dimension by gage blocks

- **5.020 mm, 6,120mm**

- Select the gage blocks from the blow table.

مقدار التزايد (الخطوة) (mm)	أطوال القوالب (mm)	عدد القوالب
0.005	من1.005إلى 1.01	2
0.01	من1.02إلى1.10	9
0.1	من1.20إلى1.90	9
1	من1إلى10	10
10	من20إلى30	2
30	60	1

2- Describe the gages used in difficult transferring dimension and not available in ordinary measurement devices?

3- Explain in details each of the following:

1) Indicating and recording element (mechanical movement, electromechanical movement, and electronic indication).

2) Mechanical amplification.

3) Fluid amplification.

4) Optical amplification.

5) Electrical amplification.

Q3.   **(10 marks)**

  a. Mention the four sources of errors in semi conductor strain gauges

  b. A force transducer with sensitivity of **2m**V/V and maximum capacity of **50** ton is used in a platform scale. If the excitation of the sensor circuit is **5V**, obtain the force (ton)-output (volt) equation and calculate the sensor output if the vehicle weight was **30** ton.

Q4.   **(15 marks)**

  i.   Explain in details with simple drawing the **source of error in** measurement equipment;

  ii. Define the calibration of measuring, and mention the steps of calibration?

  iii. Explain in details with drawing the following **Torque measurement:**

         a- Torque measurement by mechanical technique.

         b- Torque measurement by electrical technique.

Dr. Eng. Maher . R. Elsadaty