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, 28-2016   SECOND TERM   TOTAL ASSESSMENT MARKS: 75   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 physical basis for existence of a *critical insulation radius*? How do the thermal conductivity and the convection coefficient affect its value?   (4 Marks)

(b) If the air in the contact region between two surfaces is replaced by helium, how is the thermal contact resistance affected? How is it affected if the region is evacuated?   (3 Marks)

(c) A stainless steel (AISI 304) tube used to transport a chilled pharmaceutical has an inner diameter of 36 mm and a wall thickness of 2 mm. The pharmaceutical and ambient air are at temperatures of 6 °C and 23 °C, respectively, while the corresponding inner and outer convection coefficients are 400 W/m^2. K and 6 W/m^2. K, respectively. (a) What is the heat gain per unit tube length?
(b) What is the heat gain per unit length if a 10-mm thick layer of calcium silicate insulation (k_{ins} = 0.050 W/m. K) is applied to the tube?   (7 Marks)

Problem number (2)   (14 Marks)

a) What are the mechanisms of heat transfer? how are they distinguished from each other? (3 Marks)

b) What is the physical interpretation of the *Biot number and Fourier number*?   (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/m^2. 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) How are the effectiveness and efficiency of a fin affected if its thermal conductivity is increased? If the length of the fin is increased?   (4 Marks)

b) What is the *Planck distribution*? What is *Wien's displacement law*? (4 Marks)

c) The engine cylinder of a motorcycle is constructed of 2024-T6 aluminum alloy (k = 186 W/m. K.) and is of height H = 0.15 m and outside diameter D = 50 mm. Under typical operating conditions the outer surface of the cylinder is at a temperature of 500 K and is exposed to ambient air at 300 K, with a convection coefficient of 50 W/m². K. Annular fins are integrally cast with the cylinder to increase heat transfer to the surroundings. Consider five such fins, which are of thickness t = 6 mm, length L = 20 mm, and equally spaced. What is the increase in heat transfer due to use of the fins? (6 Marks)

Problem number (4)   (14 Marks)

a) Is the lumped capacitance method of analysis likely to be more applicable for a hot solid being cooled by forced convection in air or in water? By forced convection in air or natural convection in air? (3 Marks)

b) A 5-cm-high rectangular ice block (k = 2.22 W/m·K and α = 0.124 x 10^{-7} m²/s) initially at - 20°C is placed on a table on its square base 4 cm x 4 cm in size in a room at 18°C. The heat transfer coefficient on the exposed surfaces of the ice block is 12 W/m²·K. Disregarding any heat transfer from the base to the table, determine how long it will be before the ice block starts melting. Where on the ice block will the first liquid droplets appear? (11 Marks)

Problem number (5)   (14 Marks)

a) What is the relation between radiosity, blackbody emissive power, and irradiation for a reradiating surface? Does the temperature of such a surface depend on its radiative properties? (3 Marks)

b) What is a *radiation shield* and how is net radiation transfer between two surfaces affected by an intervening shield? Is it advantageous for a shield to have a large surface absorptivity or reflectivity? (3 Marks)

c) Two concentric spheres of diameter D_1 = 0.8 m and D_2 = 1.2 m are separated by an air space and have surface temperatures of T_1 = 400 K and T_2 =300 K

(a) If the surfaces are black, what is the net rate of radiation exchange between the spheres?

b) What is the net rate of radiation exchange between the surfaces if they are diffuse and gray with ϵ_1 = 0.5 and ϵ_2 = 0.05? (8 Marks)

With my best wishes

EXAMINERS   DR. ELSAYED ELSAID

Tanta University		Department: Production Engineering & Mechanical Design Total marks: 75 Marks		Faculty of Engineering

Course Title: Joining of Materials
Course Code: MPD2211
Year: 2nd Year Production

Final term Exam

Date: 4 – 6 - 2016
Allowed time: 3
No. of pages: 2

Answer all the following questions with help of sketch

Q1. **(25 marks)**

1. What are the many different energy sources can be used for welding processes?

2. Explain with drawing the several zones in a fusion welded join?

3. What are the types of joints and welding positions?

4. What is the function of electrode (flux) in arc welding?

5. Describe with sketch the different types of the flame in oxyacetylene welding?

Q2. **(25 marks)**

a. Compare between oxyacetylene welding, arc welding and gas tungsten arc welding from the advantages and disadvantages of them.

b. Mention the main advantage, disadvantage and applications of the shielded metal arc welding (SMAW) process?

c. What are the advantages of SSW over FW Processes?

d. What are the types of solid state welding processes (SSWP)? Indentify your answer by simple drawing.

Q3. **(25 marks)**

i. Discus with drawing the welding defects?

ii. What is the importance of industrial security?

iii. What are the most important measures that limit accidents in the factories?

iv. Mention the rules of industrial safety in detail when working on machines to reduce accidents?

v. A **50** mm diameter solid shaft is welded to a flat plate as shown in **Fig.1**. If the size of the weld is **15** mm, find the maximum normal and shear stress in the weld.
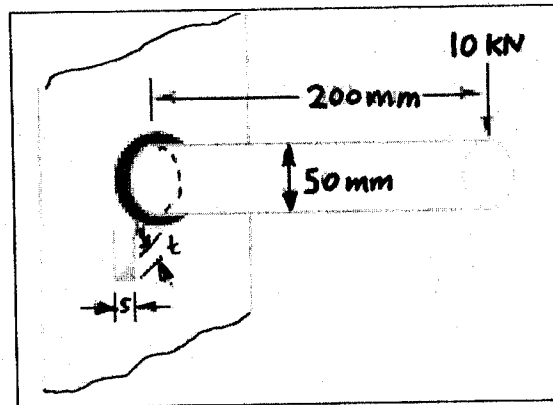

Fig.1

With my best wishes

Dr. Eng. Maher. R. Elsadaty

بسم الله الرحمن الرحيم

Tanta University
Engineering Faculty
2 nd Year Production

Final Escamn
2015/2016

Machine Design
June 2016
Time 4 hours

Answer all the following questions :

Question (1) (20 marks):

a)- State the advantages and disadvantages of belt use.

b) _ A flat belt has an elastomer envelope is 200 mms wide & and transmits 60 KW at a belt speed of 5 m/s. The belt is used crossed configuration to connect a 300 mms driving pulley to 900 mms diameter driven Pulley at a shaft spacing of 6 m . Calculate the belt length and the angles of warp & calculate the belt tension based on a cofficient of friction of 0.38 & Compute also the minimum belt thick if the allowable stress on the belt is 16 Kgs/cm².

Question (2) (25 marks):

a)_ What are the types of Welding.

b)_ A bracke as shown in Fig.(1) carries a load of 15 KN. Find the size of the weld if allowable shear stress is not exceed 80 N/mm².

a=60 mm   115 mm
t
b=100 mm
15 KN

Fig. (1)
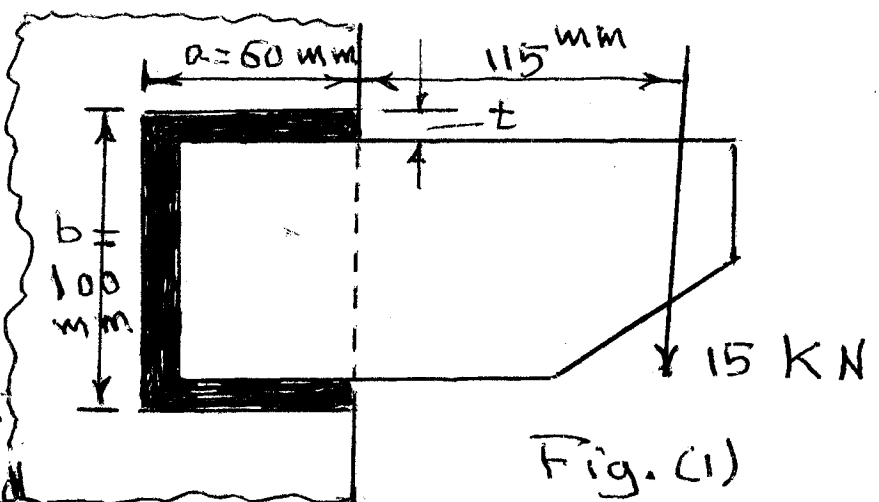
Question (3) (30 marks)

An eccentrically load lap riveted joint is to be

designed for a steel bracket as shown in Fig. (2).
The bracket is 10 mms thick. All rivets are to be
the same size. The loads on the bracket are

P = 1250 Kgs

Q = -1000 Kgs.

The rivets specing
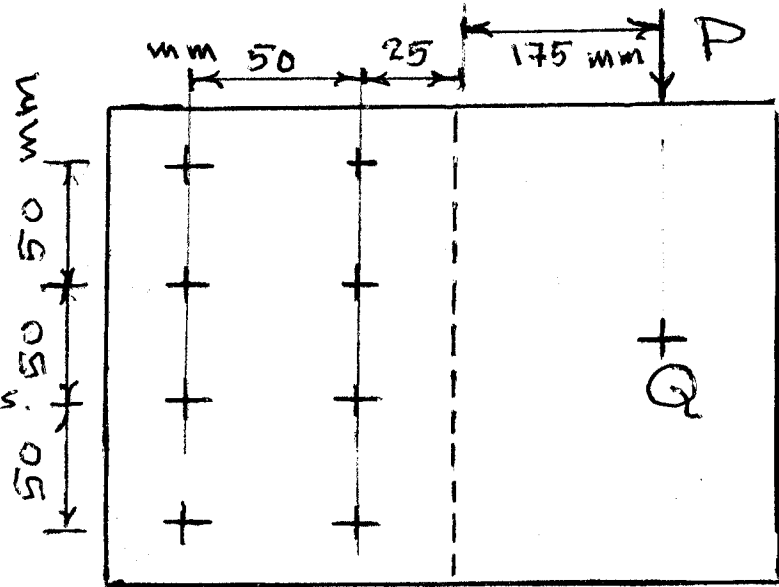is   C = 50 mms
6 load arm = 22.5 Cms.

Fig. (2)

Question (4) (25 marks)

A pulley bracket as
shown in Fig. (3) is
supported by 6
bolts 6 two at
A-A 6 two at B-B
and two at c-c.
Find the size of
bolts using on
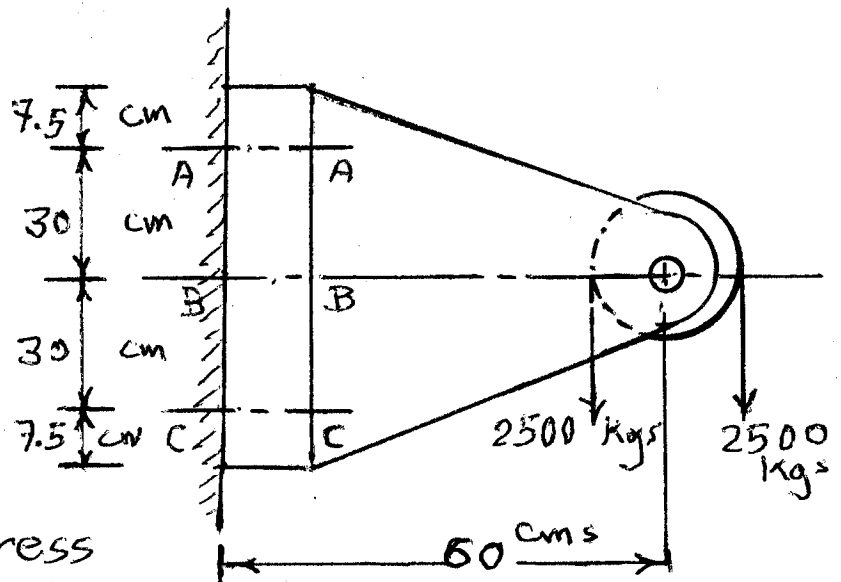allowable shear stress
of 250 Kgs/cm² for
the material of bolts.

Fig. (3)

End of questions

مع أطيب التمنيات بالتوفيق .... بالنجاح لكم والمستقبل

Electrical Power and Machines Engineering Department

TANTA UNIVERSITY

Faculty Of Engineering

Final EXAM 2015/2016 - Second Term

Course	Electrical Machines (EPM2244)		Time Allowed	3 hours
Students	2nd Year (Production Engineering and Mechanical Design)		Total Mark	85
Date	8/ 6/ 2016		Number of pages	2

Answer ALL the following questions:

	The first question (17 marks)
A	Explain in detail the construction of a dc machine.
B	A four pole, lap wound long shunt compound generator has 1200 armature conductors. The armature, series field and shunt field resistances are 0.1 ohm, 0.15 ohm and 250 ohm respectively. If the flux per pole is 0.075 Wb. calculate the speed at which the machine should be driven so that it can deliver the load of 50 Kw at 500 V. take overall voltage drop due to brush contact as 2 volts.

|	**The second question (17 marks)**
A	Explain the characteristic of d.c series motor.
B	A 250 V d.c. series motor takes 30 A when running at 800 r.p.m., calculate the speed at which motor will run if field winding is shunted by a resistance equal to field winding resistance and the load torque is increased by 50 %. Armature resistance is 0.15 ohm and series field resistance is 0.1 ohm. Assume the flux produced is proportional to the field current.

	The third question (17 marks)
A	Explain the short circuit test and open circuit test on transformer. Why these tests are to be performed?

B	A 1100/110V step down single phase transformer has the following parameters. $R_c = 2K\Omega$, $X_m = 1.5\ K\Omega$, $R_1 = 4\Omega$, $X_1 = 3\ \Omega$, $R_2 = 0.04\ \Omega$, $X_2 = 0.03\ \Omega$
	 If the transformer delivers its output to a load of 5.5 kVA with 0 8 lagging power factor at 110V Calculate '
	   a. The primary voltage b. The voltage regulation
	   c. The transformer efficiency

	The fourth question (17 marks)
A	List the various methods of speed control of a three-phase induction motor.

B	A 25 Kw, 4 pole, three-phase, 50 Hz induction motor is running at 1410 rpm, supplying full load. The mechanical losses are 850 W and stator losses are 1.7 times of rotor copper losses on full load. calculate:
	   a- gross mechanical power developed
	   b- rotor copper losses
	   c- the value of rotor resistance per phase if rotor current on full load per phase is 65 A
	   d- the full load efficiency

1/2

The fifth question (17 marks)	
A	Draw the phasor diagram of a synchronous generator at laging power factor, leading power factor and unity power factor
B	A 40kVA, 380V, 4-pole, 50Hz, star connected, 3-phase synchronous generator has per phase armature resistance of 0.04Ω & armature reactance of 0.42Ω. The generator has 100 turns per phase. Determine: a) The generated e.m.f voltage (E_{ph}) at full load with 0.8 lagging pf b) The full load voltage regulation. c) The generator driving speed d) The flux per pole

Good Luck and best wishes
Prof. Essam Eddin M. Rashad
Dr. Abdelwahab Hassan
Dr. sherif Dabour
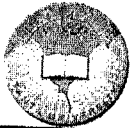
Course title: **Furnaces and Heat Treatment**	
Course code: MPD 2213	Date: 15 June 2016
Year: 2nd – Production Engineering and Mechanical Design	Total marks: 75
2nd Term – Final Exam	Time allowed: 3 hrs
	No. of pages: 2

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

Q1: Choose the **most** correct answer

(25 marks)

1. Kilns operate at (higher – the same – lower - minimum) temperature range of the furnaces and are normally used for (melting metals – extraction of metals – refining molten metals – firing ceramics).

2. Induction heating of furnaces use high voltage direct current (True – False)?

3. 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.

4. The specific heat, C_p, and thermal conductivity, k, of furnace lining can reduce energy losses to LOWEST level if (C_p decreases and k increases – C_p increases and k decreases – both of C_p & k decrease – both of C_p & k increase - neither C_p nor k has influence).

5. Excess air in fuel heated furnaces (forms diffusion flame – maximizes the heat generated – leads to incomplete combustion – reduces furnace thermal efficiency)

6. The charge of blast furnace consists of: (a) coke + limestone + pig iron; (b) coke + limestone + iron ore; (c) coke + limestone + scrap; (d) coke + limestone + sponge iron

7. Permanent jamming of cupola is mainly caused by (delay of tapping the molten metal – low furnace temperature – frequent pocking of the charge – lack of coke in charge).

8. The oxygen free steel is also known as (killed – semi-killed – capped – rimmed) steel.

9. Aluminum is produced in electrolysis cells by the decomposition of alumina (True – False)?

10. (Increasing ductility of – Increasing strength of – Homogenizing – Improving corrosion resistance of) the material is NOT of the objectives of heat treatment.

11. TTT diagram provides information about (cooling rate and composition – cooling rate – composition – temperature – time) required to obtain certain transformation structure of austenite.

12. Brine is faster quenchant than water since the soluble salts (provide thicker vapor blanket – increase thermal conductivity of water – stabilize cooling rate – explode causing elimination of vapor blanket).

13. The resulting structure after Isothermal tempering and quenching of carbon steel contains (only martensite – tempered martensite & pearlite – tempered martensite & bainite – martensite and tempered bainite – only bainite) and the obtained hardness and tensile strength is (higher – lower – equal to that) obtained from martempering of the same alloy.

14. Nitriding is a case hardening process of (alloy – low carbon – medium carbon – plain carbon) steel. The most common nitriding agent is (nitrogen – sodium carbide – ammonia – sodium cyanide).

15. 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 (1.65 – 0.21 – 1.17 – 0.27) mm.

16. Very long annealing time after cold working leads to (polygonization - growth – recovery – recrystallization – melting) of the distorted solid grains.

17. Strengthening of be ageing basically occurs in alloys with (no – limited – unlimited) solid solubility by forming of (coarse – fine – soft – macroscopic) precipitates of (eutectic – liquid – a coherent – a non-coherent) phase.

18. The best practice أفضل اسلوب for double strengthening an age treatable alloy is:
    a) Age hardening followed by cold working
    b) Age hardening followed by grain refinement
    c) Age hardening followed by precipitation hardening
    d) Cold working followed by age hardening
    e) Hot working followed by age hardening
    f) Age hardening followed by hot working

19. Resistance welding electrodes are normally made of (Stainless steel – Cu-0.5%Cr – Beryllium-bronze – Al-4%Cu – Cu-Brass – Cu-50%Cr – Cu-50%Ni) alloy.

Q2:   (5+6+3×4=**23 marks**)

1) Explain with aid of sketches the basic steps of steelmaking in BOF.

2) Differentiate briefly between the following terms
    a- Iron, iron ore, pig iron, sponge iron, steel and cast iron.
    b- The characteristics of combustion flame with- and without-recirculation.
    c- Primary and secondary air in fuel burners.
    d- Martempering and austempering

Q3:   (**14 marks**)

For the given schematic IT-diagram, where A=austenite, P=pearlite, B= bainite, answer the following:

a. What are the benifets of IT diagrams

b. Why austenite still existing below the lower transformation temperature on the left of S-curve?

c. What is the resulting structure for the time lines A →D?

d. Draw schematically the slowest cooling rate to form 100% martensite.

e. Draw the cooling pathes for mar-tempering and isothermal tempering and quenching.
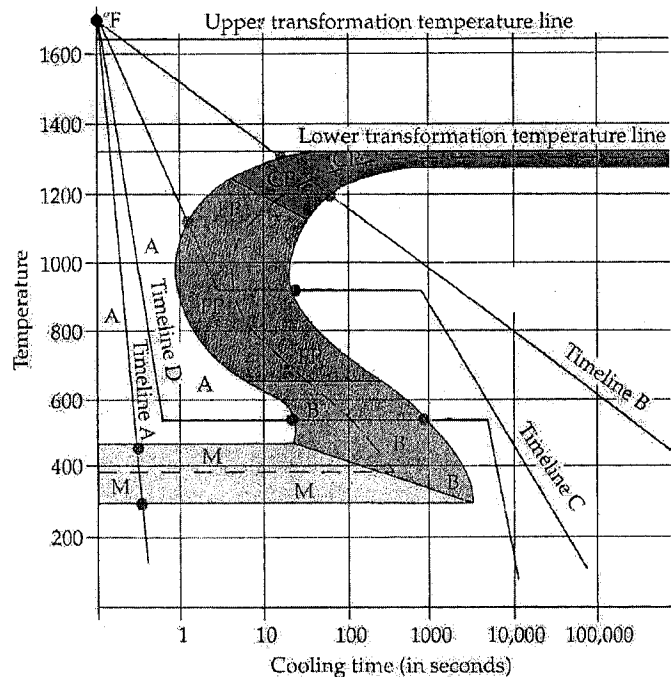
Q4:   (4+3+6=**13 marks**)

a) What is meant by high and shallow hardenable steels? How to achieve each?

b) Explain shortly the different types of surface carburizing methods.

c) List four mechanisms for strengthening nonferrous alloys. Show with help of sketches the procedure of strengthening Al-4%Cu alloy aging heat treatment. Draw the lattice structure of a well-aged alloy

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Best wishes,
Assoc. Prof. Mahmoud Ahmadein

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

Final term Exam

Date: 11- 6- 2016
Allowed time: 3 hrs.
No. of pages: 2

Answer all the following questions:

Q1.

(15 marks)

a. Define Metrology?

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

c. What are the uses of Gage Blok in the industry?

d. Mention the types of Gauges?

e. What do you know about elements of measuring systems? Please identify your answer with help of sketch?

Q2.

(15 marks)

- Explain in details each of the following:

1. Mechanical amplification.
2. Fluid amplification.
3. Optical amplification.
4. Electrical amplification.
5. Indicating and recording element (mechanical movement, electromechanical movement, and electronic indication).


Q3.

(10 marks)

a- A piezo-resistive pressure transducer with sensitivity of 3mV/V and maximum capacity of 150 bar is used to monitor the inside pressure of a hydraulic press. If the excitation of the sensor circuit is 10V, obtain the pressure (bar)-output (volt) equation and calculate the sensor output at 90 bars.

b- In order to calculate the principal stresses in a test sample three strain gauges at used at different angles as shown in fig. (1). The following reading are obtained:

Gauge number	strain
1	$850 * 10^{-6}$
2	$-100 * 10^{-6}$
3	$350 * 10^{-6}$
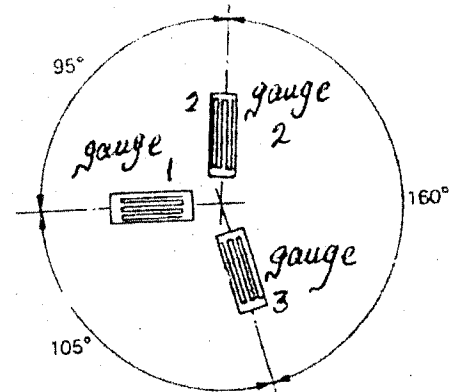
Calculate the principal strains.

Fig. (1): Three strain gauges at three different angles.

(20 marks)

Q4.

i. Calculate the absolute error in the volume of a cylinder if the cylinder diameter (D) is 5cm and the height h is 10cm. the measuring error for the cylinder diameter and height is 0.2%.

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

    1. Manufacture errors.

    2. Design errors.

    3. Operating errors.

    4. Environmental errors.

    5. Application errors.

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

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

    a- Torque measurement by mechanical technique.

    b- Torque measurement by electrical technique.

With my best wishes

Dr. Eng. Maher. R. Elsadaty