

جامعة طنطا		قسم هندسة القوى الميكانيكية اسم المادة: الأمن الصناعي و التشريعات MEP22H6		كلية الهندسة
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تاريخ الاختبار 2015/6/16  
زمن الاختبار ساعتين  
الدرجة العظمى 50 درجة

قسم هندسة القوى الميكانيكية  
الفرقة الثانية لائحة 2005  
اختيار نهاية العام  
العام الجامعي 2014/2015

اجب على الاسئلة الاتية:

(14 درجة)

السؤال الاول

- (a) لأسباب كثيرة تعتبر المواد الكيميائية من أشد وأخطر ما يواجه الإنسان، اذكر اهم أسباب خطورة تداول المواد الكيميائية؟  
(b) اذكر مع الشرح اهم مسببات الحوادث الكهربائيه  
(c) للجهاز الاداري دور هام للحد من الحوادث، اشرح هذه العبارة موضحا مع الشرح اهم الخصائص التنظيمية لهذا الجهاز؟  
(d) اشرح ما تعرفه عن: بطاقات تعريف المواد الكيميائية- مخاطر الحمل اليدوي - مخاطر الرطوبة - قيمه حد الاحتمال

(9 درجة)

السؤال الثاني

(a) أحسب لما يلي مقدار الجرعة الضووضائية وناقش قيمتها؟

ديسبل 110	ديسبل 105	ديسبل 95	ديسبل 87	مستوى ضوضاء
24 دقيقة	1 ساعة	4 ساعة	12 ساعة	الزمن المصرح
10 دقائق	15 دقيقة	45 دقيقة	3 ساعة	زمن المعرض له

(b) ما هي العوامل المؤثرة في تحديد درجة خطورة القيام بعمل ما ؟ وضح ذلك بمثال ؟

(15 درجة)

السؤال الثالث

- (a) اذا كان مستوى ضوضاء ماكينة عند نقطة تبعد عنها مسافه 20 متر هو 55 ديسبل فما هو مستوى ضوضاء الماكينة  
(b) عدد مع الشرح اهم الاخطاء الشائعة في عمليات التخزين؟  
(c) اذكر مع الشرح اهم خصائص عناصر نظام العمل ؟  
(d) ما مدى خطوره الصدمة الكهربائيه على الانسان وما هي العوامل التي تعتمد عليها درجة خطورتها ؟  
(e) قارن بين مطفاه ثاني اكسيد الكربون و مطفاه البودره الكيميائيه و مطفاه الماء المضغوط من حيث الاستخدام واللون

(12 درجة)

السؤال الرابع

ضع علامة (√) امام العبارة الصحيحة و علامة (X) امام العبارة الخاطئة تم صحح أو صوب الخطأ

1. مستلزمات الوقاية الشخصية هي الادوية والتطعيمات اللازمة لوقاية العامل من الامراض
2. كلما زاد عدد العمال بالعمل يزداد معامل تردد وقوع الحوادث (بفرض ثبوت عدد الحوادث)
3. أحد الامثلة على ادراك العامل للمخاطر وابعادها "في بداية وردية العمل لاحظ عامل في أحد ورش اللحام وجود فيروسين مسكوب على الارض فقام العامل بتنظيف الارض من الفيروسين قبل مغادرته العمل مباشرة (في نهاية الوردية)"
4. يفضل عمل مساراخلاء واحد فقط لعدم تشتت الافراد وانقسامهم أثناء الاخلاء في حالة الطوارئ
5. ارتفاع حرف العلامات الإرشادية لمخارج الطوارئ يجب ان لا يقل عن 10 سم
6. من شروط مخارج الهروب. يجب أن تفتح الابواب للداخل وتكون غير موصده و سهلة الفتح
7. الخطر التدميري للحرائق هو الخطر الذي يهدد الاماكن والمنشآت القريبة لمكان الحريق
8. حرائق النوع الثالث (Class C) هي حرائق تمت بسبب وجود عناصر الاشتعال الثلاثة في وقت واحد
9. قيمة حد للاحتمال (احد معايير قياس تلوث الهواء) وهو مقدار التركيز المسموح به للتعرض خلال فتره زمنية
10. مستلزمات الوقاية الشخصية هي الادوية والتطعيمات اللازمة لوقاية العامل من الامراض
11. من خصائص الخوذ ان تكون المسافه بين الحامل المرن الداخلي والغلاف الخارجي للخوذة مسافة حوالي 10 سم
12. الجهاز الواقي الكيماوي هو عبارة عن مرشحات من الورق أو القطن أو الإسفنج تمنع وصول الأتربة إلى الجهاز التنفسي
13. من قواعد السلامة المهنية وجود اسطوانات اطفاء الحريق داخل جميع الحجرات
14. التلوث المادي مثل الضوضاء والاشعاع و البصري و الحراري
15. النظام الاداري الجيد هو الذي يفرق في التعامل بين العمال ويحايى البعض على الاخر اى كما يقال "فرق تسود"
16. عناصر نظام العمل هي راس المال - المواد - الافراد
17. اسطوانه مطفاه ثاني اكسيد الكربون لونها احمر
18. تعتمد نظرية اطفاء الحريق على مثلث الاشتعال وذلك بإزالة كل أضلاعه (عناصر الاشتعال)

خالص تحياتي و شكري

**Question (2) ( 25 marks)**

**2-a)- Assigned if the following statements is correct ✓ or incorrect ✗ ( 10 Marks)**

- 1- In steady flow the velocity varies with time only, the patterns of fluctuation, with respect to time, being same at all points.
- 2- In turbulent flow the shear stress is mainly due to the dynamic viscosity of the fluid.
- 3- The boundary layer exists in flow over flat surfaces only.
- 4- The displacement thickness is the layer which represents reduction in momentum caused by the boundary layer.
- 5- For circular pipe, the flow is turbulent when the Reynolds number lower than 2100.
- 6- Dimensional homogeneity states that every term in an equation when reduced to fundamental dimensions must contain identical powers of each dimension.
- 7- The Kinematic similarity means the similarity of forces between the model and prototype.
- 8- Reynolds number is defined as the ratio of the inertia force to the pressure force of flowing fluids.
- 9- To apply Buckingham theorem, m repeating variables are selected from amongst the n variables influencing the phenomenon. The repeating variables are selected such that they in combination contain each of the m fundamental dimensions involved in the problem.
- 10- Geometric similarity between the model and prototype is the similarity of forces.

2-b) Draw a neat sketch of the Reynolds apparatus, and explain how the different types of flow can be demonstrated with the help of apparatus. (5 Marks)

2-c) Explain the Buckingham's theorem for dimensionless analysis, The resistance **R** experienced by a partially submerged body depends upon the velocity **V**, length of the body **l**, viscosity of the fluid  $\mu$ , density of the fluid  $\rho$  and gravitational acceleration **g**. Obtain a dimensionless expression for **R**. (5Marks)

2-d) Draw the Boundary layer and velocity distribution indicating Laminar, Transition and Turbulent regions for: a- flat plate b- pipes (5 Marks)

**Question (3) ( 20 marks)**

3-a) Derive the Von-Karman momentum integral equation for the flow in boundary layer. (10 Marks)

3-b) The velocity distribution in the boundary layer over the face of a spillway was observed to be:

$\frac{u}{U} = \left( \frac{y}{\delta} \right)^{0.22}$ , the free stream velocity **U** is 20 m/s and boundary layer thickness 5 cm at a certain section. The discharge is 5 m<sup>3</sup> /s per meter length of spillway. Calculate displacement thickness, energy thickness and loss of energy up to section under consideration. (5 Marks)

3-c) Explain what is meant by separation of boundary layer? Describe with sketches the methods to control separation. (5 Marks)

**Question (4) ( 20 marks)**

4-a) Derive the relation between shear stress and head losses in pipeline flow (5 Marks)

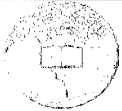
4-b) Derive the Hagen –Poiseuille flow and state the assumptions made. (5 Marks)

4-c) A new cast iron pipeline 0.30 m in diameter and 300 m long connects two reservoirs having surface elevation 30 m and 45 m. Calculate the flow rate through this line, assuming water at 10 °C and a square – edged entrance, For water at 10°C:  $\nu=1.306 \times 10^{-6} \text{ m}^2/\text{s}$ .

Assume that the relative roughness  $e/d$  equal to 0.00083. (10 Marks)

*With Best Wishes Dr. Mohamed Amro*

- 17- **The boundary layer exists in which of the following?**  
 a- flow of real fluid  
 b- flow of ideal fluids  
 c- flow over flat surfaces only  
 d- pipe flow only
- 18- **the displacement thickness is**  
 a- the layer in which the loss of energy is minimum  
 b- the layer which represents reduction in momentum caused by the boundary layer  
 c- the thickness up to which the velocity approaches 99% of the free-stream velocity  
 d- The distance measured perpendicular to the boundary by which the free-stream is displaced on account of formation of boundary layer.
- 19- **...is defined as the layer which represents reduction in momentum caused by the boundary layer**  
 a- boundary layer thickness  
 b- displacement boundary layer thickness  
 c- momentum boundary layer thickness  
 d- energy boundary layer thickness
- 20- **Over a long flat plate, the laminar boundary layer becomes unstable and changes flow characteristics from laminar to turbulent when the plate Reynolds number approaches a value between:**  
 a-  $3 \times 10^4$  to  $5 \times 10^4$   
 b-  $3 \times 10^5$  to  $6 \times 10^5$   
 c-  $2 \times 10^6$  to  $5 \times 10^6$   
 d-  $5 \times 10^6$  to  $8 \times 10^6$
- 21- **Von Kàrman momentum integral equation is applicable to:**  
 a- laminar boundary layer flow only  
 b- turbulent boundary layer flow only  
 c- transition boundary layer flow only  
 d- laminar, transition, and turbulent boundary layer flows
- 22- **Which of the following factors determine the friction factor for turbulent flow in a rough pipe?**  
 a- Mach number and relative roughness  
 b- Froude number and Mach number  
 c- Reynolds number and relative roughness  
 e- Froude number and relative roughness
- 23- **Boundary layer separation occurs when**  
 a-  $\frac{dp}{dx} < 0$   
 b-  $\left(\frac{du}{dy}\right)_{y=0} = 0$   
 c-  $\left(\frac{du}{dy}\right)_{y=0} > 0$   
 d- none of the above
- 24- **the separation of boundary layer can be prevented by**  
 a- providing small divergence in a diffuser  
 b- providing a trip-wire ring in the laminar region for the flow over a sphere  
 c- providing a bypass in the slotted wing  
 d- Suction of the slow moving fluid by a suction slot.
- 25- **Which of the following is the condition for detached flow?**  
 a-  $\left(\frac{du}{dy}\right)_{y=0} = 0$   
 b-  $\left(\frac{du}{dy}\right)_{y=0} > 0$   
 c-  $\left(\frac{du}{dy}\right)_{y=0} < 0$   
 d- none of the above



Tanta University  
Faculty of Engineering  
Mechanical Power Engineering Department  
2<sup>nd</sup> Year Power Mechanics

Subject: Fluid Mechanics (1-B)  
Code: MEP2203  
Final Exam, Full Marks: 90 points  
Time allowed: 3 Hours, Date: 14-6-2015



Remarks: (answer the following questions and assume any missing data)  
الاختبار في أربع ورقات بالإضافة إلى خريطة مودى

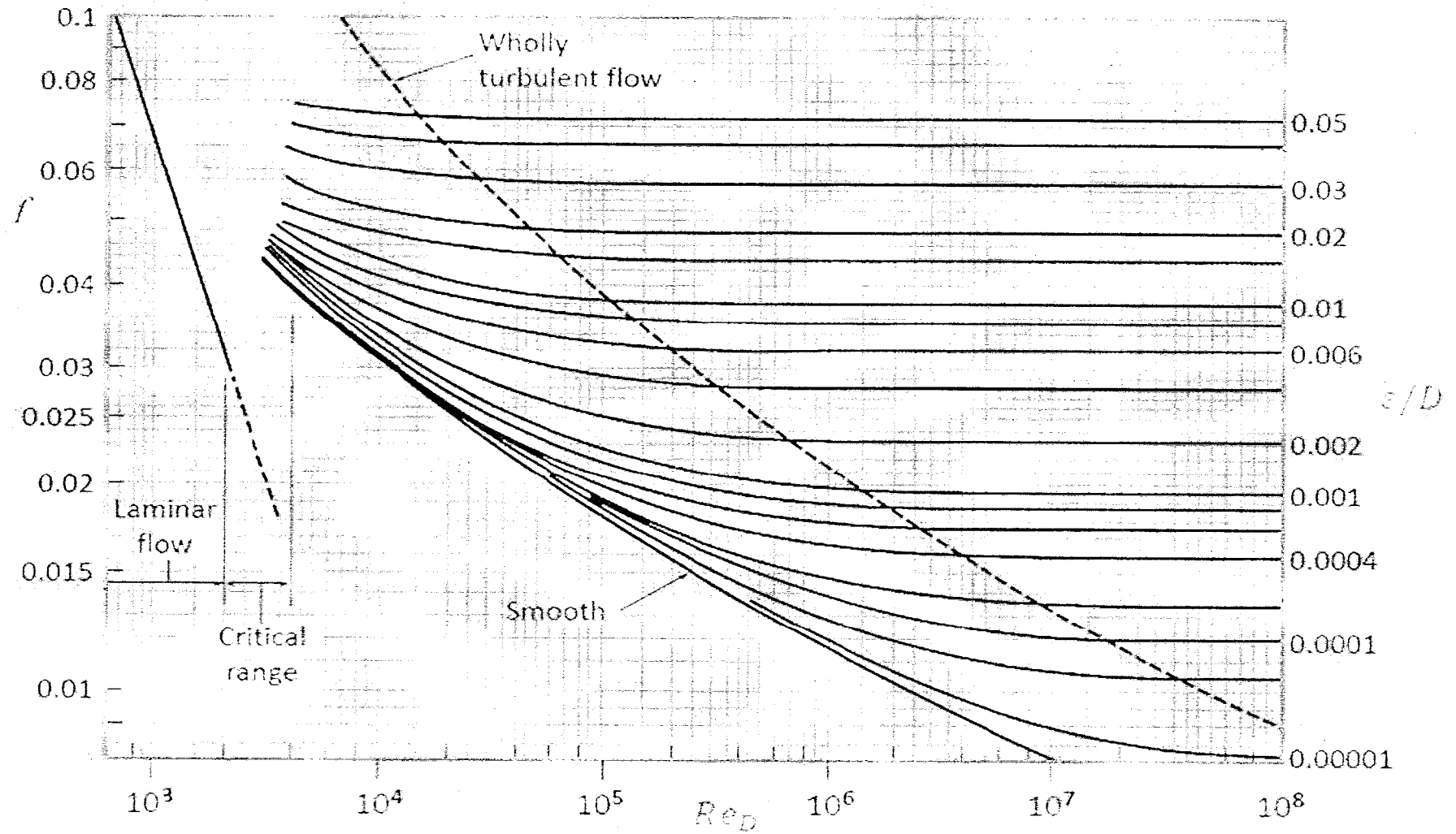
**Question (1) ( 25 Marks)**

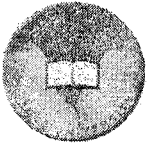
Choose the correct answer:

- 1- When the fluid flows along the solid boundary, more and more fluid gets retarded in the vicinity of the boundary; this deceleration is due to:
  - a- high velocity of the fluid
  - b- high velocity flow outside the boundary layer
  - c- high velocity gradient which exist at and near the boundary
  - d- none of the above
- 2- All real fluids are:
  - a- incompressible
  - b- compressible to some extent
  - c- compressible to any extent
  - d- none of the above
- 3- ..... studied the laminar flow through a circular tube experimentally
  - a- Prandtl
  - b- Pascal
  - c- Hagen and Poiseuille
  - d- None of the above
- 4- Momentum thickness is given by which of the following relations?
  - a-  $\int_0^{\delta} \left(1 - \frac{u}{U}\right) dy$
  - b-  $\int_0^{\delta} \frac{u}{U} \left(1 - \frac{u}{U}\right) dy$
  - c-  $\int_0^{\delta} \frac{u}{U} \left(1 - \frac{u^2}{U^2}\right) dy$
  - d- None of the above
- 5- In case of laminar flow, the loss of pressure head is proportional to
  - a- velocity
  - b- velocity<sup>2</sup>
  - c- velocity<sup>3</sup>
  - d- None of the above.
- 6- The pressure gradient in the direction of flow is equal to the shear gradient in the direction
  - a- Parallel to the direction of flow
  - b- Normal to the direction of flow
  - c- Either of the above
  - d- None of the above
- 7- The maximum velocity in a circular pipe when flow is laminar occurs at
  - a- The top of the pipe
  - b- The bottom of the pipe
  - c- The center of the pipe
  - d- Not necessarily at the center

- 8- **Dimensional analysis is used to**  
a- Test the dimensional homogeneity of any equation  
b- Derive rational formula for a flow phenomenon  
c- Derive equations expressed in terms of non-dimensional parameters  
d- All of the above
- 9- **In dimensional analysis the Buckingham's  $\pi$ -theorem is widely used and expresses the resulting equation in terms of**  
a- The repeating variables  
b- Geometric, kinematic and dynamic variables  
c- (n-m) dimensionless parameters  
d- n dimensionless parameters.
- 10- **In which of the following methods of dimensional analysis, a functional relationship of some variables is expressed in the form of an exponential equation, which must be dimensionally homogeneous?**  
a- Buckingham's method  
b- Rayleigh's method  
c- Bridgman's method  
d- Matrix-tensor method
- 11- **Dynamic similarity between the model and prototype is the**  
a- Similarity of motion  
b- Similarity of lengths  
c- Similarity of forces  
d- None of the above
- 12- **..... is equal to the product of shear stress due to viscosity and surface area of flow.**  
a- Viscous force  
b- Inertia force  
c- Pressure force  
d- Gravity force
- 13- **..... is the ratio of the inertia force to the viscous force.**  
a- Froude number  
b- Weber number  
c- Reynolds number  
d- Mach number
- 14- **Mach number is defined as the square root of the ratio of the**  
a- Inertia force to the pressure force  
b- Inertia force to the surface tension force  
c- Inertia force to the elastic force  
d- None of the above.
- 15- **The shear in turbulent flow is mainly due to**  
a- Heat transfer  
b- Mass transfer  
c- Momentum transfer  
d- All of the above.
- 16- **In Turbulent flow the shear stress is mainly due to the:**  
a- dynamic viscosity of the fluid  
b- kinematic viscosity of the fluid  
c- eddy viscosity of the fluid  
d- all of the above

# Moody Diagram to Read Friction Factor for Pipe Flows





TANTA UNIVERSITY  
FACULTY OF ENGINEERING  
DEPARTMENT OF MECHANICAL POWER ENGINEERING  
SECOND YEAR STUDENTS OF MECHANICAL POWER ENGINEERING  
COURSE TITLE: HEAT TRANSFER (1) COURSE CODE: MEP2206  
DATE: MAY, 31-2015 SECOND TERM TOTAL ASSESSMENT MARKS: 90 TIME ALLOWED : 3 HOURS

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

**Problem number (1) (18 Marks)**

- a) Consider a medium in which the heat conduction equation is given in its simplest form as

$$\frac{1}{r} \frac{\partial}{\partial r} (kr \frac{\partial T}{\partial r}) + \frac{\partial}{\partial z} (k \frac{\partial T}{\partial z}) + q_v = 0$$

- (a) Is heat transfer steady or transient? (b) Is there heat generation in the medium?  
(c) Is heat transfer one-, two-, or three-dimensional?  
(d) Is the thermal conductivity of the medium constant or variable? (4 Marks)
- b) We often turn the fan on in summer to help us cool. Explain how a fan makes us feel cooler in the summer. Also explain why some people use ceiling fans also in winter? (4 Marks)
- c) A stainless steel sphere ( $k = 16 \text{ W/m} \cdot \text{°C}$ ) having a diameter of 4 cm is exposed to a convection environment at  $20 \text{ °C}$ ,  $h = 15 \text{ W/m}^2 \cdot \text{°C}$  heat is generated uniformly in the sphere at the rate of  $1.0 \text{ MW/m}^3$ . Calculate the steady state temperature for the center of the sphere. (10 Marks)

**Problem number (2) (18 Marks)**

- a) How does heat conduction differ from convection? (3 Marks)
- b) Drive an expression for the critical radius of insulation for the cylinder? (4 Marks)
- c) Annular aluminium fins of rectangular profile are attached to a circular tube having an outside diameter of 50 mm and an outer surface temperature of  $200 \text{ °C}$ . The fins are 4 mm thick and 15 mm long. The system is in ambient air at a temperature of  $20 \text{ °C}$ , and the surface convection coefficient is  $40 \text{ W/m}^2 \cdot \text{°C}$ . (a) what are the fin efficiency and effectiveness?  
(b) if there are 125 such fins per meter of tube length, what is the rate of heat transfer per unit length of tube? (11 Marks)

**Problem number (3) (18 Marks)**

- a) Consider heat transfer between two identical hot solid bodies and the air surrounding them. The first solid is being cooled by a fan while the second one is allowed to cool naturally. For which solid is the lumped system analysis more likely to be applicable? Why? (5 Marks)
- b) Drive an expression for the efficiency of tip insulation fin? (5 Marks)
- c) Hot and cold water pipes 8 m long run parallel to each other in a thick concrete layer. The diameters of both pipes are 5 cm, and the distance between the centrelines of the pipes is 40 cm.

the surface temperatures of the hot and cold pipes are  $60\text{ }^{\circ}\text{C}$  and  $15\text{ }^{\circ}\text{C}$ , respectively. Taking the thermal conductivity of the concrete to be  $k = 0.75\text{ W/m}\cdot^{\circ}\text{C}$ , determine the rate of heat transfer between the pipes. (8 Marks)

**Problem number (4)** (18 Marks)

- a) What is meant by a time constant ? (3 Marks)
- b) How can we use the transient temperature charts when the surface temperature of the geometry is specified instead of the temperature of the surrounding medium and the convection heat transfer coefficient? (3 Marks)
- c) In areas where the air temperature remains below  $0\text{ }^{\circ}\text{C}$  for prolonged periods of time, the freezing of water in underground pipes is a major concern. Fortunately, the soil remains relatively warm during those periods, and it takes weeks for the subfreezing temperatures to reach the water mains in the ground. Thus, the soil effectively serves as an insulation to protect the water from subfreezing temperatures in winter. The ground at a particular location is covered with snow pack at  $-10\text{ }^{\circ}\text{C}$  for a continuous period of three months, and the average soil properties at that location are  $k = 0.4\text{ W/m}\cdot^{\circ}\text{C}$  and  $\alpha = 0.15 \times 10^{-6}\text{ m}^2/\text{s}$ . assuming an initial uniform temperature of  $15\text{ }^{\circ}\text{C}$  for the ground, determine the minimum burial depth to prevent the water pipes from freezing. (12 Marks)

**Problem number (5)** (18 Marks)


- a) Define the properties emissivity and absorptivity. When are these two properties equal to each other? (3 Marks)
- b) What are the summation rule and the superposition rule for view factors? (3 Marks)
- c) A thermocouple shielded by aluminium foil of emissivity 0.15 is used to measure the temperature of hot gases flowing in a duct whose walls are maintained at  $T_w = 380\text{ K}$ . The thermocouple shows a temperature reading of  $T_{th} = 530\text{ K}$ . Assuming the emissivity of the thermocouple junction to be  $\epsilon = 0.7$  and the convection heat transfer coefficient to be  $h = 120\text{ W/m}^2\cdot^{\circ}\text{C}$ , determine the actual temperature of the gas. What would the thermocouple reading be if no radiation shield was used? (12 Marks)

*With my best wishes*

EXAMINERS DR. ELSAYED ELSAID



C.10 | 7/2

	TANTA UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT OF MECHANICAL POWER ENGINEERING			
	EXAMINATION FOR FRESHMEN (2014 YEAR), STUDENTS OF 2 <sup>th</sup> GRADE MECHANICAL POWER			
	COURSE TITLE:	Measuring instruments		COURSE CODE: MEP2205
DATE:	June 4, 2015	TERM: 2 <sup>nd</sup>	TOTAL ASSESSMENT MARKS: 75	TIME ALLOWED (HOURS): 3

**(Answer the following 5 questions, with simple drawing)**

**Q1 (15 mark)**

- a) Define the following (Modifying Inputs –Static correction – Scale span)
- b) In a test, temperature is measured 100 times with variations and procedure. After applying the known correction, the results are:

Temp. °C	96	97	98	99	100	101	102	103	104	105
Frequ. F	1	3	8	23	39	13	6	4	2	1

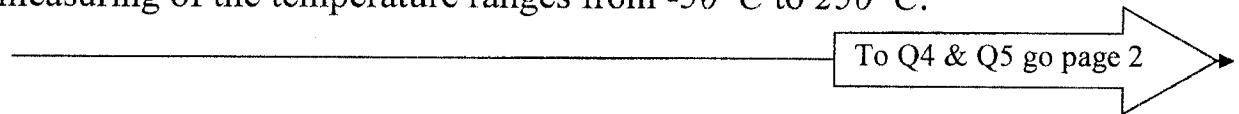
Calculate: (a) arithmetic mean, (b) mean deviation, (c) standard deviation and probable error of the mean, and (f) standard deviation of standard deviation.

**Q2 (15 mark)**

- a) Define the following terms (Static Calibration – Reproducibility – Static Sensitivity).
- b) A resistor R of a copper wire is given by;  $R = R_0 [1 + \alpha (t - 20)]$  where; the resistance of the wire at 20 °C is  $R_0 = 4.5 \Omega \pm 0.25\%$ , the resistance temperature co-efficient of copper  $\alpha = 0.0045/^\circ C \pm 1.5\%$ , Find the resistance of the wire at temperature of 75°C and its probable error.

**Q3 (15 mark)**

- a) A thermometer is quickly taken from a temperature 0°C to a water tank having a positive temperature. If the temperature indicated after 1.5 s is 34.86% of the water temperature. Find its time constant, then find the time required to reach 95% of the maximum value of the temperature.
- b) A bimetallic strip element has one end fixed and other free, with the length of cantilever being 40 mm. the thickness of each metal is 0.25mm and the element is initially straight at 20 °C. One of the metals with an expansion co-efficient of  $12.5 \times 10^{-6} / ^\circ C$  and modulus of elasticity of 150 GPa, and the other with an expansion co-efficient of  $2.5 \times 10^{-5} / ^\circ C$  and modulus of elasticity of 90 GPa. Calculate the maximum and minimum movement of the free end, if the measuring of the temperature ranges from -50 °C to 250 °C.



**Q4 (15 mark)**

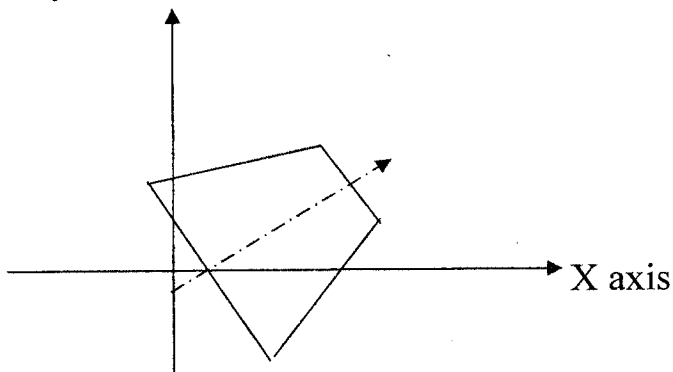
a) With simple drawing, explain McLeod Gauge to measure the negative pressure.

b) A mercury U-tube manometer used for measurement of low steam pressure shows a positive head of 35mm of mercury above atmosphere, but 48mm of water has condensed above the lower level of mercury in the tube. If the barometer pressure is 762.1mm of mercury, calculate the absolute pressure of steam. What percentage error is incurred if the head of condensed water is not taken into account?

**Q5 (15 mark)**

a) With simple drawing, express the equation of the mass flow rate using the Rotameter as a measuring device.

b) A Venturimeter having a throat diameter  $d_2=100 \text{ mm}$  is fitted into a pipeline which has a diameter  $d_1=250 \text{ mm}$  through oil of specific gravity 0.85 is following. The pressure at the entry is 2.25 bar while at throat is 1.426 bar. Calculate the mass flow rate through the pipeline, if the angle between the pipe centerline and the X axis is  $30^\circ$  and the distance between the Venturimeter entry and its throat is 75mm.



EXAMINERS	Dr. Esam Elkenany	
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BestWishes

C.10 / 7 / V

Tanta  
University



Department of  
Production Engineering and Mechanical Design



Faculty of  
Engineering

Course Title: Production Engineering  
Course Code: MPD 2252  
Year: 2<sup>nd</sup> – Mechanical Power Engineering  
2<sup>nd</sup> Term, Final Exam

Date: 07 Jun 2015  
Total Marks: 75 Marks  
Time allowed: 3 hrs  
No. of pages: 2

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

**Q1: State which of the following statements is true (✓) and which is false (✗):** (12 marks)

1. The finer the sand grains, the greater the GFN.
2. Turbulence of molten metal is more likely **يُرجح** to occur by casting through the bottom gates.
3. The extreme oxyacetylene flame temperature is achieved by using the oxidizing flame.
4. Brazing provides thermally more stable joints compared to soldering.
5. Vertical milling of gears is less accurate than horizontal milling of gears.
6. Grit size is considered one of the main process parameters of WJM.

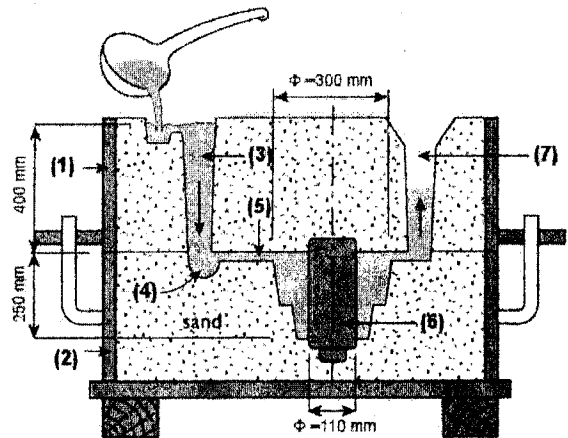
**Q2: Select only one correct answer** (20 marks)

1. (Low manometer reading – long air escape time – fast drop of the balance air tank – overflow of water tank) is an indicator for low permeability during sand permeability test.
2. In low pressure die casting, (wooden – metallic – no – plaster) patterns are used to form the mold.
3. In centrifugal casting, a gravity factor (GF) is defined as the ratio of (centrifugal force/casting weight – casting weight /gravitational force – gravitational force/casting weight – centrifugal force/rotational speed).
4. In sand casting, surface porosity defects are mainly caused by (lack of feeding – moisture in sand – turbulence flow of molten metal – high temperature of molten metal).
5. In which welding process slag entrapment defects are expected?  
(SMAW – RSW – TIG – MIG)
6. (TIG – MIG – Submerged arc – Resistance) welding is more extensively used in automobile industry.
7. The temperature of the Thermite mixture to repair steel rails may reach (3200 – 320 – 2700 – 300) °C.
8. Which of the following techniques can be used for welding of plastics?  
(Friction welding – GTAW – Brazing – Resistance welding)
9. Hobbing is used to produce only:  
helical gears – spur gears – external gear teeth – internal gear teeth.
10. In ECM, higher metal removal rate is obtained at:
  - a. low electrolyte resistivity and low voltage
  - b. high electrolyte resistivity and low voltage
  - c. low electrolyte resistivity and high voltage
  - d. high electrolyte resistivity and high voltage

Q3: For the shown sand casting mold

(7+4+3=14 marks)

- a- Name the parts 1 through 7 of the mold and gating system. State briefly the function of each.
- b- Find the necessary mass to counteract the effects of metal head and the effect of buoyancy forces to cast the shown hollow cylindrical part, given the material density of the casting=  $7.6 \text{ g/cm}^3$  and of the sand core=  $1.8 \text{ g/cm}^3$ .
- c- A standard sand specimen (5.08 cm in height and  $20.268 \text{ cm}^2$  area) was tested for permeability. It was found that a volume of air of  $2000 \text{ cm}^3$  was passed through the specimen in a period of 30 seconds. Under a pressure of 3.5 cm.water. Find the sand permeability.



Q4:

(4+5+6=15 marks)

- a- Give short notes about the following issues:
1. The **nature** and the **function** of the electrodes used in each of the following welding processes: SMAW, GMAW, GTAW, and resistance spot welding.
  2. Weldability; the definition, the factors affecting it, and how to predict.
- b- Draw one welding symbol that includes all the following information: Single V-groove weld of a butt joint with  $20^\circ$  bevel angle to be welded in the field. An intermittent weld seam with length 50 mm and 90 mm pitch. A back weld is also performed to reinforce the root pass.

Q5:

(5+9=14 marks)

- a) With the aid of sketches explain gear generation by rack shaping and list the advantages and limitations of the technique.
- b) In ECM process:
1. Explain with the aid of sketches the principle of the process.
  2. Considering the efficiency of the electrical circuit, derive a relationship to calculate the tool feed rate.
  3. Calculate the feed rate and the time required to cut a  $10 \times 30 \text{ mm}$  rectangular hole through a 12 mm thick aluminum plate. The operation is accomplished at 1200 amp current and the current efficiency was 95%. [The specific removal rate for aluminium,  $C = 0.0344 \text{ mm}^3/\text{A.s}$ ]

Best wishes,  
Assoc. Prof. Mahmoud Almadain



## Final EXAM 2014/2015 - Second Term

Course	Electrical Machines(EPM2245)	Time Allowed	3 hours
Students	2 <sup>nd</sup> Year (Mechanical Power Engineering)	Total Mark	85
Date	11 / 6/2015	Number of page	1

**Answer ALL the following questions:****The first question (17 marks)**

A	Explain the procedure of voltage building in self-excited generator.
B	A 50 kW, 250 V series generator has an armature resistance of $0.02\Omega$ and series field resistance of $0.045\Omega$ . The stray losses are 2.5 kW. At rated load. Calculate: a) Armature current. <span style="float: right;">d) Generated voltage.</span> b) Armature copper losses. <span style="float: right;">e) Field copper losses.</span> c) The generator efficiency.

**The second question (17 marks)**

A	Why a d.c. series motor cannot be started on no load?
B	A 250V d.c shunt motor has a shunt field resistance of 200 ohm and armature resistance of 0.3 ohm. For a given load, motor runs at 1500 r. p. m. drawing a current of 22 A from the supply. If a resistance of 150 ohm is added in series with the field winding, find the new armature current and speed. Assume load torque constant and magnetization curve to be linear.

**The third question (17 marks)**

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

- The efficiency on full load, 0.8 lagging power factor.
- The voltage regulation on full load, 0.8 leading power factor.
- The efficiency on 60% full load, 0.8 leading power factor.
- Draw the equivalent circuit referred to primary and insert all the values in it.

**The fourth question (17 marks)**

A	1- A three-phase induction motor does not run at synchronous speed. Why? 2- List out the names of starters used for three-phase induction motor.
B	A 3-phase, 20hp, 500V, 50Hz, 6-pole, star connected induction motor running at 950rpm with 0.85 lagging power factor. The mechanical losses are 1hp, the stator copper losses are 1500W, while the core losses are 500W. Calculate: a- The rotor copper losses <span style="float: right;">c- The line current</span> b- Motor efficiency <span style="float: right;">d- The slip</span>

**The fifth question (17 marks)**

A	1- State the various types of single-phase induction motor. 2- Draw the phasor diagram of three-phase synchronous generator at lag power factor, lead power factor and unity power factor
B	A 3-phase, star connected, 6-pole synchronous generator supplies a 3-phase load of 100 kW, 0.8 leading power factor at 60 Hz, 2kV line voltage. The machine per phase armature resistance & reactance are $0.4\Omega$ & $4\Omega$ respectively Find: a) Voltage regulation <span style="float: right;">b) Maximum developed power</span> <span style="float: right;">c) Efficiency if <math>P_r = 10</math> kW</span>