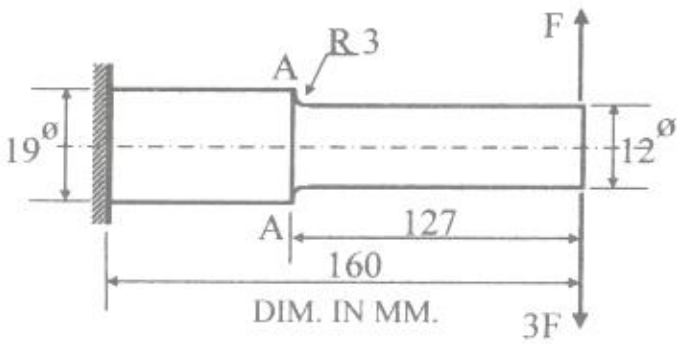


Fig. 1

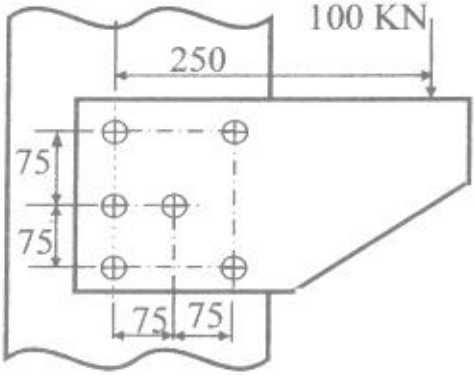


Fig. 2

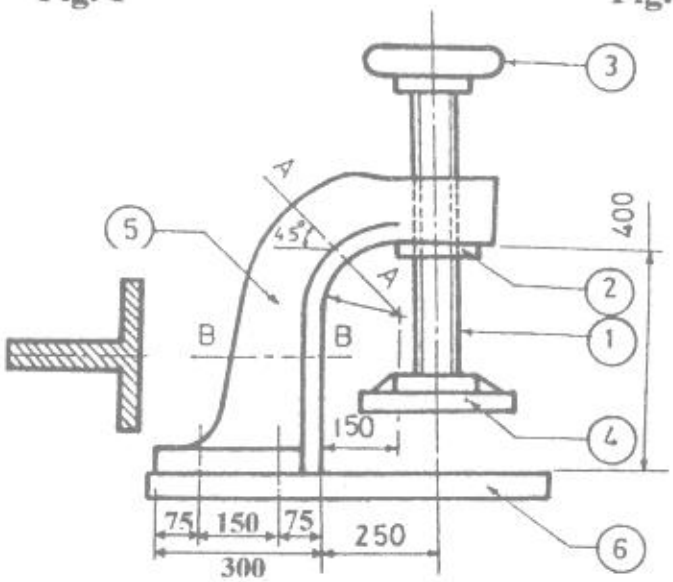


Fig. 3

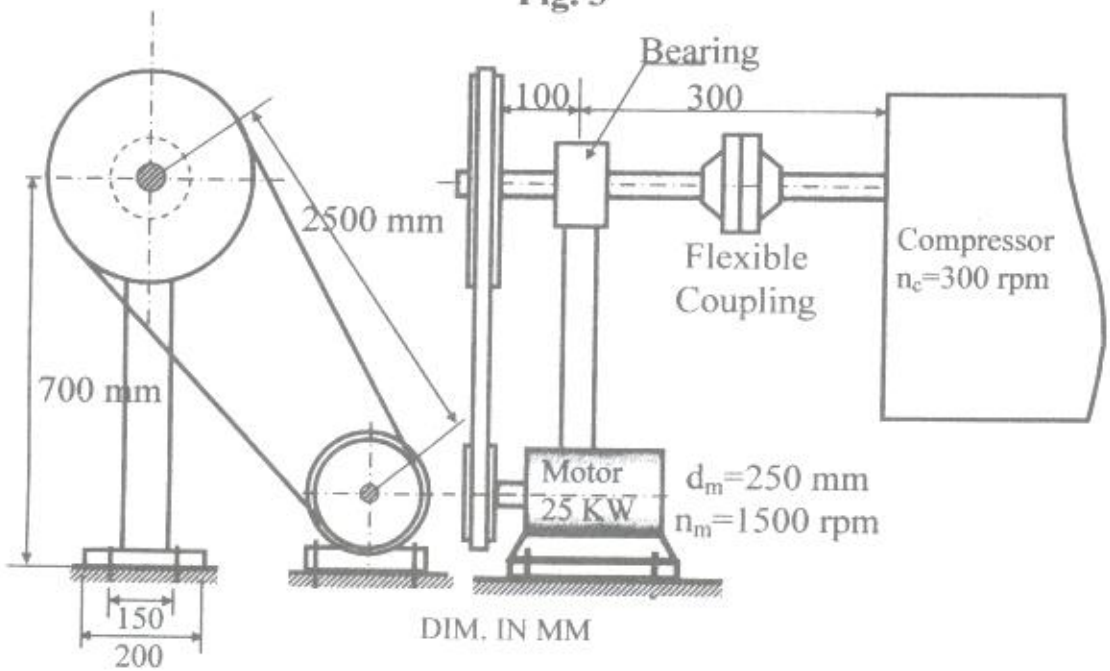
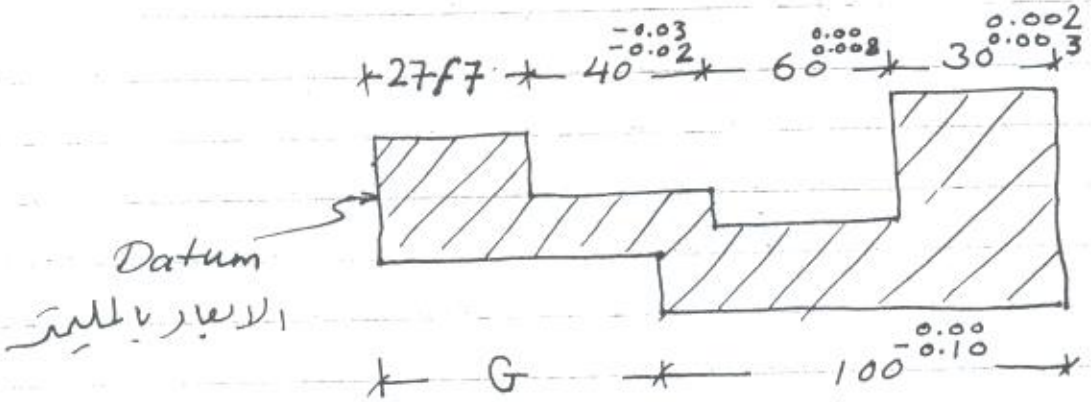
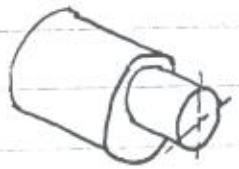


Fig. 4

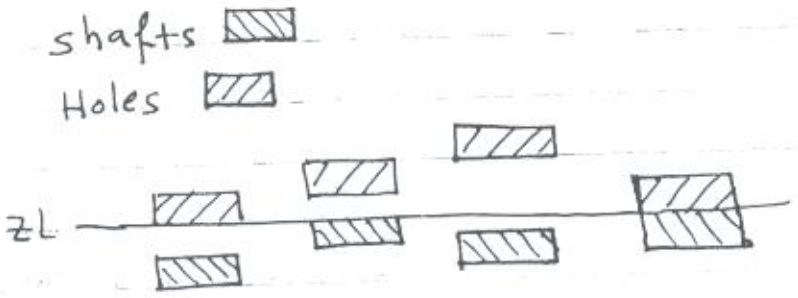
Good Luck



(٤) شكل



(٥) شكل



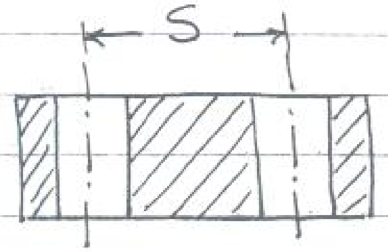
(٦) شكل

مجال البعد الاسمي أكبر من ... حتى	نقب	أعمدة								نقب	عمود	نقب	أعمدة		عمود	نقب			نقب		عمود	نقب	
	H7	s6	r6	n6	k6	j6	g6	f7	H8	e8	H11	d9	c11	h6	G7	h9	F8	E9	D10	h11	C11	A11
18 ... 30	+21 0	+48 +35	+41 +28	+28 +15	+15 +2	+9 −4	−7 −20	−20 −41	+33 0	−40 −73	+130 0	−65 −117	−110 −240	0 −13	+28 +7	0 −52	+53 +20	+92 +40	+149 +65	0 −130	+240 +110	+430 +300
30 ... 40	+25	+59	+50	+33	+18	+11	−9	−25	+39	−50	+160	−80	−120 −280	0	+34	0	+64	+112	+180	0	+280 +120	+470 +310
40 ... 50	0	+43	+34	+17	+2	−5	−25	−50	0	−89	0	−142	−130 −290	−16	+9	−62	+25	+50	+80	−160	+290 +130	+480 +320
50 ... 65	+30	+72 +53	+60 +41	+39	+21	+12	−10	−30	+46	−60	+190	−100	−140 −330	0	+40	0	+76	+134	+220	0	+330 +140	+530 +340
65 ... 80	0	+78 +59	+62 +43	+20	+2	−7	−29	−60	0	−106	0	−174	−150 −340	−19	+10	−74	+30	+60	+100	−190	+340 +150	+550 +360
80 ... 100	+35	+93 +71	+73 +51	+45	+25	+13	−12	−36	+54	−72	+220	−120	−170 −390	0	+47	0	+90	+159	+260	0	+390 +170	+600 +380
100 ... 120	0	+101 +79	+76 +54	+23	+3	−9	−34	−71	0	−126	0	−207	−180 −400	−22	+12	−87	+36	+72	+120	−220	+400 +180	+630 +410
120 ... 140		+117 +92	+88 +63										−200 −450								+450 +200	+710 +460
140 ... 160	+40 0	+125 +100	+90 +65	+52 +27	+28 +3	+14 −11	−14 −39	−43 −83	+63 0	−85 −148	+250 0	−145 −245	−210 −460	0 −25	+54 +14	0 −100	+106 +43	+185 +85	+305 +145	0 −250	+460 +210	+770 +520
160 ... 180		+133 +108	+93 +68										−230 −480								+480 +230	+830 +580

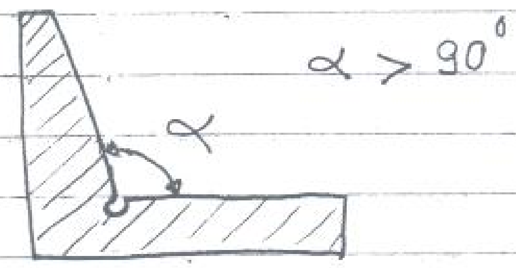
تابع سؤال [٤]

جـ - للتوافق 25H7/g6 احسب ابعاد كل من GO and NO GO gauges. وضح الاجابة بالرسم مع تخطيط لـ plug gauge و snap gauge

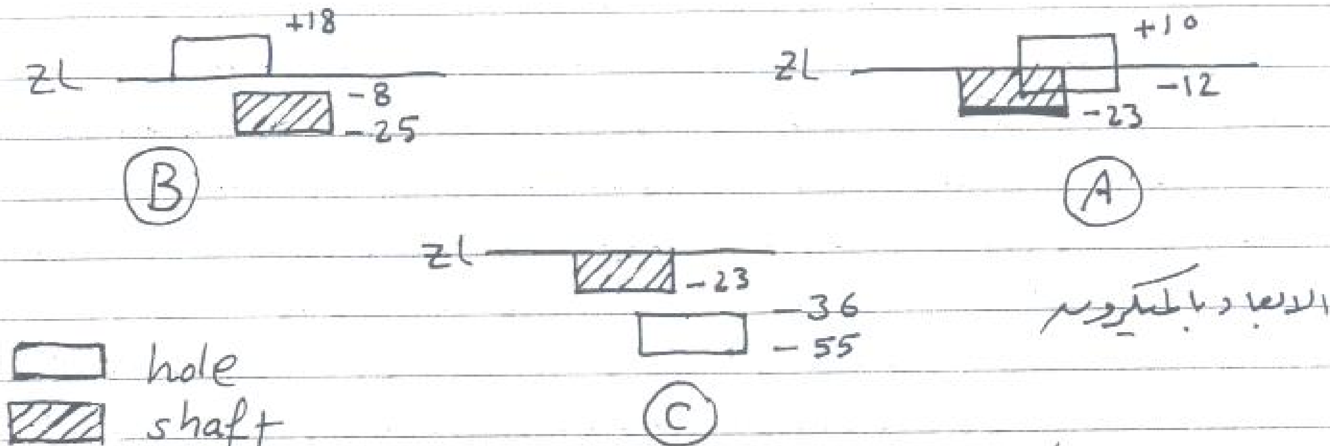
د - يراد ثقب شغله بقطر 25mm دقة الثقب هي $^{+0.02}_{-0.02}$ مم وذلك بنظام تناسب على الثقب. يلزم الحصول على عمود ليزدوج مع الثقب مكونا clearance fit بحيث تكون لهذا الازدواج maxi. clearance = 0.08 mm و allowance = 0.01 mm ما هو tolerance on the shaft



شكل (٢)



شكل (١)



شكل (٣)

جامعة طنطا — اختبار نهاية الفصل الدراسي الثاني ٢٠١٠

كلية الهندسة — الفرقة الثانية — الزمن ٣ ساعات

قسم هندسة الإنتاج — أجهزة قياس مترولوجية — الدرجة ٦٠

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[١] أ- ما هو الفرق بين Precision و accuracy

ب- ناقش العلاقة بين كل من

الدقة والتكاليف — التجاوز والتكاليف

جـ- إذا كان هناك لا مركزية بين عمود وكرسي تحميل أي أجهزة المقارنة تستخدم في اختبار اللامركزية. اشرح فكرة هذا الجهاز ومميزاته وعيوبه

د- اشرح طريقة قياس الزاوية α في القطعة المبينة بشكل ①

[٢] أ- حول الازدواج H8/f6 إلى نظام العمود.

ب- ارسم تخطيط لنوع الازدواج الذي له min. clearance مساوياً للصفر

جـ- اشرح مع الرسم طريقة قياس البعد L في شكل ②

د- أيهما تفضل hole basis system أم shaft basis sys. ولماذا.

[٣] أ- حدد نوع الازدواج واحسب مقادير الخلوص والتداخل لكل حالة في شكل ③

ب- الشكل ④ يوضح قطعة ذات أبعاد لها تجاوزات. احسب البعد G بتجاوزاته

جـ- شكل ⑤ يوضح عمود به لا مركزية كيف يمكن حساب اللامركزية. دعم الإجابة بالرسم

د- في شكل ⑥ أي من الازدواجات يتبع نظام الثقب وأيهم يتبع نظام العمود

[٤] أ- اذكر استخدامات قوالب القياس. مع رسم تخطيطي لاستخدامين منها

ب- يراد تكوين مجموعة من قوالب القياس للبعد 58.975 mm باستخدام مجموعة قوالب القياس

عدد قوالب القياس	أبعاد القوالب (مم)
٩	من ١,٠٠١ إلى ١,٠٠٩
٤٩	من ١,٠١ إلى ١,٤٩
٤٩	من ١,٥٠ إلى ٢٤,٥
٤	من ٢٥ إلى ١٠٠

جامعة طنطا - كلية الهندسة		
قسم هندسة الإنتاج والتصميم	امتحان الفصل الدراسي الثاني	الفرقة / الثانية
الزمن ٣ ساعات	التاريخ ٢١ / ٦ / ٢٠١٠	المادة / آلات الكـــهربية

Answer the Following Questions:

Question(1)

(a) Discuss the various losses occurring in a D.C generator .

(b) A shunt d.c generator delivers 195 A at a terminal voltage of 250 V. The armature resistance and shunt field resistance are 0.02 Ω and50 Ω respectively. The stray losses equal 950 W . Calculate : (i) e.m.f generated ; (ii) copper losses
(iii) out put of the prime mover in KW ; (iv) efficiency of the generator

Question (2)

(a) Discuss the torque / speed characteristic of a series d.c motor and explain why such motors can not be started without mechanical load on its shaft .

(b) A 240 V series d.c motor has an armature resistance of 0.06 Ω and field resistance of 0.04 Ω produces full-load torque when running at 500 rpm taking a current of 40 A . If the effect of saturation is neglected and the machine producing 1/4 full-load torque, calculate :
(i) the armature current. (ii) the motor speed

Question (3)

(a) Prove the condition for maximum efficiency of a single-phase transformer .

(b) A 660/220 V single-phase transformer takes a no-load current of 2 A at a power factor of 0.225 lagging . The transformer supplies a load of 30 A at a power factor of 0.9 lagging . Calculate (i) the primary current (ii) the primary power factor

Question (4)

(a) Prove that for induction motors :
(i) the maximum starting torque occurs when $R_2 = X_{2o}$
(ii) the rotor frequency is given by $f_r = S\,f$

(b) The power input to the motor of a 440 V, 50 Hz, 3-phase, induction motor is 42 KW . The rotor frequency is 2 Hz and the stator losses are 2 KW . Calculate : (i) the slip
(ii) rotor speed (iii) rotor copper loss (iv) mechanical power developed
(v) the rotor resistance per phase if the rotor current is 65 A .

Question (5)

(a) Draw the phasor diagram of a loaded alternator for : unity p.f, lagging p.f, leading p.f .

(b) A 3- phase Y- connected synchronous generator rated at 10 KVA, 230 V has a synchronous reactance of 1.2 Ω per phase and an armature resistance of 0.5 Ω per phase . Calculate the percentage regulation at full-load for power factor of :
(i) 0.8 lagging (ii) 0.8 leading (iii) unity

Good Luck

Tanta University

Department of
Production Engineering and Mechanical Design

Faculty of Engineering

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

Date: 23 Jun 2010
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 (X): **(20 marks)**

1. The core box is used to produce cores necessary for sand casting of hollow parts
2. Jolting machines introduce the highest sand compaction near the pattern surface
3. Cores are not essential for production of a hollow statue using slush casting process
4. The turbulence flow is more likely to occur by casting through the bottom gates
5. In welding, increasing heat input rate reduces the width of HAZ
6. The highest oxyacetylene flame temperature is achieved by using the oxidizing flame
7. Brazing provides stronger and thermally more stable joints compared to soldering
8. Dye-Penetrant method can be used to detect subsurface welding defects
9. In electrochemical machining, workpiece hardness does not affect metal removal rate
10. Stream pressure is considered one of the main process parameters of Water Jet Machining

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

1. Expendable patterns are utilized in (sand and lost foam – lost foam and investment – centrifugal and precision – plaster mold and precision) casting processes.
2. 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).
3. The effect of gravity is less dominant in (centrifugal – semi-centrifugal – permanent mold – centrifuging – investment) casting process.
4. In which welding process slag entrainment defects are expected? (SMAW – RSW – TIG – MIG)
5. (TIG – MIG – Submerged arc – Resistance) welding is more extensively used in automobile industry.
6. The temperature of the Thermit mixture to repair steel rails may reach (3200 – 320 – 2700 – 300) °C.
7. Which of the following techniques can be used for welding of plastics?
   (Friction welding – SMAW – Brazing – Resistance welding)
8. Filler metals in soldering and brazing must have good (thermal conductivity – corrosion resistance– electrical conductivity – capillary action) to accomplish a good weld joint.
9. In ECM, higher metal removal rate is obtained at:
   a. low electrolyte resistivity and low voltage
   b. low electrolyte resistivity and high voltage
   c. high electrolyte resistivity and low voltage
   d. high electrolyte resistivity and high voltage
10. Tool wear is minimum in: ultrasonic machining – electrochemical machining – electrical discharge machining – electrical discharge wire cutting

Q3: **(10 marks)**

a- Differentiate between the following:

1. The electrodes used in shielded metal arc welding, GMAW, GTAW, and resistance spot welding, in terms of their **nature** and the **function**.
2. Distructive and non-distructive tests of weldments.
3. Casting and welding in terms of: solidification, microstructutre, and heat flow

b- Name the letters for the welded joint shown in Figure 2.

Q4: For the casting mold shown in Figure 1 **(15 marks)**

a- Name the parts 1 through 7 of the mold and gating system and mention 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 that the core diameter is 110 mm and the density of the casting and core materials are 7.6 and 1.8 g/cm^2.

c- A standard sand specimen (5.08 cm in height and 20.268 cm^2 area) was tested for permeability. It was found that a volume of air of 2000 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.

Q5: **(10 marks)**

Using the table below to setup your answer, compare the following non-conventional machining processes: USM – ECM – EDM with respect to the given terms as per table.

	Process	USM	ECM	EDM
1	Principle	(Only drawing)	(Only drawing)	(Only drawing)
2	Tool material			
3	Workpiece material			
4	Characteristics of cutting fluid			
5	Function of cutting fluid			
6	Factors affecting metal removal rate			

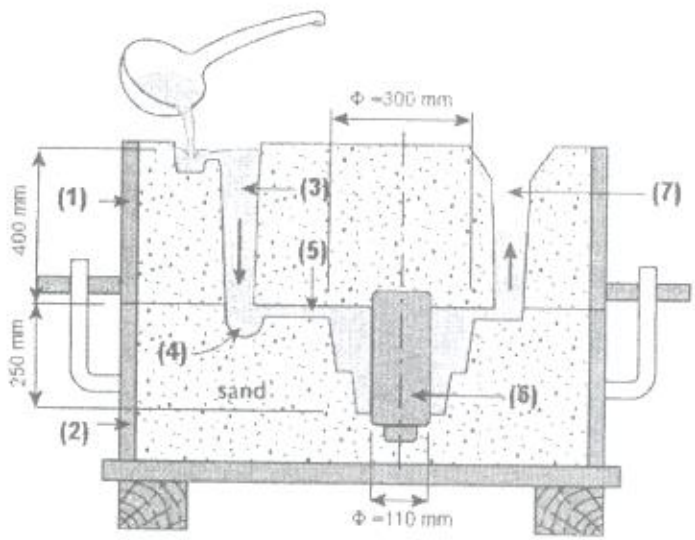

Figure 1

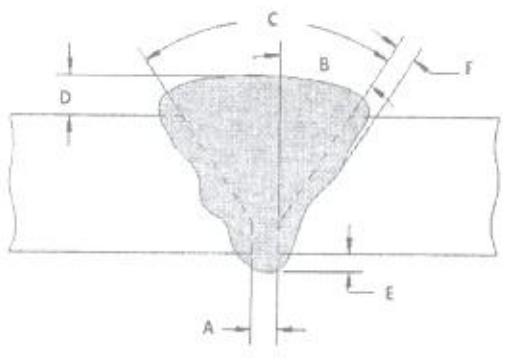

Figure 2

Best wishes,
Dr. Eng. Mahmoud Ahmadein

جامعة طنطا
كلية الهندسة
قسم هندسة الإنتاج والتصميم الميكانيكي

المادة / وصل المواد (MPD2211)
الفرقة الثانية(إنتاج)

بسم الله الرحمن الرحيم
التاريخ :١٤ /٦/ ٢٠١٠
الزمن : ٣ ساعات

أجب عن الأسئلة الآتية:- (٧٥ درجة)

السؤال الأول:-

١ـ اشرح مع الرسم أنواع الوصل.

٢ـ اكتب نبذة مختصرة عن كل من :- الاستلين – الأكسجين – أنواع اللهب مع الرسم.

٣ـ لماذا يعتبر وجود كبريتيد الهيدروجين ضار في الاستلين إذا استخدم الغاز في اللحام.

٤ـ أذكر مع الرسم أشكال الوصلات الملحومة ورموزها.

السؤال الثاني:-

١ـ اكتب نبذة مختصرة عن:-

طريقة لندا للحام - منظم الضغط مع الرسم - نظرية عمل بوري القطع مع الرسم.

٢ ـ تكلم عن أهم العدد والأدوات المستخدمة في اللحام تحت سطح الماء.

٣ـ تكلم عن القطع باستخدام القوس والأكسيجين.

السؤال الثالث:-

١ـ تكلم عن لحام التدفق مع رسم تخطيطي لعملية الصب أثناء لحام التدفق.

٢ـ تكلم بالتفصيل عن أنواع اللحام بالاحتكاك مع التوضيح بالرسم لكل نوع.

٣ـ تكلم بالتفصيل عن خواص اللحام الجيد وعيوب اللحام.

٤ـ اشرح آلية انتقال المعدن من الالكترود إلى الوصلة.

السؤال الرابع:-

١ـ اكتب نبذة مختصرة عن:-

لحام الهيدروجين الذرى - الاختبارات الغير متلفة – القطع الحراري.

٢ـ في عملية لحام بالقوس الكهربي المحجب كان التيار المستخدم ١٨٠ أمبير وكان جهد القوس ٤٠ فولت وكانت سرعة اللحام ١٨ سم / دقيقة – احسب الحرارة الداخلة أثناء إجراء عملية اللحام هذه ؟

مع أطيب التمنيات بالنجاح
ا.د/عبد الفتاح مصطفى خورشد

Tanta University
Faculty of Engineering
Production Engineering &
Machine Design Department

Final exam (June 2010)
Heat transfer (ME2304)
Time allowed 3 hours
12/6/2010

يصرح باستخدام جداول وخرائط انتقال الحرارة

Answer all the following questions

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

a) Derive a relation for critical radius of insulation for a sphere?

b) An insulated steam pipe having outside diameter of 3 cm is to be covered with two layers of insulation each having a thickness of 2.5 cm. The average thermal conductivity of one material is 5 times that of the other. Assuming that the inner and outer surface temperatures of composite insulation are fixed, how much will the heat transfer be reduced when the better insulating material is next to the pipe than it is outer layer?

Question (2) **(12 Marks)**

a) When may one expect radiation heat transfer to be important?

b) Discuss the mechanism of heat convection?

c) A very long copper rod [k=372 W/m.°C] 2.5 cm in diameter has one end maintained at 90 °C. The rod is exposed to a fluid whose temperature is 40 °C and the heat transfer coefficient is 60 W/m^2. °C. How much heat is lost by the rod?

Question (3) **(10 Marks)**

a) Define the following: thermal conductivity of a material, thermal contact resistance, and conduction shape factor.

b) A Consider a large 5 cm thick brass plate (k = 111 w/m.°C) in which heat is generated uniformly at a rate of 2×10^5 w/m^3. One side of the plate is insulated while the other side is exposed to an environment at 25 °C with a heat transfer coefficient of 44 w/m^2.°C. Explain where in the plate the highest and lowest temperatures will occur, and determine their values.

Question (4) **(12 Marks)**

a) Define irradiation and radiosity?

b) What is Kirchhoff's identity?

c) Two large parallel planes having emissivities of 0.3 and 0.5 are maintained at temperatures of 800 K, respectively. A radiation shield having an emissivity of 0.05 on both sides is placed between the two planes. Calculate (a) the heat-transfer rate per unit area if the shield were not present, (b) the heat-transfer rate per unit area with the shield present, (c) the temperature of the shield.

Question (5) **(12 Marks)**

a) What is meant by a lumped capacity? What are the physical assumptions necessary for a lumped-capacity analysis to apply?

b) A short aluminum cylinder 5.0 cm in diameter and 10.0 cm long is initially at a uniform temperature of 200 °C. It is suddenly subjected to a convection environment at 70 °C, and h=525 W/m^2. °C. Calculate the temperature at a radial position of 1.25 cm and a distance of 0.625 cm from one end of the cylinder 1 min after exposure to the environment; calculate also the heat loss from the cylinder.

Question (6) **(12 Marks)**

a) What are the heat exchanger types?

b) Define the heat exchanger effectiveness, and fouling factor?

c) A small cubical furnace 50 by 50 by 50 cm on the inside is constructed of fireclay brick [k=1.04 W/m.°C] with a wall thickness of 10 cm. the inside of the furnace is maintained at 500 °C, and the outside is maintained at 50 °C. Calculate the heat lost through the walls.

تابع

Tanta University
Faculty of Engineering
Production Engineering &
Machine Design Department

Final exam (June 2010)
Heat transfer (ME2304)
Time allowed 3 hours
12/6/2010

يصرح باستخدام جداول وخرائط انتقال الحرارة

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

a) Derive a relation for critical radius of insulation for a sphere?

b) An insulated steam pipe having outside diameter of 3 cm is to be covered with two layers of insulation each having a thickness of 2.5 cm. The average thermal conductivity of one material is 5 times that of the other. Assuming that the inner and outer surface temperatures of composite insulation are fixed, how much will the heat transfer be reduced when the better insulating material is next to the pipe than it is outer layer?

Question (2) **(12 Marks)**

a) When may one expect radiation heat transfer to be important?

b) Discuss the mechanism of heat convection?

c) A very long copper rod [k=372 W/m.°C] 2.5 cm in diameter has one end maintained at 90 °C. The rod is exposed to a fluid whose temperature is 40 °C and the heat transfer coefficient is 60 W/m^2. °C. How much heat is lost by the rod?

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Tanta University
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Production Engineering &
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Final exam (June 2010)
Heat transfer (ME2304)
Time allowed 3 hours
12/6/2010

يصرح باستخدام جداول وخرائط انتقال الحرارة

Answer all the following questions

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

a) Derive a relation for critical radius of insulation for a sphere?

b) An insulated steam pipe having outside diameter of 3 cm is to be covered with two layers of insulation each having a thickness of 2.5 cm. The average thermal conductivity of one material is 5 times that of the other. Assuming that the inner and outer surface temperatures of composite insulation are fixed, how much will the heat transfer be reduced when the better insulating material is next to the pipe than it is outer layer?

Question (2) **(12 Marks)**

a) When may one expect radiation heat transfer to be important?

b) Discuss the mechanism of heat convection?

c) A very long copper rod [k=372 W/m.°C] 2.5 cm in diameter has one end maintained at 90 °C. The rod is exposed to a fluid whose temperature is 40 °C and the heat transfer coefficient is 60 W/m^2. °C. How much heat is lost by the rod?

Question (3) **(10 Marks)**

a) Define the following: thermal conductivity of a material, thermal contact resistance, and conduction shape factor.

b) A Consider a large 5 cm thick brass plate (k = 111 w/m.°C) in which heat is generated uniformly at a rate of 2×10^5 w/m^3. One side of the plate is insulated while the other side is exposed to an environment at 25 °C with a heat transfer coefficient of 44 w/m^2.°C. Explain where in the plate the highest and lowest temperatures will occur, and determine their values.

Question (4) **(12 Marks)**

a) Define irradiation and radiosity?

b) What is Kirchhoff's identity?

c) Two large parallel planes having emissivities of 0.3 and 0.5 are maintained at temperatures of 800 K, respectively. A radiation shield having an emissivity of 0.05 on both sides is placed between the two planes. Calculate (a) the heat-transfer rate per unit area if the shield were not present, (b) the heat-transfer rate per unit area with the shield present, (c) the temperature of the shield.

Question (5) **(12 Marks)**

a) What is meant by a lumped capacity? What are the physical assumptions necessary for a lumped-capacity analysis to apply?

b) A short aluminum cylinder 5.0 cm in diameter and 10.0 cm long is initially at a uniform temperature of 200 °C. It is suddenly subjected to a convection environment at 70 °C, and h=525 W/m^2. °C. Calculate the temperature at a radial position of 1.25 cm and a distance of 0.625 cm from one end of the cylinder 1 min after exposure to the environment; calculate also the heat loss from the cylinder.

Question (6) **(12 Marks)**

a) What are the heat exchanger types?

b) Define the heat exchanger effectiveness, and fouling factor?

c) A small cubical furnace 50 by 50 by 50 cm on the inside is constructed of fireclay brick [k=1.04 W/m.°C] with a wall thickness of 10 cm. the inside of the furnace is maintained at 500 °C, and the outside is maintained at 50 °C. Calculate the heat lost through the walls.

انتاج جديد

جامعة طنطا
كلية الهندسة
قسم هندسة الإنتاج والتصميم الميكانيكي

المادة / وصل المواد (MPD2211)
الفرقة الثانية(إنتاج)

بسم الله الرحمن الرحيم
التاريخ :١٤ /٦/ ٢٠١٠
الزمن : ٣ ساعات

أجب عن الأسئلة الآتية:- (٧٥ درجة)

السؤال الأول:-

١ـ اشرح مع الرسم أنواع الوصل.

٢ـ اكتب نبذة مختصرة عن كل من :- الاستلين – الأكسجين – أنواع اللهب مع الرسم.

٣ـ لماذا يعتبر وجود كبريتيد الهيدروجين ضار في الاستلين إذا استخدم الغاز في اللحام.

٤ـ أذكر مع الرسم أشكال الوصلات الملحومة ورموزها.

السؤال الثاني:-

١ـ اكتب نبذة مختصرة عن:-

طريقة لندا للحام - منظم الضغط مع الرسم - نظرية عمل بوري القطع مع الرسم.

٢ ـ تكلم عن أهم العدد والأدوات المستخدمة في اللحام تحت سطح الماء.

٣ـ تكلم عن القطع باستخدام القوس والأكسيجين.

السؤال الثالث:-

١ـ تكلم عن لحام التدفق مع رسم تخطيطي لعملية الصب أثناء لحام التدفق.

٢ـ تكلم بالتفصيل عن أنواع اللحام بالاحتكاك مع التوضيح بالرسم لكل نوع.

٣ـ تكلم بالتفصيل عن خواص اللحام الجيد وعيوب اللحام.

٤ـ اشرح آلية انتقال المعدن من الالكترود إلى الوصلة.

السؤال الرابع:-

١ـ اكتب نبذة مختصرة عن:-

لحام الهيدروجين الذرى - الاختبارات الغير متلفة – القطع الحراري.

٢ـ في عملية لحام بالقوس الكهربي المحجب كان التيار المستخدم ١٨٠ أمبير وكان جهد القوس ٤٠ فولت وكانت سرعة اللحام ١٨ سم / دقيقة – احسب الحرارة الداخلة أثناء إجراء عملية اللحام هذه ؟

مع أطيب التمنيات بالنجاح
ا.د/عبد الفتاح مصطفى خورشد

ميكانيكا انتاج

Tanta University

Department of
Production Engineering and Mechanical Design

Faculty of Engineering

Course Title: Furnaces and Heat Treatment
Course Code: MPD 2213
Date: 16 Jun 2010 (2nd term, final exam)
Year: 2nd – Production Engineering and Mechanical Design

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 (X): **(15 marks)**

1. The huge magnetic separators are of the means used to concentrate the iron ore.
2. Aluminum is produced in electrolysis cells by the decomposition of cryolite
3. Induction heating of furnaces uses high voltage direct current.
4. Killed steels are free from oxygen.
5. The latent heat of fusion is taken as on of design considerations of heat treatment furnaces.
6. The greater the surface area of the part to be austenitized, the longer is the soaking time.
7. Quenching in air could be used to harden special steels with high Cr and Mo content.
8. TTT diagram provides information about the cooling rate and composition required to obtain certain structure of steel.
9. On TTT diagram, the % phase transformation is proportional to the isothermal transformation time.
10. Quenching of steel does not necessarily increase its hardness

Q2: Underline the correct answer: **(20 marks)**

1. 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
2. Tuyers in cupola are used for (molten metal collection – feeding the charge –air passage – tapping).
3. Stainless steels are best produced in (cupola – BOF – electric arc furnace – Bessemer converter)
4. Excess air in fuel heated furnaces (forms diffusion flame – maximizes the heat generated – leads to incomplete combustion – reduces furnace thermal efficiency)
5. Eutectoid steel contains about (0.79% – 2.00% – 4.30% – 6.67%) of carbon.
6. The guide ways of lathe beds فرش المخرطة are hardened by
   (a) carburizing (b) cyaniding (c) nitriding (d) induction hardening
7. The most gentle quench medium for hardening sharp edges is (molten salt bath – air – oil – brine).
8. Hardenability is
   a) A heat treatment to increase the hardness of steel
   b) The ability of steel to be hardened by quenching
   c) The resistance of the material for indentation and scratching
   d) The depth to which austenite can be transformed into pearlite
9. The most common nitriding agent is (ammonia – nitrogen – sodium carbide – sodium cyanide).
10. Given that the diffusion coefficient of carbon in a steel sleeve is $1.51*10^{-5}$ cm^2/s at carburizing temperature, then the calculated case depth after 15 min is:
    (a) 1.65 mm (b) 0.21 mm (c) 1.17 mm (d) 0.27mm

Q3: Differentiate briefly between the following terms **(15 marks)**

a- Furnace, kiln, and oven.

b- Bauxite and alumina

c- Premixed and diffusion flames

d- Pearlite, bainite, and martensite

e- Martempering and austempering

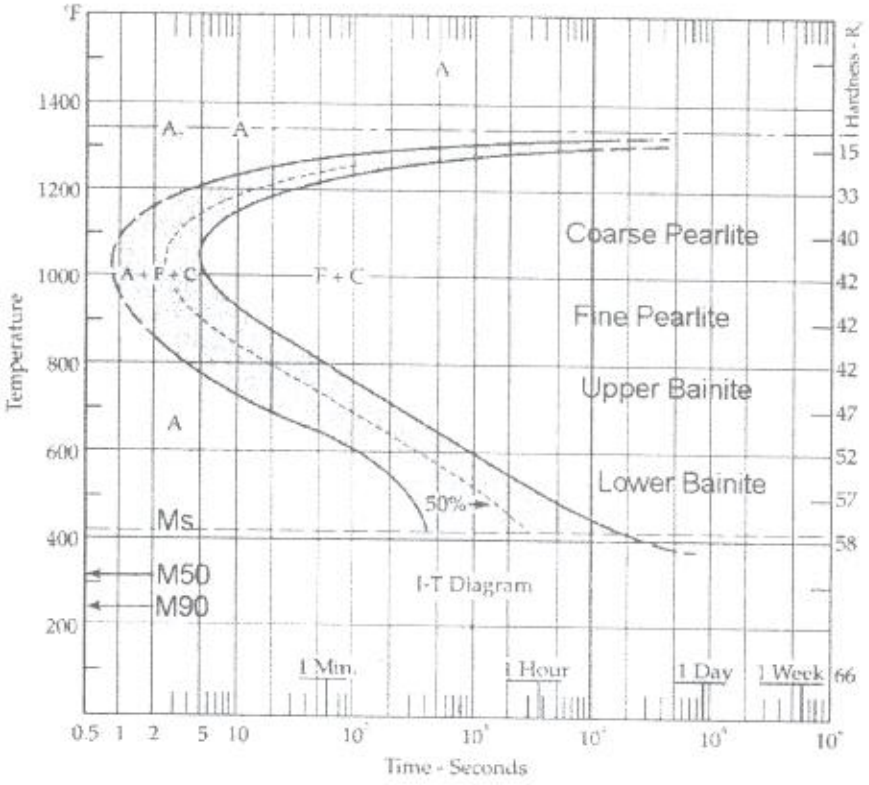
Q4: **(15 marks)**

a) What are the experimental procedure to construct an IT-diagram?

b) For the given IT-diagram draw the cooling paths (**schematicllly**) and find the range of **hardness values** and the final **microstructure** of the following samples:

Sample (1) is cooled from 1500°F to 500°F in one second and then held at 500°F for 10hr. Finally, it is cooled to room temperature in 1hr.

Sample (2) is cooled from 1500°F to 1000°F in 2 seconds and then held at 1000°F for one second. Finally, it is cooled to 200°F in 7 seconds.

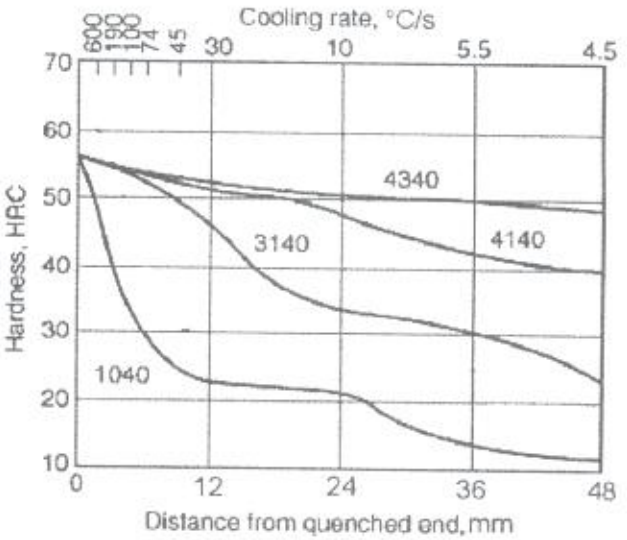


Q5: **(10 marks)**

a- Explain with the aid of sketches the principle of Jominy end-quench test for hardenability.

b- The hardenability test results of different steel samples are shown at right. Indicate which of these steel types have the highest and which have the lowest hardenability.

c- If you know that the 1040 is a plain carbon steel with 0.4%C, whereas the other; 3140, 4140, and 4340 are alloy steels containing also 0.4%C. What are the alloying elements you expect to find in 4340 to achieve this hardenability behaviour?



Best wishes.

Dr. Eng. Mahmoud Ahmadein

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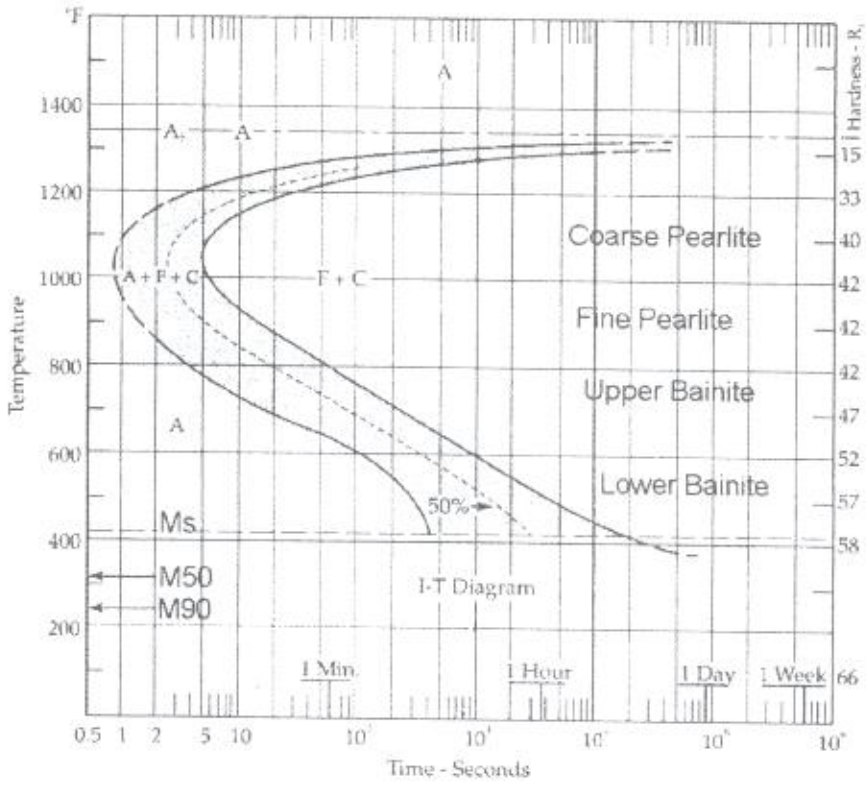

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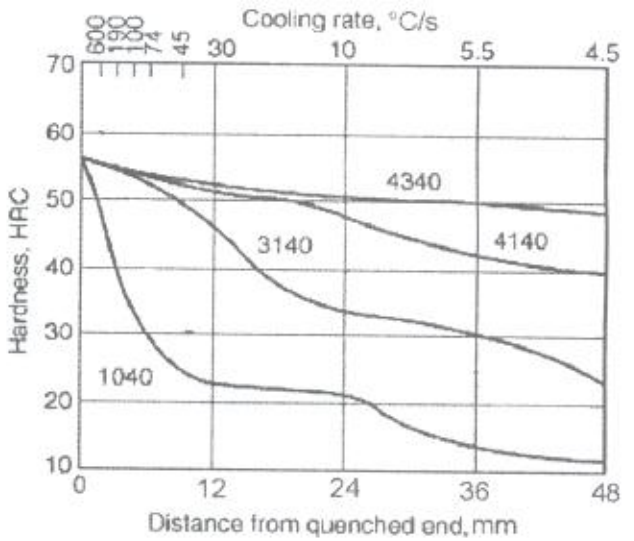

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STUDENTS ARE ALLOWED TO USE TABLES

1- A cantilever beam shown in Fig. 1 made of 0.2 % CD steel is subjected to a load which varies from –F to 3F. The surface is ground. Determine the maximum load that this member can withstand for an infinite life and 90% reliability using a factor of safety of 2. *Analyze at the change of the cross section only (A-A).* **(Mark 15%)**

2- Determine the diameter of the rivet for the bracket shown in Fig. 2, if the maximum shear stress is limited to 63 MPa. **(Mark 10%)**

3- As shown in Fig. 3, a 3 tons hand screw press consists of a spindle (1), a nut (2), a hand wheel (3), a pressure plate (4), and a cast iron frame (5) bolted to a cast iron bed plate (6). Make complete design calculations for the following:

a- The power screw with a trapezoidal thread (Check for buckling)
b- The nut, **c-** The hand wheel
d-The cast iron frame **e-** The 4 bolts fixing the press to the bed plate.

Then make a complete construction drawing for the machine showing all details of construction and the main dimensions. **(Mark 40%)**

4- Figure 4 shows two views of the driving unit for a compressor. The motor power and speed are 25 Kw and 1500 rpm respectively. The motor pulley diameter is 250 mm. The driven shaft speed is 300 rpm. The center distance between the driving and driven pulleys is 2500 mm. The height of the driven shaft from the foundation is 700 mm. You are required to:

a- Design the Flat belt, assuming the allowable strength of belt material is 3 MPa, the specific weight of belt material is 10 KN/m^3 and the coefficient of friction is 0.3.
b- Design the driven pulley.
c- Design the driven shaft considering the weight of the driven pulley is 2000 N.
d- Design the flexible coupling, assuming the bearing strength of the rubber is 3.45MPa.
e- Design the two bolts fixing the bearing to the foundation.

(Mark 35%)

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