Tanta University
Faculty of Engineering
Production Engineering & Design Dept.
2nd Year Prod. 2010/2011

تحليل اجهادات
د. انتاج

Stress Analysis
Wednesday, 12.01.2011
Time allowed : 3 hours
Final Grade : 100 Marks

Final Exam

Solve all questions and make use of the given information whenever possible:

Question 1 : (20 marks)

Three steel bars "**A**", "**B**" and "**C**" shown in figure have lengths of 4 m, 4 m and 2 m respectively. All bars have the same cross-sectional area of 500 mm^2. The beam "**OG**" is rigid and subjected to a load **F** .

i. Determine the reaction at the support "**O**" .
ii. What are the internal forces in bars "**A**" and "**B**".
iii. How much is the value of "**F**" necessary to make contact at point "**E**".
iv. If force "**F**" is removed calculate the incease of the temperature of bar "**A**" in order to keep the contact at point "**E**".

Question 2 : (25 marks)

a) A square cross-section of side length "**a**" subjected to a direct shear force W. Derive an expression for the shear stress distribution on the cross section.
(Hint: Assume a cantilever of the same cross-section subjected to end load W)

b) For the shown stepped shaft subjected to twisting moment T :
i. Draw the twisting moment and twist angle along the shaft.
ii. Calculate the maximum shear stress in the shaft and plot the stress variation across the section having maximum stress.
iii. Determine the strain energy absorbed by the shaft.

Question 3 : (25 marks)

A simply supported rounded beam (d = 30 mm) of steel is loaded at its mid-span with a force of 1 kN. The beam supports also twisting moment over its length (2.0 m) of 500 N.m..

i. Plot SFD, TMD and BMD
ii. Draw the stress state at the critical point.
iii. Use Mohr's circle to get the principal stresses at the critical point.
iv. What is the factor of safety according to von-Mises and Tresca criteria if the used material has a yield strength of 300 MPa.

Question 4 : (15 marks)

Use Castigliano's theorem to get the vertical deflection of the free point for the beam shown.

P.T.O.

Question 5 : (25 marks)

A closed thick-walled pressure vessel is made of steel, has an inside diameter of 100 mm, and an outside diameter of 141.421 mm and length of 500 mm. The pressure inside the vessel reaches 500 atm.

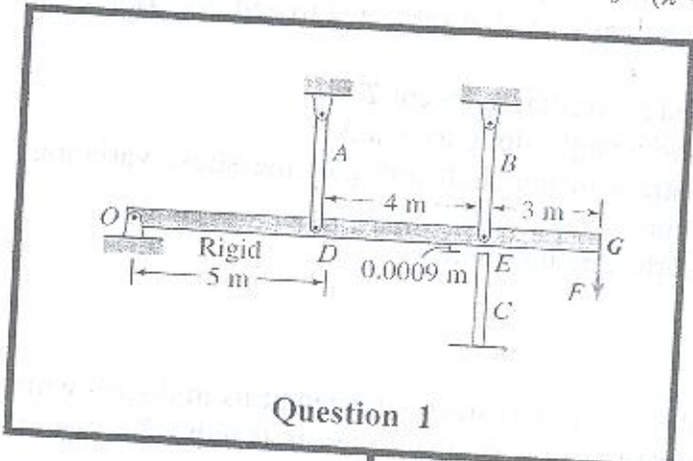
i. Sketch the stress components across the wall thickness.
ii. Calculate the strain components at the inner diameter.
iii. Derive the internal volumetric strain in terms of strains and hence calculate the change of the internal volume.
iv. If the previous vessel is replaced by a thin walled cylinder having the same length and internal volume and subjected to the same pressure. Its material has an allowable shear stress double than that of the material of the thick-walled pressure vessel. What will be the thickness of the new cylinder?

Useful information:

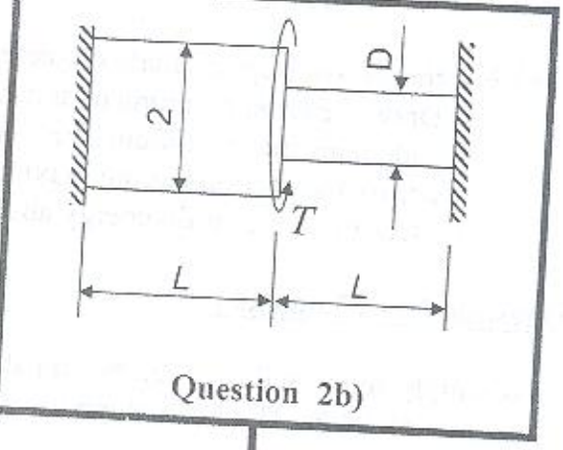
For steel : E = 200 GPa , $\nu = 0.3$, $\alpha = 12\times10^{-6}$ /°C

Castigliano's theorem : $\nu = \dfrac{\partial}{\partial P_c}\int_0^L \dfrac{M_z^2}{2EI}dx$

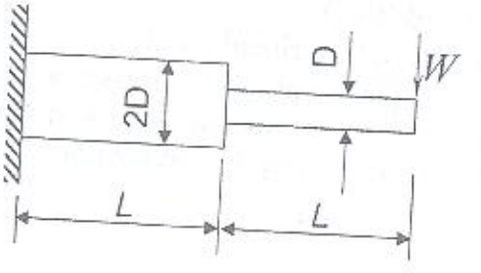
Stresses on thick-walled cylinders : $\sigma_{t,\theta} = \dfrac{P_i}{(\lambda^2-1)}\left(1 \mp \dfrac{r_o^2}{r^2}\right)$ $\sigma_z = \dfrac{P_i}{(\lambda^2-1)}$



Question 1



Question 2b)



Question 4

مع تمنياتى بالتوفيق و النجاح

Q3: Give short notes about the following **(use neat sketches)** **(20 marks)**

1. Constitutional undercooling and its influence on nucleation and growth modes.
2. Shrinkage during solidification of castings; the phenomenon, the consequences and the treatment.
3. The uphill and downhill ingot casting.
4. Development of continuous casting machines in terms of metal path.

Q4: With the help of sketches explain one technique for the following **(15 marks)**

1. Sand molding machines.
2. Mold knock-out.
3. Nondestructive testing of castings.

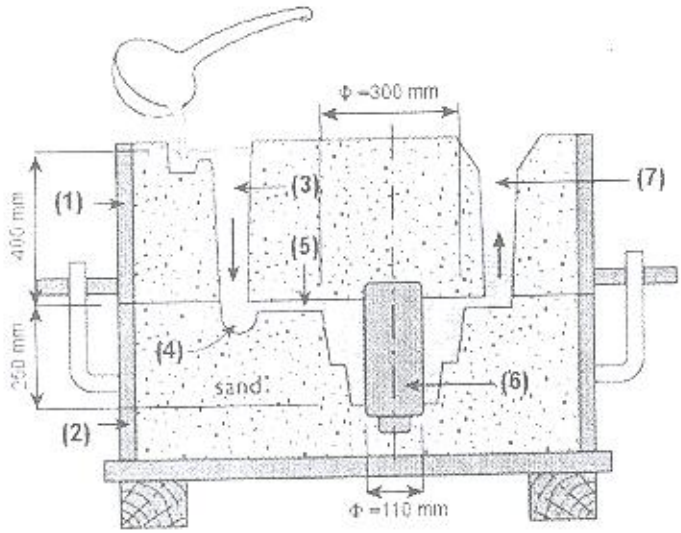
Q5: **(4+5+2+4 = 15 marks)**

a) For the casting mold shown in the figure:

i. Name the parts 1 through 7 of the mold and gating system and mention briefly the function of each.

ii. 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.

iii. If the sprue base diameter is 20 mm, find the diameters of sprue top and sprue well.



b) 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.

End of exam questions

Best wishes.
Dr. Eng. Mahmoud Ahmadein

تابع ٢

TANTA UNIVERSITY
FACULTY OF ENGINEERING
PRODUCTION ENG. DEPART.
SECOND YEAR

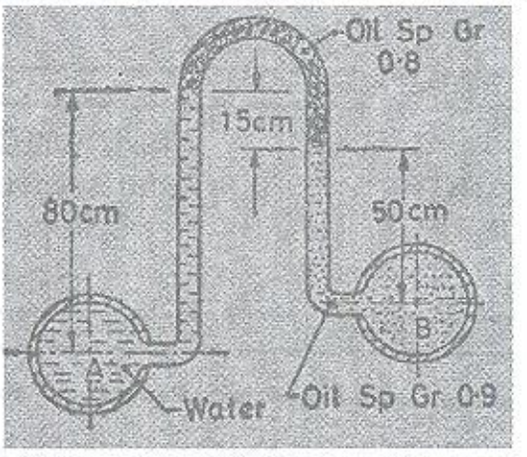
FLUID MECHANICS
Time allowed: 3 hours
Date: 17/1/2011
ميكانيكا موائع

Please, answer the following questions: (Total Marks 75)

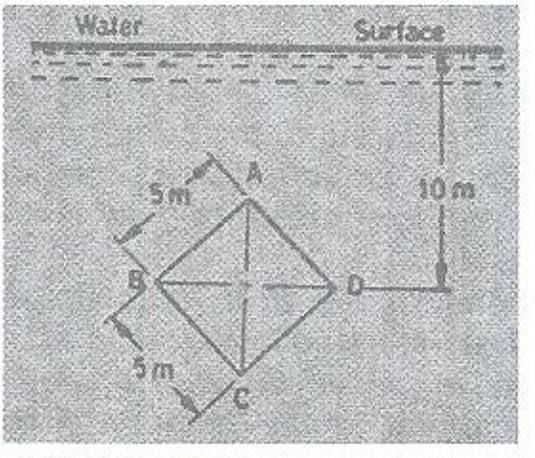
1) *Give a scientific expression for each of the following statements:* (15 Marks)

1.1) *The ratio of the inertia force to the viscous force.*
1.2) *The ratio of the kinematic viscosity to the thermal diffusivity.*
1.3) *A pressure of 760 mm Hg.*
1.4) *The ratio of the shear stress to the rate of shear strain.*
1.5) *The ratio of the volumetric strain to the compressive stress.*
1.6) *The force which resulting from adhesion or cohesion of liquids.*
1.7) *A device for measuring low pressures, where accuracy is of much importance.*
1.8) *The ratio of the second to the first moment of inertia for an immersed surface about the liquid level.*
1.9) *fluid particles that have passed through a fixed point in a flow field. The locus of locations, at any instant of time, of all the*
1.10) *The imaginary line drawn in the fluid so that the tangent to it at any point and at any instant gives the direction of motion of the fluid particles at this point and at that instant.*
1.11) *The point that is always below the centre of gravity of an immersed surface by a distance of* $(I_G \sin^2\theta / A\, h_G)$.
1.12) *A flow, in which the fluid particles do not rotate about their own axes, and retain their original orientations.*
1.13) *A function, which describes the form of pattern of flow or in other words it is the discharge per unit thickness.*
1.14) *A flow that takes place when the temporal rate of change of the dependent fluid variables at any point in the flow vanishes.*
1.15) *The ratio of the area of jet at vena contracta to the area of the orifice.*

2) *An inverted differential manometer, when connected to two pipes A and B, gives the readings as shown in the figure. Determine the pressure in the pipe B, if the pressure in the pipe A be 1 bar.* (12 Marks)



3) *A square plate 5 m × 5 m hangs in water from one of its corners, as indicated in the figure. The center of gravity of the plate is at a depth of 10 m from the water surface. Find the pressure force on the plate and the position of the center of pressure.* **(12 Marks)**



4.1) *Does a velocity field given by* $U = 5x^3\, i - 15x^2 y\, j + t\, k$ *Represent a possible fluid motion of an incompressible fluid?* **(6 Marks)**

4.2) *The velocity in a flow field is given by* $u = 3$ *m/s and* $v = 6$ *m/s. Determine the equation of streamline passing through the origin and the one passing through the point (2 m , 3 m).* **(6 Marks)**

5) *A pipe 300 m long has a slope of 1 in 100 and tapers from 1 m diameter at the higher end to 0.5 m at the lower end. Quantity of water flowing is 5400 liters/min. If the pressure at the higher end is 0.7 bar, find the pressure at the lower end.* **(12 Marks)**

6) *A venturi-meter is to be fitted to a 25 cm diameter pipe, in which the maximum flow rate is 7200 liters/min. and the pressure head is 6 m of water. What is the minimum diameter of throat so that there is no negative head in it. Take the coefficient of discharge of venturi-meter to be 1.* **(12 Marks)**

نظرية ماكينات
٢ اتاج

Tanta University
Faculty of Engineering
Prod. Eng. and Mech. Design Dept

Time 3 hr

Theory of Machines
2nd Year
First Term Exam (Jan 2011)

-Answer all questions:

(1) In the fig.1, ω2 = 5000 rpm CCW (constant) and the resisting force on the slider D P =1000 N.

(a) Find (The extreme positions ,Time ratio, Stroke of the slider D)
(b) What is the effect of increase the crank length (AB) on the time ratio and the stroke of the slider D?
(c) Find the velocity and acceleration of the slider D, and the angular velocity and acceleration of link CE.
(d) Is the acceleration of the slider D is constant?
(e) Find the driving torque on the crank AB.
(f) If the crank angle change from 45° to 30°,the required driving torque is the same in both cases or not?

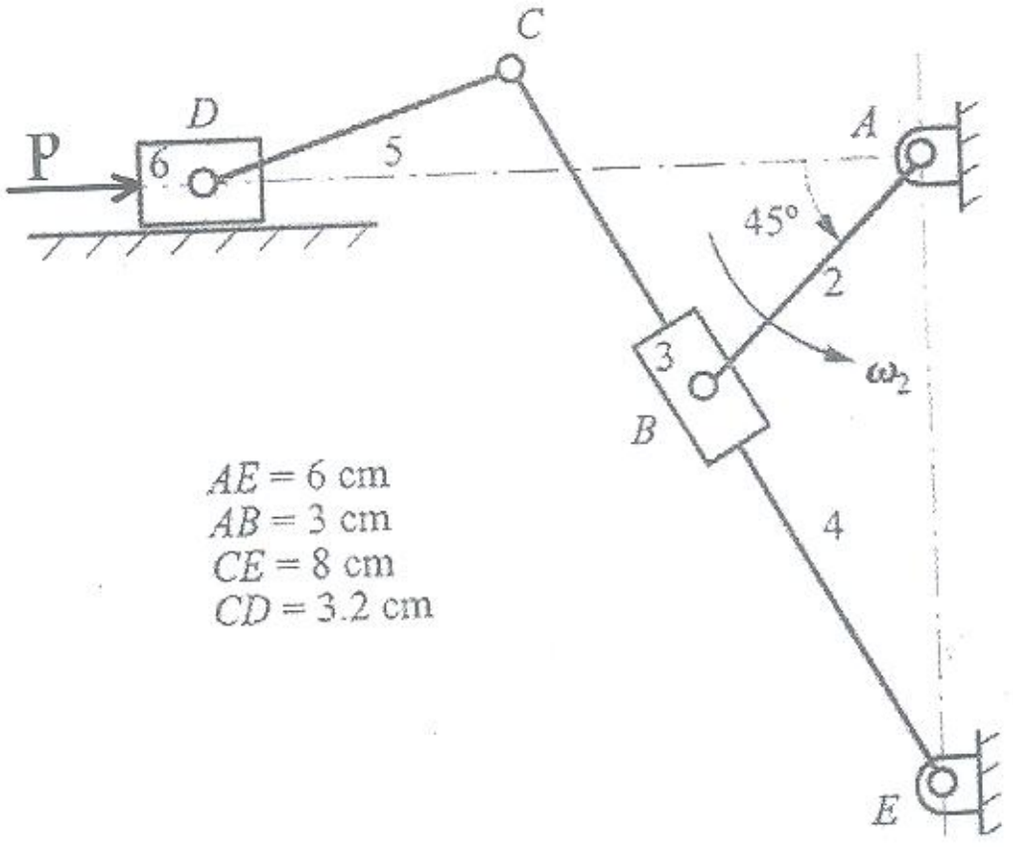


Fig. 1

Dr. Ahmed Al Kassas

(2) A cam, with a minimum radius of 30 mm, rotates at uniform speed of 300 rpm (cw).Design the cam to give the following motion to a knife edge follower:

1- To rise the follower 45 mm during 60° of the cam rotation with cycloid motion.(up)
2- To keep it fully raised through the next 60°.(dwell)
3- To lower the follower 20 mm during the next 60° with S.H.M.(down)
4- To keep it raised at the last lift for the next 60°.(dwell)
5- To lower the follower 25 mm during the next 60° with S.H.M. (down)
6- To keep it for the remaining 60°.(dwell)

Design the cam profile for the following two cases:

a- The line of motion of the follower passes through the axis of the cam.
b- The line of motion of the follower is offset 15 mm from the axis of the cam.

(3) For the gear train shown in fig. 2, it is required to make output shaft rotate at N7=200 rpm (c.w.),find the speed of the input shaft N2.

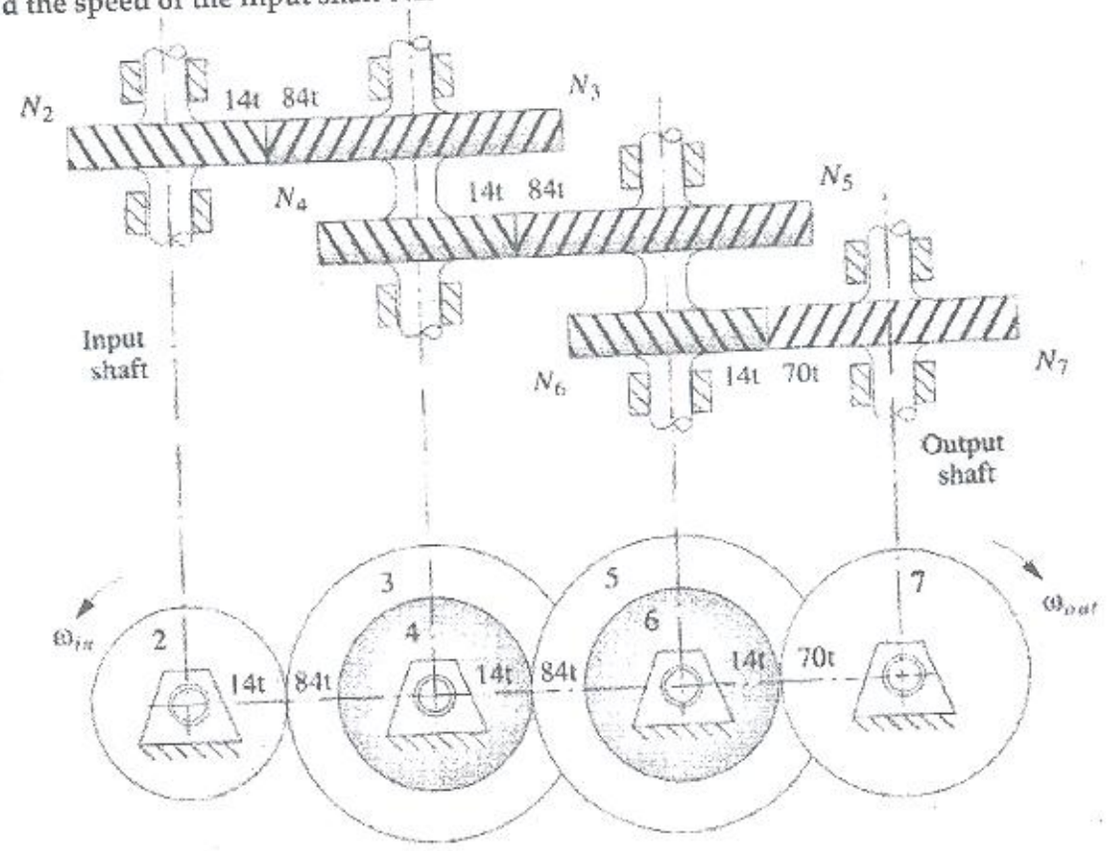


Fig. 2

Tanta University — Department of Physics & Mathematics — Faculty of Engineering

Course Title: Complex and Special Functions — Year: 2nd Mech-Prod-
Date: 2011 (First term) — Allowed time: 3 hrs

Problem number (1)

a) Prove that if $f(z) = u(x,y) + iv(x,y)$ is analytic and $u^2 + v^2 =$ constant then f(z)= constant.

b) Find all valus of z such that $\sinh z = 2$.

c) Prove that if the analytic complex potential of the fluid flow is $F(z) = \phi(x,y) + i\psi(x,y)$ then

(i) $\phi(x,y)$, $\psi(x,y)$ are harmonic

(ii) $\overline{F(Z)'} = V$ where $V = v_1 + iv_2$ is the velocity of the fluid flow.

Problem number (2)

a) Evaluate $\oint_C \frac{\sin z}{(z-1)^4 (z-5)} dz$ around $C: |z| = 3$.

b) Evaluate $\oint_C z^2 e^{\frac{1}{z-1}} \cosh(\frac{1}{z-1}) dz$ around $C: |z-1+i| = 3$.

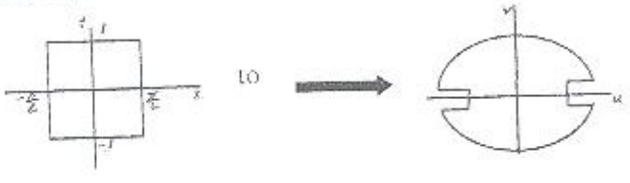
c) Show that $\oint_c (z-z_0)^m dz = \begin{cases} 2\pi i & \text{if } m = -1 \\ 0 & \text{if } m \neq -1 \end{cases}$ where c: $|z - z_0| = r$

Problem number (3)

a) Evaluate (i) $\int_0^\infty x^{2n} e^{-ax^2} dx$, (ii) $\int_0^1 x^5 (\ln(x^3))^8 dx$,

b) Prove that $\int_0^1 \frac{x^n}{\sqrt{1-x^2}} dx = \frac{\sqrt{\pi}\Gamma(\frac{n+1}{2})}{\Gamma(\frac{n+2}{2})}$

c) Show that w= sinz conform the region $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$ and $-1 \le y \le 1$ to the indicated region in figure



Problem number (4)

a) Using complex theory to evaluate $\int_{-\infty}^{\infty} \frac{\cos x}{1+x^4} dx$

b) Using generating function of Bessel function $e^{\frac{x}{2}(t - \frac{1}{t})} = \sum_{n=-\infty}^{n=\infty} J(x)_n t^n$

to prove that $J_n(x) = \frac{1}{\pi} \int_0^\pi \cos(x \sin x - n\theta) d\theta$

c) Evaluate $\int x (\ln x) J_o(x) dx$

With my best wishes

Dr. M.Shokry

جامعة طنطا
كلية الهندسة
قسم هندسة الإنتاج والتصميم الميكانيكي

المادة/ إقتصاد هندسى
(MPD21H3)
الفرقة الثانية

بسم الله الرحمن الرحيم
التاريخ :٢٠١١/١/٢٦
الزمن : ٣ ساعات

أجب عن الأسئلة الآتية:- (٤٠ درجة)

السؤال الاول:- (١٥ درجة)

١- اكتب نبذة مختصرة عن أنواع التكاليف. (٣ درجات)

٢- ماالغرض من دراسة الاقتصاد الهندسى؟ (٣ درجات)

٣- تكلم بالتفصيل عن أهم العناصر الاساسية للتصنيع. (٤ درجات)

٤- يعتمد الاقتصاد الصناعى والاقتصاد التجارى والاقتصاد الزراعى والاقتصاد القومى والاقتصاد الهندسى على مبادىء اساسية اذكر اهمها مع الشرح. (٦ درجات)

السؤال الثانى:- (١٠ درجات)

١- تريد شركة اضافة ماكينة جديدة على خط الانتاج للتغلب على الاختناقات الحالية. فاذا كان لدى الشركة بديلين A&B حيث كانت التكلفة الثابتة السنوية 30000 S للبديل A ، 25000 S للبديل B وكانت التكلفة المتغيرة لكل وحدة منتجة من البديل A 10S وللبديل B 12S ، وعائد البيع لكل وحدة من البديل A 15S ، والبديل B 16S

١- حدد نقطة التعادل لكل بديل بالوحدات؟

٢- ماهو حجم الانتاج الذى يجعل الربح لكلا البديلين متساويا؟

٣- اذا كان الاحتياج المتوقع السنوى 12000 وحدة فأى من البديلين سوف يحقق اعلى ربح؟

السؤال الثالث:- (١٠ درجات)

١- كوبرى جديد عمره الافتراضى ١٠٠ سنة وتكلفته الاولية ٢٠ مليون دولار يتم اعادة رصف الكوبرى كل خمس سنوات بتكلفة مقدارها ١ مليون دولار ، كما تقدر تكاليف التفتيش والتشغيل بمبلغ ٥٠٠٠٠ دولار، حدد قيمة التكلفة الحالية للكوبرى باستخدام اسلوب قيمة رأس المال (بمعنى نعتبر ان عمر الكوبرى مالانهاية) . معدل الفائدة ١٠% فى السنة تركيب سنوى.

السؤال الرابع:- (٥ درجات)

٢- ما هو المبلغ الذى تحتاج ايداعه فى حالة ٨% سنويا لمدة ٩ سنوات ابتداء من ١ يناير ١٩٨١ لكى يتراكم مبلغ ١،٩٦٤ دولار فى تاريخ اخر وديعة ، أى فى ١يناير ١٩٩٠؟

Tanta University

Department of
Production Engineering and Mechanical Design

Faculty of Engineering

Course Title: **Metal Casting**
Course Code: MPD2108
Year: 2nd – Production Engineering and Mechanical Design
2nd Term, Final Exam

Date: 15 Jan 2011
Total Marks: 90 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 (✗): (20 marks)

1. During solidification, higher temperature gradients, G, favor the formation of planer solid/liquid front.
2. The core box is used to produce cores necessary for sand casting of hollow parts.
3. Jolting machines introduce the highest sand compaction near the mold surface.
4. The turbulence flow is less likely to occur by casting through the bottom gates.
5. To insure effective feeding, the module of the feeder must be less than the module of the casting.
6. Pressures applied in hot chamber die casting are normally higher compared to cold chamber.
7. Draft allowances are essential in sand and die casting processes.
8. Bonding strength of green sand is directly proportional to the moisture content.
9. Numerical simulation can be considered as a tool for in-process quality control of casting.
10. Dye-Penetrant method can be used to detect surface and subsurface casting defects.

Q2: Select the most correct answer (20 marks)

1. During solidification of metals, if the contact angle "θ" between the solid crystal and a substrate is zero, which of the following is expected to take place: (Solidification stops – Only heterogeneous nucleation – Only homogeneous nucleation – Only growth).
2. During cooling of metals, recalescence is the event where: (a) nucleation ends – (b) growth ends – (c) growth rate is maximum – (d) temperature rises – (a and b) – (a and c) – (a, c and d) – (a, b and d).
3. Loose pieces of pattern are essential to facilitate (easy release of pattern from mold – directional solidification – hot spots – simpler patter design).
4. Expendable patterns are utilized in (sand and lost foam– centrifugal and precision – plaster mold and precision – lost foam and investment) casting processes.
5. Of the advantages of die casting: No limit to part size – Minimum porosity – Low cost of die and equipment – Casting of ferrous and non-ferrous alloys.
6. 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).
7. The effect of gravity is less dominant in (centrifugal – semi-centrifugal – permanent mold – centrifuging – investment) casting process.
8. The usual casting method for making dental crowns is (permanent mold – investment – die – continuous – centrifuging) casting.
9. A dummy bar is provided at the beginning of the continuous casting to (promote initial solidification – avoid sticking to the mold – produce hollow sections – support the mold).
10. The most probable reason for the formation of hot tears is (too high pouring temperature – restricted metal contraction – soluble gases in metal – oxide film inclusions).