ماينه ميكانيكا

Zagazig University
Faculty of Engineering
Materials Engineering Dept.

Final Exam

June – 04 - 2008

Metallurgy
2nd Year Mechanical Engineering
Time: 3 hours

Answer the following questions.

Question # 1 (12 marks)

a) Consider the hypothetical simple eutectic phase diagram for metals **A** and **B**, which is similar to that for the lead–tin system. Assume that *(1)* α and β phases exist at the **A** and **B** extremities of the phase diagram, respectively; *(2)* the eutectic composition is **47 wt% B–53 wt% A**; and *(3)* the composition of the β phase at the eutectic temperature is **92.6 wt% B–7.4 wt% A**. **Determine** the composition of an alloy that will yield **primary** α and **total** α mass fractions of **0.356** and **0.693**, respectively.

b) What is the principal difference between **congruent** and **incongruent** phase transformations?

c) In a hypoeutectoid steel, both eutectoid and proeutectoid ferrite exist. **Explain** the difference between them. **What** will be the carbon concentration in each?

Question # 2 (20 marks)

a) Consider **2.5 kg** of austenite containing **0.65 wt% C**, cooled slowly to **725°C**.

(1) Draw the iron-carbon phase diagram system.

(2) What is the proeutectoid phase?

(3) How many kilograms each of total ferrite and cementite form?

(4) How many kilograms each of pearlite and the proeutectoid phase form?

(5) Schematically draw the cooling curve the microstructure of the alloy.

(6) Write -the invariant reactions that may be found in this system.

b) In the solidification of a pure metal **what** are the two energies involved in the transformation? **Write** the equation for the total free-energy change involved in the transformation of liquid to produce a solid nucleus by homogeneous nucleation. **Also** illustrate graphically the energy changes associated with the formation of a nucleus during solidification. ***(All terms should be defined)***

نماذج يحيى

Zagazig University
Faculty of Engineering
Dept. of Mech. Design & Produc.

Mechanics of Machines(II)
Jan. 2008

2nd.Mech.
3 hrs.

* جميع الطلبة (إنتظام + تخلفات)

Attempt all problems & assume any missing data:-

1. The mechanism in Fig. (1), the drive wheel AB rotating at a constant 560 rpm. Using complex method to determine: (a) degrees of freedom, (b) instant centers, (c) V_B , V_C , V_X , ω_{CX} ; (d) A_B , A_C , A_X , α_{CX} .

2. The pump mechanism in Fig.(2), the crank rotates at constant speed 20 rad/s clockwise. Using graphical method to construct the velocity and acceleration diagrams . Determine; (a) angular velocity of cylinder, sliding velocity of plunger & absolute velocity of plunger; (b) sliding acceleration of slider C relative to cylinder walls & angular acceleration of the piston rod.

3. The mechanism in Fig. (3) has ; m_1 = 1.36 kg, m_2 = 2.27 kg, m_3 = 1.82 kg, $I_1 = 2.12 \times 10^{-4}$ kg.m^2 , $I_2 = 3.90 \times 10^{-4}$, $I_3 = 4.68 \times 10^{-4}$ kg.m^2, $A_{G_1} = A_{G_2} = 0.318$ m/s^2 , $A_{G_3} = 0.457$ m/s^2, $\alpha_2 = 11.64$ rad/s^2 (ccw), $\alpha_3 = 6.5$ rad/s^2 (ccw). Make complete static and dynamic force analysis and determine; (a) forces in all joints & inertia forces; (b) torque on shaft at A; (c) shaking force and its location.

4. The landing mechanism of small airplanes in Fig. (4), has; $W_4 = 444.8$ N, k_4 (radius of gyration) = 0.36 m, $W_3 = 88.96$ N , ℓ_3 (slender rod) = 1.05 m , $W_2 = 66.72$ N , $\ell_2 = 0.6$ m, $w_2 = 0.3$ m , $t_2 = 0.075$ m. (motor crank sec.). The motor link is rotating (ccw) at 3 rad/s and accelerating at 10 rad/s^2. Determine all forces acting on the joints of all links and the torque required to drive the motor link .

5. A single-cylinder diesel engine in Fig. (5) , the crank rotates at a constant speed 1800 rpm (ccw) , P = 17800 N. Masses; $M_2 = 2.26$ kg, $M_3 = 3.63$ kg, $M_4 = 2.72$ kg; (a) Draw shaking force diagram without and with counter-balance ($\theta = 0 \rightarrow 360^\circ$) {use counter-balance force = centrifugal force + 0.6 the max. primary inertia force};
   (b) Find the shaking-force before and after counter-balance;
   (c) If the center of mass of the counter-balance mass is 38 mm from the crank-shaft axis ; Determine the mass of counter-balance.

6. In the epicyclic train in Fig.(6) , the arm A carries compound wheels P_1 and P_2 having 36 and 20 teeth . Planet P_2 meshes with the ring gear R and planet P_1 meshes with the sun S having 22 teeth. Given that the modules of P_1 and S are 4 and that those of P_2 and R are 6, calculate (i) the number of teeth on the ring gear, (ii) the speed ratio between the sun and the arm .

I=1

الصفحه الأولى : من فضلك الإمتحان صفحتان

Final Exam 2008/2009
SECOND YEAR
STRESS ANALYSIS

(all questions are equally in marks)

1- Knowing that for the clamp shown has been tightened until P=85 lb, determine a) **the stress at point A, b) the stress at point D, c)the location of the neutral axis. Fig. 1**

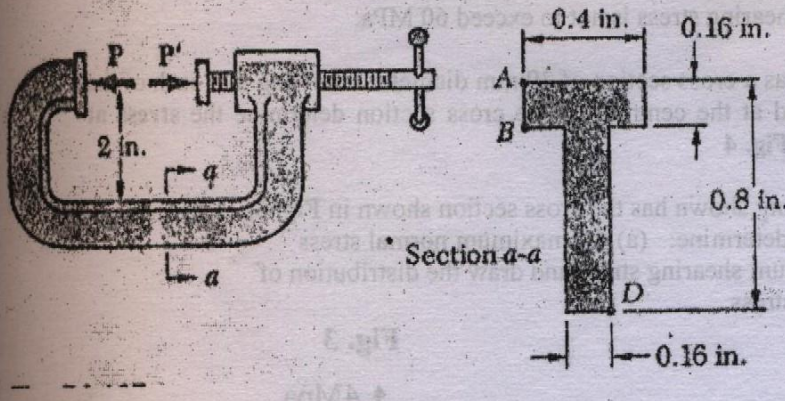

Fig. 1

2- The 14 mm diameter rod CE and the 18 mm diameter rod DF are attached to the rigid bar AEFB as shown. Knowing that the rods are made of aluminum (E=70 GPa), determine(a) the force in each rod caused by the loading shown, (b) the corresponding tensile stresses in rodes. Fig. 2

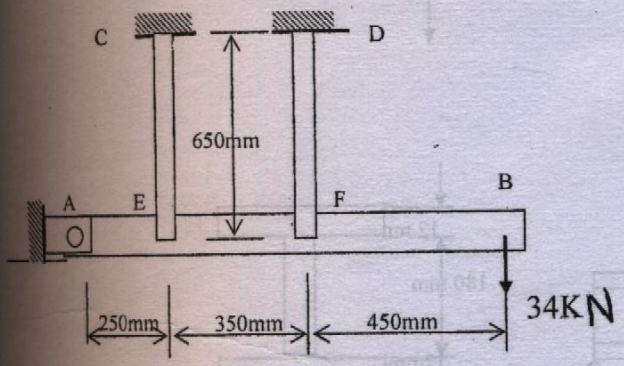

Fig. 2

Final Exam 2008/2009
SECOND YEAR
STRESS ANALYSIS

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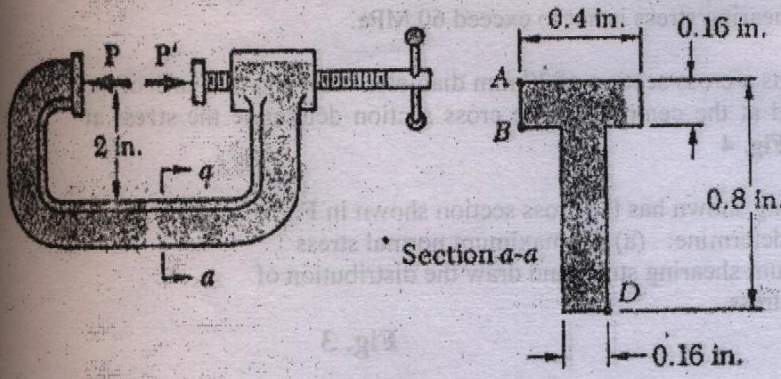

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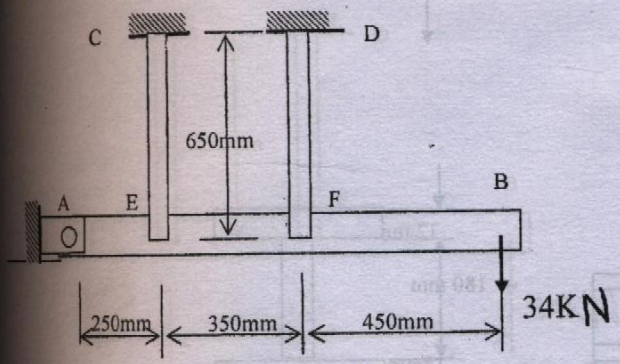


Fig. 2

لاتنسى صلاة

Zagazig University
Faculty of Engineering
Production Technology 2

الأمتحان صفحتان + ورقة جداول

Production Technology Exam (Jan 2009)
Second Year Mechanical
Time: 3.0 Hours

Attempt all questions. Show your answers clearly with neat sketches. State any assumptions, if any.

Question No. 1

The flywheel shown in **Figure 1** made from steel is to be produced by sand casting. Surfaces are to be machined are indicated by symbol "f" (1st degree). Consider shrinkage allowance 2 %, melt density = 7.5 g/cm^3, s =1.6, μ =0.2. Find out the pattern, core and flask dimensions. Use the pressurized gating system; find ingate, runner and sprue sectional areas.

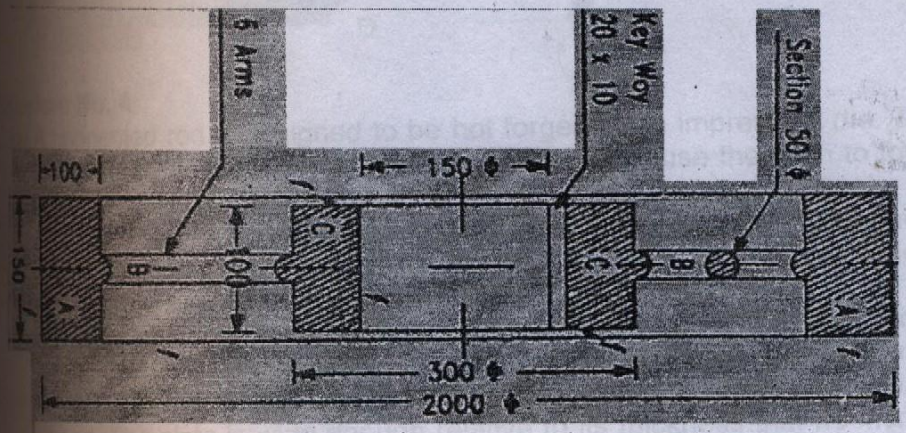


Figure 1 flywheel Casting. **Dimensions are millimeters**

Question No. 2

a. "Fluidity is the ease with which a metal flows into casting cavities". Explain this sentence and write down the factors that affect fluidity and sketch spiral mold test for fluidity.

b. The gating shown in **Figure 2** is used to feed steel casting that has dimensions of 600x150x60 mm. Write the name of gating elements shown in Figure and explain why element b has greater area at its top relative to its bottom. Also choose suitable riser dimensions for such casting. The selected riser should have height to diameter ratio = 2. The riser diameter solidification time would be 30 % longer than casting.

Question No. 3

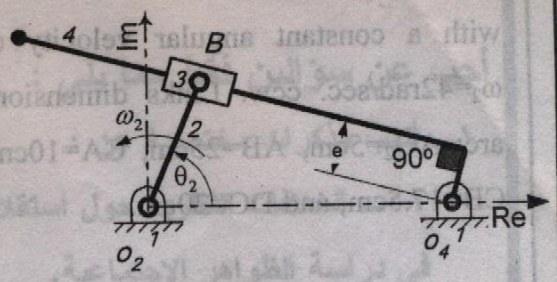
a) Compare between continues, individual and over lapping weld nuggets. What are the factors that determine the spacing between nuggets?

b) A resistance seam-welding operation, with 10-in.-diameter electrode wheels is performed on two pieces of steel. The weld current in the operation is 10000 A, the weld duration 0.4 sec, and the resistance at the interface is 120 μΩ. The centre to centre separation between weld nuggets is 1.2 in. and the individual weld nugget has diameter of 0.2 in. and thickness of 0.12 in. The power unit driving the process requires an off-time between spot welds of 1.0 sec. Given that unit melting energy U_m = 133 Btu/in^3 (1 Btu = 1055 Watt). Determine proportion of heat energy used to form the joint and rotational speed of the electrode wheels.

Solve the Following five Questions.

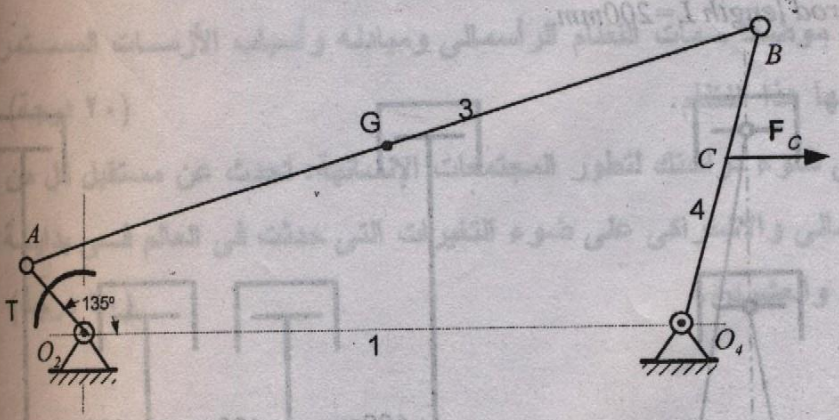
Question # 1

Make a complete kinematic analysis for the offset sliding contact linkage shown in figure by using complex number method. Determine the unknown positions velocities and accelerations at the instant $\theta_2=75^0$. The crank rotate with constant angular velocity $\omega_2=25$rad/sec ccw. *Note: $O_2B=20cm$, $e=15cm$, $O_2O_4=50cm$*



Question # 2

Find the reactions at pin joints and the applied torque T on the crank at the instant shown. The magnitude of the external $\vec{F}_c = 200\angle 0^\circ$ N. links Lengths are: O_2A=75mm, AB=510mm, O_4B=255mm, O_2O_4=355mm, AG=255mm, O_4C=145mm, neglect mass of link-2 and link-4, while link-3 have a mass of m_3=3.2kg and mass moment of inertia about its mass center I_G=0.07kg/m^2. Kinematics analysis gave: angular acceleration of link-3 α_3=250rad/sec^2, acceleration of its mass center G is $\vec{a}_c = 230\angle 310^\circ$ m/s^2.



Question # 3

Construct the displacement diagram and cam profile for a plate cam with reciprocating radial roller follower. The follower rises 50mm with simple harmonic motion in 150° of cam rotation, then dwells for 30°, returns with cycloidal motion in 120°, and dwells for 60°. The prime circle of the plate is 20mm and the follower radius is 10mm.

Look to back

Faculty of Eng. | **Heat Transfer**
Second year | **Jan. 2009**
Mechanical Power Depart. | **Time Allowable: 3 hrs**

Answer The Following Questions and Assume any Missing Data:

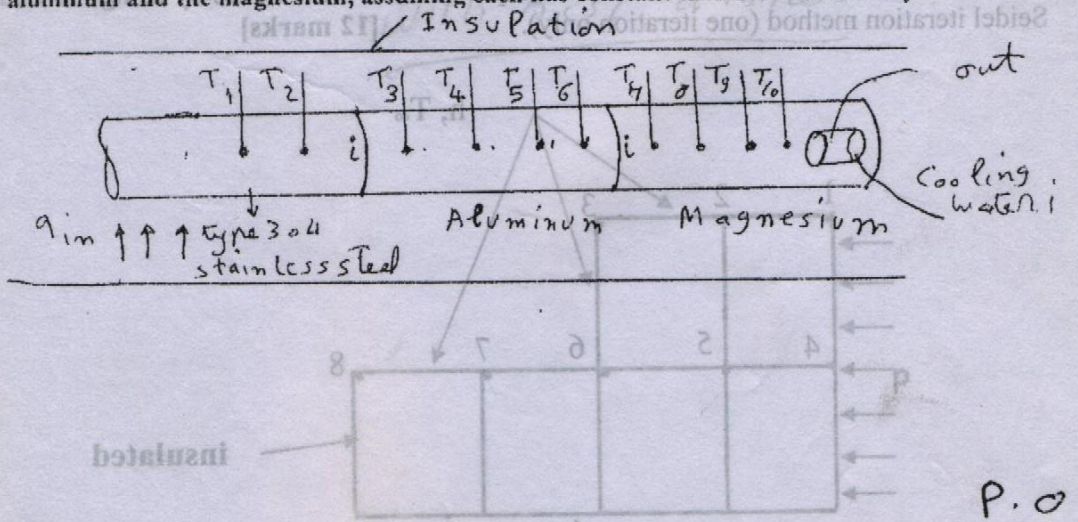
1-a) **Beginning with the proper form of the general heat diffusion equation, apply the following assumptions to derive the appropriate temperature distribution: 1):cylinder coordinates 2)steady state 3) one dimension 4)constant thermal conductivity 5) internal heat generation. [4 marks]**

1-b **Aluminum rods of circular cross section (D=2 mm, L = 50 mm) are used to enhance the heat transfer rate between two surfaces, one of which is maintained at a temperature of 150°C, the other at a temperature of 5°C. One end of each rod is attached to the hot surface (x=0) while the other end is attached to the cold surface (x=50 mm). Air flows between the two surfaces and over the rods, maintaining an average convection coefficient of $\bar{h}$ = 120 (w/m^{2}k). The temperature of the air is T_∞ = 5°C. Calculate:**
i) The rate of heat transfer by convection from each rods to the air.
ii) The total rate of heat transfer from a 1 (m) by 1 (m) section of the hot surface, if a bundle of the rods is installed on 10 (mm) centers.
(Take for aluminum : k = 240 (w/mk), c_p = 940 (J/kg.k), ρ = 2700 (kg/m^3) [11marks]

2-a) **Deduce the overall heat transfer coefficient for the inside and outside surface area for composit cylinder. [4 marks]**

2-b) **Figure below shows a device that can be used to measure thermal contact resistance. It consists of three rods 4.175 cm in diameter. The stainless steel (k=14.4 W/m K) is heated by electrical resistance heaters. Heat flows axially through the aluminum and magnesium to the cooling water chamber. Ten thermocouples are located as shown. Distances between adjacent thermocouples are given : Δz_{1-2} =35 mm , Δz_{2-3} =32 mm, Δz_{3-4} =25 mm, Δz_{4-5} =45 mm, Δz_{5-6} =45 mm, Δz_{6-7} =45 mm, Δz_{7-8} =25 mm, Δz_{8-9} =45 mm, Δz_{9-10} =45 mm, and Δz_{10-1} =45 mm.**

Temperature data obtained from the device are as follows: T_1 =543 K T_2 =460 K, T_3 =391 K, T_4 =382 K, T_5 =374 K, T_6 =366 K, T_7 =349 K, T_8 =337 K, T_9 =325 K, and T_{10} =319 K. Determine the thermal contact resistance between the aluminum and the magnesium, assuming each has constant thermal conductivity. [11 marks]



P.O.T

الأمتحان صفحتان + ورقة جداول

g University
y of Engineering
ction Technology 2

Production Technology Exam (Dec 2005)
Second Year Mechanical
Time: 3.0 Hours

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pt all questions. Show your answers clearly with neat sketches

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tion No. 1

e steel part shown in **Figure 1** is to be produced by sand casting. Find out the table machining allowances, flask dimensions and core prints. Consider shrinkage owance 2 % and all surfaces except webs are to be machined. (ρ= 7.8 g/cm^3, s =2, =0.4). Find out

Dimensions of pattern and core.
Gating areas.

tion No. 2

vacuum molding, the vacuum is used instead of binder" Explain this sentence write down the advantage and disadvantages of this molding technique.
hat does chaplet mean in foundry molds? Sketch a mold using chaplets
castings has cuboid shape with dimension 1000x500x250 mm is molded mpletely in the drag. Find Cope dimension and calculate the buoyancy forces s on inner surface of copes in following cases. Melt density = 8.7 g/cm^3.
- If face of sides 250x500 mm is located at top of the casting inside the mold.
- If face of sides 250x500 mm is located at side of the casting inside the mold.

evious observations have indicated total solidification time for the casting shown question 2c is 25 min. The riser has a height equal to double its diameter. etermine the riser size, using Chivornov's method, that the solidification time of er is longer than casting by 5 minutes.

tion No. 3

hat are the similarities and differences between transferred Plasma arc and Atomic drogen welding? Which one can be used to weld nonconductive material and hy? Which one may give higher heat energy and why?

esistance seam welding on two pieces of steel (T_m=1760 K) having thickness 3 to fabricate a container. The weld current is 10,000 A, the weld duration 0.3 sec, the resistance at the interface is 75 $\mu\Omega$. Continuous motion welding is used, with mm diameter electrode wheels. Weld nuggets have diameter =6 mm and ness = 4mm. (assume the weld nuggets are disc shaped). These weld nuggets st touch each other to form a sealed seam. The power unit driving the process ires an off-time between spot welds of 1.0 sec. Given these conditions, determine The unit melting energy of stainless steel. K= 3.33x10^{-6} and 1 btu= 1055 w
Proportion of energy generated that goes into the weld.
The rotational speed (rpm) of the electrode wheels.

ماينه ميكانيكا

Zagazig University
Faculty of Engineering
Materials Engineering Dept.

Final Exam

June – 04 - 2008

Metallurgy
2nd Year Mechanical Engineering
Time: 3 hours

Answer the following questions.

Question # 1 (12 marks)

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b) What is the principal difference between **congruent** and **incongruent** phase transformations?

c) In a hypoeutectoid steel, both eutectoid and proeutectoid ferrite exist. **Explain** the difference between them. **What** will be the carbon concentration in each?

Question # 2 (20 marks)

a) Consider **2.5 kg** of austenite containing **0.65 wt% C**, cooled slowly to **725°C**.

(1) Draw the iron-carbon phase diagram system.

(2) What is the proeutectoid phase?

(3) How many kilograms each of total ferrite and cementite form?

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(5) Schematically draw the cooling curve the microstructure of the alloy.

(6) Write -the invariant reactions that may be found in this system.

b) In the solidification of a pure metal **what** are the two energies involved in the transformation? **Write** the equation for the total free-energy change involved in the transformation of liquid to produce a solid nucleus by homogeneous nucleation. **Also** illustrate graphically the energy changes associated with the formation of a nucleus during solidification. ***(All terms should be defined)***

Question # 3 (16 marks)

a) Explain why:-

1- Upon solidification, an alloy of eutectic composition forms a microstructure consisting of alternating layers of the two solid phases.

2- Fine pearlite is harder and stronger than coarse pearlite.

3- Martensite is so hard and brittle.

4- The hardness of tempered martensite diminishes with tempering time (at constant temperature) and with increasing temperature (at constant tempering time).

5- The isothermal transformation (TTT curve) of eutectoid steel has a C-shape.

6- A proeutectoid (primary) phase forms along austenite grain boundaries.

b) With the aid of proper sketches, explain briefly the steps of **full annealing** and **normalizing** processes when performing on **hypereutectoid steels**.

Question # 4 (12 marks)

a) Schematically draw the isothermal transformation diagram for an iron–carbon alloy of eutectoid composition and then sketch and label time–temperature paths on this diagram to produce the following microstructures:

(1) 100% coarse pearlite

(2) 50% martensite and 50% austenite

(3) 50% coarse pearlite, 25% bainite, and 25% martensite

b) Briefly cite the differences between **pearlite**, **bainite**, **martensite**, and **spheroidite** relative to **microstructure** and **mechanical properties**.

With Our Best Wishes

نماذج يحيى

Zagazig University
Faculty of Engineering
Dept. of Mech. Design & Produc.

Mechanics of Machines(II)
Jan. 2008

2nd.Mech.
3 hrs.

* جميع الطلبة (إنتظام + تخلفات)

Attempt all problems & assume any missing data:-

1. The mechanism in Fig. (1), the drive wheel AB rotating at a constant 560 rpm. Using complex method to determine: (a) degrees of freedom, (b) instant centers, (c) V_B , V_C , V_X , ω_{CX} ; (d) A_B , A_C , A_X , α_{CX} .

2. The pump mechanism in Fig.(2), the crank rotates at constant speed 20 rad/s clockwise. Using graphical method to construct the velocity and acceleration diagrams . Determine; (a) angular velocity of cylinder, sliding velocity of plunger & absolute velocity of plunger; (b) sliding acceleration of slider C relative to cylinder walls & angular acceleration of the piston rod.

3. The mechanism in Fig. (3) has ; m_1 = 1.36 kg, m_2 = 2.27 kg, m_3 = 1.82 kg, $I_1 = 2.12 \times 10^{-4}$ kg.m^2 , $I_2 = 3.90 \times 10^{-4}$, $I_3 = 4.68 \times 10^{-4}$ kg.m^2, $A_{G_1} = A_{G_2} = 0.318$ m/s^2 , $A_{G_3} = 0.457$ m/s^2, $\alpha_2 = 11.64$ rad/s^2 (ccw), $\alpha_3 = 6.5$ rad/s^2 (ccw). Make complete static and dynamic force analysis and determine; (a) forces in all joints & inertia forces; (b) torque on shaft at A; (c) shaking force and its location.

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الصفحه الأولى : من فضلك الإمتحان صفحتان

Final Exam 2008/2009
SECOND YEAR
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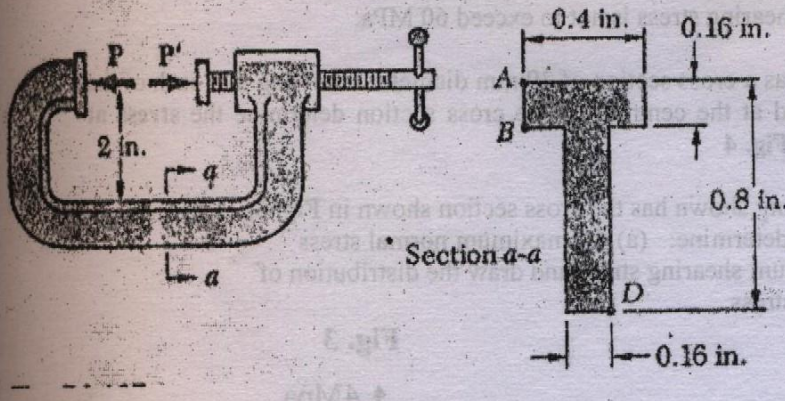

Fig. 1

2- The 14 mm diameter rod CE and the 18 mm diameter rod DF are attached to the rigid bar AEFB as shown. Knowing that the rods are made of aluminum (E=70 GPa), determine(a) the force in each rod caused by the loading shown, (b) the corresponding tensile stresses in rodes. Fig. 2

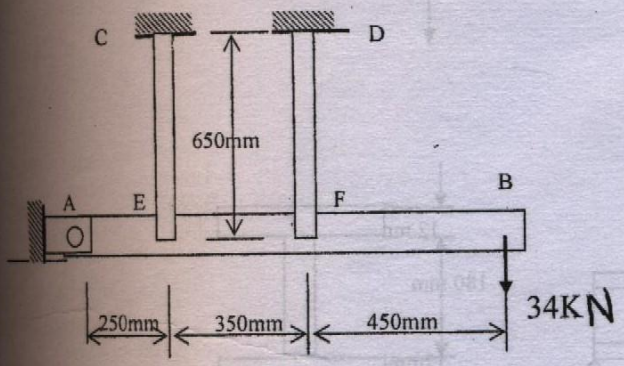

Fig. 2

Final Exam 2008/2009
SECOND YEAR
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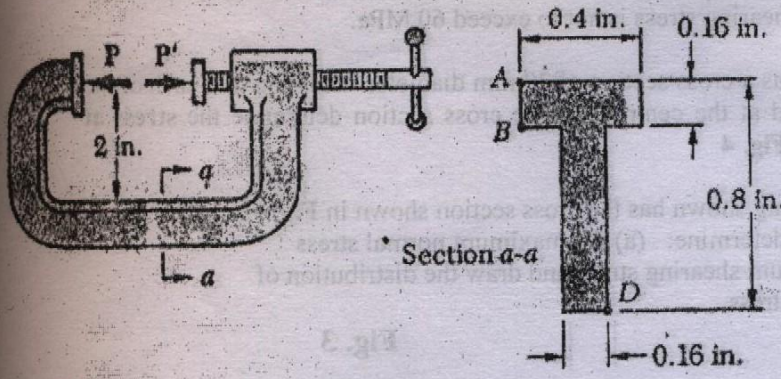

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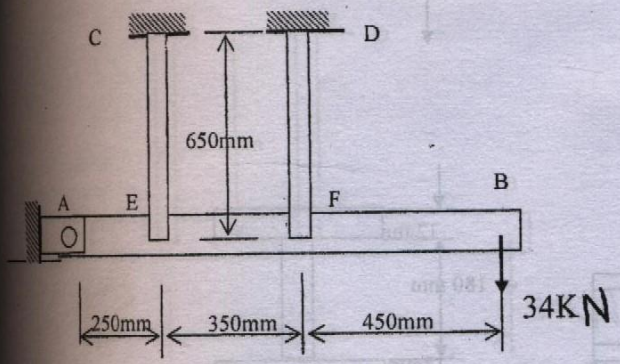

Fig. 2

لاتنسى صلاة

Zagazig University
Faculty of Engineering
Production Technology 2

الأمتحان صفحتان + ورقة جداول

Production Technology Exam (Jan 2009)
Second Year Mechanical
Time: 3.0 Hours

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The flywheel shown in **Figure 1** made from steel is to be produced by sand casting. Surfaces are to be machined are indicated by symbol "f" (1st degree). Consider shrinkage allowance 2 %, melt density = 7.5 g/cm^3, s =1.6, μ =0.2. Find out the pattern, core and flask dimensions. Use the pressurized gating system; find ingate, runner and sprue sectional areas.

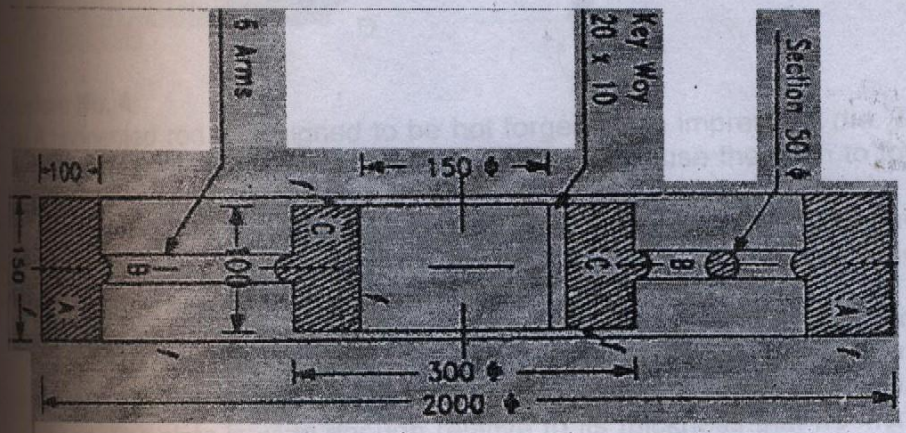


Figure 1 flywheel Casting. **Dimensions are millimeters**

Question No. 2

a. "Fluidity is the ease with which a metal flows into casting cavities". Explain this sentence and write down the factors that affect fluidity and sketch spiral mold test for fluidity.

b. The gating shown in **Figure 2** is used to feed steel casting that has dimensions of 600x150x60 mm. Write the name of gating elements shown in Figure and explain why element b has greater area at its top relative to its bottom. Also choose suitable riser dimensions for such casting. The selected riser should have height to diameter ratio = 2. The riser diameter solidification time would be 30 % longer than casting.

Question No. 3

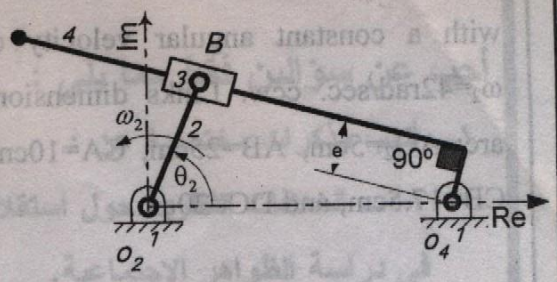
a) Compare between continues, individual and over lapping weld nuggets. What are the factors that determine the spacing between nuggets?

b) A resistance seam-welding operation, with 10-in.-diameter electrode wheels is performed on two pieces of steel. The weld current in the operation is 10000 A, the weld duration 0.4 sec, and the resistance at the interface is 120 μΩ. The centre to centre separation between weld nuggets is 1.2 in. and the individual weld nugget has diameter of 0.2 in. and thickness of 0.12 in. The power unit driving the process requires an off-time between spot welds of 1.0 sec. Given that unit melting energy U_m = 133 Btu/in^3 (1 Btu = 1055 Watt). Determine proportion of heat energy used to form the joint and rotational speed of the electrode wheels.

Solve the Following five Questions.

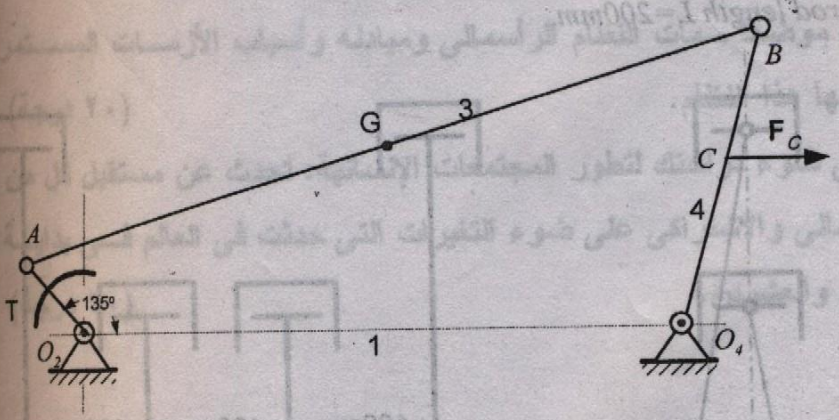
Question # 1

Make a complete kinematic analysis for the offset sliding contact linkage shown in figure by using complex number method. Determine the unknown positions velocities and accelerations at the instant $\theta_2=75^0$. The crank rotate with constant angular velocity $\omega_2=25$rad/sec ccw. *Note: $O_2B=20cm$, $e=15cm$, $O_2O_4=50cm$*



Question # 2

Find the reactions at pin joints and the applied torque T on the crank at the instant shown. The magnitude of the external $\vec{F}_c = 200\angle 0^\circ$ N. links Lengths are: O_2A=75mm, AB=510mm, O_4B=255mm, O_2O_4=355mm, AG=255mm, O_4C=145mm, neglect mass of link-2 and link-4, while link-3 have a mass of m_3=3.2kg and mass moment of inertia about its mass center I_G=0.07kg/m^2. Kinematics analysis gave: angular acceleration of link-3 α_3=250rad/sec^2, acceleration of its mass center G is $\vec{a}_c = 230\angle 310^\circ$ m/s^2.



Question # 3

Construct the displacement diagram and cam profile for a plate cam with reciprocating radial roller follower. The follower rises 50mm with simple harmonic motion in 150° of cam rotation, then dwells for 30°, returns with cycloidal motion in 120°, and dwells for 60°. The prime circle of the plate is 20mm and the follower radius is 10mm.

Look to back

Faculty of Eng. | **Heat Transfer**
Second year | **Jan. 2009**
Mechanical Power Depart. | **Time Allowable: 3 hrs**

Answer The Following Questions and Assume any Missing Data:

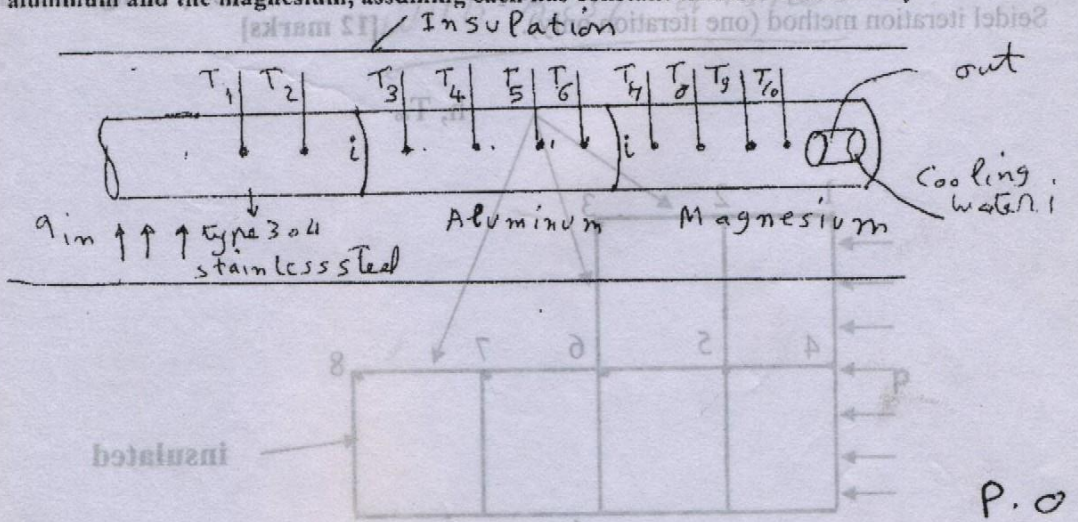
1-a) **Beginning with the proper form of the general heat diffusion equation, apply the following assumptions to derive the appropriate temperature distribution: 1):cylinder coordinates 2)steady state 3) one dimension 4)constant thermal conductivity 5) internal heat generation. [4 marks]**

1-b **Aluminum rods of circular cross section (D=2 mm, L = 50 mm) are used to enhance the heat transfer rate between two surfaces, one of which is maintained at a temperature of 150°C, the other at a temperature of 5°C. One end of each rod is attached to the hot surface (x=0) while the other end is attached to the cold surface (x=50 mm). Air flows between the two surfaces and over the rods, maintaining an average convection coefficient of $\bar{h}$ = 120 (w/m^{2}k). The temperature of the air is T_∞ = 5°C. Calculate:**
i) The rate of heat transfer by convection from each rods to the air.
ii) The total rate of heat transfer from a 1 (m) by 1 (m) section of the hot surface, if a bundle of the rods is installed on 10 (mm) centers.
(Take for aluminum : k = 240 (w/mk), c_p = 940 (J/kg.k), ρ = 2700 (kg/m^3) [11marks]

2-a) **Deduce the overall heat transfer coefficient for the inside and outside surface area for composit cylinder. [4 marks]**

2-b) **Figure below shows a device that can be used to measure thermal contact resistance. It consists of three rods 4.175 cm in diameter. The stainless steel (k=14.4 W/m K) is heated by electrical resistance heaters. Heat flows axially through the aluminum and magnesium to the cooling water chamber. Ten thermocouples are located as shown. Distances between adjacent thermocouples are given : Δz_{1-2} =35 mm , Δz_{2-3} =32 mm, Δz_{3-4} =25 mm, Δz_{4-5} =45 mm, Δz_{5-6} =45 mm, Δz_{6-7} =45 mm, Δz_{7-8} =25 mm, Δz_{8-9} =45 mm, Δz_{9-10} =45 mm, and Δz_{10-1} =45 mm.**

Temperature data obtained from the device are as follows: T_1 =543 K T_2 =460 K, T_3 =391 K, T_4 =382 K, T_5 =374 K, T_6 =366 K, T_7 =349 K, T_8 =337 K, T_9 =325 K, and T_{10} =319 K. Determine the thermal contact resistance between the aluminum and the magnesium, assuming each has constant thermal conductivity. [11 marks]



P.O.T

Faculty of Eng. **Heat Transfer**
Second year **Jan. 2009**
Mechanical Power Depart. **Time Allowable: 3 hrs**

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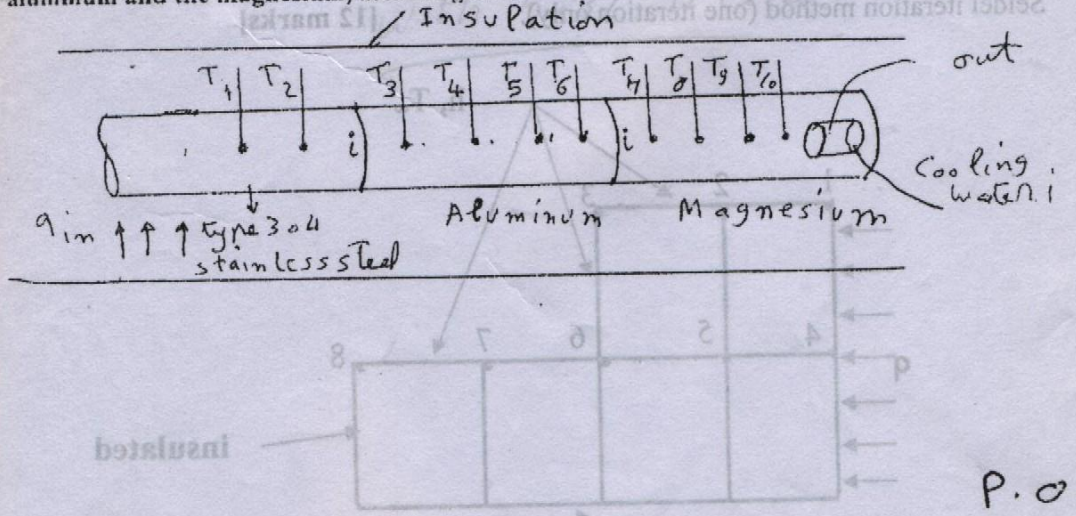

P.O.T

Faculty of Eng. **Heat Transfer**
Second year **Jan. 2009**
Mechanical Power Depart. **Time Allowable: 3 hrs**

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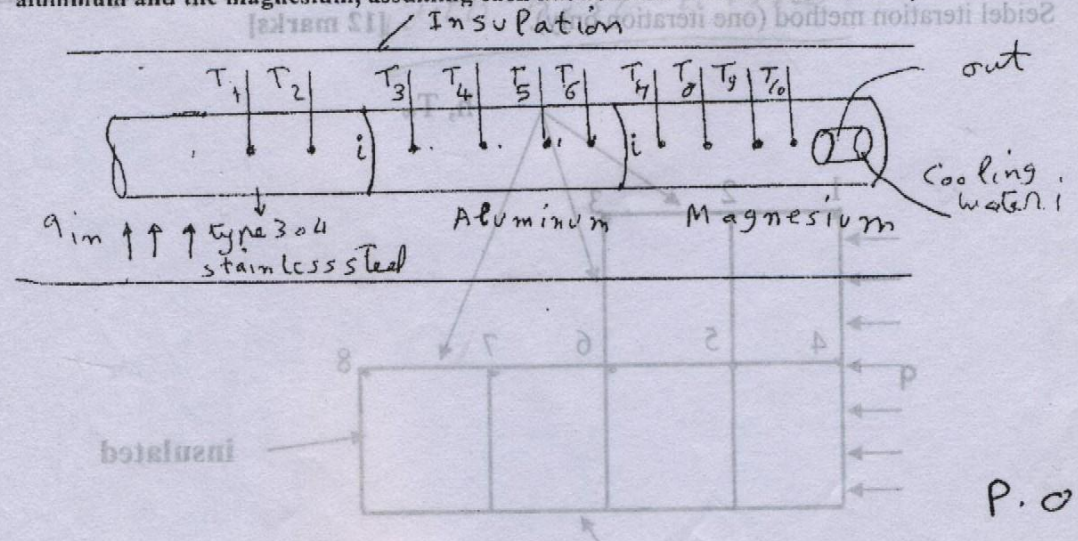

P.O.T

Faculty of Eng. Heat Transfer
Second year Jan. 2009
Mechanical Power Depart. Time Allowable: 3 hrs

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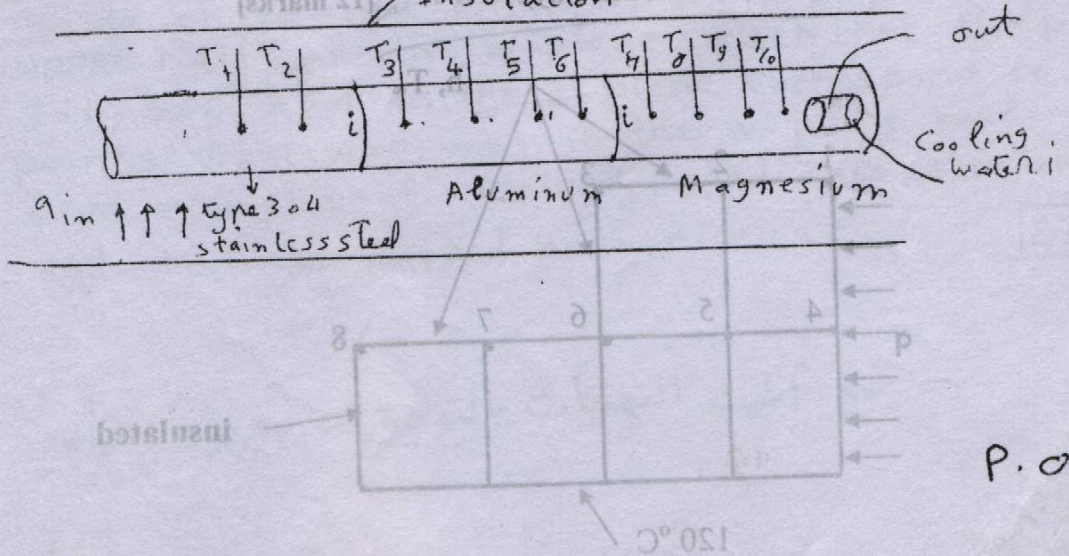


P.O.T

ZAGAZIG UNIVERSITY — FINAL EXAM. IN MATH. 3
FACULTY OF ENGINEERING — TIME : 3 HOURS.
SECOND YEAR (MECH. & INDUSTRY) — JANUARY 2009

1. (i) Find a Laurent expansion for $f(z)=\dfrac{1}{z^2-3z+2}$ valid between two concentric circles.

(ii) Prove that the infinite series:
$$az+\frac{a(a-2b)}{2!}z^2+\frac{a(a-3b)^2}{3!}z^3+\cdots+\frac{a(a-nb)^{n-1}}{n!}z^n+\cdots$$
has a radius of convergence $=\dfrac{1}{e|b|}$ [21]

2. Use Frobenius Method to solve the Bessel Equation: of order one half: $x^2y''+xy'+[x^2-(\frac{1}{2})^2]y=0$. [15]

3. (i) Show that:
$$\beta(m,n)=\int_0^\infty \frac{x^{m-1}}{(1+x)^{m+n}}\,dx,$$
Hence prove that:
$$\int_{-\infty}^{\infty}[e^{2t}/(ae^{3t}+b)]\,dt=\frac{2\pi}{3\sqrt{3}\,a^{2/3}b^{1/3}}$$

(ii) Draw the modular surface of the function: $w=\bar{z}+\dfrac{1}{z}$

(iii) Show that $\displaystyle\int_{-\infty}^{\infty}[e^{\alpha t}/(1+e^t)]\,dt=\frac{\pi}{\sin\alpha\pi}$ [27]

4. Determine the stream lines and the equipotential lines of two vortices of equal and opposite strength located at $z=1$ and $z=-1$. Show that the two vortices generate in the limit a dipole [20]

5. (i) Show that:
$$\int_0^{2\pi}\frac{d\theta}{a+b\cos\theta}=\frac{2\pi}{\sqrt{a^2-b^2}}$$

(ii) Find the bilinear transformation which maps the inside of the unit circle in the z-plane onto the upper half of the w-plane, such that the points $z=1$, $z=i$, $z=-1$ in the z-plane correspond to the points $w=-1$, $w=0$, $w=1$ in the w-plane resp. Give examples of circles mapped onto str. lines and str. lines mapped onto circles. [27]

مع أطيب التمنيات بالتوفيق

أ.د/ محمد عطوت عبد المجيد

Zagazig University
Faculty of Engineering
Electronics and Communications Department

Electronic (2ed year Mechanical)
Final Exam (May 2008)
Time: 1.5 Hours.

Answer ALL questions **Part - II**

1. **EQ 1**
   a. Explain the difference between: Intrinsic and Extrinsic semiconductor materials **Also** photo diode, LED and Zener diode.
   b. pn junction diode has $N_A=10^{16}$ cm^{-3}, $N_D=6x10^{18}$ cm^{-3} and $n_i= 4x10^{15}$ cm^{-3}. Calculate the barrier potential of the pn junction at room temperature (k= $8.62x10^{-5}$eV/K) , q=$1.6x10^{-16}$c.
   c. In the circuit shown in **Fig. 1** Find I and V_0 if the diode is consider as :
      i. Ideal.
      ii. 0.7 model.
      iii. Practical with I-v characteristic shown in **Fig. 1.(iii)**.
2. **EQ . 2**
   a. Draw the physical structure of the BJT (npn &pnp). Draw the output characteristic of BJT with explanation of regions of operation.
   b. In the amplifier shown in **Fig. 2,** C_L=20pF Find :
      i. Q point of the transistor.
      ii. The gain of the amplifier
      iii. The input impedance of the amplifier.
3. **EQ 3**
   a. What are the ideal characteristics of the operational amplifier?
   b. Find the feedback gains of the circuit shown **in Fig. 3**.
   c. Use the operational amplifier circuit applications to solve the following second order mechanical system:
      i. $y'' + 4y' + 5y = 2 \sin \omega t$.

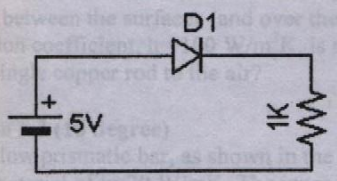


Fig. 1

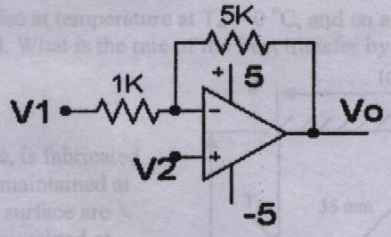


Fig. 3

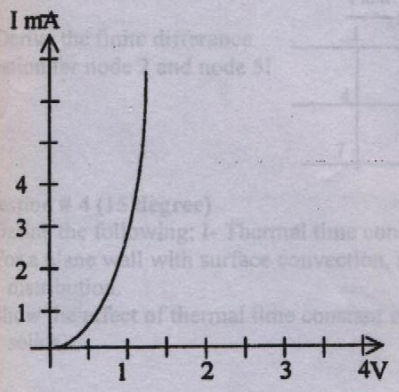


Fig. 1(iii)

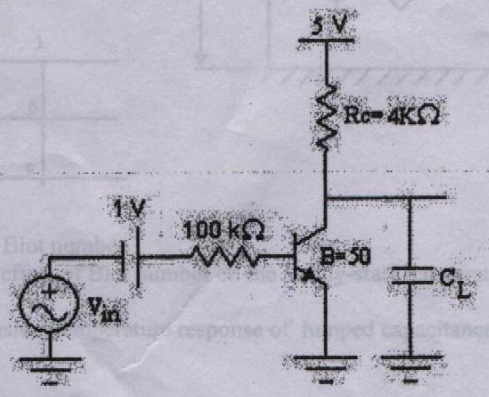


Fig. 2

Faculty of engineering
Second Year
Mechanical Power depart.

Heat transfer
January, 2008
Time: 3:00 Hours

Question # 1 (15 degree)

a) Beginning with the correct form of the general conduction equation, apply the following assumption and drive the temperature distribution for

1- Spherical coordinates 2- with heat generation 3- Steady state
4- Temperature varies only with r 5- constant thermal conductivity

b) A homeowner, whose water pipes have frozen during a period of cold weather, decides to melt the ice by passing an electric current I through the pipe wall. The inner and outer radii of the wall are designated as r_1 and r_2, respectively, and its electrical resistance per unit length is designated as $R_e(\Omega/m)$. The pipe is well insulated on the outside, and during melting the ice (and water) in the pipe remain at a constant temperature T_m, associated with the melting process.

i) Assuming that steady-state conditions are reached shortly after application of the current, determine the form of the steady state temperature distribution, T(r), in the pipe wall during the melting process.

ii) Develop an expression for the time, t_m, required to completely melt the ice. Calculate this time for I=100 A, $R_e = 0.30$ (Ω/m), r_1=50 mm, $\rho = 920$ kg/m^3, and $h_{fg}=3.34\times10^5$ J/kg.

Question # 2 (15 degree)

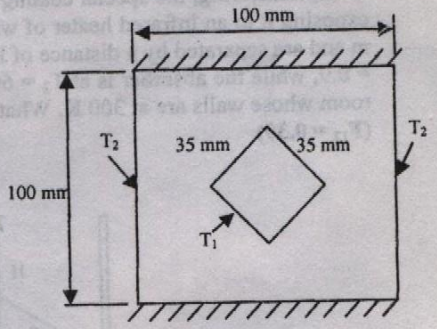
a) Answer the following short questions:

1) The thermal conductivity of a solid may be ------ than four order of magnitude larger than that of a gas.
2) The effective conductivity of the system --------- several characteristics, which include the thermal conductivity and the surface radiative properties of the solid material and the nature and volumetric fraction of the air or void space.
3) In composite systems, the temperature drop across the interface between materials is due to ----------
4) The effectiveness of the fin is the ratio of the ---------- to ----------

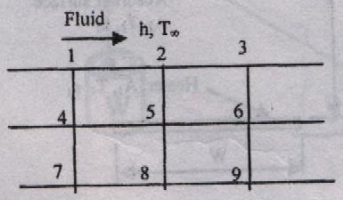
b) Circular copper rods (k=400 W/mK) of diameter D=1 mm and length L=25 mm are used to enhance heat transfer from a surface which is maintained at $T_{s,1}$ =100 °C. One end of the rod is attached to this surface (at x=0), while the other end, (x = 25 mm), is joined to a second surface, which is maintained at T = 0 °C. Air flowing between the surfaces (and over the rods) is also at temperature at T_∞ = 0 °C, and an average convection coefficient, h= 100 W/m^{2}K, is maintained. What is the rate of the heat transfer by convection from a single copper rod to the air?

Question # 3 (10 degree)

a) A hollow prismatic bar, as shown in the next figure, is fabricated from a material of k=20 W/mK. The inner surface is maintained at T_1= 500 K. The top and the bottom sides of the outer surface are kept insulated while the left and the right sides are maintained at T_2= 300 K. Find the shape factor and the heat transfer rate per unit length of the bar.



b) Derive the finite difference equation for node 2 and node 5!



Question # 4 (15 degree)

a- Define the following; I- Thermal time constant II- Biot number
b- For a plane wall with surface convection, show the effect of Biot number on the steady-state temperature distribution.
c- Show the effect of thermal time constant on the transient temperature response of lumped capacitance solids.

ZAGAZIG UNIVERSITY — FINAL EXAM. IN MATH. 3
FACULTY OF ENGINEERING — TIME : 3 HOURS.
SECOND YEAR (MECH. & INDUSTRY) — JANUARY 2009

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مع أطيب التمنيات بالتوفيق ،،

أ.د/ محمد عفوت عبدالمجيد

(all questions are equally in marks)

1- Knowing that for the clamp shown has been tightened until P=85 Ib, determine a) **the stress at point A, b) the stress at point D, c)the location of the neutral axis. Fig. 1**

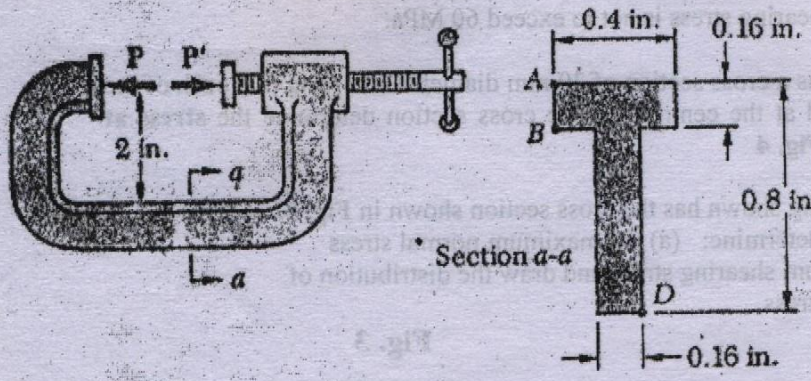


Fig. 1

2- The 14 mm diameter rod CE and the 18 mm diameter rod DF are attached to the rigid bar AEFB as shown. Knowing that the rods are made of aluminum (E=70 GPa), determine(a) the force in each rod caused by the loading shown, (b) the corresponding tensile stresses in rodes. Fig. 2

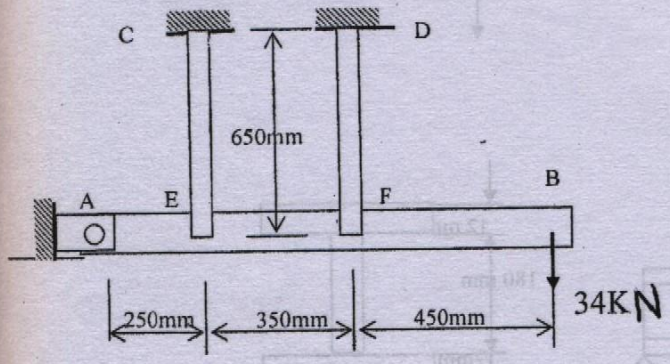
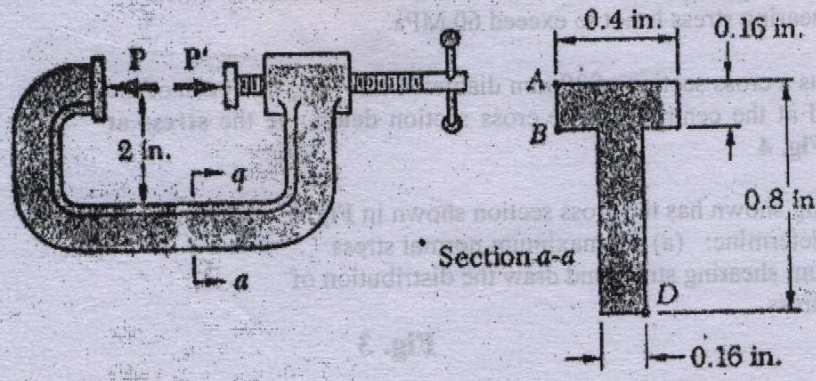


Fig. 2

(all questions are equally in marks)

1- Knowing that for the clamp shown has been tightened until P=85 Ib, determine a) **the stress at point A, b) the stress at point D, c)the location of the neutral axis. Fig. 1**



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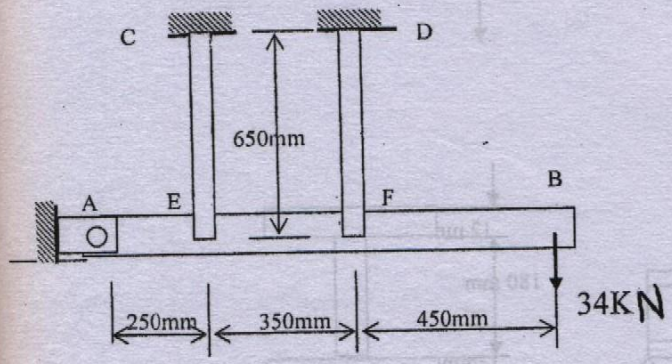

Fig. 2

University
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ion Technology 2

الأمتحان صفحتان + ورقة جداول

Production Technology Exam (Jan 2009)
Second Year Mechanical
Time: 3.0 Hours

t all questions. Show your answers clearly with neat sketches. State any assumptions, if any.

tion No. 1

e flywheel shown in **Figure 1** made from steel is to be produced by sand casting. Surfaces to be machined are indicated by symbol "**f**" (1st degree). Consider shrinkage allowance 2 melt density = 7.5 g/cm^3, s =1.6, μ =0.2. Find out the pattern, core and flask dimensions. e the pressurized gating system; find ingate, runner and sprue sectional areas.

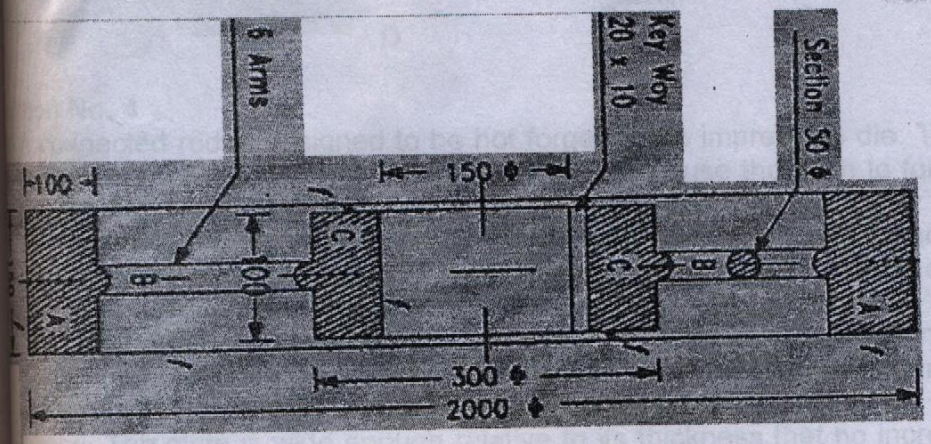

Figure 1 flywheel Casting. **Dimensions are millimeters**

tion No. 2

luidity is the ease with which a metal flows into casting cavities". Explain this sentence d write down the factors that affect fluidity and sketch spiral mold test for fluidity.

e gating shown in **Figure 2** is used to feed steel casting that has dimensions of 0x150x60 mm. Write the name of gating elements shown in Figure and explain why ment b has greater area at its top relative to its bottom. Also choose suitable riser mensions for such casting. The selected riser should have height to diameter ratio = 2. The er diameter solidification time would be 30 % longer than casting.

on No. 3

Compare between continues, individual and over lapping weld nuggets. What are the factors that determine the spacing between nuggets?

A resistance seam-welding operation, with 10-in.-diameter electrode wheels is performed on two pieces of steel. The weld current in the operation is 10000 A, the weld duration 0.4 sec, and the resistance at the interface is 120 μΩ. The centre to centre separation between weld nuggets is 1.2 in. and the individual weld nugget has diameter of 0.2 in. and thickness of 0.12 in. The power unit driving the process requires an off-time between spot welds of 1.0 sec. Given that unit melting energy U_m = 133 Btu/in^3 (1 Btu = 1055 Watt). Determine proportion of heat energy used to form the joint and rotational speed of the electrode wheels.

جامعة الزقازيق
كليـــة الهندسة
قسم ميكانيكا ــ هندسة صناعية

الفرقة الثانية
مادة : انسانيات (علم اجتماع)
الزمـــن : ساعتان

امتحان الفصل الأول يناير ٢٠٠٩م

أجب عن سؤالين فقط مما يلى :

١ــ أكتب مذكرات مختصرة عن :

١ ــ الخلافات النظرية حول استقلالية علم الاجتماع وامكانية استخدام المنهج العلمى فى دراسة الظواهر الاجتماعية.

٢ ــ تعدد المنهج العلمى أو وحدته.

٣ ــ وظائف المنهج العلمى. (٢٠ درجة)

٢ ــ تعتبر الدولة من أهم الأنساق السياسية فى المجتمع الإنسانى الحديث. ناقش موضحا:

ــ تعريف الدولة ــ نشأتها ــ النظريات المفسرة لها. (٢٠ درجة)

٣ ــ يرى البعض أن الأزمة الاقتصادية التى واجهت العالم فى نهاية عام ٢٠٠٨م تعود إلى طبيعة النظام الرأسمالى نفسه والذى يحمل فى داخله جوانب متناقضة كثيرة. أشرح موضحا سمات النظام الرأسمالى ومبادئه وأسباب الأزمات المستمرة التى يواجهها هذا النظام. (٢٠ درجة)

٤ ــ على ضوء دراستك لتطور المجتمعات الإنسانية: تحدث عن مستقبل كل من النظام الرأسمالى والاشتراكى على ضوء التغيرات التى حدثت فى العالم فى بداية القرن الواحد والعشرين. (٢٠ درجة)

مع أمنياتى الطيبة لكم بالنجاح

د. صلاح الدين منسى