ميكانيكا الموائع

Tanta University — **Time allowed 3 hr**

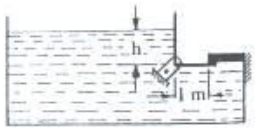
Faculty of Engineering — **12 Jan 2008.**

Mech. Production. Dept. — **Fluid Mechanics.** — **Second Year**

Question 1

A. Write a short note on: single tube manometer, U-tube manometer and differential manometer.

B. A rectangular gate shown should tip automatically when the water rises above a certain level. Determine that level.



Question 2.

A. Are The following statements true or false:

1) Viscosity of a gas increases with temperature.
2) Fluid kinematics deals with the study of fluid at rest.
3) Bulk modulus is independent of temperature .
4) For a centrifugal pump, the discharge varies directly with the speed.
5) A fluid machine which converts fluid power of a gas to mechanical power is called gas turbine.

B. An open cylindrical container 0.3 m in diameter, 0.6 m high, two third filled with oil of specific gravity 0.8 is rotated about its vertical axis. Determine the speed of rotation when:

(1) the oil just starts spilling over the prim.

(2) the point at the center of the base is just exposed and the percentage of oil left in the container.

Question 3.

A. State the difference between a centrifugal pump and a reciprocating pump.

B. A centrifugal pump of 1.5 m diameter runs at 210 r.p.m. and pumps 1800 liters of water per second. The angle which the vane makes with the tangent to the impeller at exit is 25°. Taking the velocity of flow throughout as 2.5 m/sec, determine the power required to derive the pump, P_{im}. If the manometric efficiency of the pump is 65%, find the average lift of the pump, H_m.

Question 4.

A. For a fully developed laminar flow through a horizontal round pipe with longitudinal pressure gradient dp/dx; show that the velocity profile is a parabolic and derive expressions for the maximum velocity U_{max}, average velocity U_a, total discharge through the pipe Q and the drag coefficient C_f.

B. An oil having $\mu=0.0098$ $kg_f.s/m^2$ and specific gravity of 1.59 flows through a horizontal pipe of 5 cm diameter with a pressure drop of 0.06 kg_f/cm^2 per meter length. Determine the rate of flow, the wall shear stress, the total drag and the power required to maintain the flow for 100 m length of the pipe.

Question 5.

A. **Choose the correct or the most appropriate response from the given alternatives:**:

1) The centre of pressure of a plane submerged surface: -always coincides with the centroid of the surface --may be above or below the centroid -cannot be above the centroid of the surface.
2) Inviscid fluid refers to: - Constant viscosity -Zero viscosity -Variable viscosity
3) Steadiness refers to: -No change in space -No change with time -No change in density.
4) Laminar flow refers to: -ideal flow - viscous flow - Reynolds number is less than critical value.
5) The delivery of centrifugal pump is: -pulsating -continuous - pulsating and continuous.

B. A Pelton wheel having semi-circular buckets and working under a head of 140 m is running at 600 r.p.m. The discharge through the nozzle is 50 liters/sec and diameter of the wheel is 60 cm. Find the available power at the nozzle and the hydraulic efficiency of the wheel.

C. Show that the velocity components $u=2x-x^2y+y^3/3$, $v=xy^2-2y-x^3/3$ represent a possible irrotational two-dimensional flow. Obtain an expression for the stream function ψ and for the velocity potential φ. Does each expression satisfy the Laplacian equation? Explain.

Assume any missing data. **Good Luck.** **Dr Gamal Bedair.**

جامعة طنطا - كلية الهندسة
قسم هندسة القوى والميكانيكا

العام الدراسي ٢٠٢٠/٢٠٢١
الفصل الدراسي الأول
الفرقة الدراسية الثالثة
الزمن ٣ ساعات

التخصص: هندسة الإنتاج والتصميم الميكانيكي (لائحة قديمة)
المادة: ميكانيكا وآلات مواقع

عدد الصفحات: ٢ عدد الأسئلة: ٤ أجب على جميع الأسئلة

1-a) Using the control volume concept, derive the law of mass conservation (Continuity equation) for 1-D steady flow.

b) Derive and explain with drawing the Bernoulli's equation for 1-D flow.

c) Derive the linear impulse momentum equation.

2-a) Draw the scheme and explain the principle of operation of centrifugal pump.

b) Draw the scheme and explain the principle of operation of one stage axial flow compressor.

c) Draw the scheme and explain the principle of operation of one stage axial flow turbine.

3-a) Define and explain with drawing if necessary:

- Steady and unsteady flow, pathline, streamline and streakline.
- Energy line EL and Hydraulic Grade Line HGL.
- Control volume, control surface and fluid system.

3-b) In the ideal flow around a half streamline body, the stream function ψ is given in polar coordinates by:

$$\psi = V_o r \sin\theta + q\frac{\theta}{2\pi}$$

Whereas the free stream velocity $V_o = 0.5$ m/s and the strength of the source $q = 2$ m²/s. And the radial and tangential velocity components are:

$V_r = \frac{\partial\psi}{r\partial\theta}$ & $V_t = \frac{\partial\psi}{\partial r}$ respectively.

Determine the fluid velocity and its direction at a point $r = 10$m and $\theta = 120°$.

And draw the stream function for $\psi = 4$ and $\psi = 6$.

4) The angle between a pair of lock gates is 140° as shown in plan view, Fig.a and each gate is 6 m height and 1.8 m wide and is supported on two hings 0.6 m from top and bottom of the gate, Fig.c. If the depth of water on the upstream and downstream sides are 5 m and 1.5 m respectively, Fig.b.

Calculate the reactions at the top and bottom hings for each gate. Assume that the force exerted by one gate on the other F is act perpendicular to the axis of the lock as shown in Fig. b. While for the equilibrium state F, R (resulant of both reactions at hings) and P (resultant water pressure force on the gate) are coplaner and they will meet at a point.

given: $\rho_{wat} = 1000$ kg/m³ ; for rectangular shape $\square$ b, H, $I_c = \frac{bH^3}{12}$

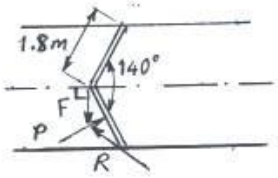


Fig.a

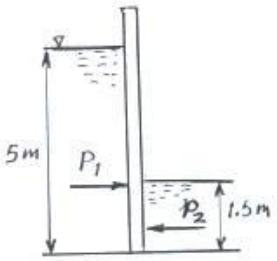


Fig. b

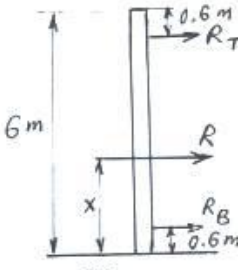


Fig. c

Lock gates

Tanta University		**2nd year: production.**
Faculty of Engineering		**Time allowed: 3 hrs.**
Production Eng. &Mech.Des.Dept.	(*Casting of metals*)	**Date:19-1-2008**

Answer the following questions:

1- Distinguish between the following three types of melting furnace?

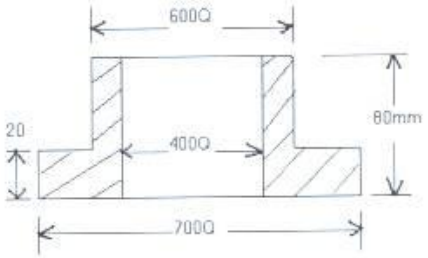
a- Copula Furnace
b- Electric Furnace
c- Siemens Martin Furnace

2- What do you know about the following?
الدك او الرك
a- Jolt ramming.
b- Squeeze molding
c- Sand Slinger

3- What are the basic requirements of core sand? In what respect does it differ from the molding sand?

4- Describe briefly, with the help of sketch, the lost-wax casting?
5- You are asked to produce the shown casting from an Al alloy.
Required:
a- the shape and dimensions of the pattern.
b- Draw the risering equation of Al alloy and then find out the optimum size and dimension of the riser or (risers) required to feed the casting showing its location, and the risering equation of Al: Fr = 1.38/[1-(0.0417/VR)].

Where, Fr = freezing ratio = (Ac/Vc)/ (Ar/Vr)
VR= volume ratio = (Vr/Vc), use standard feeder.
Cheek your results analytically.



Some useful data:

Coefficient of linear thermal expansion of cast iron = 11×10^{-6} / °C.

Coefficient of linear thermal expansion of aluminum = 24.10^{-6} / °C.

Freezing temperature of cast iron = 1150 °C.

Melting point of aluminum = 660 °C.

Machining allowance = 3 mm.

9- calculate the carbon index and the chemical composition of the cast iron produced from the following charge:

Raw Material	% C	% Si	% Mn	% P	% S
60% Hematite	4	2.5	0.8	0.1	0.04
20% Iron scrap	3.5	1.8	0.5	0.2	0.02
20% Pig iron	3-4	2-3	0.3-0.9	0.3	0.02
0% FeSi	-	75			

The average losses of C, Si and Mn are 5, 10, and 15% respectively.

The iron will be inoculated with 0.2% FeSi just before pouring.

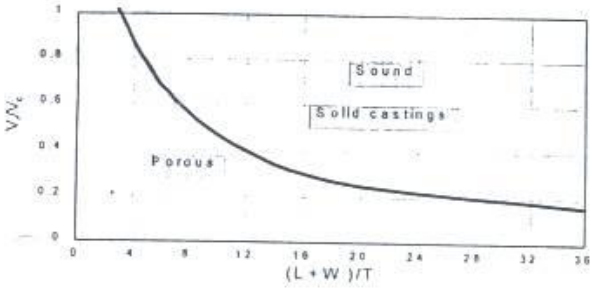


Fig.(1)

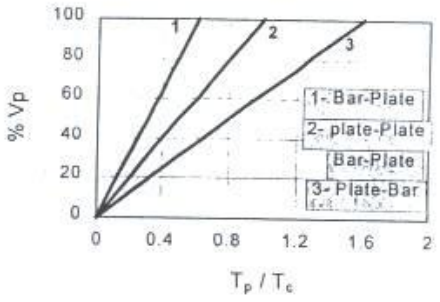


Fig.(2)

Good Luck

Prof.Dr.AbdelFattah M.Khourshid

بسم الله الرحمن الرحيم

جامعة طنطا
كلية الهندسة
الفرقة الثانية

الفصل الدراسي الأول ٢٠٠٧/٢٠٠٨
ميكانيكا إنتاج لائحة جديدة

المادة : تحليل إنشاءات
التاريخ : ٢٠٠٨/١/٢١
الزمن : ٣ ساعات

Answer all the following questions :-

(1)-For the beam of variable cross-section shown in Fig.(1) required d for the max. deflection $\Delta_{max} = 1$ mm & E = 200 GPa using Castiylinn's theorem.

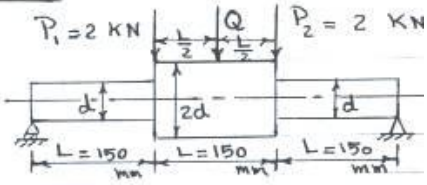
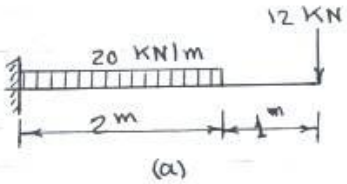


Fig. (1)

(2)-At a point in a bracket the stresses on two mutally perpendi planes are 35 MN/m^2 (tensile) and 15 MN/m^2 (tensile). The shear stress across these planes is 9 MN/m^2. Find the norma and tangential stresses on a plane making an angle of 30 with the plane of first stress. Find also the magnitude and direction of the principle stresses and the planes which they act Compare these values with those obtained from solving the problem using Mohr's circle.

(3)- A cantilever 3 m long is of rectangular section 100 mm wide and 200 mm deep. It carries a uniformly distributed load of 20 KN per unit meter length for a length of 2 meters from the fixed end and a point load of 12 KN at the free end as shown in Fig. (2-a) & (E = 200 GN/m^2). Find the slope and deflection at the free end.

If it is propped at the free end as shown in Fig. (2-b) & an the magnitud of P is such that there is no deflection & Find F



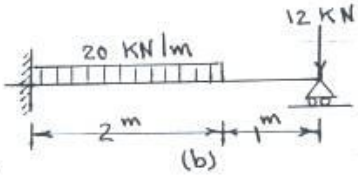


Fig. (2)

(أنظر خلفه)

(4)- A spherical tank for storing gas under pressure is 24 m in diameter and is made from structural steel 15 mm thick. The yield point of the material is 250 MPa. and a safety factor of 2.5 is adequate. Determine the maximum permissible internal pressure assuming the welded seams between the various plates are as strong as the plate itself.

(5)- A machine member is represented by a cantilever beam and loaded as shown in Fig. (3). The member has a square cross-section b x b and from steel having a yield stress of 300 MPa. Calculate the dimension b of this member. Assume safty factor 3. If the member is hollow and the inner to outer squre area is 0.5 6 Calculate the percentage change in the member weight.

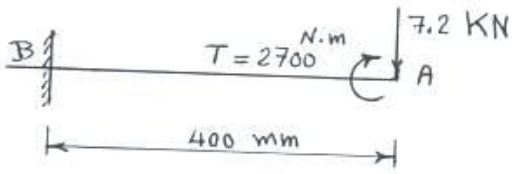


Fig. (3)

End of Questions

Good Luck

Dr. H.M. Hendawy