قوى ميكانيكى

Tanta University		Department: Mechanical Power Engineering		Faculty of Engineering
Course Title: Elective Course (1) Advanced Fluid Mechanics			Course Code: MEP 3113	Years: 3th
Date: January, 22 – 1 - 2014		Allowed time: 3 hrs	Full Marks: 85	No of Pages: 2
Name: Dr. Mohamed Abd Elgaied Ahmed				Final Exam

Answer the following questions: Assume any necessary assumptions. **Marks**

Question No. 1 (15)

Oil flows between two parallel plates, one of which is fixed and other moves with a velocity U. find the relation between U and dp/dx for the following cases:

a) The wall shear stress at the fixed plate is zero,
b) The wall shear stress at the moving plate is zero.

Calculate the pressure gradients and shearing stresses of the moving plate of the case (a) and the fixed plate of case (b) if U = 0.46 m/s, h = 3.8 cm, and μ = 0.048 Pa.s.

Question No. 2 (10)

Vertical shaft of diameter 100 mm rotates at 750 rpm. The lower end of the shaft rests in a foot step bearing and is separated by an oil film of thickness 0.5 mm the lubricating oil having dynamic viscosity 12 poise, Calculate the power loss absorbed in overcoming the viscous force on the bearing

Question No. 3 (15)

If the pressure gradient through a slipper bearing is designed according to the following relation:

$$\frac{dp}{dx} = \frac{-6\,\mu\,U}{h^3}(h - h_o)$$

Drive an expression for:

- The equation of pressure distribution as function of h_1, h_2.
- The maximum pressure and its location.

Question No. 4 (10)

A slipper bearing consists of a sliding block moving over stationary guide and inclined at a small angle. If μ = 0.096 Pa.s, U = 0.9 m/s, L/h_1 = 500, $K = h_2/h_1 = 2$ and $h_o = 1.27 * 10^{-5}$ m.

Plot the pressure distribution in the gap as a function of x/L.

Question No. 5 (10)

If the turbulent mean velocity profile of the oil flow in a pipe 60 cm in diameter may be approximated by:

$$\bar{u} = 3.61 \times y^{1/7}$$

The shear stress in the fluid 15.2 cm from the pipe wall is 6.22 Pa. calculate the eddy viscosity, mixing length, turbulence constant and the frictional velocity at this point. The specific gravity of the oil is 0.9.

Question No. 6

In a laboratory test 3.7 kg/s of water flow through a section of pipe line 5 cm diameter and 10 m length. A differential manometer, connected to the beginning and the end of this section, shows the reading of 48 cm. if the fluid in manometer has a specific gravity 3.2; calculate the friction factor and the Reynolds number. Take the water viscosity $1* 10^{-6}$ m^2/s. (10)

Question No. 7 (15)

The mean velocity in a 30.5 cm diameter pipe line is 3m/s. the relative roughness of the pipe is 0.002 and the kinematic viscosity of the water is $9.15* 10^{-7}$ m^2/s. determine the friction factor, the friction velocity, center line velocity, the velocity at 5 cm from the pipe wall and head lost in 300 m length of this pipe, the wall shear stress, the shear stress and the velocity 2.5 cm from the pipe centerline, and the thickness of the laminar sub-layer.

The Navier – Stokes Equation for Cartesian Coordinates:

Continuity Equation: $\frac{\partial \rho}{\partial t} + \frac{\partial (\rho u)}{\partial x} + \frac{\partial (\rho v)}{\partial y} + \frac{\partial (\rho w)}{\partial z} = 0.0$

Momentum Equation:

x- Component: $\rho\left(\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z}\right) = \rho g_x - \frac{\partial p}{\partial x} + \mu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right)$

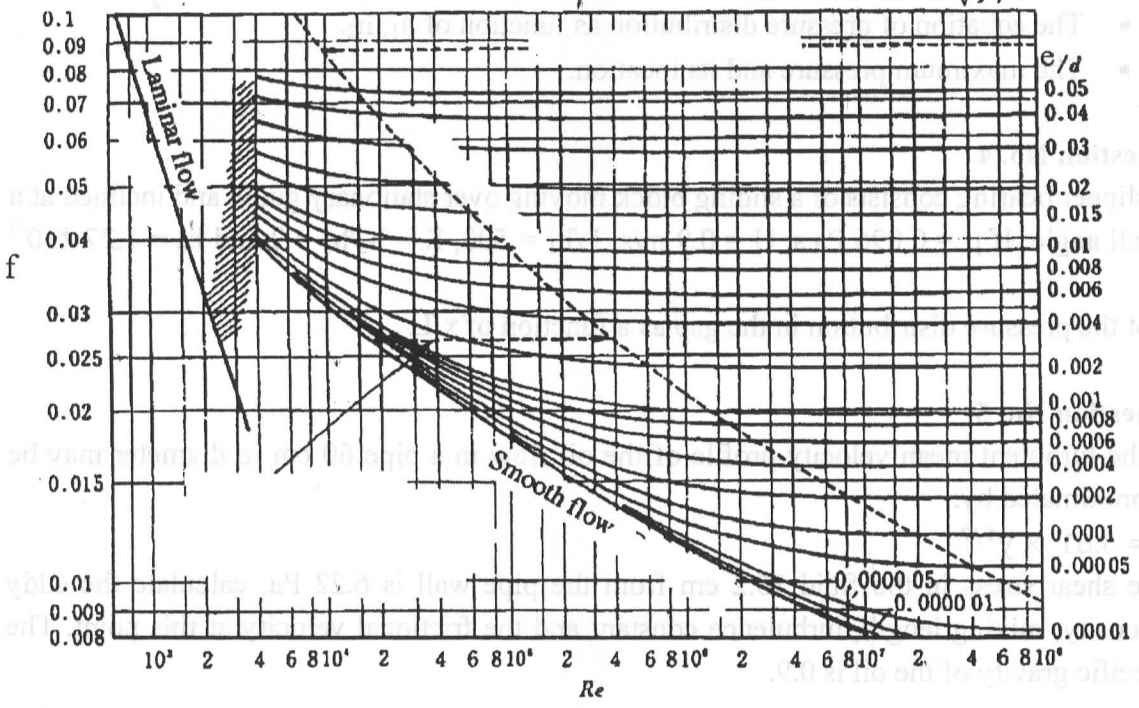
y- Component: $\rho\left(\frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} + w\frac{\partial v}{\partial z}\right) = \rho g_y - \frac{\partial p}{\partial y} + \mu\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2}\right)$

z- Component: $\rho\left(\frac{\partial w}{\partial t} + u\frac{\partial w}{\partial x} + v\frac{\partial w}{\partial y} + w\frac{\partial w}{\partial z}\right) = \rho g_z - \frac{\partial p}{\partial z} + \mu_1\left(\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2} + \frac{\partial^2 w}{\partial z^2}\right)$

Turbulent flow equation for wholly rough pipe.

$$\frac{u}{v_*} = 8.48 + 5.75\, log\left(\frac{y}{e}\right) \qquad \frac{1}{\sqrt{f}} = 1.14 + 2\, \log\left(\frac{d}{e}\right)$$

$$\frac{v_* \delta_{sub}}{\vartheta} = 11.6 \qquad \frac{U}{u_c} = \frac{1}{1 + 4.07\sqrt{f/8}}$$



Good luck. Dr. Mohamed Abd Elgaied Ahmed

ميكانيكا موائع

Tanta University Faculty of Engineering Mechanical Power Department 3rd Year Power Mechanics Examiner: Dr., M.I.Amro	Subject: Fluid Mechanics II Code: 311 Final Exam full marks:75 Time allowed: 3 Hours, Date: 6 -1-2014

Try answer all the following questions:

1-a) Derive the Chezy's formula for loss of head in pipes

1-b) a pipeline 800 m long connects two reservoirs. For the first 400m, its diameter is 20cm, which reduces suddenly to 10cm for the remaining portion. Water discharges into the side of the lower reservoir below the water surface. If the difference of water surface levels in the two reservoirs is 80m, determine the discharge in l/s.
Consider all loss. Assuming the coefficient of contraction to be Cc=0.6 and Darcy's coefficient of friction to be f=0.03

2-a) Prove that, the total supply head for maximum power is equal to three times of friction head loss.

2-b) Find the diameter of the nozzle and the maximum power transmitted by a jet of water discharge freely out of a nozzle, fitted to a pipe 400 m long and 15 cm diameter with Darcy coefficient of friction as 0.05. The available gross head is 100 m. Find also the velocity of water at nozzle exit and the efficiency of transmission.

3-a) Prove that the flow through a By-Pass or Diversion is equal to $q = \dfrac{Q_o}{\left[1 + \sqrt{\left[\dfrac{D}{d}\right]^5 \left[\dfrac{l + dK_1}{L}\right]}\right]}$ **, where Q_o is the total discharge through the main pipe before section of Diversion, D, d the diameters of the pipe and Diversion respectively. L, l is the lengths of diversion and pipe. The coefficient of By-Pass is K_1**

3-b)Two reservoir, having difference of water level of 15m are connected by a pip line 4000m long and of 0.4m diameter. Find the discharge through the pipe. If two pipes of 2000m length and 0.4m diameter each replace the last 2000m of the pipe, determine, the increase and percentage increase, in discharge. Assuming Darcy friction coefficient in the pipe is equal 0.05.

4-a) Prove that, the condition for maximum discharge through a channel of trapezoidal section is $\frac{b+2nd}{2} = d\sqrt{n^2+1}$, $m = d/2$, where d is water depth, 1/n is the side slop; b is width of channel at bottom.

4-b) A trapezoidal channel with side slope 1 to 1 has to be designed to convey 10 m^3/s at a velocity of 2 m/s, so that the amount of concrete lining for the bed and sides is maximum.
Calculate the wetted area of lining required for one-meter length of the channel.

5-a) Describe and classify the drag types?

5-b) Define the water hammer and write down the factors related to it. These must be taking into account in the design of the pipes.

5-c) A water main of concrete pipe, 5 Km long and 25cm diameter discharges into a reservoir at the rate of 10^4 m^3/day. If the flow of water gradually brought to rest by closing a valve at the reservoir end in 25s. Find, Is there a risk of pipe burst? The test pressure of concrete pipe is 25m water.

With my best wishes

Dr/ M.I. Amro

قوى ميكانيكيه + اهتزازات

Tanta University

Department: Production and Mechanical Design
Total Marks: 100 Marks

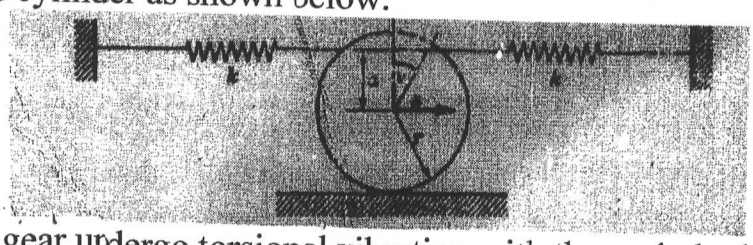
Faculty of Engineering

Course Title: Theory of Mechanical Vibrations	Course Code: MPD3115	Year: 3rd
Date: Jan 2014 (First term Exam)	Allowed time: 3 hrs	No. of Pages: (2)

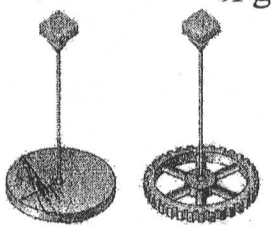
Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches)

Problem number (1) **(30 Marks)**

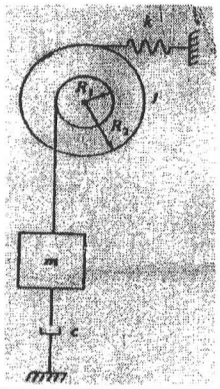
a) Use the energy method to find the natural frequency of oscillation of the homogeneous cylinder as shown below. (8 Marks)



b) The disk and gear undergo torsional vibration with the periods shown. (10 Marks)
Assume that the moment exerted by the wire is proportional to the twist angle. Determine *a*) the wire torsional spring constant, *b*) the centroidal moment of inertia of the gear, and *c*) the maximum angular velocity of the gear if rotated through 90o and released. (τn =1.13 s of desk), (τn =1.9ɔ s of gear) and W of disk = gear =20Ib.



c) The amplitude of vibration of the system of figure shown decays to half of the initial value in 11 cycles with a period of 0.3 sec. Determine the spring stiffness and the viscous damping coefficient. Where I =2.4 kg.m², m = 5 kg, R1= 20 cm, R2 =40 cm. (12 Marks)



Problem number (2) **(15 Marks)**

A machine of 100 kg mass has a 20 kg rotor with 0.5 mm eccentricity. The mounting springs have k=85 kN/cm and the damping is negligible. The operating speed is 600 r.p.m and the unit is constrained to move vertically. Determine:

i) The dynamic amplitude of the machine.
ii) Redesign the mounting so that the dynamic amplitude is reduced to one half of the original value if the same natural frequency is maintained (i.e., find new M and k).

Problem number (3) **(15 Marks)**

A rotor of speed of a turbo-supercharger of 6 kg mass is keyed to the centre of 2 cm diameter steel shaft ($E = 2 \times 10^6$ Kgf/cm²). The distance between bearings is 30 cm. Assuming the shaft to be simply supported, determine:

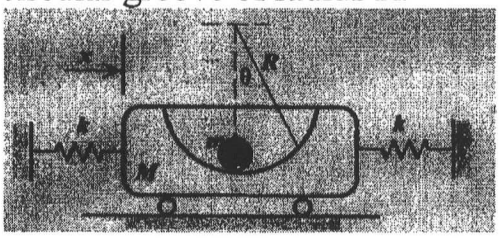
i) The critical speed.
ii) The amplitude of vibration of rotor at a speed of 600 r. p. m. if eccentricity is 0.002 cm.
iii) The maximum vibration force transmitted to the bearings.

Problem number (4) **(25 Marks)**

a) A vehicle has a mass of 1800 kg, the wheel base is 3.6 m, the cg is 1.6 from front axle, and the radius of gyration about cg is 1.4 m. If the spring constants of front and rear are 42000 and 48000 N/m respectively, determine:

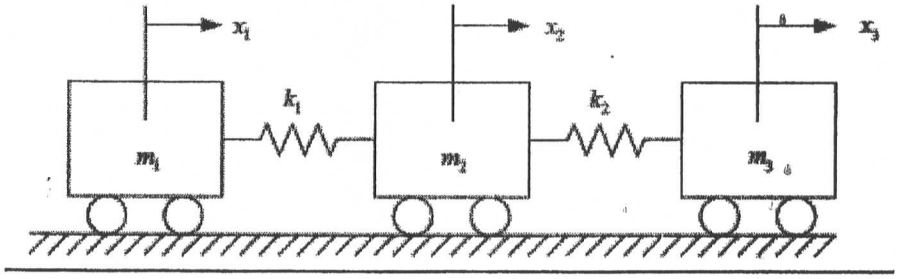
i) The two natural frequencies of the system.
ii) The principle modes of vibration.
iii) The motions x(t) and θ(t). (13 Marks)

b) Using Lagrange's equations to drive the equation of motions of the system shown in the figure below. The circular cylinder has a mass m, radius r, and rolls without slipping inside the circular groove of radius R. (12 Marks)



Problem number (5) **(15 Marks)**

In the system shown below in Figure, the displacements $x1$, $x2$ and $x3$ are measured from the static equilibrium position of the system. Write a Matlab program to compute the eigenvalues and eigenvectors (modes shapes) of the system.
Assume that $k1 = k2 = k = 1$N/m, and $m1 = m2 = m3 = m = 1$ kg.



جامعة طنطا – كلية الهندسة
امتحان الفصل الدراسى الأول
عام 2013 / 2014

المقرر : محركات حرارية (أ)
الفرقة : الثالثة ميكانيكا قوى
الدرجة النهائية : 85 درجة
الزمن : 3 ساعات

أجب عن الأسئلة الآتية :- **استخدم الرسم كلما أمكن ذلك**

السؤال الأول (20 درجة)

أ- اشرح مع الرسم كيف تؤثر العوامل الآتية على أداء محركات الإحتراق الداخلى :

1- نسبة الخليط

2- شحن وتفريغ الغازات

3- توقيت الإشعال والحقن

ب- اشرح مع الرسم الفرق بين طبيعة الدق فى كل من محركى البنزين والديزل ؟ ثم اذكر الآثار الضارة للدق ؟

ج- عرف كلا من :-

1- الكفاءة الحجمية 2- القدرة النوعية

3- الكفاءة الميكانيكية 4- الضغط المتوسط البيانى

السؤال الثانى (20 درجة)

أ- اشرح مع الرسم كيفية قياس القدرة المفقودة فى المحرك ثم اشرح كل من :-

1- إختبار مورس 2- خط ويلانز

ب- اشرح كيف تؤثر العوامل الآتية على الدق فى كل من محركى البنزين والديزل :

1- توقيت الإشعال والحقن

2- درجة حرارة المحرك

3- حركة الخليط

السؤال الثالث (25 درجة)

أ – اشرح مع الرسم مراحل الإحتراق فى محركات البنزين والديزل ؟

ب- اشرح كيف تؤثر العوامل الآتية على القدرة القصوى لمحرك احتراق داخلى :

1- دورة التشغيل 2- نسبة الوقود / الهواء 3- الفقد

ج- اذكر ما تعرفه عن أجزاء دورة التبريد بالماء فى محركات الإحتراق الداخلى ؟ ثم اشرح كيفية صيانة أجزاء هذه الدورة ؟

اقلب الصفحة من فضلك

السؤال الرابع (20 درجة)

أ- اشرح مع الرسم تجربة عملية لقياس أداء محرك احتراق داخلى اشتعال بالضغط ذو اسطوانة واحدة ؟

ب- محرك احتراق داخلى اشتعال بالضغط رباعى الأشواط ذو ست اسطوانات , قطر اسطوانته 110 مم , وطول شوط مكبسه 115 مم

أجريت له تجربة معملية عند سرعة دوران 2500 لفة فى الدقيقة , وأخذت له القراءات الآتية :

الحمل على الفرملة (كجم)	16	48	87
معدل استهلاك الوقود (كجم/دقيقة)	0,14	0,27	0,43

ثم أجريت له تجربة أخرى عند سرعة دوران 3000 لفة فى الدقيقة , وأخذت له القراءات الآتية :

الحمل على الفرملة (كجم)	20	46,5	87
معدل استهلاك الوقود (كجم/دقيقة)	0,16	0,277	0,45

إذا كانت القدرة المفقودة فى الأحتكاك فى المحرك P_f (kw) تتناسب مع سرعة دوران المحرك تبعا للعلاقة :

$$P_f \ \alpha \ (N)^b$$

حيث b ثابت

$$\text{القدرة الفعالة (kw)} = \frac{\text{الحمل على الفرملة (kg) * سرعة الدوران (r.p.m)}}{1000}$$

المطلوب :

1- قيمة المقدار الثابت b

2- ارسم العلاقة بين القدرة الفعالة للمحرك وكل من الكفاءة الميكانيكية للمحرك ومعدل الإستهلاك النوعى للوقود (kg/kw.hr) عند سرعه دوران 3000 لفة فى الدقيقة

مع اطيب التمنيات بالنجاح أ.د.م/ الشناوي عبد الحميد الشناوي

ميكانيكا قوى

Tanta University		Mechanical Power Engineering Department Course Title: Heat transfer (2) MEP3108		Faculty Of Engineering

Dept	Mechanical Power Engineering	Date	4 January th 2014
Year	3rd, (new curriculum) 2005	Allowed time	3 hrs
Final exam	January (First term)	Total Marks	75 Marks
		Academic Number	2013/2014

Close book exam. All questions must be answered. Draw schematic whenever applicable, and clearly state your assumptions. You can use heat transfer tables and charts

يسمح للطالب باستخدام جداول وخرائط انتقال الحراره

Question (1) (17 marks)

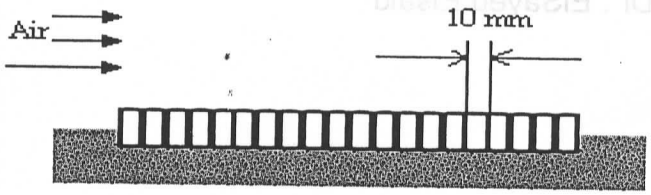
(a) If you have a piece of hot potato, it is better to cool it naturally (free convection) or by blow up a warm air over the piece (forced convection)? Explain

(b) What are the differences between inline tube arrangement and staggered flow arrangement ?

(c) A 4 m diameter circular horizontal disk is placed in room air at 15 °C. Both top and bottom surfaces disk temperatures are 50 °C. Estimate the total heat transfer loss by free convection

Question (2) (20 marks)

(a) An array of 50 silicon chips, each of length 10 mm on a side, is insulated on one surface and cooled on the opposite surface by atmospheric air in parallel flow with t_∞ = 24 °C and u_∞ = 40 m/s. If the top surface of the array nearly has a uniform temperature of 80 °C. At what chip is the electrical input a minimum? What is the value of this input?



(b) A fine wire having a diameter of 2.54×10^{-5} m is placed in a one atm air stream at 25 °C having a flow velocity of 50 m/s perpendicular to the wire. An electric current is passed through the wire, raising its surface temperature to 50 °C. Calculate the heat loss per unit length

Question (3) (19 marks)

(a) Why does radiation play a significant role in film-boiling heat transfer.

(b) What is the modified latent heat of vaporization? For what is it used? How does it differ from the ordinary latent heat of vaporization?.

(c) What is the difference between film and dropwise condensation? Which is a more effective mechanism of heat transfer.

(d) One hundred tubes of 1.27 cm diameter are arranged in a square array and exposed to atmospheric steam. Calculate the mass of steam condensed per unit length of tubes for a tube wall temperature of 98 °C?

Question (4) **(19 marks)**

(a) How could you classify the heat exchangers according to flow arrangements?

(b) Explain the different boiling regimes they occur in a vertical tube during flow boiling?

(c) Can the temperature of the cold fluid rise above the inlet temperature of the hot fluid at any location in a heat exchanger? Explain

(d) The condenser of a large steam power plant is a heat exchanger in which steam is condensed to liquid water. Assume the condenser to be a shell-and-tube heat exchanger consisting of a single shell and 30,000 tubes, each executing two passes. The tubes are of thin wall construction with D = 25 mm, and steam condenses on their outer surface with an associated convection coefficient of h_o = 11,000 W/m^2. K. The heat transfer rate that must be effected by the exchanger is q = 2 x 109 W, and this is accomplished by passing cooling water through the tubes at a rate of 3 x 104 kg/s (the flow rate per tube is therefore 1 kg/s). The water enters at 20 °C, while the steam condenses at 50 °C. What is the temperature of the cooling water emerging from the condenser? What is the required tube length L per pass?

All the best

Dr. Y. EL-Samadony
Dr . ElSayed Elsaid

Tanta University		Mechanical Power Engineering Department Course Title: Refrigeration and air conditioning (A), MEP3107		Faculty Of Engineering

Dept	Mechanical Power Engineering	Date	January 18th 2014
Year	3rd , (new curriculum) 2005	Allowed time	3 hrs
Final exam	January (First term)	Total Marks	85 Marks
		Academic Number	2013/2014

Close book exam. Answer all questions. Draw schematic whenever applicable, and clearly state your assumptions. Rrefrigerants charts and steam tables/chart are permitted

يسمح للطالب باستخدام خرائط التبريد وجداول وخريطة البخار

Question (1) (17 marks)

(a) Draw flow diagram and T-S chart for reduced ambient air cooling systems?

(b) A boot strap cooling system is used for an aeroplane to take 10 tons cooling load. The temperature and pressure conditions of atmosphere are 15 °C and 0.9 atm. The pressure of air is increased from 0.9 to 1.1 atm due to ramming action of the plane. Pressure of air leaving the main compressor and auxiliary compressor are 3.2 atm and 4.2 atm respectively. All expansion and compression processes are isentropic. About 55 % of the total of air leaving the main compressor is removed in the first heat exchanger and 30% of the total heat of air leaving the auxiliary compressor is removed in the second heat exchanger using ramming air. Assuming the ramming action is isentropic, determine :

i. H.P. required to take the cabin load,

ii. COP of the system

The required cabin pressure is 1.03 ata and the temperature of air leaving the cabin should not exceed 27°C

Question (2) (16 marks)

(a) List the main advantages and disadvantages of the hermetic compressors?

(b) In milk cooler, a simple vapour compression system is convenient for chilling milk from 30 °C to 8 °C. The evaporator temperature is – 3 °C and the condensing pressure is 10 bar. R-12 is used as a refrigerant with mass flow rate of 3 kg/min. The specific heat and density of milk are 3.9 kJ/kg.K and 850 kg/m^3. Single acting compressor has one cylinder runs at 900 rpm with 100% volumetric efficiency. Estimate the following items:

i. Refrigeration capacity, in TOR

ii. Compressor power and cylinder dimensions if L/D=1.15.

iii. Heat rejection,

iv. Milk flow rate,

v. Inside diameter of cooler tube if the velocity of milk is 0.5 m/s

Question (3) (18 marks)

A cold store building consists of three rooms, requires a refrigeration system of three evaporators with the following specifications:

Evaporator (1) capacity 10 TOR, temperature 10 °C;

Evaporator (2) capacity 30 TOR, temperature 0 °C;

Evaporator (3) capacity 20 TOR, temperature -10 °C;

Condensing temperature 40 °C;

The following assumptions are considered for the unit:

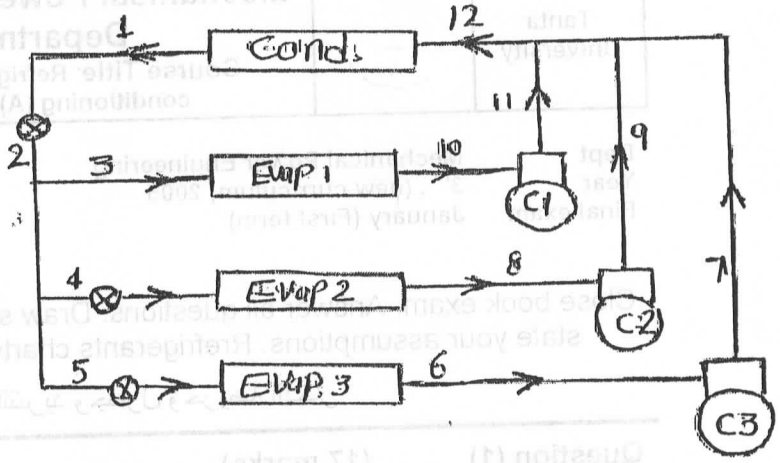
- Isentropic compression,
- Saturation vapour at evaporator outlet;
- Saturation liquid at condenser outlet.

Draw p-h diagram on NH3 chart and calculate the following:

(i)- Power required to drive the compressors;

(ii)- Condenser capacity;

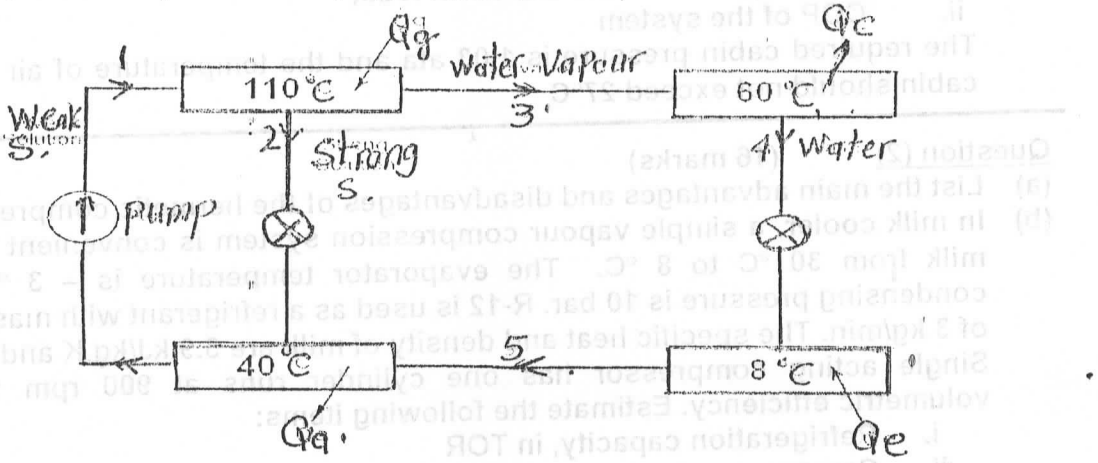
(iii)- Unit COP



Question (4) (17 marks)

(a)- List the main advantages and disadvantages of the absorption refrigeration unit?

(b)- Compute the rate of refrigerant (water) through the condenser and evaporator for water-lithium bromide chilled water plant cycle shown in the figure below, if the pump delivers 0.6 kg/s and the operating conditions for cycle are as follows: generator temperature = 110 °C, condenser temperature= 60 °C, evaporator temperature= 8 °C, absorber temperature= 40°C and temperature of solution entering generator = 85 °C. Compute also, for the same system Q_g, Q_a, Q_c, Q_e and the system COP (neglect pump work).



Question (5) (17 marks)

(a)- A simple vapour compression cycle works between fixed pressure limits. List three methods to improve its coefficient of performance?

(b) A steam jet refrigerator unit is supplied with dry and saturated steam at 5.5 bar. The evaporator pressure is 0.017 bar and steam to vapour ratio is 1.7 to 1. All processes in the nozzle and diffuser are reversible adiabatic. Calculate the pressure to which the jet compressor can discharge

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All the best

Dr. Y. EL-Samadony