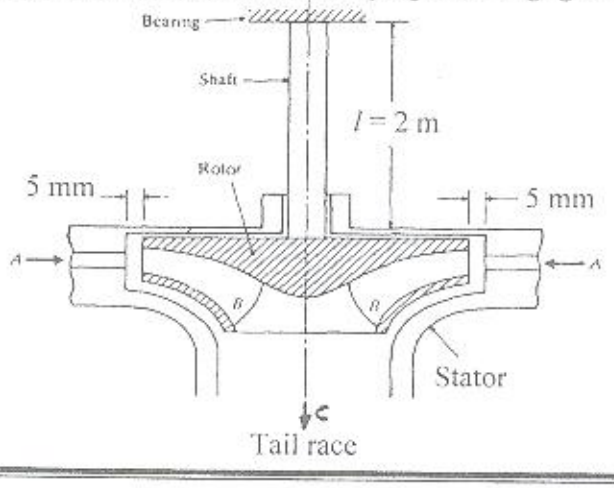
b) A mass of 1 kg is suspended from a spring of stiffness 700 N/m and is subjected to a harmonic force F= 0.5 cosγt N. The damping factor is 0.05. Find: **(12 Marks)**

- Natural frequency.
- Resonant amplitude.
- Peak amplitude.
- Peak frequency.
- Peak phase angle.
- Amplitude and phase angle under a frequency of 300 rpm with and without damping.

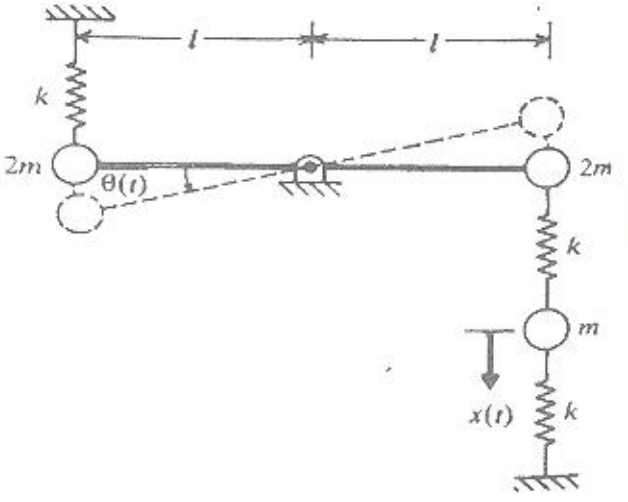
Problem number (4) (20 Marks)

a) The schematic diagram of a Francis water turbine is shown in figure. Water flows from A into the blades B and down into the tail race C. The rotor has a mass of 250 kg and an unbalance (me) of 5 kg.mm. The radial clearance between the rotor and the stator is 5 mm. The turbine operates in the speed range 600 to 6000 rpm. The steel shaft carrying the rotor can be assumed to be clamped at the bearings. Determine the diameter of the shaft so that the rotor is always clear of the stator at all the operating speeds of the turbine. Assume damping to be negligible.



Problem number (5) (20 Marks)

a) A rigid rod of negligible mass and length 2*l* is pivoted at the middle point and is constrained to move in the vertical plane by springs and masses, as shown in figure.
Find the natural frequencies and mode shapes of the system.



,,,,,,With the best wishes,,,,,,

Dr. Eng. Mohamed Mahgoub Bassuni

Course Title: Refrigeration and Air conditioning | Course Code: EPM3101 | Year: 3rd Pro.Des.Mech.Dept
Date: May 3rd 2011 (First term) | Allowed time: 3 hrs | No. of Pages: (2)

Remarks: [answer the following questions-Both tables and charts of refrigeration and air conditioning are allowed (available with students)].

Problem number (1) **(6 Marks)**

a) What is the difference between a heat pump and a refrigerator? (2 Marks)

b) A refrigerator is to remove heat from the cooled space at a rate of 300 kJ/min to maintain its temperature at -8°C. If the air surrounding the refrigerator is at 25°C, determine the minimum power input required for this refrigerator. (4 Marks)

Problem number (2) **(14 Marks)**

a) Define the following:

1) Refrigeration effect
2) Ton of Refrigeration
3) Volumetric efficiency of compressor. (3 Marks)

b) Discus and draw a schematic diagram of Bell – Coleman air Refrigerator (was used in ships carrying frozen meat) and plot it on the T-S chart. (3 Marks)

c) A boot-strap cooling system of 20 tons capacity is desired for an aeroplane cabin and the plane speed is 1100 km/hr. The temperature and pressure conditions of the atmosphere are 20 °C and 0.8 bar. The pressure of air is increased due to ramming action with efficiency 80 %. The pressure of air leaving the main compressor and auxiliary compressor are 3.5 bar and 5.25 bar respectively. The internal efficiency of both compressors is 85% and that of turbine is 80%. The effectiveness of two heat exchangers is 70%. Assuming that the cabin pressure is 1.03 bar. The temperature of air leaving the cabin should not exceed 27 °C, find the COP of the system. (8 Marks)

Problem number (3) **(8 Marks)**

a) Compare between the systems for cooling three stores in the flowing:

1. Separate expansion valves with one compressor.
2. Multiple expansion valves with three stages compressor. (4 Marks)

b) An R-12 single-store refrigeration system operating at 0.1 MPa with cooling capacity 25 T.R. Condensing pressure is 0.8 MPa. Assume simple vapour compression cycle determine:

i) The mass flow rate of refrigerant in kg/s and power of compressor in kW.
ii) COP of the cycle. (4 Marks)

Problem number (4) **(12 Marks)**

a) Estimate types of cooling loads. (2 Marks)

b) A department store 50 X 80 m (with the longer wall oriented facing north) is to be conditioned. The store is located in top floor of a building. The building site is 40° North latitude. West and east walls separate the auditorium from unconditioned space and they are constructed from 100 mm heavyweight concrete + finish. Other walls are side streets and are constructed from 200 mm heavyweight concrete + finish. Space height is 7 m.

the underneath floor is conditioned. Windows are 16 m total wide and 4.5 m height on each side and are made from 6 mm single glass sheets with light color, open weave indoor shading. Ceiling has mass inside insulation, R = 0.5 m^2k/W and has suspended ceiling. Number of occupants is 500 person. Lighting is unvented and unsuspended fluorescent lamps, with 15 W/m^2 light density and works from 9:00 am till 5:00 pm (total time of store occupation). Ventilation requirement is estimated to be 2.5 L/s of outdoor air per person. Outside door condition is 50°C dbt 70 % RH, inside condition is 24°C dbt and 50 % RH. Base your condition on 21 August at 2 pm, 32° north latitude and calculate the total load of the system and the sensible heat factor (SHF).

(10 Marks)

Problem number (5) **(10 Marks)**

a) Define the following:

1. Dry Bulb Temperature
2. Wet Bulb Temperature
3. Relative Humidity
4. Specific humidity
5. Dew Point Temperature.

(5 Marks)

b) Air at 308 K dbt and 298 K wbt is to be cooled and dehumidified by passing it over a direct expansion coil. The air leaves the coil at 289 k and 90 % RH. Find the heat and moisture remove per kg of dry air, SHF and the apparatus dew point temperature.

(5 Marks)

Course Examination Committee

Dr. **Abd-elkader saad**

Course Coordinator: Prof. **Elsaid khalil**

٢ اشتاع ٢٠١١/١/٢٠

Tanta University

Department: Mechanical power Engineering
Total Marks: 75 Marks

Faculty of Engineering

Course Title: Heat transfer (2)	Course Code: MEP3108	Year: 3rd
Date: Jan 20th 2011 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions; assume any missing data, steam and heat tables and charts are allowed)

Problem number (1) **(15 Marks)**

a) Define the Grashof number. What is its physical significance? (4 Marks)

b) Discuss the problem of combined free and forced convection? (4 Marks)

c) A 4 by 4 m horizontal heater is placed in room air at 15 °C. Both top and the bottom surfaces are heated to 50 °C. Estimate the total heat transfer loss by free convection. (7 Marks)

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

a) What is the hydraulic diameter? (3 Marks)

b) What is the Peclet number? (3 Marks)

c) Air at a pressure and temperature of 1 atm and 50 °C respectively is in parallel flow over the top surface of a flat plate that is heated to a uniform temperature of 100 °C. The plate has a length of 0.2 m (in flow direction) and a width of 0.1 m. The Reynolds number based on the plate length is 40000. What is the rate of heat transfer from the plate to the air? If the free stream velocity of the air is doubled and the pressure is increased to 10 atm, what is the rate of the heat transfer? (9 Marks)

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

a) Why does radiation play a significant role in film-boiling heat transfer? (4 Marks)

b) What is meant by subcooled and saturated boiling? (3Marks)

c) Air at 1 atm and 10 °C flows across a bank of tubes 15 rows high and 5 rows deep at a velocity of 7 m/s measured before the air enters the tube bank. The surface of tubes is maintained at 65 °C. The diameter of tubes is 2.5 cm. They are arranged in an in-line manner so that the spacing in both the normal and parallel directions to the flow is 5 cm. Calculate the total heat transfer per unit length for the tubes, exit air temperature and air pressure drop? (8 Marks)

P.T.O.

Problem number (4) **(15 Marks)**

a) Why are higher heat-transfer rates experienced in dropwise condensation than in film condensation? (4 Marks)

b) Draw the boiling curve and identify the different boiling regimes. Also explain the characteristics of each regime? (5 Marks)

c) A vertical square plate, 30 by 30 cm, is exposed to steam at atmospheric pressure. The plate temperature is 98 °C. Calculate the heat transfer and the mass of steam condensed per hour. (6 Marks)

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

a) Under what conditions is the effectiveness-NTU method definitely preferred over the LMTD method in heat exchanger analysis? (5 Marks)

b) A 2-shell passes and 4-tube passes heat exchanger is used to heat glycerin from 20 °C to 50 °C by hot water, which enters the thin-walled 2-cm-diameter tubes at 80 °C and leaves at 40 °C. The total length of the tubes in the heat exchanger is 60 m. the convection heat transfer coefficient is 25 $W/m^2.°C$ on the glycerin (shell) side and 160 $W/m^2.°C$ on the water (tube) side. Determine the rate of heat transfer in the heat exchanger (a) before any fouling occurs and (b) after fouling with a fouling factor of 0.0006 $m^2.°C/W$ occurs on the outer surfaces of the tubes. (10Marks)

Tanta University
Faculty of Engineering
Production Engineering & Design Dept.
3rd Year Prod. 2010/2011

Theory of Metal Forming
Sunday, 23.01.2011
Time allowed : 3 hours
Final Grade : 100 Marks

Final Exam

Solve all questions and make use of the information given at the end :

Question 1 : (20 marks)

a) Differentiate between cold and hot metal forming processes. Give three examples for each type.

b) A circle 1 cm diameter was printed on a sheet of metal prior to a complex stamping operation. After the stamping, it was found that the circle had become an ellipse with major and minor diameters of 1.4 and 1.1 cm.

i. Determine the effective strain.
ii. If a condition of plane stress ($\sigma_3 = 0$) existed during the stamping, and the ratio $\alpha = \sigma_2 / \sigma_1$ remained constant, what ratio ($\sigma_1 / \bar{\sigma}$) must have existed?
iii. Using the principle of normality, determine the stress ratio, $\alpha = \sigma_2 / \sigma_1$, for the von-Mises and the Tresca criteria.

Question 2 : (25 marks)

a) Consider the following test data were obtained from tensile test conducted on low carbon steel (Y_0 = 220 MPa, E = 200 GPa) round specimen of 15 mm diameter and 50 mm gauge length:

Load P(kN)	40	46.3	49.3	51.3	52	52.5 (max)
Length L(mm)	52.04	54.16	56.37	58.68	61.07	64.85

Use the above data to represent the flow stress-strain behavior of the steel by fitting to the empirical law $\sigma = K \varphi^n$

b) A Steel wire of the material tested above has to be drawn from 1.1 mm diameter to 1.0 mm diameter. The friction between the die and the drawn metal is 0.25 and the die angle was taken as 18°. The prestrain of the material is 0.025 .

i. Calculate the total drawing force required to accomplish the drawing process.
ii. Derive an expression for the optimum die angle in the wire drawing processes.
iii. What is the optimum die angle and how much is the reduction in the drawing force?
iv. If the input speed is 1.2 m/s and the mechanical efficiency is 95 %, what is the power required for the process?

Question 3 : (25 marks)

a) Derive an expression to calculate the amount of springback of a sheet being bent by a 3-roll mechanism.

b) A sheet metal, 1 mm thick and 1 m long, is bent by a 3 roll bend. It is required to produce pipes of 12 cm out of the sheet. The flow stress in plane strain is 210 MPa and E = 224 GPa and the metal is assumed to behave elastic-perfectly plastic. Calculate the amount of the lateral movement of the moveable roll, knowing that the distance between each roll and its succeesive one is 25 cm.

Question 4 : (20 marks)

a) Derive the power required to extrude a rod from an initial diameter D_1 to a final diameter D_2 with a ram speed of v_r .

b) Cupper rods 25 mm in diameter are formed by hot extrusion. The billet's diameter is 75 mm and have a length of 500 mm. The mean flow stress of the heated billets is 65 N/mm^2 . Calculate the extrusion force and the power required to extrude the rods at a rate of 2 m/s.

Question 5 : (20 marks)

a) What are the necessary conditions to produce a superplastic product?

b) What are the undesirable effects occurred upon the use of elevated temperature during hot working?

c) Calculate the temperature rise in a high-strength steel that is adiabatically deformed to a strain of 1.2 .

Take $\rho = 7.87\times10^3$ kg/m^3, σ_a= 800 MPa, C = 0.46×10^3 J/kg °C.

Useful information:

Flow rule: $$\frac{d\varphi_1}{(\sigma_1-\sigma_m)}=\frac{d\varphi_2}{(\sigma_2-\sigma_m)}=\frac{d\varphi_3}{(\sigma_3-\sigma_m)}=\frac{3}{2}\frac{d\bar{\varphi}}{\bar{\sigma}}$$

For wire drawing: $$F_D = A_2\,\sigma_{f_m}\ln\left(\frac{A_1}{A_2}\right)\left[1+\frac{\mu}{\alpha}+\frac{2}{3}\alpha\Big/\ln\left(\frac{A_1}{A_2}\right)\right]$$

For temperature rise during plastic deformation : $$\alpha\int_0^{\bar{\varphi}}\bar{\sigma}\,d\bar{\varphi}=\rho\,C\,\Delta T$$

مع تمنياتي بالتوفيق و النجاح

Tanta University

Department: Production and Mechanical Design
Total Marks: 60 Marks

Faculty of Engineering

Course Title: Machining Machine	Course Code: MPD3118	Year: 3rd
Date: Jan 25th 2011 (First term)	Allowed time: 3 hrs	No. of Pages: (1)

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

Problem number (1) **(10 Marks)**

a) Define, Machine Tool, stiffness, Accuracy, Precision and productive time? (2.5 Marks)

b) Classify the types of frames of machine tool; support your answer with neat sketches? (2.5 Marks)

c) Using sketches to compare between different types of beds and ribs? (2.5 Marks)

d) Compare between different types of slide and slide ways with the help of neat sketches? (2.5 Marks)

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

a) Compare between different types of Joints, support answer with the help of neat sketches? (5 Marks)

b) The length of joint under tension load is L=350 mm, $\frac{\delta_j}{\delta_s} = 2.2*10^{-3}, 0.9*10^{-4}$ and $m = 2.44*10^{2}\,mm^{-1}, 58.46*10^{2}\,mm^{-1}$ for slab milling and fine grinding respectively. Then if F = 500 Kgf., diameter of solid = 20 mm. Calculate the joint area necessary to fulfil the given requirements of As(solid)/Aj(joint), $\delta_j(joint)/\delta_s(solid)$ for each value of m. Also the number of bolts required if compression σ =20 Kgf/mm². where E=2100 Kgf./mm², Pm=0.75 Kgf./mm² and As(solid)/Aj(joint) =2/3, Bolt diameter(M) mm, Area bolt mm², M6 , 20.1, M8, 36.6, M10, 58.6, M12, 84.3 respectively. (10 Marks)

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

a) What are causes of vibrations of machine tools? What are the types of damping in machine tools? (5 Marks)

b) For a certain machine tool having a dynamic stiffness of 600 N/mm. The logarithmic damping decrement (Δ) 0.125. From power spectrum the amplitude $A/\sqrt{2}$ μm at the band width ($\Delta\omega$) is 30 Hz. Calculate the dynamic load and natural frequency of this machine. (10 Marks)

Problem number (4) **(20 Marks)**

a) What are the general rules should taken when erection of machine tools? (2.5 Marks)

b) Explain the order of machine tools test? (2.5 Marks)

c) The column weight (w_m) 400 KN was moving from the central position of the bed to the end of the bed. The total stiffness of the steel bed foundation system is 960 *10⁶ N/m. The measured deflections of an actual machine were 0.45 mm at the metallic bed, 0.15 mm at the concrete. Length of the bed 7.5 m, flexural rigidity (EI) of bed 240 * 10⁶ N m² and 260 *10⁶ N m² for concrete. If we change the bed material by CI with EI of 20*10⁶ N m². a) Calculate the soil stiffness and joint stiffness before change the bed material. b) Calculate the depth of concrete when changing the bed material while keeping the total stiffness not changed, load become 200 KN, assume that concrete width and modulus of elasticity are 1.25 m, 25*10⁹ N/m², respectively.

Useful equations, stiffness bed $S_b = \frac{60(EI)_1}{L^3}$, stiffness concrete $S_c = \frac{60(EI)_2}{L^3}$, Ss stiffness subsoil, Sj stiffness joint, overall stiffness $S = S_b + \frac{(S_c + S_s)S_j}{S_c + S_s + S_j}$, deflection $\Delta = \frac{w_m}{S}$, $\frac{S_c + S_s}{S_j} = \frac{\Delta - \delta}{\delta}$, $\Delta = 0.445mm, \rightarrow \delta = 0.15mm$. (15 Marks)

الثالثة انتاج المادة/ التصميم الميكانيكي التاريخ ٢٧/١/٢٠١١

TANTA UNIVERSITY
FACULTY OF ENGINEERING

DEPARTMENT OF : **Production Engineering & Mech. Design Dep.**
EXAMINATION (3 YEAR) STUDENTS OF Production ENGINEERING

COURSE TITLE: **Mechanical Design (2)**			COURSE CODE: PMD3219
DATE:27- 01-2011	TERM: First term	TOTAL ASSESSMENT MARKS: 75	TIME ALLOWED: 3 HOURS

Notes:
It is allow for student to use bearing table and only one text book
Systematic arrangement of calculations and clear neat drawings are essential. الإمتحان مكون من ٣ أسئلة فى صفحتين وورقتين
Any data not given is to be assumed – Answer as many questions as you can. Answer as brief. as possible.

PROBLEM # ONE (30%)

I- What types of bearings do you chose for a turbine running at 100 RPS with a rotor weight 250 kN and shaft diameter 30 cm? Justify your answer.

II- A sleeve of journal bearing is 40 mm long and 40 mm in diameter. It has a clearance of 0.04 mm and uses SAE 20 lubricant at operating temperature of 60 oC. The bearing supports a load of 280 Kgf. Calculate the heat generated for speeds of 1000, 2000, 4000 RPM and construct a graph of your results. Using your graph predict the heat generated for 3000 RPM speed.

PROBLEM # TWO (40 %)

I- Why are rolling bearings used? What magnitude of thrust load can they withstand?

II- A spindle for a milling machine is to be supported by two bearings. The end mill holder (located outside of the bearings supports as shown in figure (1)) is to rotate at 4000 RPM. Under the most severe conditions, the bearing (A in the figure (1)) closest to the end mill holder will experience a radial load of 2100 N and axial load of 1600N.The bearing (B) farthest from the end mill holder will experience only a radial load of 1800 N. If the shaft is subjected to a light shock loading and cannot exceed 60 mm diameter. Select suitable bearings for this operation. What is the rating life in hours for the bearings selected? Compare this life with the suggested hours of operation stated in the text book you have. Assume the machine work continuous for 8 hr/day. Draw with scale the suggested bearings arrangement with the bearings being separated by 10 cm.

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TANTA UNIVERSITY

FACULTY OF ENGINEERING

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Tanta University

Department: Mechanical Power Engineering
Total Marks: 100 Marks

Faculty of Engineering

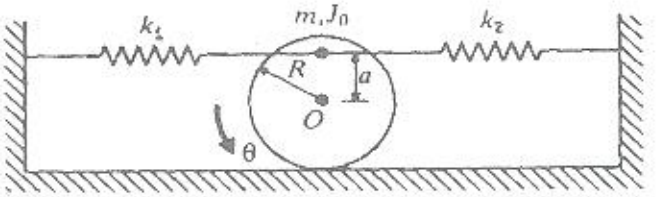
Course Title: Vibration theory	Course Code: MEP3127	Year: 3rd
Date: Jan. 16th 2011 (first term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (Answer the following questions, assume any missing data, answers may be supported by sketches).

Problem number (1) (20 Marks)

a) Define the vibration? What are the elements of a vibratory system? **(5 Marks)**

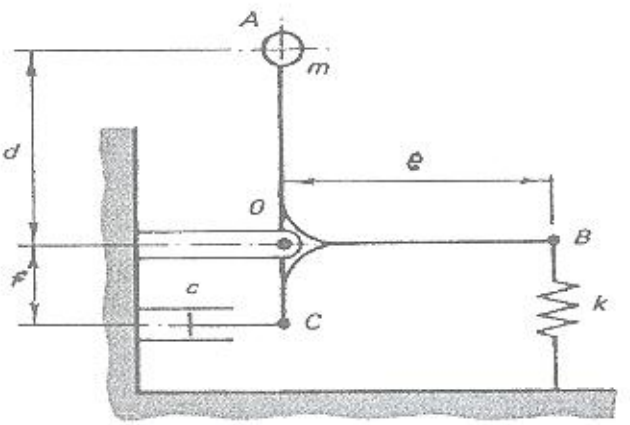
b) A cylinder of mass m and mass moment of inertia J_o is free to roll without slipping but is restrained by two springs of stiffness k_1 and k_2 as shown in figure. Find its natural frequency of vibration. **(15 Marks)**



Problem number (2) (20 Marks)

a) Define the degree of freedom of a vibratory system. **(5 Marks)**

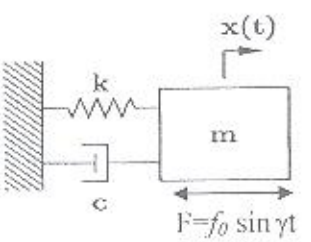
b) For the shown figure, determine the frequency of small amplitude damped oscillations of the pendulum about o and find the critical damping coefficient in terms of the given parameters. **(15 Marks)**



Problem number (3) (20 Marks)

a) For the shown figure, prove that: **(8 Marks)**

$$\frac{X}{X_{st}} = \frac{1}{\sqrt{\left(1-\left(\frac{\gamma}{\omega}\right)^2\right)^2 + \left(2\zeta\frac{\gamma}{\omega}\right)^2}}$$



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