Tanta University **Theory of Vibrations** **Third Year**
Faculty of Engineering **Date: 10-1-2013**
Mech. Design& Prod. Eng.Dep. Time: 3 Hours

Answer All The Following Questions:-

Problem No. 1 (20 marks)

(a) Write the equation of motion of the system shown in Fig. 1.
(b) Calculate the natural frequency and the damping ratio.
(c) What is the amplitude of the forced (steady-state) response of the 40 kg mass.

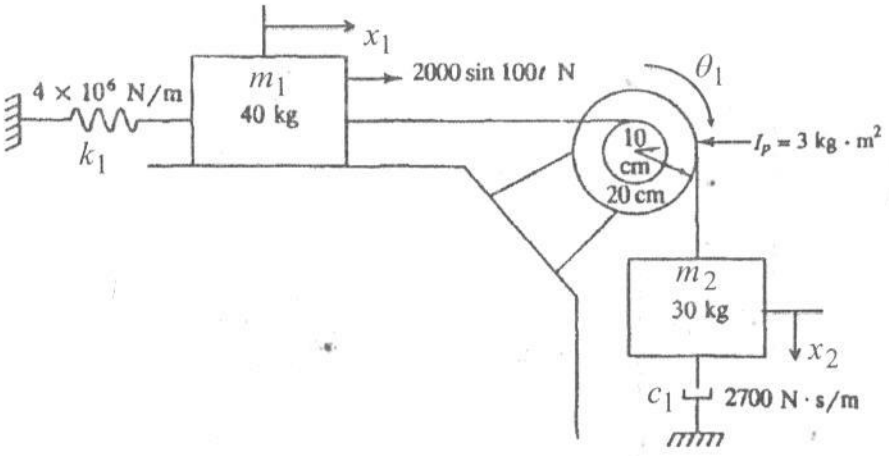


Fig. 1

Problem No. 2 (20 marks)

A mechanical structure consisting of four circular rods and two coil springs is shown in Fig. 2.

All rods are made of steel with $E = 210 \times 10^9$ N/m^2. $k_1 = k_2 = 5000$ N/m. Calculate:

(a) the equivalent stiffness by using the basic rules of spring combination.
(b) the natural frequency if $m_1 = 100$ kg.

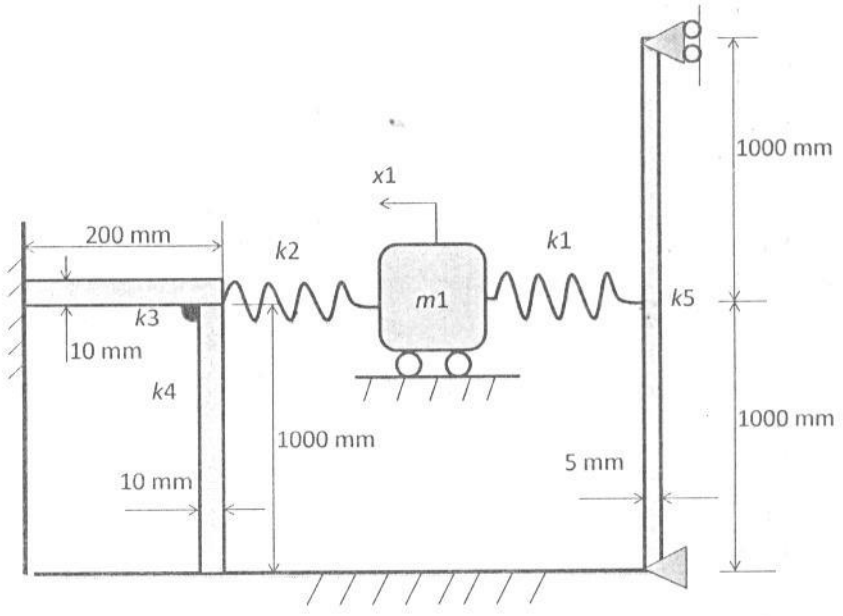
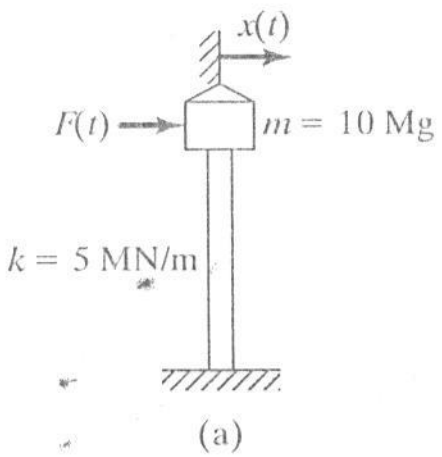


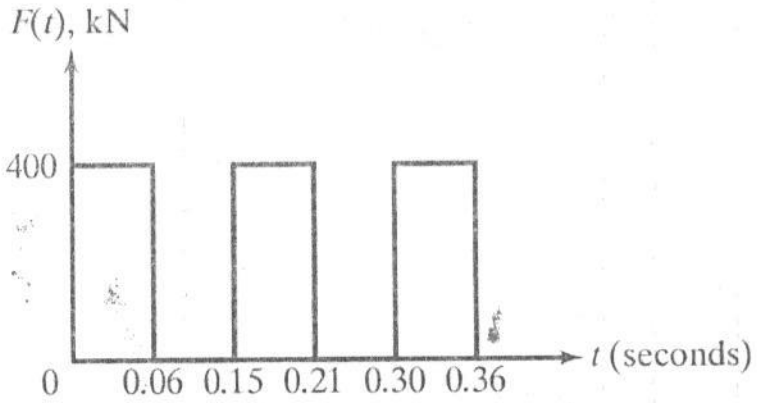
Figure 2

Problem No. 3 (20 marks)

Expand the Fourier series to the third term and obtain the displacement of the water tank shown in the Figure 3a under the periodic force shown in the Figure 3b.



(a)



(b)

Problem No. 4 (20 marks)

1- Two ideal pendulums having mass $5m$ and m can swing about pivots as shown in Fig. 4. Their motion is restrained by the three springs each of spring constants k. Determine the natural frequencies and modes of vibration of the system if $k=mg/L$.

Figure 4.

Problem No. 5 (20 marks)

A 1500-kg compressor is mounted on springs of stiffness 4×10^5 N/m at the middle of a floor in an industrial plant, which can be modelled as a simply supported beam of length 10 m, elastic modulus 200×10^9 N/m^2, and has a cross-sectional moment of inertia of 2.5×10^{-4} m^4 and mass of $m_b = 7500$ kg. The beam rests on soil whose equivalent stiffness is $k_{soil} = 6\times10^6$ N/m:

(a) Compute the equivalent stiffness of the beam k_b.

(b) Determine the natural frequencies and mode shapes of the resulting 2-DOF system

(c) Find the system response if you are given the following initial conditions:

$$\begin{bmatrix} x_c(0) \\ x_b(0) \end{bmatrix} = \begin{bmatrix} 0.01 \\ 0 \end{bmatrix} \qquad \begin{bmatrix} \dot{x}_c(0) \\ \dot{x}_b(0) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

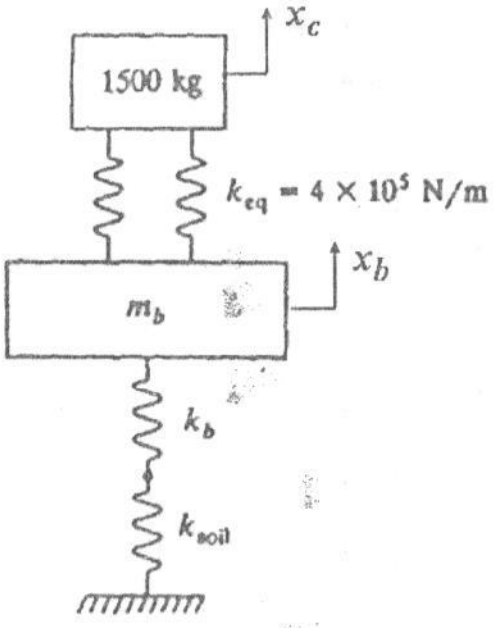


Fig.5

Tanta University

Department: Production and Mechanical Design
Total Marks: 100 Marks

Faculty of Engineering

Course Title: Theory of Metal Cutting	Course Code: MPD3115	Year: 3rd
Date: Jan 13th 2013 (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) **(20 Marks)**

a) Define the theory of metal the cutting? (4 Marks)
b) What is an unexpected long chip may cause? (4 Marks)
c) What are the assumptions in orthogonal metal cutting? (4 Marks)
d) What does mean: chatter and how to solve it? (4 Marks)
e) Distinguish between continuous chips and built up edge chips? (4 Marks)

Problem number (2) **(30 Marks)**

a) Conclude the equation of shear strain? (5 Marks)
b) What is efficient chip control contributes to? (5 Marks)
c) An orthogonal cut is made with a carbide tool having a 15° positive rake angle. The various parameters were noted, the cut width was 0.25" , the feed was set at 0.0125" , the chip thickness was measured to be 0.0375" , the cutting speed was 250 ft./min. and the forces measured were Fc = 375 lb. and Ft = 125 lb.

a) Use Merchant's Circle to scale, and the velocity diagram
b) From the Merchant Circle diagram find the shear angle (φ), friction force (F), friction normal force (N), and shear force (Fs).
c) From the Velocity diagram find the friction velocity (Vf).
d) Calculate values for the coefficient of friction (μ) and the metal removal rate.

(20 Marks)

Problem number (3) **(25 Marks)**

a) What are the indications of excessive tool wear? (5 Marks)
b) Explain the properties effect on the cutting tool materials? (5 Marks)
c) In cutting mild steel in rough cutting at cutting velocity 60 ft/min. the cutting tool life was 3 hours between grind and regrind. Find the cutting tool life at the same conditions but at cutting velocity is 80 ft/min with m=1/8. (15 Marks)

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

a) What are the types of tool wear? (3 Marks)
b) Cutting fluids fall into four main categories, Mention it? (3 Marks)
c) What are the desired properties of cutting fluids? (3 Marks)
d) What are the factors effects on the temperature Rise? (3 Marks)
e) How to separate the cutting fluids and chips? (3 Marks)
f) The power required to cut a certain materials is 0.75 hp/in^3/min. A cut 0.20 in deep*0.05 in/rev feed is taken at cutting speed 110 ft/min. The work is cooled by flow of one gallon per min. of coolant with specific heat 0.85 and specific gravity 0.90 which conducts away 0.80 of the heat produced, determine the rise in the temperature of coolant due to this cut in F° and C°. (10 Marks)

Tanta University

Department: Production and Mechanical Design
Total Marks: 60 Marks

Faculty of Engineering

Course Title: Machining Machines	Course Code: MPD3118	Year: 3rd
Date: Jan 13th 2013 (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) (15 Marks)

Write short notes on:

a) Machine Tool, stiffness and Accuracy-Precision? (3 Marks)
b) Types of frames and beds? (3 Marks)
c) Types of slide and slide ways? (4 Marks)
d) Classification of machine tools according to types of operation and criteria? (2.5 Marks)
e) Error of machine tools? (2.5 Marks)

Problem number (2) (15 Marks)

a) Classify the different types of joints in the horizontal milling machine? (3 Marks)
b) Why the joints in machine tools are important? (2 Marks)
c) The length of joint under tension load is L=200 mm, $\frac{\delta_j}{\delta_s} = 3.8*10^{-3}, 1.6*10^{-4}$ 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, Areas of 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 the sources of vibrations in the machine tools and how to reduce it? (5 Marks)
b) Machine tool having a dynamic load of 6 N. The logarithmic damping decrement (Δ) 0.125. From power spectrum the amplitude $A/\sqrt{2}$ =7.07μm at the band width ($\Delta\omega$) is 40 Hz. Calculate the dynamic stiffness and natural frequency of this machine. (5 Marks)
c) Assume initial clamping load is 2.5 KN. Load P = 5 KN as shown in Fig. 1. Allowable tensile stress = 160 MPa., and Kp=2.5 Kb. Determine size of bolt . (5 Marks)

Electric motor weighing 10 kN is lifted by means of eye bolt as shown in Fig. Eye bolt is made of steel having permissible yield strength of 50 MPa. Determine the size of bolt.

Problem number (4) (15 Marks)

a) What are the general rules should taken when set up machine tools on the foundation? (2 Marks)
b) Explain the geometrical and practical test of machine tools? (2 Marks)
c) Explain in detail, the Forces developing and acting in Machine tools? (3 Marks)
d) Distribute the forces act in shaping machine as shown in the Fig. 2? (8 Marks)

M thread Coarse series	M thread Fine series
M 4 × 0.7	M 6 × 0.75
M5 × 0.8	M 8 × 1
M6 × 1	M 10 × 1
M8 × 1.25	M 10 × 1.25
M10 × 1.5	M 12 × 1.25
M12 × 1.75, M14× 2	M 12 × 1.5
M16 × 2	M 14 × 1.5
M20× 2.5	M 16 × 1
M24 × 3	M 16 × 1.5

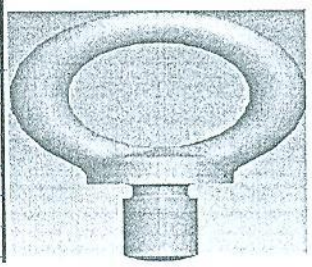


Fig. 1

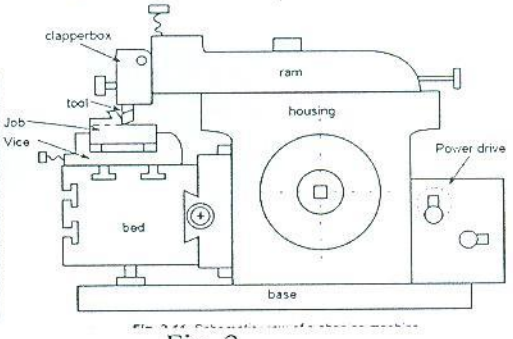


Fig. 2

Tanta University
Faculty of Engineering
Mechanical Power Eng. Dept.
January 20, 2013 – 3rd Year

First Semester Exam
Refrigeration& Air conditioning
Time: 3 hours – Full Mark: [50]

Answer the following questions. Assume any necessary assumptions.
Use of tables and charts of Refrigeration& Air conditioning is allowed. Mark

1. A refrigeration system operates on the reversed Carnot cycle. The higher temperature of the refrigerant in the system is 40°C and the Lower is -20°C. The Capacity is to be 10 tons. Neglect all losses Determine : [5]
   i) Coefficient of Performance (C.O.P.)
   ii) Heat rate rejected from the system
   iii) Power required.

2. A brine-cooling machine with ammonia is running under the following conditions. Rate of flow of brine through the machine 8000 liters/hr. specific gravity of brine 1.2, and its specific heat 2.9 kJ/kg.K. Temperature of brine entering the evaporator -10 °C temp. of brine leaving the evaporator -20 °C ammonia pressure 1.8 atm in evaporator, and 14 atm in condenser. Ammonia leaves the brine cooler with 5 °C superheat, and there is no subcooling, calculate the following. [10]
   i) The cooling capacity of the machine in tons refrigeration
   ii) The compressor bhp.
   ii) The amount of cooling water required for the condenser in liters per minute, based on 18 °C temp. rise in the cooling water.
   iv) The COP of the machine.

3. A refrigerant 12 vapor - compression system includes a subcooling heat exchanger. The heat exchanger cools saturated liquid coming from the condenser from 30°C to 20°C with vapor which comes from the evaporator at - 10°C. The compression is isentropic in both cases listed below. [10]
   a) Calculate the COP of the system without heat exchanger but with condensing temp. of 30°C and an evaporator temp. of -10°C.
   b) Calculate the COP with heat exchanger.

4. A boot-strap cooling system is used for an aeroplane to take 10 tons load. The temperature and pressure conditions of atmosphere are 15 C and 0.9 bar. The pressure of air is increased from .9 to 1.1 bar due to ramming action of the plane. The pressure of air leaving the main compressor and auxiliary compressor are 3.2 and 4.2 respectively. Isentropic efficiency of both compressors is 90% and isentropic efficiency of the turbine is 85%. About 55% of the total heat 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 rammed air. [15]
   Assuming the ramming action is isentropic, determine:
   a) H.P. required to take the cabin load;

b) COP of the system;
The required cabin pressure is 1.03 bar and the temperature of air leaving the cabin should not exceed 27 C.

5. A room 5m×4m×3m height (with the longer wall oriented facing north direction) in a gymnasium building is to be conditioned. The building site is 32 North latitude. East wall separate the room from conditioned space otherwise south wall separates the room from unconditioned space. Other walls (north and west) are side streets. All walls are constructed from 100-mm face brick, 50-mm insulation and 100-mm concrete. The room has single window facing north with 2m×1.5m and 6-mm single glass having light colour medium weave shading. The average number of occupants in space is 15 person s works from 8.00 Am till 4.00 Pm. Lighting is unvented and unsuspended fluorescent lamps, number of lamps are 8 and each lamp has 40 watt. Inside design condition is 25 C and outdoor air is assumed to be 40 C. Neglect all other loading and calculate the space total load and the sensible heat factor (SHF). Base your calculations on June, 2.00 Pm O'clock. [10]

Good luck,

Dr. M. K. El-Fakharany

Tanta University

Department: Production and Design Engineering Department

Faculty of Engineering

Course Title: Theory of Metal Forming
Date: Jan 22nd 2013

Course Code:
Allowed time: 3 hrs

Year: 3 rd.
No. of Pages: (1)

ANSWER THE FOLLOWING QUESTIONS:

Q.1 A 300mm-wide aluminum alloy strip is hot-rolled in thickness from 20 to 15 mm. the rolls are 1m in diameter and operate at 100 rpm. The uni-axial flow stress for aluminum alloy can be expressed as $\sigma=140\ \varepsilon^{0.2}$ MPa. determine the rolling load and the power required for this hot reduction.

Q.2 A bar 10 cm long is elongated to 20 cm by rolling in three steps: 10 cm to 12 cm, 12 cm to 15 cm, and 15 cm to 20 cm.

a- Calculate the engineering strain for each step and compare the sum of these with the overall engineering strain.
b- Repeat for true strains.

Q.3 Define and Classify the forming process?

Q.4 Compare between ductile and brittle materials?

Q.5 Compare between the cold working and hot working?

Q.6 Mention and explain the defects in drawing process and rolling process?

Q.7 What are the key factors in Deep Drawing?

Q.8 What is the extrusion and what are the classification of extrusion processes?

Q.9 Explain the extrusion equipments?

Best Regards superiority
Dr. Abdullah Ahmed

TANTA UNIVERSITY — MACHINE DESIGN (2)

FACULTY OF ENGINEERING — (MPD 3114) Third Year

Production Eng. & Mechanical Design Dept. — Time : 3 Hours

Date : 24 / 1 / 2013 — Total Mark : 75 Marks

Final - First – Term Examination

Tables can be use .

Q-1 (25 Marks)

Determine necessary size of shaft given the following data. See Fig.(1).Sketch the designed shaft. Torsion moment equal 2387.5 Kg.cm. The belt on pulley S is in horizontal plane & the belt on pulley T is in vertical plane .

Q-2 (15 Marks)

Design the Feather- key of Pulley S (See Fig. 1).

Q- 3 (20 Marks)

Design the pulley S (See Fig. 1) , where the permissible belt tension is 50.3 Kg / cm. width (3 mm. thickness) Leather belt , heavy duty . Sketch the designed pulley .

Q- 4 (15 Marks)

Design a sliding Gear-box gives 18 Speeds , taking into consideration minimum box size .

Good luck ! Dr. GABER SHEHA

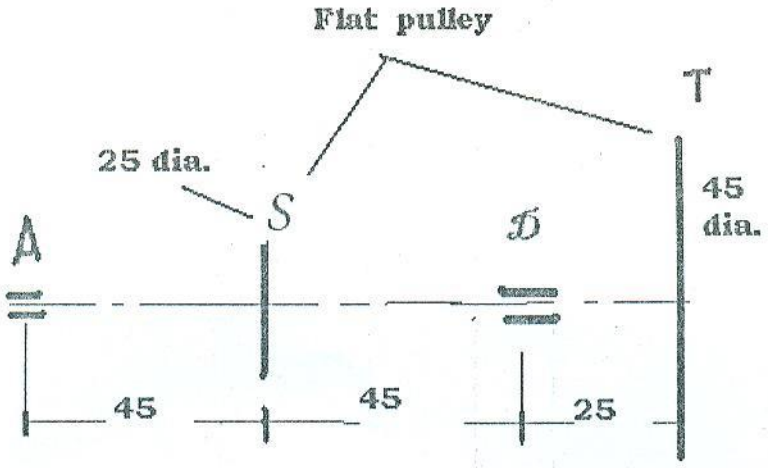


Fig.(1)

Dims. in cm.

T1/T2=S1/S2
= 2.75