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Tanta University

Department: Production and Mechanical Design
Total Marks: 100 Marks

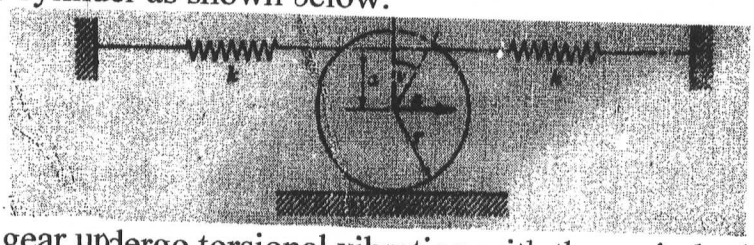
Faculty of Engineering

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)

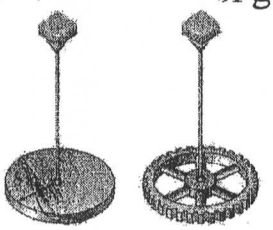
Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches)

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

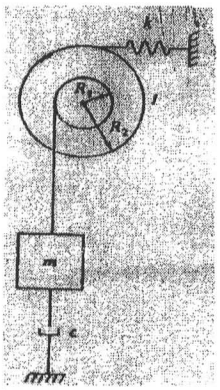
a) Use the energy method to find the natural frequency of oscillation of the homogeneous cylinder as shown below. (8 Marks)



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=1.95 s of gear) and W of disk = gear =20lb.



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 ($E = 2\times10^6$ Kgf/cm²). The distance between bearings is 30 cm. Assuming the shaft to be simply supported, determine:

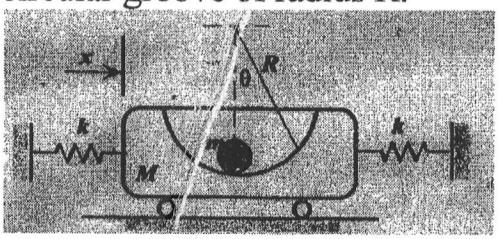
i) The critical speed.
ii) The amplitude of vibration of rotor at a speed of 600 r. p. m. if eccentricity is 0.002 cm.
iii) The maximum vibration force transmitted to the bearings.

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:

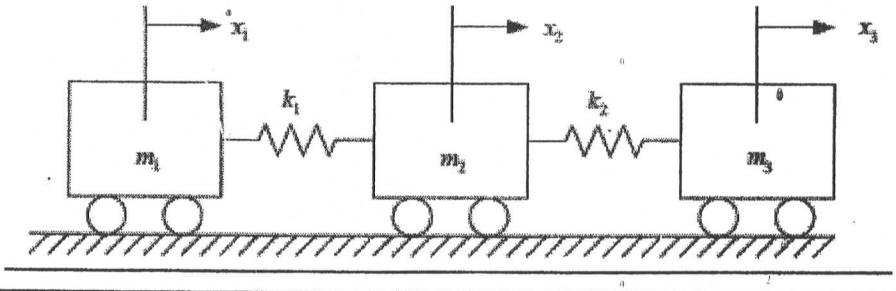
i) The two natural frequencies of the system.
ii) The principle modes of vibration.
iii) The motions x(t) and θ(t). (13 Marks)

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.



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 2014 (First term Exam)	Allowed time: 3 hrs	No. of Pages: (1)

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

Problem number (1) **(20 Marks)**

a) What is the geometry of single point tool? (4 Marks)
b) What is the importance of rake angle? (4 Marks)
c) Distinguish between an oblique and an orthogonal in metal cutting? (4 Marks)
d) Explain the dimension of chip of oblique and orthogonal in metal cutting? (4 Marks)
e) What are the variable affect on the chips? (4 Marks)

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

a) Mention the effects of a worn tool or an improper sharpen tool? (5 Marks)
b) What are the cutting tools classifications? (5 Marks)
c) In orthogonal cutting if the feed is 1.25mm/rev. and chip thickness after cutting is 2mm; determine the following:
   i) Chip thickness ratio.
   ii) Shear angle.

The tool bit has a rake angle of 10°. If shear strength 6000 kg/cm², width of cut = 10 mm, cutting speed = 30 m/min., and coefficient of friction = 0.9. Determine the following:
   i) Shearing force.
   ii) Friction angle.
   iii) Cutting force.
   iv) Horse power at the cutting tool.

(20 Marks)

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

a) Distinguish between carter and flank wear? (5 Marks)
b) Explain the cutting temperature and its importance? (5 Marks)
c) What are the factors of tool selection? (5 Marks)
d) A carbide-cutting tool, when machined with mild steel workpiece material at a cutting speed of 50 m/min lasted for 100 minutes. Determine the life of the tool when the cutting speed is increased by 25%. At what speed the tool is to be used to get a tool life of 180 minute. Assume n = 0.26 in the Taylor's expression. (10 Marks)

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

a) What are the types of the cutting tool materials? (5 Marks)
b) Explain the desired properties of cutting fluids? (5 Marks)
c) Explain the methods to separate the cutting fluids and chips? (5 Marks)
d) The power required to cut a certain materials is 0.70 hp/in³/min. A cut 0.15 in deep*0.06 in/rev feed is taken at cutting speed 100 ft/min. The work is cooled by flow of one gallon per min. of coolant with specific heat 0.80 and specific gravity 0.85 which conducts away 0.75 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. 2014 (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)

a) Classify the machine tool parts? (4 Marks)
b) What are the main types of ribbing systems? (3 Marks)
c) What are the types of chip storage of machine tool? (4 Marks)
d) What are the factors affect the accuracy of machine tool? (4Marks)

Problem number (2) (15 Marks)

a) Classify the different types of joints of the machine tools and its importance? (5 Marks)
b) A joint cantilever structure with end point load of 100 N at 120 mm distance from the joint. If the solid part has 20 mm in diameter, assume I_s / I_j =4/9, E=21000 Kgf/mm², and joint surface m= $2000mm^{-1}$. A) What is the required interface pressure and bolt size to have joint deflection of 25 μm, while the joint stiffness should not be less than $15x10^6$ N/mm. Note that the available bolt sizes Areas of bolt mm², M6, 20.1, M8, 36.6 and M10, 58.6 respectively. B) Compute the joint diameter which fulfils the above requirements. (10 Marks)

Useful equation:

For jointed cantilever with end point load; $\delta_j = \frac{\overline{WL^2}}{mP_m I_j}$

Problem number (3) (15 Marks)

a) Mention the requirements made to machine tool? (5 Marks)
b) What the ways to isolate vibrations of machine tool? (5 Marks)
c) Machine tool having a dynamic load of 7 N. The logarithmic damping decrement (Δ) 0.13. 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)

Problem number (4) (15 Marks)

a) Mention the rules should take when set up machine tools on the foundation? (3 Marks)
b) What are the geometrical and the practical test of machine tools? (3 Marks)
c) Distribute the forces act in the radial drill? (3 Marks)
d) A machine tool having a moving column with 300 Kg weights along the machine bed. The bed is 8.0 m long, 1.2 m width; flexural rigidity $EI_1 = 24\times10^6$ Kgf/m². What is the suitable concrete depth to keep the deviation from the alignment of the bed/foundation system not more than 6×10^{-5} m measured between the mid end (a=0) and its end (a=1/2). Take the concrete width is equal to the bed width, and the concrete modulus of elasticity as $24x10^8$ Kgf/m². (6 Marks)

Useful equations:

$$(EI)_3 = (EI)_1 + (EI)_2$$

The deviation from alignment is given as,

$$\Delta = \frac{W_m l^3}{(EI)_3}\left[-\frac{1}{16}\left(\frac{a}{l}\right)^2 + \frac{1}{6}\left(\frac{a}{l}\right)^3 + \frac{5}{24}\left(\frac{a}{l}\right)^4 - \frac{1}{10}\left(\frac{a}{l}\right)^6\right]$$

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: PMD3214
DATE:22- 01-2014	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 الإمتحان مكون من 3 أسئلة فى صفحتين وورقتين

Systematic arrangement of calculations and clear neat drawings are essential.

Any data not given is to be assumed – Answer as many questions as you can. Answer as brief. as possible.

PROBLEM # ONE (40%)

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 20 mm long and 40 mm in diameter. It has a clearance of 0.04 mm and uses SAE 20 lubricant at an operating temperature of 60°C. The bearing supports a load of 180 Kg_f. Calculate the heat generated for speeds of 1000, 2000, 3000, 4000 RPM, and construct a graph of the results.

PROBLEM # TWO (50 %)

I- Why are cylindrical 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 15 cm.

Please Turn Over ⟶

PROBLEM # 3 (30%)

I- What is the major assumption in Lewis equation? And what is your opinion on them.

II- Compeer between belts and gears in view of transmitting power?

III- A sleeve of journal bearing is experiences a Sommerfeld Number of 0.25 and minimum film thickens of 0.01 mm and a radial clearance of 0.02 mm so what is your suggestion for the length to diameter ratio.

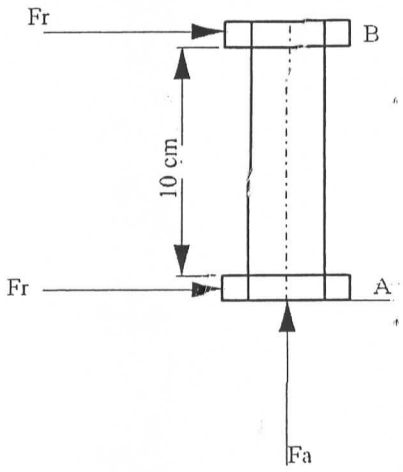


Figure (1)

Tanta University
Faculty of Engineering
Mechanical Power Eng. Dept.
January 18, 2014 – 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) What is the difference between a heat pump and a refrigerator? **[9]**
   b) Discus and draw a domestic refrigerator.
   c) Define the following
      1- Dry Bulb Temperature
      2- Wet Bulb Temperature
      3- Relative Humidity
      4- Specific Humidity

2. The cock pit of a jet plane is cooled by a simply cooling cycle. Assuming the following data, **[10]**
   Plane speed =1200km/hr
   Ram efficiency = 90%
   Ambient air pressure= 0.85 ata.
   Ambient air temperature= 30 °C.
   Pressure ratio of the main compressor = 4
   Temperature of air leaving the heat exchanger =60 °C.
   Pressure in cock pit = 1 ata.
   Temperature in cock pit = 25 °C.
   Isentropic efficiency of the main compressor is 75 % and of cooler turbine is 80%.
   Load in the cock pit = 10 tons.
   Determine:
   a) The quantity of air passed through the cooling turbine.
   b) COP of the cycle.

3. A refrigerant 12 vapor compression system operating at 0.1 Mpa with cooling capacity 25 T.R. Condensing pressure is 0.8 Mpa. **[4]**
   Determine:
   a) COP of the cycle.
   b) The mass flow rate of refrigerant in kg/s.
   c) Power of compressor in kW.

4. A vapor compression cycle utilizes 3 stores with capacities 50, 30, 40 T.R at -30, -20, and -10°C respectively. The system uses R-22 and has multiple expansion valves with flash chambers and multiple compression with flash intercooling. Condensing occurs at 45 °C. Assume no pressure drop. Draw the flow diagram and P-h chart of the cycle and **determine** [12]

a) mass of refrigerant at each compressor.
b) heat rejected from the condenser.
c) COP of the cycle.

5. A room 8m×5m×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. West wall separate the room from conditioned space otherwise south wall separates the room from unconditioned space and they are constructed from 100-mm face brick, 100-mm common brick. Other walls (north and East) are side streets and they 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 color medium weave shading. The average number of occupants in space is 15 person's works from 9.00 Am till 9.00 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 July, 3.00 Pm O'clock. [15]

Good luck, Dr. M. K. El-Fakharany

Tanta University
Faculty of Engineering
Production Engineering & Design Dept.
3rd Year Prod. 2013/2014

Theory of Metal Forming
Saturday, 4.01.2014
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) Find the relation between engineering- and true-strain and the relation between engineering- and true-stress of rounded tensile specimen.

b) A circle 1.5 cm diameter was printed on a sheet of metal with thickness 1 mm 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 1.7 and 1.5 cm. Assume that the stress strain law is:

$$\bar{\sigma} = 500\,\bar{\varphi}^{0.22}(MPa)$$

If the stress normal to the sheet is neglected and the material yields according to von-Mises criterion then determine:

i- The principal strains.
ii- The final thickness.
iii- The effective strain.
iv- The applied stress ratio $\alpha = (\sigma_2/\sigma_1)$.
v- The final stresses in the element.
vi- The total work done/unit volume in this forming process.

Question 2 : (25 marks)

a) A tension test is performed on a sample of steel 8 mm in diameter and gauge length of 8 cm and the following table shows the load and elongation counterparts:

Load (kg)	1390	1665	1920	2150
Elongation (mm)	1.21	2.53	3.52	14.25

Use the above data to get the constants "***K***" and "***n***" in the flow stress-strain relation ($\sigma = K\varphi^n$) of the steel sample.

b) Annealed rods from the steel tested in (a) of 25 mm in diameter are formed by extrusion. The billet has a diameter of 35 mm. The extrusion efficiency is 65%. Calculate:

i. The radial, tangential and longitudinal strains.
ii. The effective strain
iii. The extrusion force (Derive the used law)
iv. The power required to extrude the rods at a rate of 0.5 m/s.

Question 3 : (20 marks)

a) What are the main assumptions made for the calculation of the ideal drawing force in deep drawing processes

b) Cylindrical cups with a mean diameter of 150 mm and 250 mm height are deep drawn from sheets with thickness of 2 mm. One redrawing is necessary to produce the cup successfully. The first drawing ratio is 1.9

i- What is the blank diameter required to produce these cups?

ii- What is the redrawing ratio?

iii- Calculate the ideal drawing force during the first drawing, when the depth of drawing is 0.3 its full value at this first drawing.(take $\sigma_{fm} = 400$ MPa)

iv- Assume the same mean flow stress, get the ratio of the maximum ideal drawing forces between the two stages.

Question 4 : (20 marks)

a) Use the slab analysis to get the average pressure value acting on a slab of width "***b***" and height "***h***" and subjected to upsetting process.

b) A tensile specimen has homogeneous properties but two regions of different areas. Get the limit strain for this specimen, if the material is only strain rate sensitive.

c) The thickness of a sheet varies from 8.00 mm to 8.01 mm depending on location so tensile specimens cut from a sheet have different thicknesses. For a material with m = 0.05 and n = 0, what will be the strain in the thicker region when the strain in the thinner region is 0.5 and ∞.

Question 5 : (25 marks)

a) Derive an expression for the total drawing force required to accomplish a wire drawing process and hence find the optimum die angle.

b) A sheet of thickness 20 mm and width 1 m is requested to be bent by 3-roll forming to form a tube of diameter 1 m . The sheet is made of steel with a yield strength of 350 MPa and modulus of elasticity 200 GPa. On which radius should the bend machine be configured?

Useful information:

Flow rule: $\frac{d\varphi_1}{(\sigma_1-\sigma_m)} = \frac{d\varphi_2}{(\sigma_2-\sigma_m)} = \frac{d\varphi_3}{(\sigma_3-\sigma_m)} = \frac{3}{2}\frac{d\bar{\varphi}}{\bar{\sigma}}$; $d\bar{\varphi} = \sqrt{\frac{2}{3}\left[d\varphi_1^2 + d\varphi_2^2 + d\varphi_3^2\right]}$

von-Mises yield criterion: $\sigma_Y = \frac{1}{\sqrt{2}}\sqrt{(\sigma_1-\sigma_2)^2 + (\sigma_2-\sigma_3)^2 + (\sigma_3-\sigma_1)^2}$

For deep drawing: $F_{ideal} = \pi\, d_m\, S\, \sigma_{f_m} \ln\left(\frac{D}{d_m}\right)$; For springback calculation: $\left[\frac{1}{\rho_0} - \frac{1}{\rho_1}\right] = 3\frac{Y}{hE} - 4\rho_0^2\left(\frac{Y}{hE}\right)^3$

مع أمنياتي بالتوفيق و النجاح