Tanta University
Faculty of Engineering
Production Engineering & Design Dept.
1st Year Mechanical 2014/2015
Strength and Materials Testing

MPD 1206
Saturday, 16.05.2015
Time allowed : 3 hours
Final Grade : 120 Marks
Exam is in "2" pages

إختبار تخلف

Solve all of the following questions – You may answer in english as well as in arabic:

Question 1 : (35 marks)

a) Discuss the effect of the following factors on the mechanical properties of steel:
Test speed – Annealing – Alloying

b) What are the difficulties that show up upon performing a compression test? How can we overcome (تتغلب على) these difficulties?

c) A tension test is performed on a specimen of steel with a circular cross-section of diameter 30 mm. The readings of load and associated elongation were as following:

load (**ton**)	3.75	7.5	7.5	8.5	11	12	12.5	11.5	10
elongation (**mm**)	0.06	0.12	1.4	4.0	12.0	18.0	24.0	29.0	32.0

Draw the load-elongation curve and hence identify:
yield stress – tensile strength – elongation percentage – modulus of elasticity – modulus of resilience – modulus of toughness

Question 2 : (35 marks)

a) Explain the different types of bend (الثنى) tests and the reason for each test.

b) Identify the proof stress and the purpose for its identification? Do we identify it for all metals? Why?

c) A bending test is done on a sample of simply supported beam (كمرة بسيطة) of cast iron of diameter 4 cm and span of 46 cm. The beam was loaded at its midspan with a concentrated load till the fracture. The loads and deflections at the midspan were as following:

load (**ton**)	0	0.6	1.0	1.4	1.8	2.2	2.6	2.74	2.8
deflection (**mm**)	0	0.5	0.8	1.2	1.5	2.0	3.0	4.0	5.0

Draw the load-deflection curve and then identify:
proportional limit stress – modulus of rupture – modulus of elasticity in bending – modulus of resilience – modulus of toughness

Question 3 : (25 marks)

a) Explain the different types of the direct shear tests and the use for each one.
b) A solid shaft of diameter 20 mm and length 100 mm is tested under torsion. The modulus of rigidity is $80*10^3$ N/mm^2 . The elastic shear strength of the material is 150 N/mm^2 . Compute:
   i. The twisting moment and twisting angle in degrees at yielding.
   ii. The modulus of resilience in torsion.
   iii. If the shaft is made of ductile material, what is the shape of fracture of the shaft? Why?
c) Why do we need to apply a hardness test?

Question 4 : (25 marks)

a) A Brinell hardness test is performed on a steel specimen with a ball of diameter 10 mm. The diameter of indentation is 3.84 mm.
   i. What are the minimum dimensions of the specimen?
   ii. What is the BHN for the specimen?
   iii. Calculate the approximate values of the ultimate tensile strength and endurance limit.
   iv. If this specimen is fractured due to normal fatigue stresses, draw the cross-section after fracture explaining what you see.

b) A cantilever (كابولى) of length 150 cm with a rectangular of 25 mm depth and 75 mm height is subjected to an impact load at its free end. The load comes due to a free fall of weight "**W**" from height 100 mm. If the yield strength of the material is 28 kg/mm^2 and the modulus of elasticity is 20 ton/mm^2, find the necessary weight "**W**" to cause yielding.

مع تمنياتنا بالتوفيق و النجاح

د. حنفى هنداوى　　د. نادر الليثى

Tanta University

Department: Mechanical Power Engineering

Faculty of Engineering

امتحان التخلفات الفصل الدراسي الثاني

Total Marks 50

Course Title: Technical Reports	Course Code : MEP 12H4	Year : 1st
Date: May 19th 2015 (Second Term)	Allowed Time : 2 hours	No. of Pages: (1)

Open Book Exam. مسموح للطالب باستعمال الكتاب الخاص بالمادة

Question Number (1) (12 Marks/ 3 Mark for each term)

Explain concisely the following terms (use short words as possible)

1. Rough draft
2. Feedback
3. Appendixes
4. Illustration

Question Number (2) (10 Marks /2 Marks for each sub question)

I. Answer the following Questions (use clear drawings when possible)

1. Differentiate between the three reviewing stages of rough draft.
2. Explain the reasons for Using Illustrations in the technical writing.
3. Perform a comparison between general and technical Communication.
4. Discuss briefly the stages of managing writing process.
5. Describe the difference between line art illustrations.

II. State the difference between each of the following groups: (10 Marks)

1. Formal and informal Proposals.
2. Communication cycle and communication triangle.
3. Laboratory and Project Reports.
4. Sorting stage and outlining stage of report writing
5. Chain communication network and Wheel communication network

III. How could you build your resume (C.V)? (10 Marks)

Question Number (3) (8 Marks/1 Mark for each statement)

Read carefully and mark the following statements with true or false:

1. In the sorting stage concentration is on what results should be presented in a report.
2. Feasibility reports and recommendation reports are objective documents that identify and evaluate solutions to problems.
3. Schematics Are simplified sketches of a process or object
4. In the second review of the rough draft is of spelling and grammar, and sentence structure
5. Front matter of a formal report contains title, abstract, and introduction.
6. Summary must refer to figures and references.
7. Captions are placed below figures, while table titles are placed on the top.
8. A recommendation report is done after a tentative decision has been reached.

انتهت الاسئلة

Course Title: Engineering Mathematics (2) b — First Year (Mechanical Engineering)
Course Code: PME1206 — Date:18 / 5 / 2015 (Second term) — Allowed time: 3 hrs — No. of Pages: (2)

Remarks: (Answer the following questions. Assume any missing data…)

Problem number 1 (30 Mark)

a) Plot the function $f(x) = \begin{cases} 0 & , -\pi<x<0 \\ x/2 & , 0<x<\pi \end{cases}$, where $f(x+2\pi) = f(x)$

and then find its corresponding Fourier series. [15 Mark]

b) Find the Fourier sine series of the function

$f(x) = x + sin(2x)$, $-\pi < x < \pi$ [15 Mark]

Problem number 2 (45 Mark)

a) For Laplace transform of *f(t)*, $F(s) = \int_0^\infty e^{-st} f(t)\, dt$ [10 Mark]

If (*s*) is a real number, what is the condition for this Laplace transform to exist (to be convergence)?

b) Find Laplace transform of the function: [15 Mark]

$f(t) = \begin{cases} 0 & , 0 \le t < 4 \\ t^2 & , t \gg 4 \end{cases}$

c) Find Inverse Laplace transform: $L^{-1}[1/(s^2 + 6s + 25)]$ [10 Mark]

d) Solve the following O.D.E. using Laplace : [10 Mark]

$y' - 2y = 5e^{2t}$, $y(0) = 1$

Problem number 3 (30 Mark)

a) Obtain the P.D.E whose solution is [10 Mark]

U(*x*,*y*)=F(8*x*-4*iy*)+G(*y*)
U(*x*,*y*)=e^x . F(2*x*-3*y*)+ 3*xy*^{2}-7

b) Solve the following P.D.Es: [20 Mark]

- $u_{yy} = \frac{y\, sinsh\,(y)}{x+1} + \frac{1}{y} + 6$
- $u_{xy} + 3u_x = 2x+y$
- $u_{xx} + u_{yy} = 0$
- $u_{xx} = u_{tt}$ *where* $u(x,0) = 0$, $u_t(x,0) = \frac{1}{x^2+1}$

Problem number 4 (45 Mark)

a) Derive the solution of the following B.V.P. (Wave equation): [15 Mark]

$u_{xx} = \frac{1}{c^2} u_{tt}$, $0 \le x \le a$, $t \ge 0$, $u(x,0) = f(x)$, $u_t(x,0) = g(x)\ \forall x$,

$u(0,t) = u(a,t) = 0$, $\forall\ t$, where $f(x)$ and g(x) are given functions and a is a given constant.

b) Solve the wave equation $u_{xx} = u_{tt}$, [15 Mark]

$0 \le x \le 3$, $t \ge 0$, $u(x,0) = 0$, $u_t(x,0) = 2sinsh(4\pi x)$, $u(0,t) = u(3,t) = 0$.

c) Solve the following system of O.D.Es: $x' = \begin{pmatrix} 2 & -1 \\ -2 & 1 \end{pmatrix} x + \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ [15 Mark]

All best wishes

Dr. Yasser Gamiel

and Examination Committee

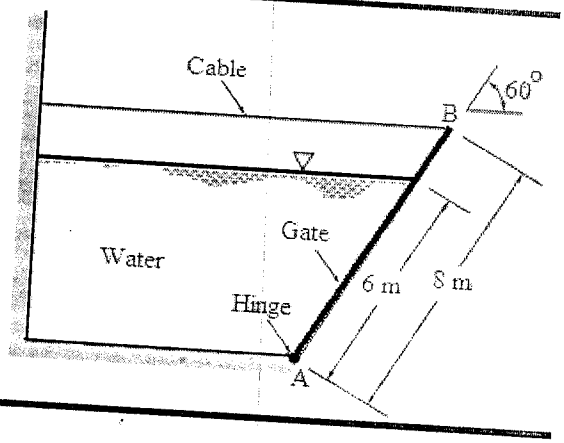
Tanta University		Mechanical Power Engineering Department Course Title: Applied Mechanics MEP 1201		Faculty Of Engineering

Dept	Mechanical Engineering	Date	20/05/2015
Year	1st, (new curriculum) 2005	Allowed time	3 hrs
Reset exam	June (second term)	Total marks	125 Marks
		Academic Number	2014/2015

Close book exam. All questions must be answered. Draw schematic whenever applicable, and c
clearly state your assumptions

Question (1) (22 marks)

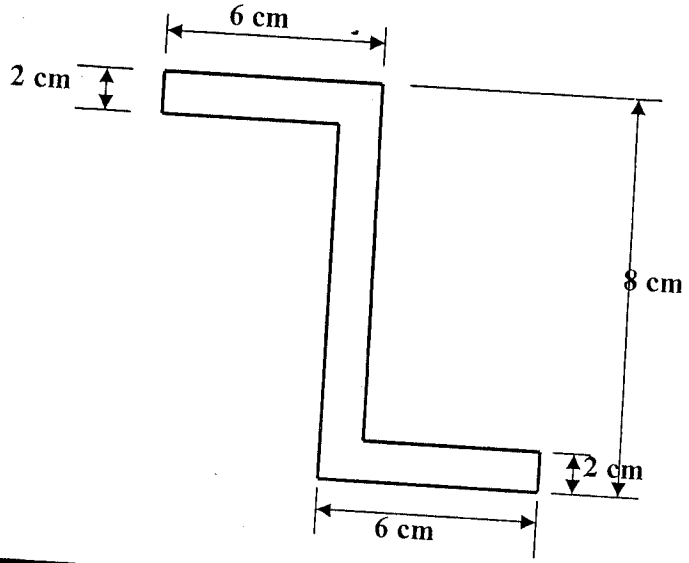
A homogeneous, 4 m wide, 8 m long rectangular gate is hinged at point A and held in place by a horizontal flexible cable through point B. Neglect the weight of the gate and friction in the hinge. Determine the tension in the cable.



Question (2) (30 marks)

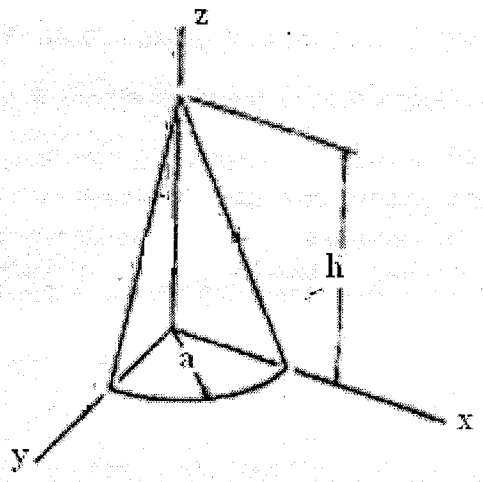
For the beam shown in Fig Determine:

a) The moment of inertia about the centroid axis.
b) The principal centroidal axes.
c) The principal centroidal 2nd moment of inertia,
d) The moment of inertia about an axes making 20° clockwise with respect to the centroid.
e) Check your results using Mohr's circle



Question (3) **(23 marks)**

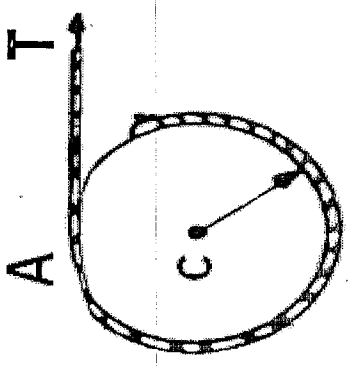
Locate the centroid of quarter cone of the shown Fig.



Question (4) **(24 marks)**

A cord is wrapped around a homogeneous sphere of radius r=0.4 m and mass m=20 kg. If the cord is pulled with a force T of magnitude 400N, determine the following:

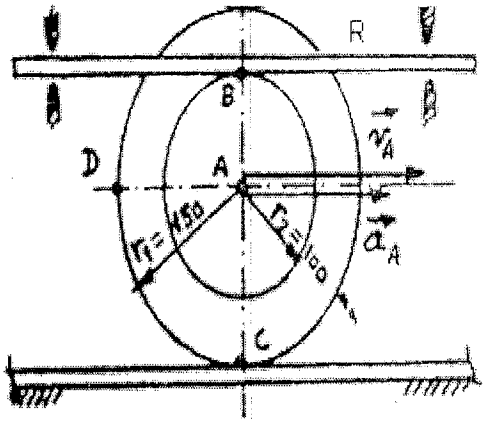
a- The acceleration of the centre of the disk
b- The angular acceleration of the disk
c- The acceleration of the cord



Question (5) **(26 marks)**

The double gear shown rolls on the stationary lower rack, the velocity and acceleration of its centre A are 1.8 m/s and 4 m/s^2 respectively directed to the right. Determine:

(a) The angular velocity of the gear,
(b) The angular acceleration of the gear,
(c) The velocities of the upper rack R and of point D of the gear
(d) The acceleration of points C and D of the gear



All the best

Dr. Yasser EL-Samadony

Dr. Mohamed Abd Elgaied