PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Mid-term Examination: Semester 2 | Academic Year: 2005

Date: December 13, 2005 | Time: 13:30-16:30

Subject: 226-305 Machine Design | Room: A400

Instructions

- Books, sheets of paper note are allowed.
- Dictionary and calculator are allowed.
- There are 4 questions in 10 pages.
- Answer all questions in these sheets.
- Total score is 25.
- Your answers could be in English or Thai.
- Please check all questions before start working.

Name:	Student ID.....

Question #	Full Score	Assigned Score
1	**10**	
2	**5**	
3	**5**	
4	**5**	
Total	**25**	

Mr.Srisit Chianrabutra

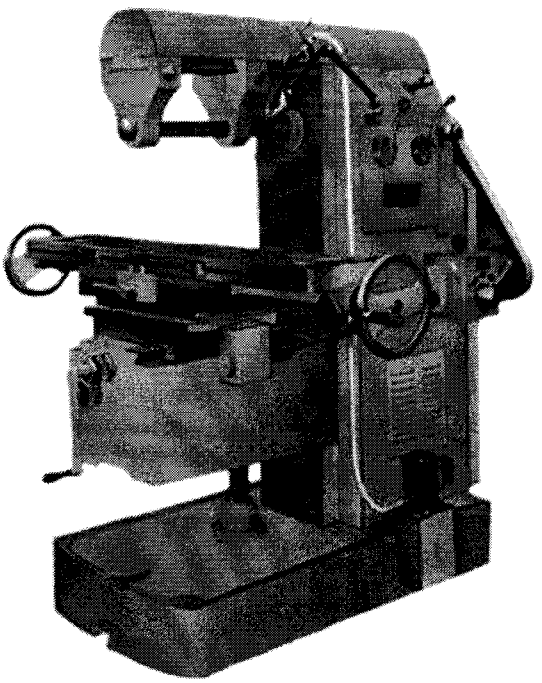
ทุจริตในการสอบโทษขั้นต่ำ คือ พักการเรียน 1 ภาคการศึกษา และปรับตกในรายวิชานั้น

Question 1: Fill the following words in the blanks. (10 Marks)

Yield Strength	Tensile Strength	Fatigue Strength
Endurance Limit	Shear Strength	Shear
Standard	True Stress	Ultimate Strength
Endurance Strength	Temperature	Code
Coulomb-Mohr Theory	Modified Mohr Theory	Maximum Shear Stress Theory
Maximum Normal Stress Theory	Distortion Energy Theory	Failure Theory

1. _____ is a set of specifications for analysis, design, manufacture and construction of an item?
2. _____ is a set of specifications for parts, materials, or processes intended to achieve uniformity, efficiency, and quality?
3. The _____ is the stress at which the material begins to plastically deform. It is usually measured as the 0.2% offset value - the point at which the stress-strain for the material intersects a line which is offset from the elastic region of the stress-strain curve by 0.2%.
4. _____ is the stress that a fatigue specimen was capable of withstanding for a specified number of load cycles, and therefore refers to any point on a standard S-N plot. _____ or endurance strength, on the other hand, is the limiting stress level below which the material will not fail regardless of the number of cycles of loading.
5. Engineered products frequently operate over a range of temperatures and often have to endure _____ extremes. The materials that are used in these products must exhibit the desired mechanical and physical properties over this range of temperatures. Thus, it is imperative that the designers consider both the short-range and long-range effects of temperature on the materials.
6. _____ is usually referred to as the capability of a material or component to take a static load; shock, force, bending moment, etc.
7. _____ focused on rupture or yielding failures, hence dealing with material strengths.
8. Both the _____ and the _____ are acceptable as failure criteria in the case of static loading of ductile, homogeneous, isotropic materials whose compressive and tensile strengths are of the same magnitude.

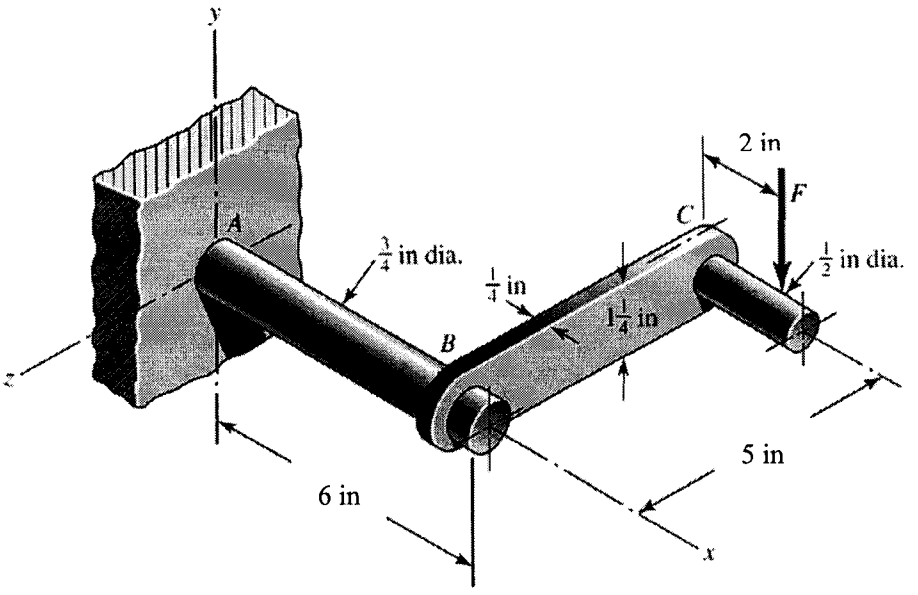
Question 2: Sketch preliminary layout of this machine. (5 Marks)



Question 3: (5 Marks)

In the figure shown, an AISI 4140 normalized steel crank loaded by a force *F* that causes twisting and bending of a ¾ in-diameter shaft fixed to a support at the origin of the reference system. In actuality, the support may be an inertia that we wish to rotate, but for the purposes of a stress analysis we can consider this a static problem. Find maximum force *F* before yielding occurs at point *A*.

(S_u = 148 kpsi, S_y = 95 kpsi, H_B = 302)



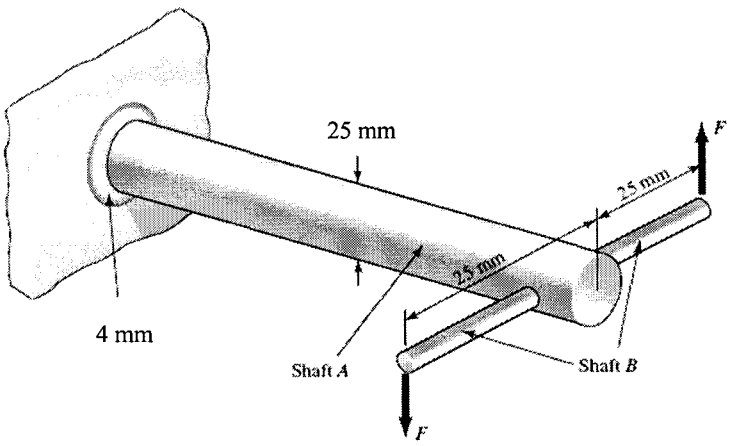
(a) Use Maximum Shear Stress Theory.

(b) Use Distortion Energy Theory.

Question 4: (5 Marks)

In the figure shown, shaft *A*, made of AISI 1040 Q&T steel and a machined surface, is welded to a fixed support and is subjected to loading by equal and opposite forces *F* via shaft *B*. A theoretical stress concentration K_{ts} of 1.6 is induced by the 4-mm fillet. The length of shaft *A* from the fixed support to the connection at shaft *B* is 1 m. The load *F* cycles from 1 to 3 kN. (at room temperature and 50 percent reliability)

(S_{ut} = 779 MPa, S_{yt} = 593 MPa, S_{su} = 522 MPa, S_{sy} = 342 MPa, H_B = 262)



(a) For shaft *A*, find the factor of safety for infinite life using the modified Goodman fatigue failure criterion.

(b) Repeat part (a) using the Gerber fatigue failure criterion.

(c) Repeat part (a) and (b) in an operating environment at 100° C for 99 percent reliability.