



SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JULY 2010 SESSION

SUBJECT CODE : FMB 22202
SUBJECT TITLE : MACHINE DESIGN
LEVEL : BACHELOR
TIME / DURATION : 12.30 pm – 2.30 pm .
(2 HOURS)
DATE : 20 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

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1. Please read the instructions given in the question paper CAREFULLY.
 2. This question paper is printed on both sides of the paper.
 3. Please write your answers on the answer booklet provided.
 4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
 5. This question paper consists of five (5) questions. Answer only four (4) questions.
 6. Answer all questions in English.
 7. Graph paper is appended.

THERE ARE 3 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer only 4 (four) questions.

Please use the answer booklet provided.

Question 1

- (a) Explain in detail five (5) factors that can be used as important guidelines for safety in the process of machine design. Use suitable examples to support your answer. (15 marks)
- (b) A 200 cm wheel is turned by the application of a 1 kN tangential force acting through its center. If the wheel completes 36 rotations, determine the work done. If the wheel is subsequently turned through an angle of π radian with the application of a torque with a magnitude of 500 N.m, calculate the work done by the wheel and the power if the process takes 4 minutes to complete. (10 marks)

Question 2

Static body stresses:

Figure 1 shows an electric motor loaded by a belt drive.

- (a) Calculate the bending stress at A (13 marks)
- (b) Calculate torsional stress over the cylindrical surface (12 marks)

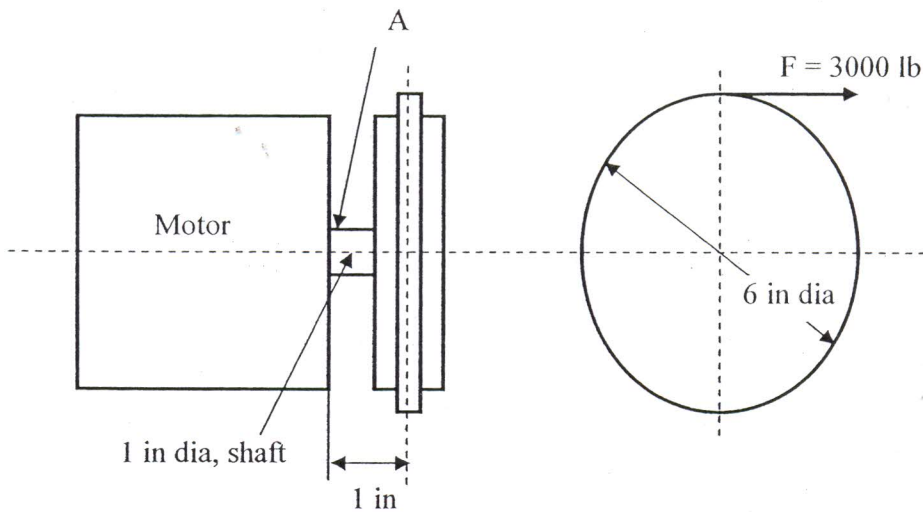


Figure 1: Part of a hand crank with static vertical load

Question 3

Mohr circle representation:

The following readings are obtained from an angular strain gage rosette mounted on a free and unloaded surface of a part: $\varepsilon_0 = +950$, $\varepsilon_{120} = +625$, $\varepsilon_{240} = +300$. Gage orientation angles are measured counterclockwise, and strain values are in micrometers per meter (or microinches per inch). Determine the magnitude of the principal strains and their orientation with respect to the 0° gage. Check the result with a Mohr circle.

(25 marks)

Question 4

Fracture mechanics:

A thin plate of width $2w = 6$ in, and thickness $t = 0.06$ in., is made of Ti-6Al-4V annealed titanium alloy, with properties of $S_u = 130$ ksi, $S_y = 120$ ksi, and plane stress $K_{IC} = 110$ ksi $\sqrt{\text{in}}$. It is used in an automotive component which will be inspected periodically for cracks. Estimate the highest load, P (as shown in Figure 2), that can be applied without causing sudden fracture when a central crack grows to length, $2c$ of 1 in.

(25 marks)

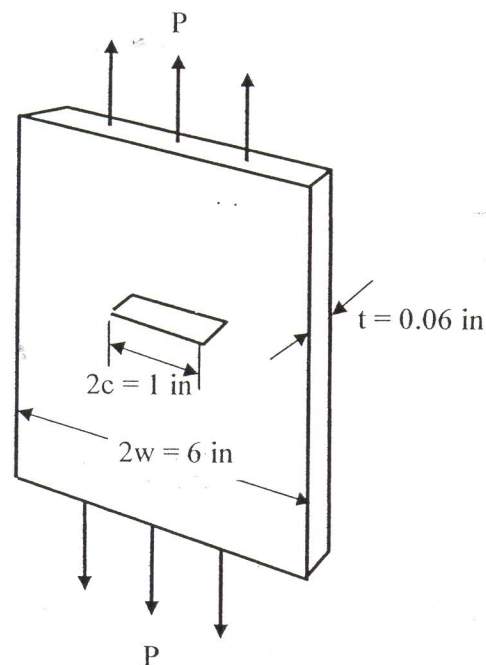


Figure 2: Thin plate with central crack

Question 5**Bearing selection:**

Select an **angular ball bearing** for an industrial machine intended for continuous one-shift (8 hour day) operation at 2000 rpm. Radial and thrust loads are **uniform without any impact**. They are 1.5 and 2.0 kN respectively. The bearing to be designed for life time of 30 000 hours with 90% reliability ($K_r = 1$, $L_r = 90 \times 10^6$ revolution live).

(25 marks)

END OF QUESTION