



SET B

**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
JANUARY 2011 SESSION**

SUBJECT CODE	:	FMB 22202
SUBJECT TITLE	:	MACHINE DESIGN
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00 am – 11.30 am (2.5 HOURS)
DATE	:	06 MAY 2011

INSTRUCTIONS TO CANDIDATES

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. Answer only four (4) out of 5 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) out of 5 (five) 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. (5 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. (20 marks)

Question 2

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)

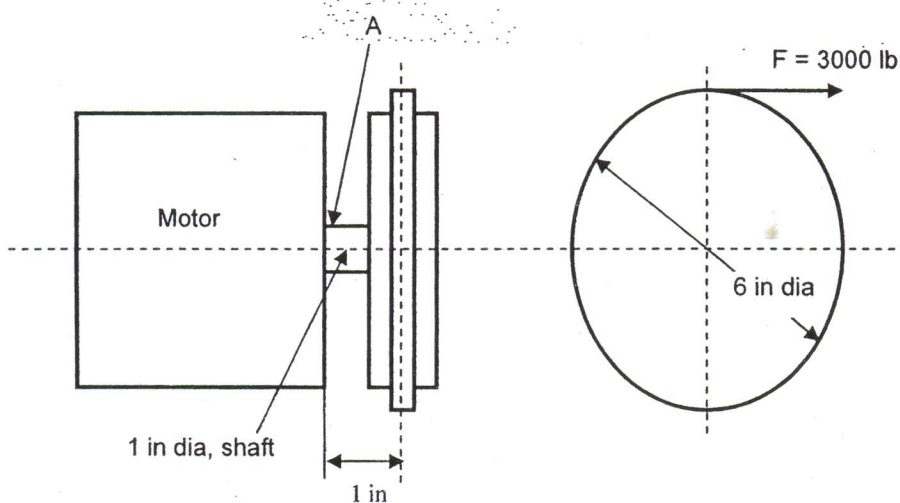


Figure 1: Part of a hand crank with static vertical load

Question 3

The surface of a hollow cylinder experiences tangential stress of 600 MPa, axial stress of 200 MPa, and torsional stress of 100 MPa. By using stress equation (related to Mohr circle), calculate:

- (a) Principal stresses (σ_1 and σ_2) (9 marks)
- (b) Maximum shear stress (τ_{\max}) (8 marks)
- (c) Angle between the principal stresses (ϕ) (8 marks)

Question 4

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 is 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)

Question 5

The 18-tooth pinion in Figure 2 is driven 800 rpm is driven by a motor that deliver 20 Nm of torque. The gears provide a double reduction in speed, with output taken from the 36 tooth gear. Both the 3 module and 4 module gears have a 25° pressure angle. Calculate:

- (a) Tangential gear tooth force (F_t) of pinion and gear 1. (7 marks)
- (b) Radial gear tooth force (F_r) of pinion and gear 1 (6 marks)
- (c) Tangential gear tooth force (F_t) of gear 2 and gear 3 (6 marks)
- (d) Radial gear tooth force (F_r) of gear 2 and gear 3 (6 marks)

END OF QUESTION

Figure 2. Pinion, gear and shaft mechanism

