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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2010 SESSION

SUBJECT CODE	:	FMB 22202
SUBJECT TITLE	:	MACHINE DESIGN
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00am – 11.00am (2 HOURS)
DATE	:	09 MAY 2010

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. This questions paper consists of TWO (2) sections. Section A and B. Answer ALL questions in section A. For section B, answer TWO (2) questions only.
6. Answer ALL questions in English.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total 40marks)

INSTRUCTION: Answer ALL questions .

Please use the answer booklet provided.

Question 1

(a) It has been estimated that 80 percent of failure in machines are due to fatigue load. Briefly describe the terms 'fatigue load' and 'fatigue failure'.

(5 Marks)

(b) Research shows that there are a few fundamental concepts of the material fatigue behaviour. Briefly explain all the fundamentals.

(15 Marks)

Question 2

(a) A 50mm length (L), 10mm width (D) rectangular plate has a 5mm diameter (d) central hole given in Figure 1. The allowable stress due to applying a tensile stress is 700 MPa. Find the maximum tensile force, P that can be applied if thickness (t) of the plate is 5mm. Find the K from Figure 2.

(10 Marks)

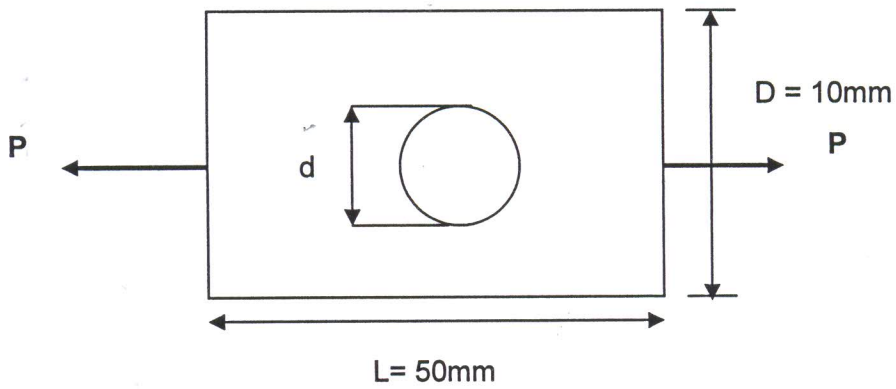

Figure 1

(b) The stresses at a point in a body are $\sigma_1 = 147\ MPa, \sigma_2 = -35\ MPa$. Material test give $\sigma_{yp} = 280MPa$.

(i) Find the factor of safety, F_S by using the maximum shear theory of failure (5 Marks)

(ii) Find the factor of safety, F_S by using the distortion energy theory. (5 Marks)

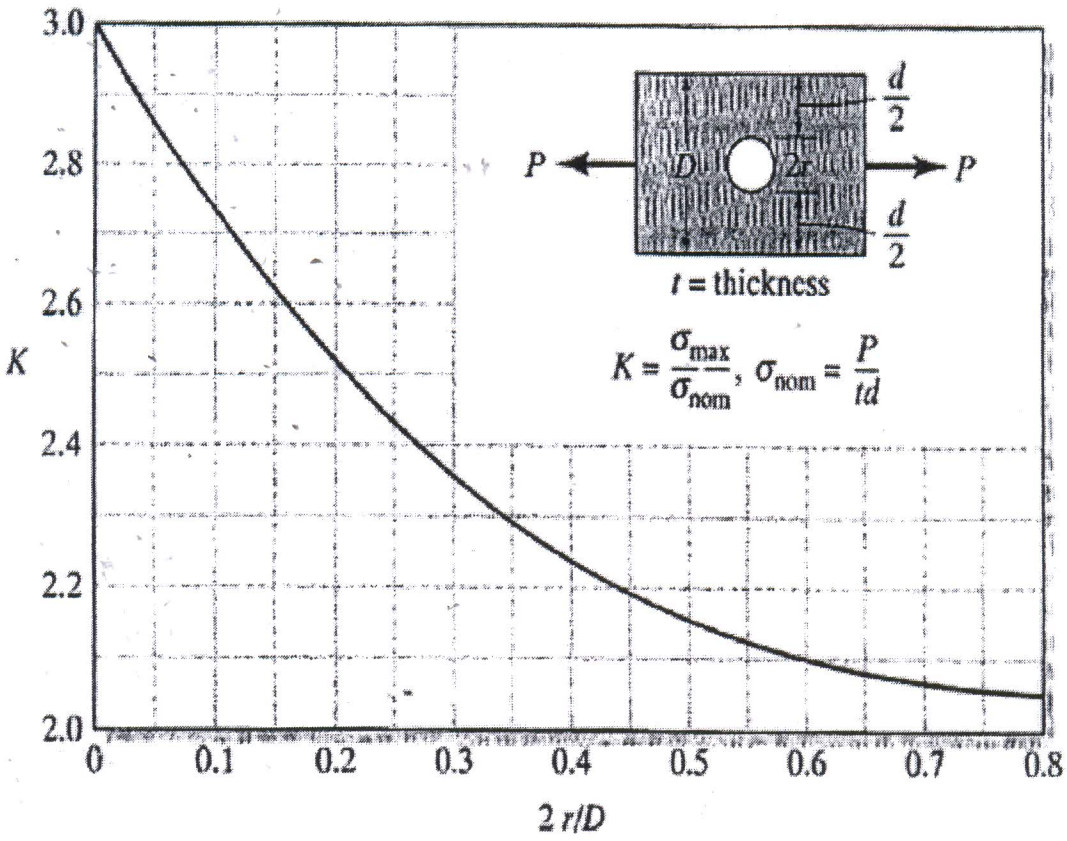

Figure 2

SECTION B (Total 60 marks)

INSTRUCTION: Answer 2 (TWO) questions ONLY.

Please use the answer booklet provided.

Question 1

(a) In the process of transmitting power at a given rotational speed, shaft may be subjected to torque. So to come out with a good shaft design it required the general procedure. Describe the five general procedures for shaft designs.

(5 Marks)

(b) An assembly of belts has tensile forces applied as shown in Figure 3 below and frictionless journal bearings at location A and B. The yield strength of the shaft material is 500 MPa and factor of safety, $F_S = 2$.

(i) Provide the free body diagram, moment diagram in x-y plane, moment diagram in x-z plane and the torque diagram for the equilibrium state of the above system.

(16 Marks)

(ii) From the moment diagram in x-y plane and moment diagram in x-z plane, compute the maximum moment, M_{MAX} which is at point C.

(3 Marks)

(iii) Determine the smallest safe shaft diameter by using the Mises-Hencky Theory

(3 Marks)

(iv) Determine the smallest safe shaft diameter by using the Maximum Shear Theory

(3 Marks)

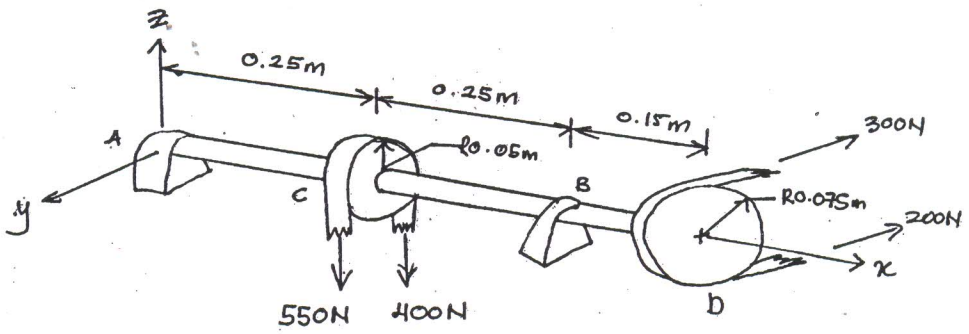

Figure 3

Question 2

A belt 100 mm wide and 10 mm thick is transmitting power at 1000 meters/min. The net driving tension is 1.8 times the tension on the slack side. If the safe permissible stress on the belt section is 16 N/mm^2 Assume density of the leather as 1000 kg/m^3 ; calculate

(a) The maximum power that can be transmitted at this speed

(13 marks)

(b) The speed of the belt for maximum power

(5 marks)

(c) the absolute maximum power that can be transmitted by this belt and the speed at which this can be transmitted?

(12 marks)

Question 3

The lead screw of a lathe has Acme thread of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial force of 2500 N in order to drive the tool carriage. The thrust is carried on a collar of 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 rpm. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar. Angle for Acme thread s is 29° or β = 14.5°. Determine,

(a) The power required to drive the screw. (20 marks)

(b) The efficiency of the lead screw (10 marks)

END OF QUESTION