L-4/T-1/IPE Date: 09/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations (January 2020 Term)

Sub: **IPE 317** (Product Design II)

Full Marks: 180 Section Marks: 90 Time: 2 Hours (Sections A + B)

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **THREE** questions in this section. Answer any **TWO**.

Assume any missing data.

Machine design book will be supplied.

1. (a) A 02-series single-row deep-groove ball bearing with a 65 mm bore is loaded with a 3 kN axial load and a 7 kN radial load. The outer ring rotates at 500 rev/min. **(20)**

   i. Determine the equivalent radial load that will be experienced by this particular bearing.

   ii. Determine whether this bearing should be expected to carry this load with a 95 percent reliability for 10 kh.

   (b) A 20° 20-tooth cast-iron spur pinion having a module of 4 mm drives a 32-tooth cast-iron gear. Find the contact stress if the pinion speed is 1000 rev/min, the face width is 50 mm, and 10 kW of power is transmitted. **(25)**

2. (a) Estimate the remaining life in revolutions of a 02-30 mm angular-contact ball bearing already subjected to 200000 revolutions with a radial load of 18 kN, if it is now to be subjected to a change in load to 30 kN. **(20)**

   (b) A 20° full-depth steel spur pinion has 24 teeth and a module of 5 mm, and it transmits 4.5 kW at a speed of 50 rev/min. Find an appropriate face width if the allowable bending stress is 140 MPa. **(25)**

3. A journal bearing has a shaft diameter of 75.00 mm with a unilateral tolerance of -0.02 mm. The bushing bore has a diameter of 75.10 mm with a unilateral tolerance of 0.06 mm. The bushing is 36 mm long and supports a load of 2000 N. The journal speed is 720 rev/min. An SAE 20 oil is used having an average temperature of 60°C. If the operating temperature is 60°C and SAE 40 lubricating oil is used, for minimum clearance assembly, find- **(45)**

   i. The magnitude and position of the minimum oil film thickness.

   ii. The eccentricity.

   iii. The coefficient of friction.

   iv. The torque to overcome friction.

   v. The power loss to friction.

   vi. Total volumetric flow rate.

vii. The side flow rate.

viii. Maximum film pressure.

ix. The angular location of the maximum pressure.

x. The terminating position of the oil film.

SECTION – B

There are **THREE** questions in this section. Answer any **TWO**.

4. (a) State the differences and similarities between Design for Assembly (DFA) and Design for Manufacturing (DFM). **(15)**

(b) State and discuss the four purposes for prototypes. **(15)**

(c) Discuss the importance of Life Cycle Thinking from the point-of-view of a manufacturer. **(15)**

5. (a) State the considerations to keep in mind for DFM (Design for Manufacturing) for Injection Molded Parts. Provide proper diagrams. **(20)**

(b) Machined parts also follow the concepts of DFM (Design for Manufacturing). State some of the instructions for DFM of machined parts. **(25)**

6. (a) State the design guidelines for DFE (Design for Environment). How will you make use of these guidelines when updating a prototype? **(15+15)**

(b) What do you understand by 'lines of maintenance'? State and discuss the different 'lines of maintenance'. **(15)**