

Program: B. Sc.(ME) / B. Sc.(IPE)/ B. Sc.(TE)  
Semester: 8<sup>th</sup> /8<sup>th</sup>/4<sup>th</sup>

Date: 5<sup>th</sup> March, 2024 (Tuesday)  
Time: 2:30 pm – 4:00 pm

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING**

**Mid Semester Examination**  
**Course Number: IPE 4821**  
**Course Title: Machine Tools**

**Summer Semester: 2022 – 2023**  
**Full Marks: 75**  
**Time: 1 Hour 30 Minutes**

There are **three** questions. Answer **all the** questions. The symbols have their usual meanings. Marks of each question are mentioned with the questions and corresponding CO and PO and the total marks are written on the right side. Assume reasonable values of missing data.

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- 1. a) Upon **defining** the term machine tool, **discuss** its unique characteristics. 25  
**Discuss** different methods which can be implemented to enhance the productivity level of machine tools. (6 Marks) (CO1)  
(PO1)
  - b) **Classify** the machine tools guideway (names only). **Suggest** the most suitable type of guideway mechanism that can minimize the stick-slip and material wear and **justify**. (6 Marks)
  - c)
    - I. **Illustrate** a center lathe and **label** the major parts. (8 Marks)
    - II. **Differentiate** between Turret Lathe and Capstan lathe in a tabular format. (5 Marks)
  - 2. a)
    - I. **Illustrate** a plain milling cutter and label its major elements. 25  
(5 Marks) (CO1)
    - II. **Illustrate** the nomenclature of a single point cutting tool. (5 Marks) (PO1)
  - b)
    - I. **Differentiate** between a shaper and a planer machine in a tabular format. (4 Marks)
    - II. **Illustrate** the kinematic system of a shaper machine. (6 Marks)
  - c) **Write** a short note on (**anyone**) of the following topics:
    - I. Abrasive grains of grinding wheel (5 Marks)
    - II. Grade of grinding wheel (5 Marks)

3. a) Write a short note on the machine tool drive system through the illustration of a simple figure showing the major sub-components. (10 Marks)
- b) A design specification of a machine tool shows that it will operate under variable loading conditions. The expected load variation based on process analysis is shown in Figure 1. For generating primary motion, a motor with an overloading coefficient of 1.3 must be used. According to the design, this machine will transfer the primary motion from the motor to the helical gear drive shaft using a v-type belt. The gear drive utilizes a disc-clutch while changing the gear ratio in speed changing mechanism. Based on the load variation graph provided in Figure 1, analyze the required power rating of the required motor for generating primary motion. (15 Marks)

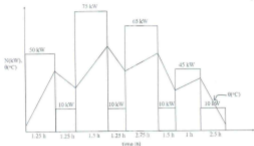


Figure 1: Variable Loading Condition of Designed Machine Tool of question 3(b).

Table 1.1 Values of coefficient of efficiency for various transmission and supports<sup>1</sup>

Type of Transmission or Support	Coefficient of Efficiency
Belt drive with flat belt	0.98
Belt drive with V-belt	0.96
Spir gear drive	0.98
Helical gear drive	0.97
Bevel gear drive	0.96
Ball or roller bearing	0.995
Crank and slider mechanism	0.90
Jaw clutch	0.95
Multiple-disc friction clutch operating in oil	0.90