B.Sc Engg. (IPE)/1st Sem

MPE Dpt.

2:30-04:30 PM Friday,09 January 2026

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

(1)

MID Semester Examination
Course No.: IPE 4101
Course Title: *Introduction to Industrial and Production Engineering*

Winter Semester: A.Y. 2024-2025
Time: 2 Hours
Full Marks: 120

There are **04 (Four)** Questions. Answer all of them. Marks in the margin indicate full marks. Do not write on this question paper. Symbols carry their usual meanings. Assume reasonable values for any missing data. Programmable calculators are not allowed.

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1. (a) SmartTech Ltd. is a manufacturing organization that produces electronic home appliances. The organization owns one factory where machines, workers, and materials are used to convert raw materials into finished products. The company management plans production, controls costs, and ensures quality and safety. Explain why the factory of SmartTech Ltd. is considered the basic unit of production and describe its **key concepts**. Explain how SmartTech Ltd. functions as a decision-making unit and identify the **types of decisions** taken at this level. **[10]** CO2, PO1 WK1, WK3

   (b) EcoHome Ltd. is a manufacturing organization that **mass** produces electric kitchen appliances. The company operates one factory where raw materials are processed, assembled, inspected, and packed. Due to increasing demand, the management plans to rearrange machines inside the factory to improve material flow and reduce handling time. Explain **which type of plant layout** is most suitable for EcoHome Ltd. and discuss its advantages and disadvantages. **[10]** CO2, PO1 WK1, WK3

   (c) EcoHome Ltd. has taken initiatives to reduce energy consumption, minimize waste generation, and improve worker safety in its manufacturing operations. Identify **which UN Sustainable Development Goal (SDG)** is being addressed by these initiatives. List the **eight targets** associated with this Sustainable Development Goal. **[10]** CO2, PO1 WK1, WK3

2. (a) A factory produces a single type of industrial component with an **annual production quantity of approximately 5,000–6,000 units**. Identify the **type of production** that should be adopted inside the factory. Draw a figure showing the relationship between **production quantity and product variety, and different types of production layouts.** **[10]** CO3, PO1 WK2, WK3

   (b) List and discuss about the four functions within the cycle of information processing activities within **'Manufacturing Support System'** **[10]** CO3, PO1 WK2, WK3

   (c) A glass manufacturing process produces flat glass sheets with a target final thickness of 6.0 mm. The process standard deviation is 0.12 mm. The company has decided to construct a 3-sigma control chart for the process mean. Five samples are taken each day, and the sample-mean thickness (mm) for five consecutive days is given below: **[10]** CO3, PO1 WK2, WK3

Day	Sample Mean
1	6.05
2	5.98
3	6.02
4	6.10
5	5.94

Draw the control chart and comment whether the process is **in-control or out-of-control**, with justification.

3 (a) Draw the **'Manufacturing Control Information Flow'** diagram and briefly discuss about **'Manufacturing Control'** function of manufacturing support system. **[15]**

CO5, PO1
WK2, WK3

(b) A quality control department collected data on customer complaints related to a manufacturing process over a certain period. The frequency of complaints in different areas is shown in the table below. **[15]**
CO5, PO1
WK2, WK3

Area of Complaint	Frequency
Dimensional error	38
Surface scratches	34
Improper assembly	6
Loose components	5
Color mismatch	4
Packaging defect	4
Missing parts	3
Excess noise	3
Wrong labeling	2
Others	1

(i) List the seven **Quality Control Tools.**

(ii) Draw a **Pareto Diagram** and identify the **vital few** and **trivial many** from the above data

4 **(a)** A factory produces a metal bracket using a **batch production** system. The bracket is processed at a work-center, and the production engineer collected the following time-study information for **one bracket**: **[18]**
CO4, PO1
WK3, WK4

Actual operation time = 2.5min/pc
Handling time = 0.8min/pc
Tool handling time = 0.7min/pc

Before starting each batch, the machine requires a **setup**:

Setup time= 45min
Batch quantity = 120pcs

The plant runs the following weekly schedule:

Number of shifts per week = 10shifts/week
Hours per shift = 8hr/shift

The same job can be processed in parallel using multiple identical resources:

Number of work-centers = 5

Now the plant manager informs you that due to real operating conditions:

Utilization, $U = 0.95$
Availability, $A = 0.95$

(i) Calculate the **cycle time**, T_c.
(ii) Calculate the **batch processing time**, T_b, to produce one full batch.
(iii) Calculate the **average production time**, T_p.
(iv) Calculate the **average production rate**, R_p(parts/hour).
(v) Calculate the **weekly production capacity**, PC(parts/week) assuming full scheduled time is available.
(vi) Calculate the **effective weekly production capacity** incorporating both **availability (A)** and **utilization (U)**.

(b) What are the important **Design Considerations** for designing Machine Tools. **[12]**
CO4, PO1
WK3, WK4