Tanta University		Production Engineering and Mechanical Design Department		Faculty of Engineering

Course Title: Industrial Organization	Date: Jan. 2022	Final exam
Course Code: **MPD 4124**	Allowed time: 3 hr.	No. of Pages: 2

Question One

a) A company is planning for the next year production plan. The demand for this year is summarized in **Table 1.** Considering the following data:

   i. Assume a starting inventory at the beginning of the year. Inventory can be modified according to conditions. All demands must be met and the same number of inventory must be at the end of the year.

   ii. Each worker can produce 1000 mobile per month on regular time. On overtime, a 25% of the regular production can be produced. Overtime can be used for only May, July and August.

   iii. Each worker is paid 1100$ monthly on regular. Overtime is paid 200% of regular time. A maximum of 30% overtime can be used during a month.

   iv. It costs 750$ to hire a worker, and 500$ to fire a worker.

   v. For inventory evaluation, the cost of carry inventory is assumed to be 1 cent per product per month.

Table 1			
Jan.	Feb.	March	April
175,000	150,000	160,000	200,000
May	Jun.	Jul.	Aug.
350,000	190,000	325,000	240,000
Sep.	Oct.	Nov.	Dec.
190,000	150,000	165,000	190,000

The management has decided to consider three aggregate plans (*Level work force, Level work force plus overtime, and Hire/Fire strategy*). Evaluate the three plans and suggest the best one.

Question Two

a) Consider the activities in the **Table 2 (without resources).**

   i. Draw the precedence diagram

   ii. Use ranked positional weight technique to design the assembly line with its workstations then compute the balance delay

   iii. Change the cycle time to get the minimum balance delay for this assembly line.

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Question Three

a) What is meant by critical path? Why it is critical?

b) Consider a project with its activities and resources in **Table 2.**
   i.   Draw AON networks
   ii. Get a **table** of the earliest start, earliest finish, latest start and latest finish time for all activities of the project.
   iii. Determine the critical path.
   iv. Draw a bar chart for the project
   v.   Develop a resource schedule according to the given data.

Table 2			Resource requirements					
Activity	Duration	Predecessor	R1	R2	R3	R4	R5	R6
C	2	-	5	2	2	2	7	4
D	4	C	3	5	2	3	9	6
E	10	C	2	4	4	2	3	1
F	20	E	5	4	3	5	5	4
G	10	C	3	5	2	3	8	0
H	5	F	4	1	4	9	2	5
I	7	D	4	1	4	3	9	8
J	14	H, I	5	5	4	0	9	1
K	1	C	3	2	4	3	4	2
L	10	K	1	5	4	6	7	3
M	3	L	3	3	2	4	5	1
N	13	M, J	3	2	2	8	3	4
O	20	N	2	2	2	2	4	8
P	7	O	1	4	4	3	4	1
Q	2	P	5	5	4	6	2	3
R	2	Q	3	2	3	4	7	8
S	7	P	4	5	4	2	3	4
T	5	S	5	3	3	3	7	8
U	4	T, R, G	2	4	6	2	3	4
Resource Limits			7	10	10	16	18	13

With my best wishes

Prof. Ahmed ElKassas

Tanta University		Production Engineering and Mechanical Design Department		Faculty of Engineering

Course Title: Plant Layout	Date: Jan. 2022	Final exam
Course Code: **MPD 4125**	Allowed time: 3 hr.	No. of Pages: 1

Question 1

(A) Mention a known mechanical machine or an assembly of at least ten parts and then construct a bill of materials, an assembly chart, and an operation process chart for it. Identify the components that are purchased and the ones that are prepared internally.

(B) Mention with sketched the types of flow in facilities.

(C) Differentiate between the product layout and the process layout.

Question 2

(A) Part A is produced on machine 1 and then machine 2. One unit of Part A is assembled with three units of Part B, which is produced on machine 3, in assembly station 4. Machine 1 has a scrap factor of 20%, and machine 2 has a scrap factor of 10%. The assembly process has a scrap factor of 15%. Another part, Part C, is produced on machine 5 and has a scrap estimate of 25%. Part C and the subassembly comprison of Part A and Part B are assembled at assembly station 6 into the completed product. Each day, 15,000 units of the completed product are required to meet demand. Assuming that machine 3 and assembly station 6 have scrap factors of 30% each, what are the requirements for Parts A, B, and C in order to meet the daily demand for the completed product?

(B) Components 1 and 2 have similar handling requirements. Moving two units of either component 1 or 2 is equivalent to moving one unit of component 3. The production volumes for components 1, 2, 3 are 30, 12, 7, respectively. Moreover, the routing sequences are A-C- B-D-E for 1, A-B-D-E for 2, and A-C-D-B-E for 3. Create a from–to chart.

Question 3

(A) A manufacturing facility consists of five departments, 1, 2, 3, 4 and 5. It produces four components having the manufacturing product routings and production volumes indicated below. Construct a relationship

Component	Production Routing	Units per Week
1	1-2-3-4-5	10
2	4-3-5	15
3	2-3-5-1	30
4	5-4-3-2-1	20

chart using the following rules: "A" for 85–66 trips between departments, "E" for 65–46, "I" for 45–26, "O" for 25–6, and "U" for 5–0. Then, find closeness ranks and selection order.
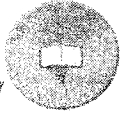
(B) Flow and distance information for three facilities A, B, C and three locations 1, 2, 3 are as shown in the following table. Apply the two-opt and three-opt heuristic on this problem. Generate all corresponding solutions, calculate the objective function value for each of them.

From\to	A	B	C	From\to	1	2	3
A	0	2	8	1	0	8	10
B	2	0	4	2	8	0	4
C	8	4	0	3	10	4	0

(C) Consider the following locations with their corresponding locations and fixed and variable associated cost as shown in the following table. Find the best location using the center of gravity method and the break-even analysis.

A	(2.5, 4.5)	$250,000	$52
B	(3.5, 2.5)	$350,000	$48
C	(4.5, 4.5)	$300,000	$25
D	(5, 2.5)	$400,000	$25

Tanta University		Department: Production and Mechanical Design Total Marks: 85 Marks		Faculty of Engineering

Course Title: (مقرر اختياري 3) CNC Machines Date: Jan. 24 th 2023 (First term)	Course Code: MPD4130 Allowed time: 3 hrs	Year: 4th No. of Pages: (2)

Remarks: (answer the following questions... assume any missing data... answers should be supported by sketches)

Problem number (1):   (15 Marks)

Choose the correct answer:

1. In NC machine tools one functions may be automatic:
   a) Changing of tools in the spindle
   b) Punched cards
   c) Magnetic tape

2. Program of instructions
   a) Closed loop
   b) 35 mm motion picture film
   c) Machine tool

3. Controller unit
   a) Limited logic beyond direct input
   b) Inch-wide punched tape
   c) Open loop

4. Basic components of NC system
   a) Machine tool or other controlled process
   b) Starting and stopping of machine tool spindle
   c) Positioning the tool tip at desired location

5. Define of Numerical Control
   a) Punched cards
   b) A form of programmable automation in which process is controlled by numbers, letters and symbols
   c) Machine tool or other controlled process

6. The step must be accomplished, To utilize NC in manufacturing
   a) Limited programming capability
   b) Limited logic beyond direct input
   c) The part programmer plans the process

7. Two Ways to program for numerical control
   a) Manual Part Programming and Computer Assistant part programming
   b) Limited programming capability and Manual Part Programming
   c) Limited logic beyond direct input and the job is produced on an N. C

8. Extensions of NC
   a) Limited programming capability and Manual Part Programming·
   b) Manual Part Programming and Computer Assistant part programming
   c) Adaptive Numerical Control and Industrial Robots

9. To select ball screws
   a) Required positional accuracy
   b) Limited programming capability
   c) Limited logic beyond direct input

10. Ball screws: drawbacks
   a) Preloading can eliminate backlash
   b) More prone to damage during installation than conventional lead screws
   c) Minimal thermal effects

Problem number (2)   (20 Marks)
Write short notes about:
   a) Write short note about Numerical Control (NC)?   (6 Marks)
   b) Ways to program for numerical control?   (7 Marks)
   c) Comparison between milling CNC and Conventional Machine?   (7 Marks)
   d) Explain CNC Components?   (6 Marks)

Problem number (3)   (20 Marks)
Write a program to turn a workpiece dimensions 60 mm diameter and 70 mm length to produce the product as shown below. To make a peck hole 12 diameter and length 70 mm length, assume speed and feed rate.
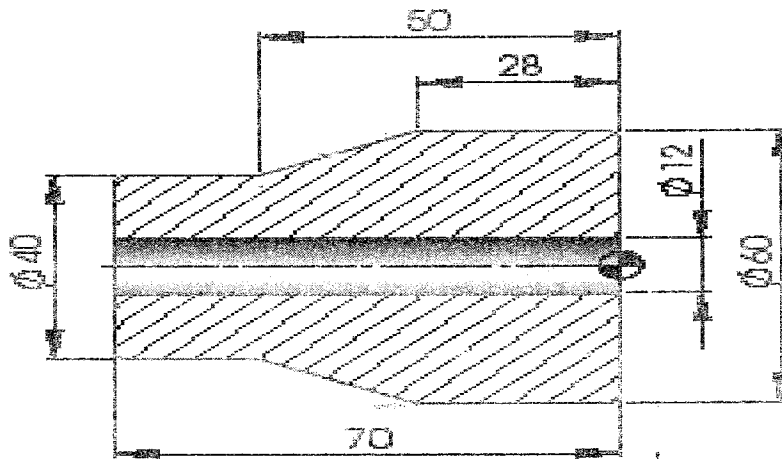
Problem number (4)   (30 Marks)
A raw material dimensions 6.0 inch X 4.0 inch and depth 1.0 inch. Write a program to produce a work piece with depth 0.5 inch as shown in Figure below, cutting conditions are speed 180m/min., and feed rate 0.15 mm/rev.

2
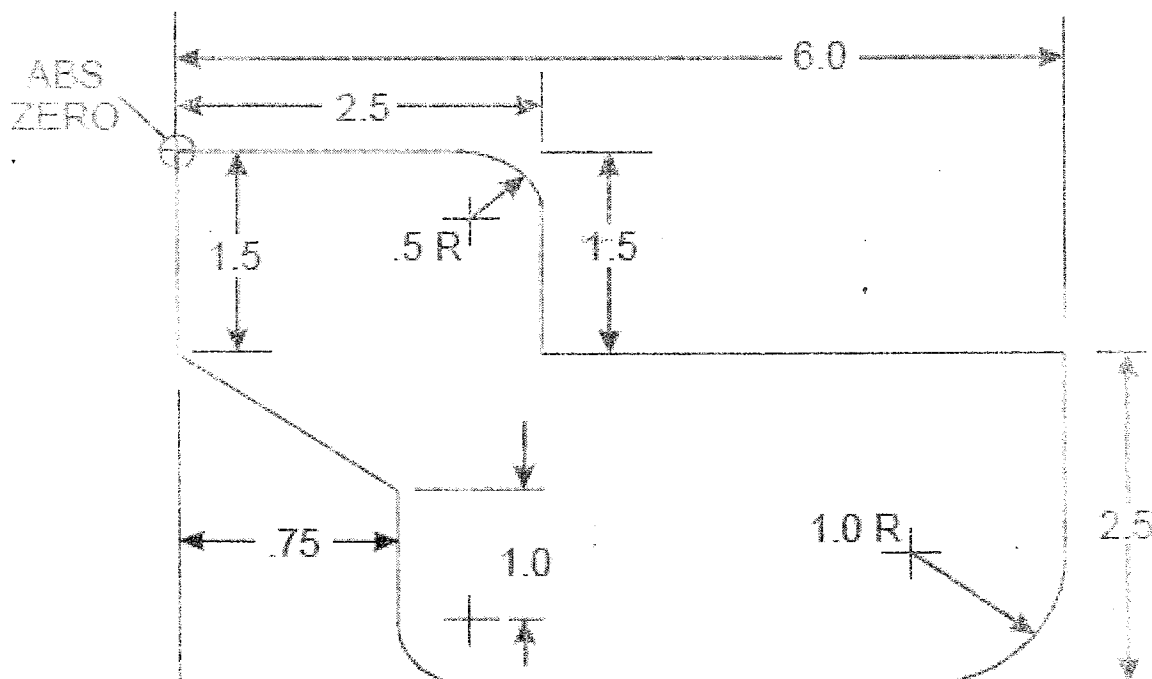
Tanta University	**Production Engineering and Mechanical Design Department** Final Exam – First Term – Academic Year 2022/2023	**Faculty of Engineering**
Course Title: Metrology	Course Code: MPD4126	Year: 4TH Year Production Students
Date: 10 January 2023	Allowed Time: 3 Hrs.	Total Marks: 90

تعليمات: (١) الامتحان مكون من سؤالين في أربع صفحات – (٢) أجب عن جميع الأسئلة مع افتراض أي بيانات ناقصة – (٣) دعم إجابتك بالرسم كلما أمكن ذلك.

Question 1: 40 × 1.25 Marks = 50 Marks

من فضلك في (١) أي تشبه رقم (١) ضع الإجابة الصحيحة (الأكثر دقة) وظلل إجابتك في ورقة التصحيح الإلكتروني (البنفسجي) كراسة الإجابة باستخدام القلم الجاف الأزرق.

1- Metrology deals with the .... aspects of measurement.
   A- theoretical   B- practical   C- historical   D- A and B

2- The true value of a measurand cannot be determined because all measurements have ....
   A- traceability   B- uncertainty   C- repeatability   D- reproducibility

3- The role of .... in metrology is to draw conclusions about the target measurement system using a finite sample of measurements.
   A- differentiation   B- algebra   C- trigonometry   D- statistics

4- The .... certificate of a measuring device contains the instrumental error that should be included in the uncertainty of its subsequent use.
   A- calibration   B- origin   C- verification   D- inspection

5- The expanded uncertainty is calculated by multiplying the combined standard uncertainty by ....
   A- 1   B- 2   C- 2.58   D- the coverage factor

6- The process variability in production is usually approximated by a .... distribution with a standard deviation σ_p.
   A- uniform   B- triangular   C- normal   D- exponential

7- In .... acceptance, the product is accepted if the measurement result lies in the specification zone and rejected otherwise.
   A- simple   B- stringent   C- relaxed   D- obligatory

8- Guard bands .... the probability of taking a wrong accept/reject decision.
   A- increase   B- decrease   C- eliminate   D- balance

9- The influence of measurement on the transparency of economic transactions is concerned by .... metrology.
   A- scientific   B- industrial   C- legal   D- commercial

10- .... cannot be exactly determined because the *true value* can never be known exactly.
   A- Accuracy   B- Precision   C- Resolution   D- Sensitivity

11- The sample mean is a common measure of ....
   A- variation   B- spread   C- central tendency   D- skewness

12- Noise generated in electrical measuring devices can be considered as a source of ....
   A- random disturbances   B- systematic errors   C- uncertainty   D- A and C

13- The level of confidence is the probability that the .... value lies in the confidence interval.
   A- accurate   B- recorded   C- true   D- precise

14- The goal of any conformance test plan is to .... bad products.
   A- detect   B- remove   C- A and B   D- prevent

15- By increasing the process capability index C_p, the fraction of nonconforming products ....
   A- increase   B- decrease   C- remain constant   D- disappear

16- The disadvantage of simple acceptance is the higher probability of accepting a bad product when the measurement result lies near the ....
   A- gauging limits   B- center limits   C- relaxed limits   D- tolerance limits

17- If the guard band multiplier h has a negative value, this means that the decision rule includes ....
   A- simple acceptance   B- relaxed acceptance   C- conditional acceptance   D- stringent acceptance

18- Today, the kilogram is defined depending on the value of ....
   A- Planck constant   B- Avogadro constant   C- Boltzmann constant   D- speed of light in vacuum

19- The least significant digit in a digital readout represents the .... of the measuring instrument.
   A- resolution   B- precision   C- accuracy   D- uncertainty

20- As per ISO 1:2016, the dimensional calibrations should be performed at ....
   A- 15 °C   B- 20 °C   C- 25 °C   D- 30 °C

21- If the width of the tolerance zone is 0.2 mm and $\sigma_p = 0.02$ mm, then the process capability index C_p equals ....
   A- 1.67   B- 2.5   C- 5   D- 10

22- A simple acceptance and rejection 5:1 decision rule requires the expanded uncertainty to be no larger than .... of the specification zone.
   A- 0.01   B- 0.02   C- 0.1   D- 0.2

23- If $T_U = 25.05$ mm, $T_L = 24.95$ mm, and $g = +0.015$ mm; then the width of the acceptance zone is ....
   A- 0.05 mm   B- 0.06 mm   C- 0.07 mm   D- 0.08 mm

24- Derived units are .... of powers of the base units.
   A- sum   B- difference   C- product   D- A or B

25- Random measurement error is ....
   A- constant   B- predictable   C- constant or predictable   D- unpredictable

26- In Type A evaluation method, the uncertainty is quantified statistically from ……… observations.

A- repeated   B- dependent   C- predicted   D- unpredicted

27- In ……… evaluation method, the uncertainty is quantified by scientific judgment.

A- Type A   B- Type B   C- Type AB   D- Type C

28- Large values of measurement capability index C_m mean low measurement ……… relative to the tolerance width.

A- repeatability   B- reproducibility   C- uncertainty   D- sensitivity

29- Stringent acceptance increases confidence in product quality by ……… the probability of accepting an out-of-specification product.

A- reducing   B- increasing   C- stabilizing   D- optimizing

30- To assure conformance probability 95 %, the gauging limits should be offset from the tolerance limits by g = ……… × U. ,,,, راجع الجدول فى نهاية الصفحة

A- 0.42   B- 0.52   C- 0.64   D- 0.82

31- ……… is used to calibrate gauge blocks.

A- Frequency meter   B- Interferometer   C- Inter-optimizer   D- Laser meter

32- ……… is the value observed and recorded at the time of measurement.

A- Repeatable value   B- Reproducible value   C- Reading value   D- Reference value

33- The resolution uncertainty of a measuring instrument is considered as a ……… uncertainty source.

A- Type A   B- Type B   C- Type AB   D- Type C

34- In the case of symmetric two-sided guard bands, ………

A- $g_L > g_U , g_U = g$ B- $g_L < g_U , g_L = g$ C- $g_L \neq g_U , g_L = g$ D- $g_L = g_U = g$

35- Typically, the supplier who requests ……… acceptance in case of conflict with the customer.

A- stringent   B- relaxed   C- conditional   D- simple

36- ……… standards typically used for the realization of the units of measurement.

A- Primary   B- Secondary   C- Working   D- Industrial

37- Metrological ……… is obtained through an unbroken chain of calibrations.

A- traceability   B- repeatability   C- reproducibility   D- referability

38- A product may be sold in reduced price if its measured feature lies in the ……… zone.

A- stringent acceptance   B- relaxed acceptance   C- relaxed rejection
D- transition

39- One-sided guard-band decision rule is used when the measured feature has ………

A- only an upper tolerance limit   B- only a lower tolerance limit   C- A or B
D- one measurement trial

40- If the temperature of a laboratory varies between 17 °C to 27°C, this means that the measure dimensions have a ……… bias انحياز.

A- positive   B- negative   C- zero   D- balanced

Question 2: 40 Marks

A $\Phi 30^{+0.75}_{-0.00}$ mm precision shaft is manufactured on a CNC-lathe machine at an industrial workshop. At the inspection stage, the final turned diameter was measured at the shop floor using a digital caliper to check its compliance with the specified tolerance. The measurement procedure was repeated 10 times, and the readings were as listed below.

i	1	2	3	4	5	6	7	8	9	10
Φ (mm)	29.96	29.95	29.97	29.93	29.97	29.96	29.94	29.95	29.97	29.96

The following data about the measurement process is known:
- The caliper's resolution is 0.01 mm
- The MPE of the caliper is less than 15 μm over its full range when measuring at 20 °C.
- The caliper CTE is in the range $(10 \pm 1) \times 10^{-6}$ / °C
- The workpiece CTE is within the range: 7×10^{-6} /°C to 13×10^{-6} /°C
- The workshop temperature is within the range: 13 °C to 27 °C
- The temperature difference between the caliper and the workpiece is within ± 0.5 °C.
- Workpiece form error: Negligible
- No correction is applied to the measurement result.

1) **Estimate:**
   - The measurement result. 4 Marks
   - Type A uncertainty. 4 Marks
   - The resolution uncertainty of the caliper. 4 Marks
   - The calibration uncertainty of the caliper. 4 Marks
   - The uncertainty due to the differential thermal expansion. 4 Marks
   - The uncertainty due to the temperature difference between the caliper and the workpiece. 4 Marks
   - The combined standard uncertainty. 4 Marks
   - The expanded uncertainty. 4 Marks

2) Check if the shaft is accepted based on a 4:1 simple acceptance and rejection decision rule. *sketch your answer.* 3 Marks

3) Write down the traceability demonstration report of the shaft measurement results as per ASME B89.7.5. 5 Marks

انتهت الأسئلة

مع أطيب التمنيات بالتوفيق والنجاح …. د.م/ أحمد حوام واللجنة

Conformance Probability, P_c	Guard Band Multiplier, h
0.80	0.42
0.85	0.52
0.90	0.64
0.95	0.82
0.99	1.16
0.999	1.55

Q1. (12 Marks)

1. Briefly explain the different classifications of the composite materials?

2. What are the advantages and limitations of composite materials?

3. List the different properties of matrix and the reinforcement in the composite materials?

4. Define the metal matrix composites and give the distinctive features, properties, and applications of it?

5. Cite the properties that may be improved by particles reinforcements in composite materials?

6. What is the dispersion strengthened composites? Show your answer with example?

Q2. (16 Mark)

1. Compare between aligned fiber composites and randomly oriented fiber composites regarding the mechanical properties?

2. Draw the curve presents the relation between the fibers orientation and the tensile strength?

3. Define the following Lamina and a laminate?

4. Explain the difference between homopolymer and copolymers?

5. List the different types of the copolymers?

6. Classify polymers based on both the mode of formation and the molecular structure? Give example for every type?

7. Define polymer crystallinity? What are the factors affect the degree of crystallinity?

8. Cite three characters of thermoset polymers?

Q3. (35 Marks)

1. A continuous and aligned glass fiber-reinforced composite consists of 40 vol% of glass fibers having a modulus of elasticity of 69 GPa (psi) and 60 vol% of a polyester resin that, when hardened, displays a modulus of 3.4 GPa (psi).

   a) Compute the modulus of elasticity of this composite in the longitudinal direction.

   b) If the cross-sectional area is 250 mm^2 (0.4 in.^{2}) and a stress of 50 MPa (7250 psi) is applied in this longitudinal direction, compute the magnitude of the load carried by each of the fiber and matrix phases.

   c) Determine the strain that is sustained by each phase when the stress in part (**b**) is applied.

2. What are the advantages and applications of carbon fibers?

3. Draw schematic diagram showing the different manufacturing processes of PMCs using thermoset and thermoplastic resins?

4. Explain briefly the hand layout manufacturing process of PMCs? and list its advantages and limitations?

5. Compare between hand lay-up and spry-up layout manufacturing process of PMCs?

Q4. (12 Marks)

1. Briefly describe pultrusion and filament winding, cite the advantages and disadvantages of each.

2. List the advantages and limitations of vacuum bagging process.

3. Compare between SMC, TMC and BMC

4. Why is necessary to thicken the SMC paste?

5. List the two thickening mechanisms in SMCs manufacturing process.

6. List the three manufacturing processes of CMCs.

With my best wishes
Dr. Eng. Saad .M. Ebied