Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	COMPUTER AIDED DESIGN AND MANUFACTURING
COURSE CODE	:	BDD 40203
PROGRAMME	:	4 BDD
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL QUESTIONS** IN **SECTION A** AND **THREE (3) QUESTIONS** IN **SECTION B**

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A: ANSWER ALL QUESTIONS

Q1 (a) Explain why datum is important in precision engineering drawing and components.

(2 marks)

(b) The dimension of hole in drawing is stated as ∅10 H7 g6. By using **Tables 2,3 and 4**, calculate:

i. tolerance of shaft and hole.

ii. name the type of fits.

(4 marks)

(c) Interpret the drawing in **Figure Q1(c)** according to the concept of Geometric Dimension and Tolerancing (GD&T).

(4 marks)

(d) As a Quality Engineer, you need to measure the dimension and accuracy of a component as shown in **Figure Q1(d)**. This component comes without any specification of GD&T. Evaluate this component and provide the details of datum reference, feature control frame and material conditions.

(10 marks)

Q2 (a) Explain the function of interpolation method in Computer Numerical Control (CNC) motion system.

(2 marks)

(b) A 40 mm diameter face mill with six cutting edges is programmed to rotate at 500 rpm. The depth and width of cut are set at 5 mm and 20 mm, respectively. The cutting process is moving at the constant feed rate of 30 mm/min on the mild steel workpiece. It has a specific cutting force of 1950 MPa and machine efficiency is at 90%. Calculate:

i. Cutting speed.

ii. Requirement of power to perform the process.

(4 marks)

(c) What is absolute positioning and incremental positioning by differentiating their concept? Sketch a drawing to support your answer.

(4 marks)

(d) Evaluate the drawing in **Figure Q1(d)**, suggest a suitable cutting tool, machining parameters to be used and construct a complete CNC part programming.

(10 marks)

SECTION B: ANSWER THREE QUESTIONS ONLY

Q3 (a) Explain the function of Terminate Section of Initial Graphic Exchange Specification (IGES).

(4 marks)

(b) How does the direct and indirect translator work under data exchange.

(4 marks)

(c) Differentiate between pre-processor and post-processor in IGES.

(6 marks)

(d) You have received a drawing from supplier and saved under .SLDPRT format. Unfortunately, the file is unable to be opened using your current CADCAM software. Provide a solution to overcome the aforementioned problem and support the answer with the Standard Communication for CAD.

(6 marks)

Q4 (a) Differentiate between Variant and Generative approaches in Computer Aided Process Planning (CAPP).

(5 marks)

(b) A vertical machining center is driven by a closed loop system consisting of a servo motor, ballscrew and optical encoder. The ballscrew has a pitch, p of 0.3 mm and is coupled to the servo motor shaft with a screw to motor gear ratio 1:1. The encoder generates 200 pulses per revolution (N) of the ballscrew. If the number of pulses (n) and the pulse rate (f) received by the control system are 1000 and 50Hz, calculate:

i) The work table speed, v.
ii) Distance traveled by the table, x.
iii) Basic length unit (BLU).
iv) The new table speed (v) if the ratio between motor and lead screw is 2:1.

(5 marks)

(c) **Figure Q1(d)** shows an engineering component to be fabricated using machining process. As a CADCAM engineer, you need to strategize and optimize the process. Propose a complete process plan to complete the machining process.

(10 marks)

Q5 (a) Local Area Network (LAN) is intended to serve a number of users who are located close together. Base from this scenario, illustrate and explain the point-to-point LAN system.

(6 marks)

(b) Open System Interconnection (OSI) consists of several layers for data communication. Explain the following layers:

i. Network layer.
ii. Presentation layer.

(4 marks)

(c) As a Process Engineer, you are assigned to set up a new manufacturing facility by implementing Flexible Manufacturing System (FMS). The equipments of FMS need to be communicated between. Propose and discuss **THREE (3)** techniques that can be used as a network topology to communicate and integrating all systems in the manufacturing plant.

(10 marks)

Q6 (a) Part classification and coding is divided into three categories. One of the category is systems based on part manufacturing attributes. Explain the function of this system in Group Technology (GT).

(4 marks)

(b) Write an OPITZ code for a given component shown in **Figure Q6 (b)**. You can use **Table 1** as a guideline.

(6 marks)

(c) Logical Decision is a traditional implementation technique used in Computer Aided Process Planning (CAPP). It consists of decision table, decision tree and artificial intelligence (AI). Give your opinion why these elements are important when developing the CAPP.

(10 marks)

- END OF QUESTION –

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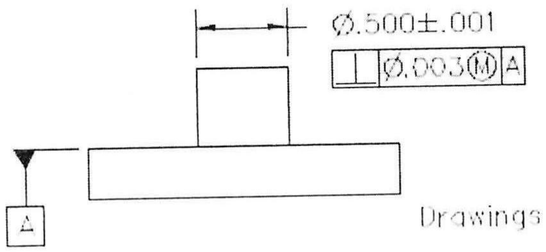
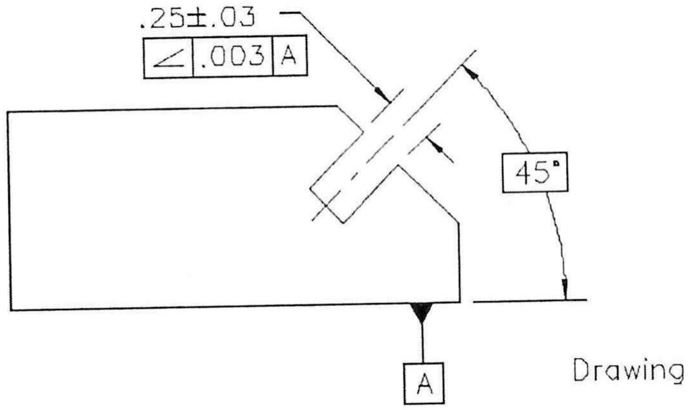


(i)



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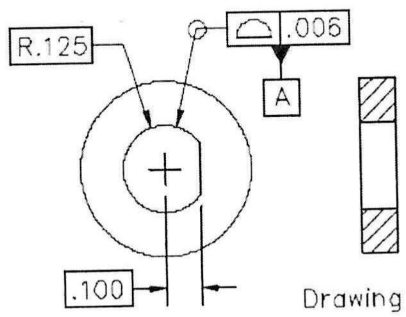

(iii)

Figure Q1(c)

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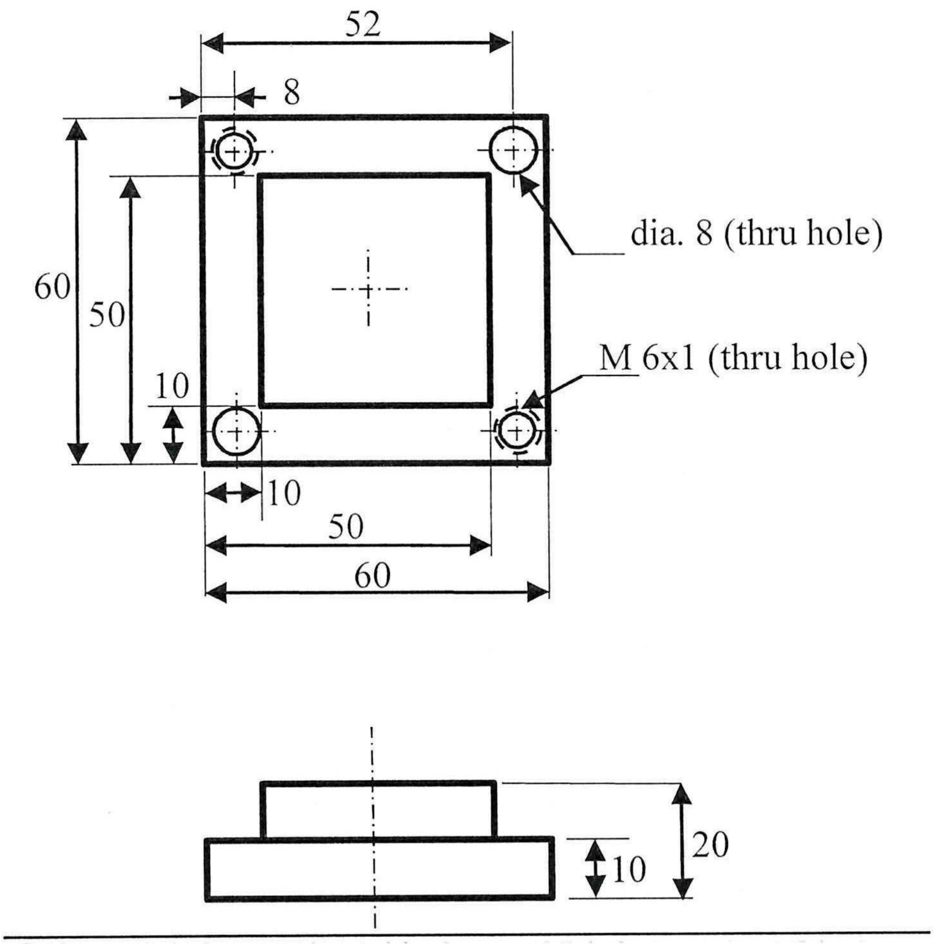

Unit is in millimeter

Figure Q1(d)

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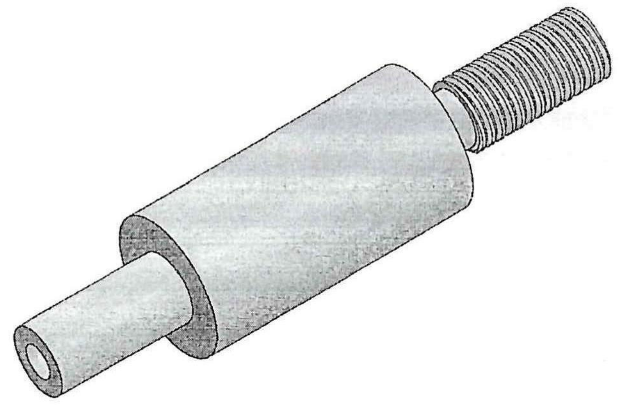

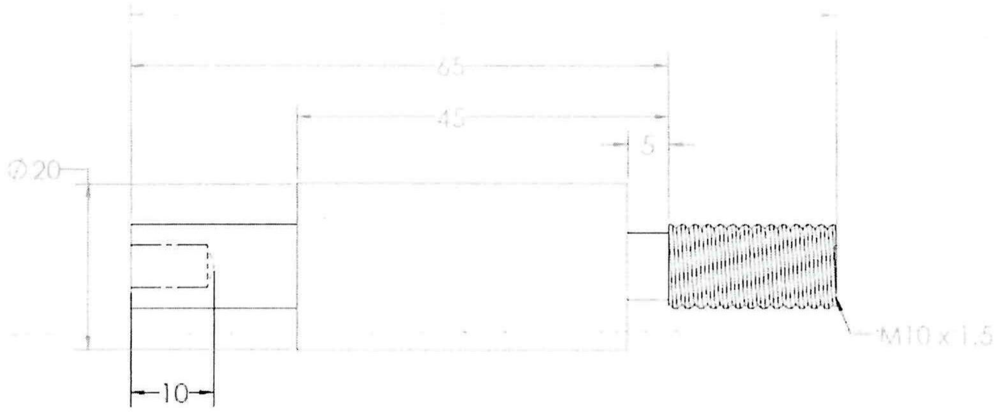

Figure Q6(b)

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Table 1 OPITZ digit

Form code (digit 1-5) for rational parts in the optiz system. Part classes 0, 1, and 2

Digit 1		Part class	Digit 2		External shape, external shape element	Digit 3		Internal shape, internal shape element	Digit 4	Plane surface machining	Digit 5		Auxiliary holes and gear teeth
0	Rotational parts	L/D ≤ 0.5	0		Smooth no shape element	0		No hole, no breakthrough	0	No surface machining	0	no gear teeth	No auxiliary hole
1	Rotational parts	0.5 < L/D < 3	1	Stepped at one end	No shape element	1	Smooth or stepped to one end	No shape element	1	Surface plane and/or curved in one direction	1	no gear teeth	Axial, not on pitch circle diameter
2	Rotational parts	L/D ≥ 3	2	Stepped at one end	Smooth thread	2	Smooth or stepped to one end	Thread	2	External plane surface related by graduation around a circle	2	no gear teeth	Axial on pitch circle diameter
3			3	Stepped at one end	Smooth functional groove	3	Smooth or stepped to one end	Functional groove	3	External groove and/or slot	3	no gear teeth	Radial, not on pitch circle diameter
4			4	Stepped at both end	No shape element	4	Stepped at both end	No shape element	4	External spline (polygon)	4	no gear teeth	Axial and/or radial and/or other direction
5			5	Stepped at both end	Thread	5	Stepped at both end	Thread	5	External plane surface and/or slot, external spline	5	no gear teeth	Axial and or radial on pitch circle diameter and or other direction
6			6	Stepped at both end	Functional groove	6	Stepped at both end	Functional groove	6	Internal plane surface and/or slot	6	With gear teeth	spur gear teeth
7	Nonrotational parts		7		Functional cone	7		Functional cone	7	Internal spline (polygon)	7	With gear teeth	Bevel gear teeth
8	Nonrotational parts		8		Operating thread	8		Operating thread	8	Internal and external polygon, groove and/or slot	8	With gear teeth	Other gear teeth
9	Nonrotational parts		9		All others	9		All others	9	All others	9	With gear teeth	All others

Table 2 IT tolerances

Basic size (mm)		Standard tolerance grades (IT)																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14[1)]	15[1)]	16[1)]	17[1)]	18[1)]
over	up to	Tolerances (μm)											Tolerances (mm)						
–	3	0.8	1.2	2	3	4	6	10	14	25	40	60	0.10	0.14	0.26	0.40	0.60	1.00	1.40
3	6	1	1.5	2.5	4	5	8	12	18	30	48	75	0.12	0.18	0.30	0.48	0.75	1.20	1.80
6	10	1	1.5	2.5	4	6	9	15	22	36	58	90	0.15	0.22	0.36	0.58	0.90	1.50	2.20
10	18	1.2	2	3	5	8	11	18	27	43	70	110	0.18	0.27	0.43	0.70	1.10	1.80	2.70
18	30	1.5	2.5	4	6	9	13	21	33	52	84	130	0.21	0.33	0.52	0.84	1.30	2.10	3.30
30	50	1.5	2.5	4	7	11	16	25	39	62	100	160	0.25	0.39	0.62	1.00	1.60	2.50	3.90

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Table 3 Hole tolerances

Nominal Bore dia. (mm)		Deviation classes of housing bore														
over	up to	E 6	F 6	F 7	G 6	G 7	H 6	H 7	H 8	H 9	H 10	JS 5	JS 6	JS 7	J 6	J 7
10	18	- 43 - 32	+ 27 + 16	+ 34 + 16	+17 + 6	+ 24 + 6	-11 0	+ 18 0	+ 27 0	- 43 0	+ 70 0	± 4	± 5.5	± 9	+ 6 - 5	+10 - 8
18	30	- 53 - 40	+ 33 - 20	+ 41 + 20	+20 + 7	+ 28 + 7	-13 0	+ 21 0	+ 33 0	- 52 0	+ 84 0	± 4.5	± 6.5	±10.5	+ 8 - 5	+12 - 9
30	50	- 66 - 50	+ 41 + 25	+ 50 - 25	+25 + 9	+ 34 + 9	-16 0	+ 25 0	+ 39 0	- 62 0	+100 0	± 5.5	± 8	±12.5	+10 - 6	+14 -11
50	80	- 79 - 60	+ 49 + 30	+ 60 + 30	+29 +10	+ 40 + 10	+19 0	+ 30 0	+ 46 0	+ 74 0	+120 0	± 6.5	± 9.5	±15	+13 - 6	+18 -12
80	120	- 94 - 72	+ 58 + 36	+ 71 + 36	+34 +12	+ 47 + 12	-22 0	+ 35 0	- 54 0	- 87 0	+140 0	± 7.5	±11	±17.5	+16 - 6	+22 -13
120	180	-110 - 85	+ 68 + 43	+ 83 + 43	+39 +14	+ 54 + 14	-25 0	+ 40 0	+ 63 0	-100 0	-160 0	± 9	±12.5	±20	+18 - 7	+26 -14
180	250	-129 -100	+ 79 + 50	+ 96 + 50	+44 +15	+ 61 + 15	-29 0	+ 46 0	+ 72 0	-115 0	+185 0	±10	±14.5	±23	+22 - 7	+30 -16

Table 4 Shaft tolerances

Nominal shaft dia. (mm)		Deviation classes of shaft dia.														
over	up to	d 6	e 6	f 6	g 5	g 6	h 5	h 6	h 7	h 8	h 9	h 10	js 5	js 6	js 7	j 5	j 6
3	6	– 30 – 38	– 20 – 28	– 10 – 18	– 4 – 9	– 4 –12	– 0 – 5	– 0 – 8	0 –12	0 – 18	0 – 30	0 – 48	± 2.5	± 4	± 6	+ 3 – 2	+ 6 – 2
6	10	– 40 – 49	– 25 – 34	– 13 – 22	– 5 –11	– 5 –14	– 0 – 6	– 0 – 9	0 –15	0 – 22	0 – 36	0 – 58	± 3	± 4.5	± 7.5	+ 4 – 2	+ 7 – 2
10	18	– 50 – 61	– 32 – 43	– 16 – 27	– 6 –14	– 6 –17	– 0 – 8	0 –11	0 –18	0 – 27	0 – 43	0 – 70	± 4	± 5.5	± 9	+ 5 – 3	+ 8 – 3
18	30	– 65 – 78	– 40 – 53	– 20 – 33	– 7 –16	– 7 –20	– 0 – 9	0 –13	0 –21	0 – 33	0 – 52	0 – 84	± 4.5	± 6.5	±10.5	+ 5 – 4	+ 9 – 4
30	50	– 80 – 96	– 50 – 66	– 25 – 41	– 9 –20	– 9 –25	0 –11	0 –16	0 –25	0 – 39	0 – 62	0 –100	± 5.5	± 8	±12.5	+ 6 – 5	+11 – 5
50	80	–100 –119	– 60 – 79	– 30 – 49	–10 –23	–10 –29	0 –13	0 –19	0 –30	0 – 46	0 – 74	0 –120	± 6.5	± 9.5	±15	+ 6 – 7	+12 – 7
80	120	–120 –142	– 72 – 94	– 36 – 58	–12 –27	–12 –34	0 –15	0 –22	0 –35	0 – 54	0 – 87	0 –140	± 7.5	±11	±17.5	+ 6 – 9	+13 – 9
120	180	–145 –170	– 85 –110	– 43 – 68	–14 –32	–14 –39	0 –18	0 –25	0 –40	0 – 63	0 –100	0 –160	± 9	±12.5	±20	+ 7 –11	+14 –11