Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	COMPUTER AIDED DESIGN AND MANUFACTURING
COURSE CODE	:	BDD 40203
PROGRAMME	:	4 BDD
EXAMINATION DATE	:	DECEMBER 2018/ JANUARY 2019
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 φ 10 H8 f7. By using **Tables 2,3 and 4**, calculate:

i. the 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 50.8 mm diameter face mill with six cutting edges is programmed to rotate at 100 rpm. The depth and width of cut are set at 12.7 mm and 50.8 mm, respectively. The cutting process is moving at the constant feed rate of 44.45 mm/min on the mild steel workpiece. It has a specific cutting force of 1950 MPa and machine efficiency is at 80%. Calculate:

i. cutting speed.
ii. required power to perform the process.

(4 marks)

(c) Differentiate between absolute positioning and incremental positioning? 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 Global Section of Initial Graphic Exchange Specification (IGES).

(4 marks)

(b) How does the pre-processor and post-processor works under IGES.

(4 marks)

(c) Differentiate between direct and indirect translator in data exchange.

(6 marks)

(d) You have received a CAD file from vendor and it was saved using .STL format. Unfortunately, you cannot open up the file using your current 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, leadscrew and optical encoder. The leadscrew has a pitch, p of 0.1 mm and is coupled to the motor shaft with a screw to motor gear ratio 1:1. The encoder generates 230 pulses per revolution (N) of the leadscrew. If the number of pulses (n) and the pulse rate (f) received by the control system are 1800 and 80Hz, 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) As a process engineer, you need to choose a suitable manufacturing process to produce a component. Evaluate the drawing in **Figure Q1(d)** and propose a proper process plan to machining the component.

(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 configuration typical LAN system.

(6 marks)

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

i. Physical layer.
ii. Data link layer.

(4 marks)

(c) As a Facility Engineer, you are requested to set up a new manufacturing plant by implementing the Flexible Manufacturing System (FMS). The machinery in the FMS needs to be communicated between each other by receiving and transferring information. Propose and discuss **THREE (3)** methods that can be used as a network topology to communicate and integrating all systems in the manufacturing plant.

(10 marks)

Q6 (a) Explain the function of part classification and coding 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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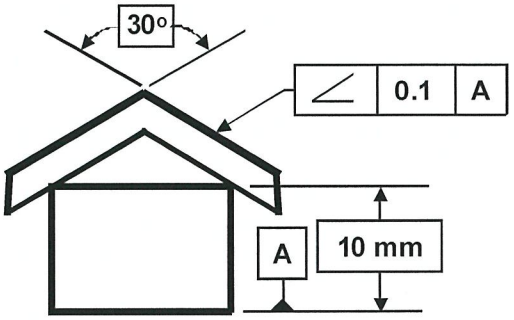
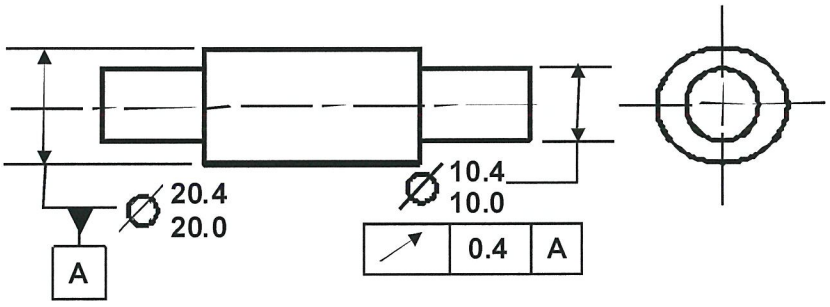


(i)



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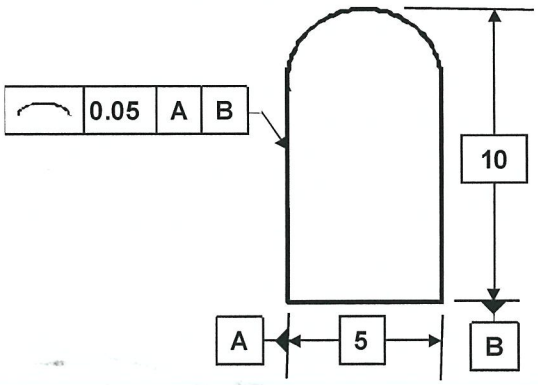

(iii)

Figure Q1(c)

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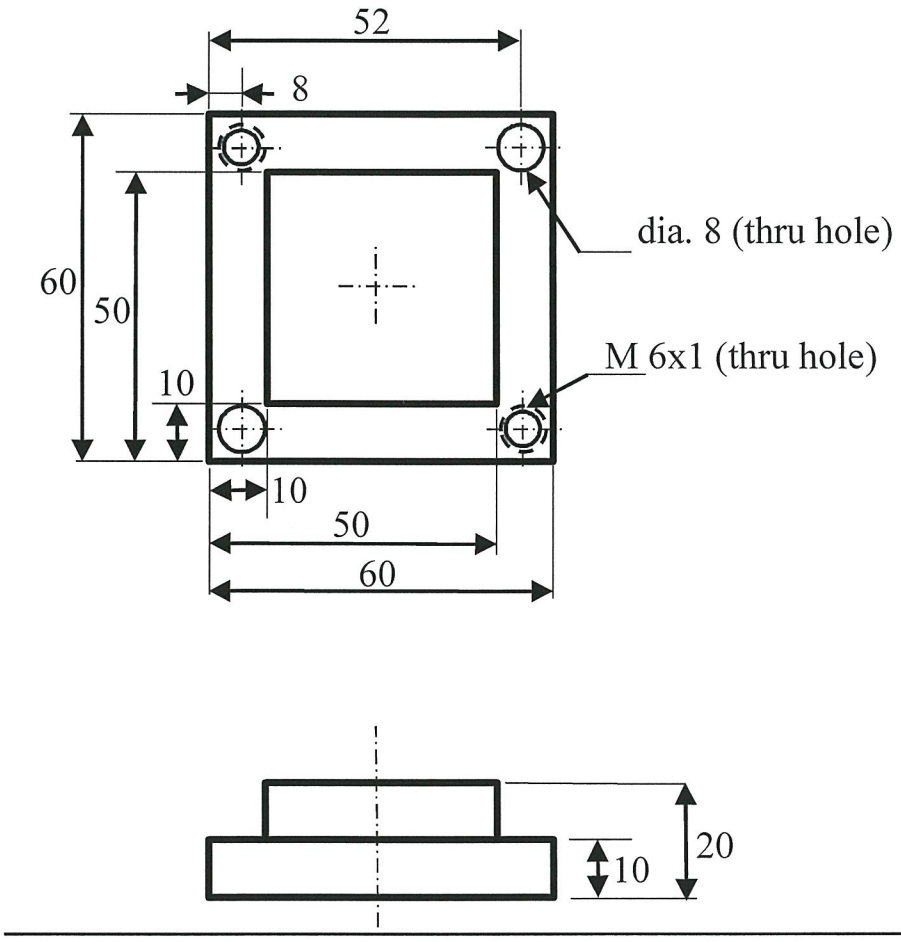

Unit is in millimeter

Figure Q1(d)

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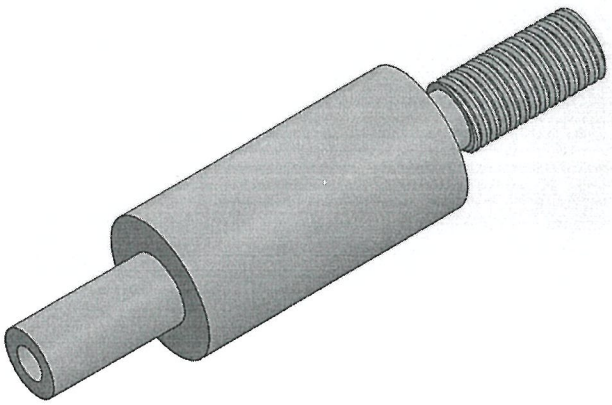

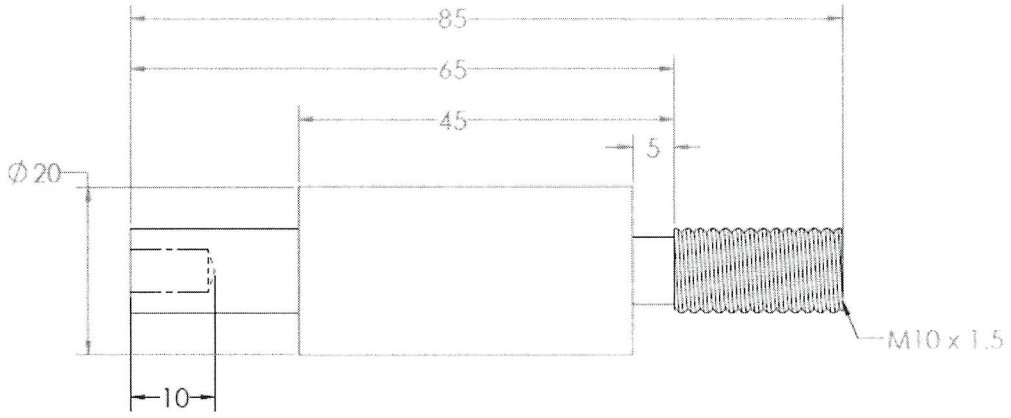

Figure Q6(b)

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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		Digit 2			Digit 3			Digit 4	Digit 5		
Part class		External shape, external shape element			Internal shape, internal shape element			Plane surface machining	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