

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION SEMESTER I SESSION 2018/2019

COURSE NAME

DESIGN FOR MANUFACTURE

AND ASSEMBLY

COURSE CODE

BDD 40103

PROGRAMME

4 BDD

EXAMINATION DATE

DEC 2018 / JAN 2019

DURATION

3 HOURS

INSTRUCTION

ANSWER ANY FIVE (5)

QUESTIONS **ONLY** FROM SIX (6)

QUESTIONS

THIS QUESTION PAPER CONSISTS OF EIGHT (8) PAGES

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Q1	(a)	There are eight (8) major steps in the new product development process in order
		the companies to stay successful and be competitive in the current market. The new
		product development process starts with 'Idea Generation'. Please discuss the roles
		of Idea Generation in new product development process.

(10 marks)

(b) List and justify **FIVE** (5) characteristics of successful product development

(10 marks)

Q2 (a) By referring Figure Q2(a), please justify the possibility of improvement in the design for machining on mechanical shaft fabrication in the aspects of DFMA roles.

(8 marks)

(b) Due to the application of high cutting speed, please justify with FOUR (4) reasons why total production cost increased after 600 FPM (feed per minute), as tolerance and surface finish becomes increasingly fine. Refer Figure Q2(b) as reference.

(12 marks)

Q3 (a) Determine the total operation time, total operation cost, and design efficiency for assembly shown in Figure Q3(a). Assume the labor rate is RM 14.40 per hour. Refer to Table Q3(a1) and Table Q3(a2) as references.

(15 marks)

(b) Please justify why DFA tool is needed as a systematic analysis in any product assembly.

(5 marks)

Q4 (a) The Boothroyd Dewhurst method provides a solution for Design for Assembly (DFA) developed in late 1970s by Professor Geoffrey Boothroyd, at the University of Massachusetts, Amherst in cooperation with Salford University of England. With the help of sketch, please justify the principles and procedures involved in the DFA process.

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(12-marks)

(b) List and justify **TWO** (2) achievements when we could apply DFA particularly in early stage product manufacturing.

(8 marks)

Q5 (a) Injection molding is the most commonly used manufacturing process but due to its intricacies product designers need to make adequate design considerations to ensure that part designs focus on maximizing molding performance and reducing tooling costs an area that often plague the injection molding industry. One of the DFMA part design considerations is about 'Radius'. By referring **Figure Q5** give the reasons and justify why 'Radius' is important.

(14 marks)

(b) With the help of sketch, please explain the working principle of Injection Molding.

(6 marks)

Q6 (a) DFMA provides design guidelines for sheet metal designer which helps to develop better quality parts at reduced cost. By referring to **Figure Q6 (a)-(b)**, please discuss the DFMA requirements from 'Punching until Lancing'.

(14 marks)

(b) With the help of sketch, please explain the working principle of Sheet Metal Working.

(6 marks)

- END OF QUESTION -





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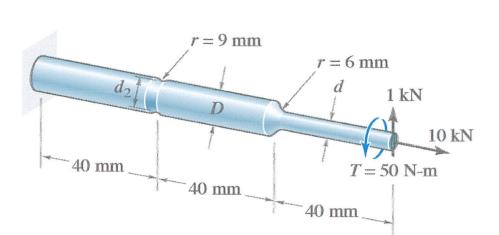


Figure Q2(a)

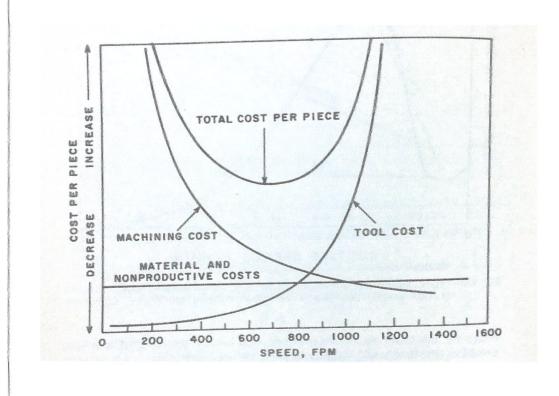


Figure Q2(b)

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PENSYARAH KANAN JABATAN REJURUTERAAN PENBUATAN PAN NUUSTEN FAKULTI KEJURUTERAAN MERANKKA ONN PERE JATAN JUNUERSITI TURUHUSSERI ONN NULAYSIA BARGO PARELI RAIN BATU PAHAT. JOHOR DARIU, TAKAN

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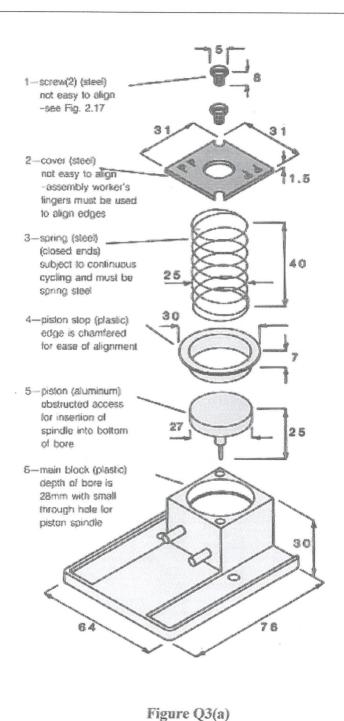
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DR. SAID SIN AHMAD
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Table Q3(a1)

MANUAL HANDLING-ESTIMATED TIMES (seconds)

				parts	are easy	to grasp	and manij	pulate	parts	present	difficultie	25 (1)		
				thic	kness > 2	2 mm	thicknes	s ≤ 2 mm	thic	kness > 2	thickness ≤ 2 mm			
Key: ONE HAND				size >15 mm	6 mm≤ size ≤15 mm	size <6 mm	size >6 mm	size ≤6 mm	size >15 mm	6 mm≤ size ≤15 mm	size <6 mm	size >6 mm	size ≤6 mm	
· Bonn	manufacture of the same of the			0	1	2	3	4	5	6	7	8	9	
tools	$(\alpha + \beta) < 360^{\circ}$		0	1.13	1.43	1.88	1.69	2.18	1.84	2.17	2.65	2.45	2.98	
	2600 - () 0			1	1.5	1.8	2.25	2.06	2.55	2.25	2.57	3.06	3	3.38
sped and one hand of grasping	$360^{\circ} \le (\alpha + \beta)$ $< 540^{\circ}$		2	1.8	2.1	2.55	2.36	2.85	2.57	2.9	3.38	3.18	3.7	
by b	540° ≤ (α+β) < 720°	3	1.95	2.25	2.7	2.51	3	2.73	3.06	3.55	3.34	4		
can boulate	< 720	VI												
arts can be anipulated thout the	$(\alpha + \beta) = 720^{\circ}$		and the same	parts need tweezers for grasping and manipulation									a se c	

α+α = /20°					parts can be manipulated without optical magnification				parts require optical magnification for manipulation				standar than	special asping rlation	
ONE HAND with GRASPING AIDS					parts are easy to grasp and manipulate		parts present handling difficulties (1)		parts are easy to grasp and manipulate		parts present handling difficulties (1)		need other	s need special s for grasping manipulation	
					thickness >0.25mm	thickness ≤ 0.25mm	thickness > 0.25 mm	thickness ≤ 0.25mm	thickness > 0.25mm		thickness > 0.25mm	thickness ≤ 0.25mm	parts r tools c	parts tools and n	
ut only Is	α ≤ 180°	0 ≤ β ≤ 180°	1	and the same	0	1	2	3	4	5	6	7	8	9	
and hand but sing tools		β = 360°		4	3.6	6.85	4.35	7.6	5.6	8.35	6.35	8.6	7	7	
sped an one han grasping				5	4	7.25	4.75	8	6	8.75	6.75	9	8	8	
parts can be grasped manipulated by one with the use of grasp	= 360°	0 ≤ β	0 ≤ β ≤ 180°		6	4.8	8.05	5.55	8.8	6.8	9.55	7.55	9.8	8	9
		2100		7	5.1	8.35	5.85	9.1	7.1	9.55	7.85	10.1	9	10	
parts or manip with th	Ø	β = 360°		-		parts p	esent no	addition	al I	parts pre	sent add	tional had	ndling di	ficulties	

ă E 3			parts p	resent no sling diffi	addition iculties	al	parts present additional handling difficultie (e.g. sticky, delicate, slippery, etc.) (1)					
			α ≤ 180	0	α=	360°	α ≤ 180°			α =	$\alpha = 360^{\circ}$	
TWO HANDS for		size > 15 mm	6 mm ≤ size ≤ 15 mm	size < 6 mm	size > 6 mm	size ≤ 6 mm	size > 15 mm	6 mm ≤ size ≤ 35 mm	size < 6 mm	size > 6 mm	size ≤ 6 mm	
MANIPULATION	0	1	2	3	4	5	6	7	8	9		
arts severely nest or angle or are flexible	8	4.1	4.5	5.1	5.6	6.75	5	5.25	5.85	6.35	7	
ut can be grasped and [#	-	All and the second second	-		The second second second	area area area area area	-	NAME OF TAXABLE PARTY.			A COURSE OF THE PARTY OF THE PA	

pai tar lifted by one hand (with the use of grasping tools if necessary) (2)

two hands required for grasping and transporting parts

parts can be handled by one person without mechanical assistance												
	parts do not severely nest or tangle and are not flexible											
	part weig	sau /	ecial	Geographic								
arts ar grasp ar nanipul		other h	resent andling ties (1)	grasp at			andling	everely or are e (2)	parts need spe grasping and n	Champion and		
≤180°	α=360°	α ≤180°	α = 360°	α≤180°	α =360°	α≤180°	α =360°	parts tangle flexibi	parts r graspir	COMMON		
0	1	2	3	4	5	6	7	8	9	Total Control		
2	3	2	3	3	4	4	5	7	9	SERVING		

TWO HANDS required for LARGE SIZE

FARGUTT KEUDRUTERAAN MENARMAL DAN PEMBUATAN UNWERSTI TUN HUSSEN CON MALEYSIA BARDYPARTITEAJA BETUFAHRI IGHUR DARUL TANZIM EMWESABBURT SANZIM

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vision (2)

vision (2)

due to obstructed access and 5

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holding down required during subsequent processes to maintain orientation or location (3)

Table O3(a2)

after assembly no holding down required

to maintain orientation and

MANUAL INSERTION—ESTIMATED TIMES (seconds)

					easy to a position assemble		not easy position assembly		easy to a position assembly	during	not easy to align or position during assembly	
	Key:	PART A	t		no resistance to insertion	resistance to insertion (5)	no resistance to insertion	resistance to insertion (5)	no resistance to insertion	resistance to insertion (5)	no resistance to insertion	resistance to insertion (5
	NOT SECURED				0	1	2	3	6	7	8	9
her	part and associated tool (including hands) can easily reach the desired location			1.5	2.5	2.5	3.5	5.5	6.5	6.5	7.5	
r part is				1	4	5	5	6	8	9	9	10
part (1) where neither or any other part is immediately	rool	due to ob-		2	5.5	6.5	6.5	7.5	9.5	10.5	10.5	11.5
part or ar mme	due to ob- structed- p as access or re- stricted		1//									

addition of any parthe part itself nor finally secured impart and associated (including hands) casily reach the delocation no screwing opera-tion or plastic deformation im-mediately after inplastic deformation immediately after insertion due to ob-structed ac-cess and rescrew tightening plastic bending rivetting or similar after insertion (6) sertion (snap/press fits, circlips, spire stricted vision (2) not easy to align or not easy to align or nuts, etc.) easy to align and position during assembly (4) easy to align and position during assembly (4) position with no resistance to insertion (4) not easy to align or position during assembly and/or resistance to insertion (5) position during position during position with no torsional resistance (4) not easy to align or position and/or torsional resistance (5) assembly assembly PART SECURED resistance resistance to insertion (5) resistance to insertion (5) resistance IMMEDIATELY easy to all position w torsional r part and associated tool (including hands) can easily reach the desired location and the tool can be operated easily addition of any part (1) where the part itself and/or other parts are being finally secured immediately part and associated tool (in-triding hands) camor easily reach perior location to old parts and castily. 100 0 1 2 3 4 5 7 8 9 6 3 7 2 5 4 5 6 8 9 6 8 due to obstructed access or restricted 4 4.5 7.5 6.5 7.5 8.5 9.5 10.5 11.5 8.5 10.5

8

restricted vision (2) mechanical fastening processes (part(s) already in place but not non-mechanical fastening processes (part(s) already in place but not non-fastening secured immediately after insertion) secured immediately after insertion) none or localized metallurgical processes etc.) chemical processes (e.g. adhasive bonding, etc.) manipulation of parts or sub-assembly (e.g. orienting, fitting or adjustment of part(s), et etc.) screw tightening (6) or other processes processes iquid insertion, clip, no additional material required (e.g. resistance, friction welding, et bending or similar processes material rivetting or similar processes etc. weld/braze processes CEPADATE soldering fit, **OPERATION** deus bress (e.g. li assembly processes where all solid 0 1 2 3 4 5 6 7 8 9 parts are in place 9 4 5 3.5 8 12 12 9 12

9

10

11

12

13

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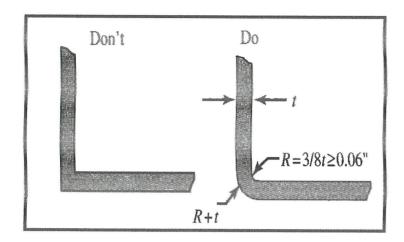


Figure Q5

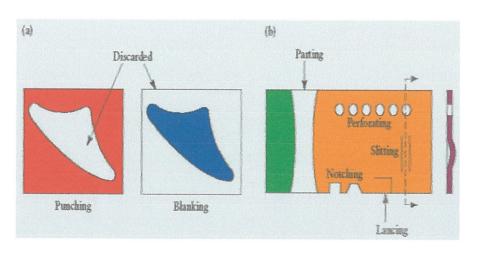


Figure Q6