INSTITUTE OF TECHNOLOGY (47, 18, 25, 48, 49, 52)

CMR INSTITUTE OF TECHNOLOGY

Internal Assessment Test 2 – May – 2017

USN	

Subject:	RAPID PROTOTYPING			Code:	10ME837
Date:	_____	Duration: 90mins	Max Marks: 50	Sem: VIII	Section: A & B

Note: Answer any 5 questions (5 x 10 = 50)

			OBE	
			CO	RBT
1.	a) Compare Indirect and Direct Rapid tooling. b) Describe the steps involved in producing silicon rubber tooling.	[4] [6]	CO3	L2
2.	Briefly explain the 3Q Keltool process and list out the materials used.	[10]	CO3	L2
3.	Briefly classify the direct methods for Rapid Tool production.	[10]	CO3	L1
4.	With a neat sketch, explain the Quick cast process.	[10]	CO3	L1

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Internal Assessment Test - 2

Solution Key Cum Scheme of Evaluation

Academic year: 2016-17 | Branch: B.E/Mechanical

Subject code: 10ME837 | Semester: 8

Subject: Rapid Prototyping. | C.I: Prof. H. Manikandan

Solution	Marks.

Indirect rapid tooling or Hard tooling are fabricated by machining either tool steel or aluminium into negative shape of the desired component.

Direct rapid tooling or soft tooling can be used to fabricate multiple wax (or) plastic parts using conventional injection moulding techniques. 4

Silicon Rubber Tooling

Steps 1: Producing any pattern using RP methods.

2: Adding Venting & Gating to the pattern.

3: Setting up the pattern in a mould box.

4: Pouring Silicon rubber to form one-half of the mould.

5: Inverting one half of the mould & removing the plasticine.

6: Pouring Silicon rubber to produce second half of the mould. 6

3Q Kel tool

Based on metal sintering process.

Steps involved

→ Fabricating master patterns of core &

Q.NO	Solution	Marks
	→ Producing RTV silicone rubber Moulds → Filling Silicon Rubber moulds with metal/mixture. → Firing Green parts in the furnace → Infiltrating sintered parts. → Finishing Core & Cavity.	8
	Materials used → Stellite. → Ab Composite tool steel.	2
3)	Direct methods of RP Tool production Can be classified into a) Firm Tooling b) Hard Tooling.	2

Firm Tooling	Hard Tooling
1) Direct AIM	EOS Direct Tool.
2) DTM copper PA Tooling	DTM Rapid Tool Process
3) LOM Tooling in Polymer	LOM Tooling in Ceramic
4) 3DP Ceramic shells.	3DP Direct metal tooling
5) DTM Sand form Tooling	

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	Solution	Marks
4)	**Quick cast process**	
	Quick cast pattern sketch	4
	This process replaces traditional wax patterns for investment casting with SLA patterns.	
	Process description	
	→ A stereolithography Quick cast pattern is created from an STL file.	
	→ Pattern is leak tested, to make sure it is air tight.	
	→ An investment caster is chosen.	
	→ Quick cast pattern is given to the caster	
	→ Caster coats part through ceramic coating process & performs firing procedures to burn out SLA pattern.	
	→ Metal is poured into the fired ceramic shell.	6
	→ Ceramic shell is broken off to reveal metal part.	
5)	**Data preparation errors in RP**	
	(i) Errors due to tessellation	
	a) Chord height	
	b) Angle control.	
	(ii) Errors due to slicing.	
	(i) Errors due to tessellation	
	A STL file approximates the surface of 3D CAD model by triangles.	(3)

Q.NO	Solution	Marks

→ Producing RTV silicone rubber Moulds
→ Filling Silicon Rubber moulds with metal mixtures.
→ Firing Green parts in the furnace
→ Infiltrating sintered parts.
→ Finishing Core & Cavity. 8

Materials used

→ Stellite.
→ Ab Composite tool steel. 2

3) Direct methods of RP Tool production.

Can be classified into
a) Firm Tooling
b) Hard Tooling.

Firm Tooling	Hard Tooling
1) Direct AIM	EOS Direct Tool.
2) DTM Copper PA Tooling	DTM Rapid Tool Process
3) LOM Tooling in Polymer	LOM Tooling in Ceramic
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2 8

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	→ Ceramic shell is broken off to reveal metal part.	
5)	**Data preparation errors in RP**	
	(i) Errors due to tesselation a) Chord height b) Angle control. (ii) Errors due to slicing.	
	(i) Errors due to tesselation	
	A STL file approximates the surface of 3D CAD model by triangles.	(3)

Chord height

This parameter specifies the maximum distance between a chord & surface. If less deviation from the actual part surface is required, a smaller chord height is required.

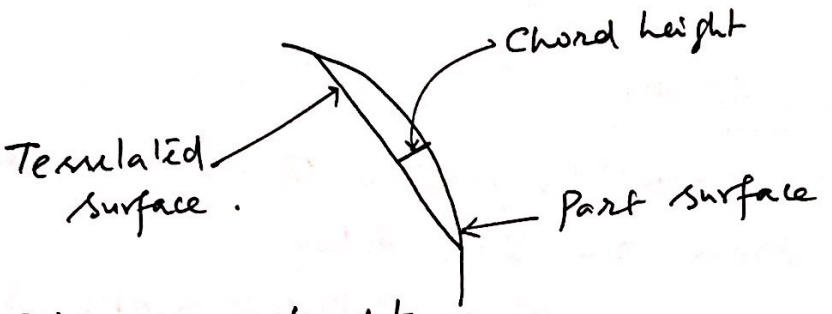

Fig : Chord height.

Angle control

This parameter specifies the required definition level along curves with small radius.

$$r < r_0 = \frac{\text{Part size}}{10.}$$

Errors due to slicing

→ RP processes have a stair-stepping problem that is found in all layer manufacturing technologies. Stair stepping is a consequence of the addition of material in layers.

→ There are 2 types of errors resulting from slicing. One is because of mismatching in height b/w slice positions and feature boundaries. The other is the replacement of polygons with stair steps.

Q.no	Solution	Marks.
6a)	**Factors influencing accuracy of RP processes** : → Errors during data preparation stage such as STL file generation, model slicing & part build direction. → Process specific parameters during the build stage; which influences accuracy of part. → Part finishing techniques employed.	5
6b)	**Part building errors in SL Process** → Curing errors → Control errors **Curing Errors** a) Over curing b) scanned line shape. * Over curing results in unusual thickness which causes a dimensional change in the Z direction along the lower feature boundary. * A scanned line is created when a laser beam scans the resin surface. The C.S of the scanned line is referred to as the scanned line shape.	(5)

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