	/		
	B)	An engineer intends to fabricate a polymer material transparent part through additive manufacturing. However, he is not able to choose the appropriate additive manufacturing technique. Help the engineer by suggesting a suitable additive manufacturing technique. Also, justify the suggestion by illustrating working principle, advantages, limitations of chosen process over other additive manufacturing processes.	(4)
	C)	Illustrate the material selection procedure for new product.	(2)
3)		With relevant sketches discuss any four design rules to be followed during powder metallurgy component design.	(4)
	A)		
	B)	With relevant sketches illustrate and justify the design modifications to be made in conventionally designed parts for efficient fabrication through additive manufacturing.	(4)
	C)	Illustrate the DFA methodology to check for part relevance in assembly.	(2)
4)	A)	The parts shown in figure a to d, are intended to be manufactured through sand casting. However, as per DFM it is observed that, the parts are not suitable for efficient casting. Identify the issues with each case and suggest suitable corrective measures as per DFM rules for sand casting.	(4)
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## **MANIPAL ACADEMY OF HIGHER EDUCATION**

### SIXTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, APRIL-MAY 2024 **DESIGN FOR MANUFACTURE AND ASSEMBLY [MME 4041]**

# Marks: 50

1)

A) B)

C)

A)

2)

2. Missing data may be suitably assumed

### Answer all the questions. Instructions to Candidates:

1. Answer ALL questions

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Exam Date & Time: 08-May-2024 (02:30 PM - 05:30 PM)



**Duration: 180 mins.** 

(4)

(4)

(2)

(4)

A

With relevant sketches, discuss DFA strategies suitable for facilitating part handling.

Explain the key factors affecting metal flow during sheet deep drawing process and

With relevant sketches explain any two design guidelines for efficient heat treatment.

With an example demonstrate the feasibility study phase of design morphology.

discuss the DFM rules which may be adopted to overcome the same.



- B) With relevant sketches explain appropriate design rules for incorporating following features in part design for die casting.
  - i) Connecting boss to wall
  - ii) Through hole on inclined wall surface
  - iii) Provision for flash and gate removal
  - iv) Lettering on parts
- C) Figure A & B, shows two identical designs of a part with specified surface roughness and tolerances which is proposed to be produced through machining. Choose the design which can be easily produced with least effort and justify the selection with suitable DFM rule applicable.



(4)

5)

A)

Evaluate and suggest a suitable bilateral dimensional tolerance for a 200 mm length hollow shaft of outside nominal diameter 48 mm and inner nominal diameter of 24 mm and a bearing hole to mount the shaft. The shaft and bearing are machined on automatic centre lathe in good condition. Also, create a representational working drawing for shaft and bearing indicating appropriate type of fit and tolerance grade in standard layout.

Reference data sheet:

Table 1.1 Standard tolerance
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Grade	IT5	IT6	177	IT8	IT9	IT10	IT11	IT12	IT13	IT14	IT15	IT16
Value	7i	10i	16i	25i	40i	64i	100i	106i	200i	400i	640i	1000i

Where,

 $i = 0.45D^{\frac{1}{3}} + 0.001D$ 

i - standard tolerance in microns D - geometric mean of the size range under consideration in mm  $D = \sqrt{D_{max}D_{min}}$ 

Table 1.2 Tolerance grade in various manufacturing processes.

Tolerance grade	Manufacturing process that can produce
16	Sand casting : flame cutting
15	Stamping
14	Die casting or moulding ; rubber moulding
13	Press work, tube rolling
12	Light press work ; tube drawing
11	Drilling, rough turning, boring, precision tube drawing
10	Milling, slotting, planing, metal rolling, or extrusion.
9	Worn capstan or automatic ; horizontal or vertical boring
8	Centre lathe turning and boring, reaming, capstan or automatic in good condition.
7	High quality turning, broaching, honing
6	Grinding or fine honing
5	Machine lapping, diamond or fine boring, fine grinding.

B) The part shown in figure is intended to be produced through operations over drilling machine.

a) List the operations to be performed in sequence to produce existing design.

b) It is observed that the part design does not facilitate efficient production as per DFM rules. Analyse the design by applying DFM rules for drilling machine operations to identify the key issues and with neat sketches suggest modifications for efficient production.



(3)

(5)

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#### MME 4041

C) A flat surface of a mating assembly component needs to have N8 grade surface roughness over a sampling length of 6 mm with parallel lay direction after milling. The machining allowance available is 0.5 mm. Indicate this information using standard (2) surface finish symbol.

-----End-----