BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2012 - 2013

COMPREHENSIVE EXAMINATION (Closed book)

SECOND YEAR

Course Code: ME F 243 | Date: 08-06- 2013

Course Title: PRODUCTION TECHNIQUES-1 | Max Marks: 70

Duration: 3 HRS | Weightage: 35%

PART A

1.(a)What are the 5 *Ms* of manufacturing? Briefly explain. **[2½M]**

(b) What are the three categories of production process? Explain with examples **[2½M]**

2.(a) Explain the different types of defects, their origin and remedies in castings **[5M]**

(b) In a foundry, three castings of same weight and material are to be produced. Shapes of the three castings are: a cube, a sphere, and a cone (radius= height). Find the cooling time ratio in all these cases. **[5M]**

3. (a) Explain **(i)** forward extrusion **(ii)** backward extrusion **(iii)** impact extrusion and **(iv)** tube extrusion processes with sketches. Give two examples in each case. **[4M]**

(b) A single -pass rolling operation reduces 20.5 mm thick plate to 18.5 mm and increases 210 mm wide to 220 mm. the starting length of the material is 1 m. The roll has a radius of 300 mm and rotational speed of one revolution per sec. The work material has strength coefficient, K = 650 MPa and strain hardening exponent, n = 0.25. Calculate **(i)** roll force **(ii)** roll torque and roll power required for this operation **(iii)** final length of the material and **(iv)** angle subtended at the centre of the roll. **[6M]**

4. Write short note on:

(a) Aspiration effect in casting **[3M]**

(b) Die material for extrusion process **[3M]**

(c) (i) Derive the angle subtended at the centre of the roll

cos α = [1- draft/diameter of roll]

(ii) Sketch & discuss the microstructure of material during rolling process from the entrance to exit **[4M]**

PART B

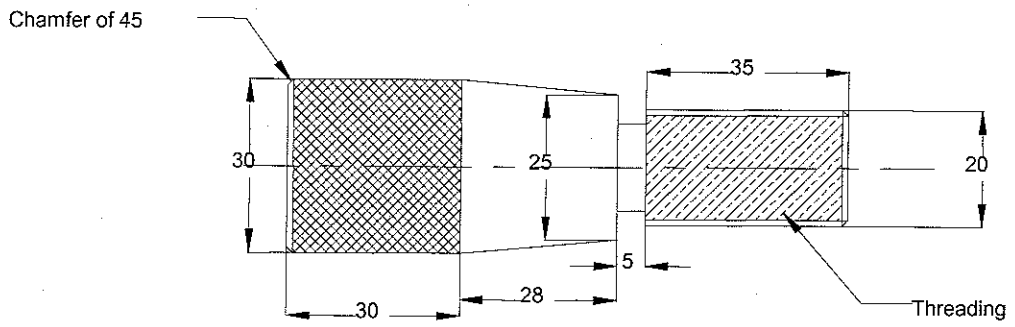
5.(a) What is the difference between Direct & Indirect measurement? **[2M]**

(b) The nominal size of a part is 30 mm. The standard tolerance selected for this part is 0.010 mm. Express the size of the part using unilateral & bilateral tolerances:- **[4M]**

6(a) List out the differences between Welding, Soldering & Brazing:- **[2M]**

(b) In a butt welding process using arc welding, the arc power is fixed to be 2.5 kVA. The process is used to weld two steel plates, each of 3 mm thickness as shown in figure. Determine width of the weld and the maximum possible welding speed. It is assumed that the metal transfer is of short circuit type and the arc is on for 85 % of the total time. Assume thermal diffusivity of the work material, α_{steel} 1.2×10^{-5} m^2/s , melting point of steel = 1530 ^0C , ambient temperature = 30^0C and thermal conductivity, k_{steel} =43.6 $W/m^0 C$ **[4M]**

7(a) The following part is to be machined from an EN9 rod of 10m long and diameter 35mm. What is the sequence of operation and how many shafts can be machined if a clearance of 5mm is used between components to part off from the bar stock.:-



[6M]

(b) A cylinder of 155 mm diameter is to be reduced to 150 mm diameter in one pass with feed of 0.15 mm/ rev and a cutting speed of 150 m/ min on a lathe .Determine **(i)** Spindle speed **(ii)** Depth of cut **(iii)** Material removal rate (MRR) **[4M]**

8(a) Explain **(i)** Counter boring **(ii)** Counter sinking **(iii)** Spot facing **[3M]**

(b) Find the machining time required for machining a surface 600 x 800 mm on a shaping machine. Assume, cutting speed as 8 m/min. the return-to cutting time ratio is 1:4, and the feed is 2 mm/double stroke. The clearance at each end is 70 mm **[4M]**

9(a) Determine the cutting time for a 125 mm long keyway using HSS end mill of 20 mm diameter having 4 cutting teeth. The depth of keyway is 4.5 mm. Feed /tooth is 0.1 mm and cutting speed is 40 m/min. assume approach & over travel distance (Including L_1 & L_2) as half of the diameter of the cutter and depth of 4.5 mm can be cut in one pass. **[4M]**

(b) Is grinding wheel a single point tool or a multi point tool / Justify your answer: - **[2M]**

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2012 - 2013

COMPREHENSIVE EXAMINATION (Closed book)

SECOND YEAR

Course Code: ME F 243 | Date: 08-06- 2013

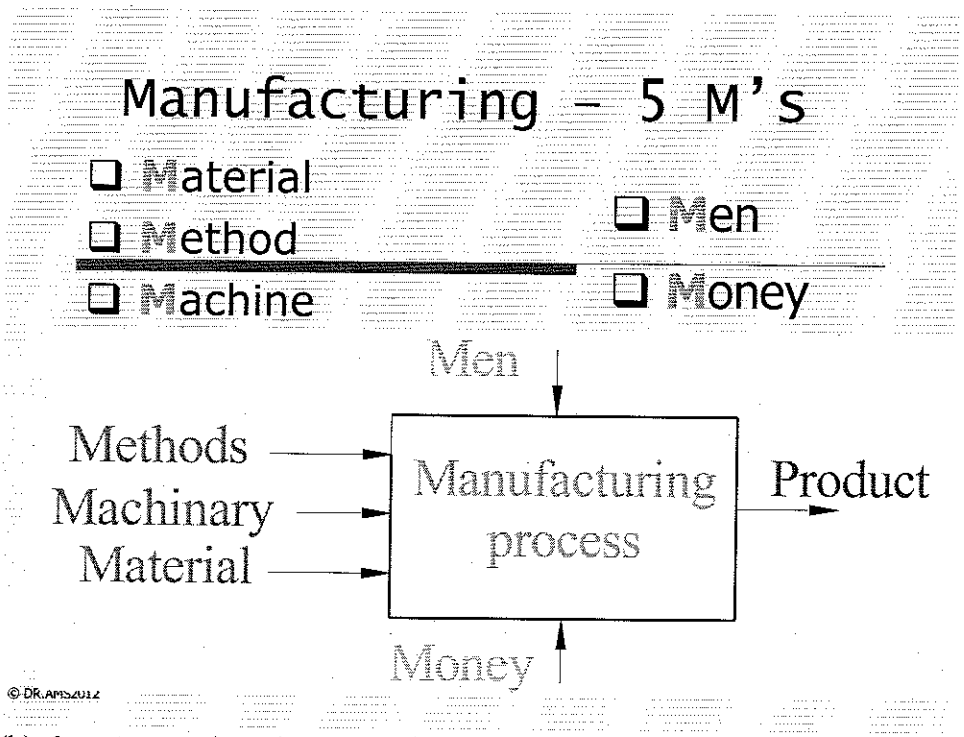
Course Title: PRODUCTION TECHNIQUES-1 | Max Marks: 70

Duration: 3 HRS | Weightage: 35%

SOLUTION KEY

PART A

1. (a) 5 ***M***s of manufacturing:



(b) three categories of production process:

1.Job shop production (low volume of production, special tool etc)2. Batch production (Medium size quantity, text book, furniture ..)3.mass production (bulk quantities, screws..)

2(a) defects, their origin and remedies in castings

Basic categories of casting defects

1. Metallic projections:
   - Fins,flash or projections
2. Cavities
   - blow holes, pin holes, shrinkage cavities
3. Discontinuities
   - cracks,cold or hot tears
   - cold shuts- improper fusion of different streams of metals
   - Improper solidification can cause tears

4. Defective surface
   - Surface folds, laps, scars, adhering sand layers and oxide scales
5. Incomplete casting
   - misruns (due to premature solidifications)
   - insufficient metal poured
   - leaks in the mold
6. Incorrect dimensions
   - incorrect allowances
   - deformed pattern
   - pattern mounting error

7. Inclusions

- nonmetallic particles usually
- bad for casting – acts as stress raiser
- materials from alloys,crucible,mold etc
- sand particles,ceramic particles,
- Can be avoided using filters, good strong molds etc

Summary of casting defects

Defect	Cause	Foundry remedy	Design remedy
Flash	Flow into mold join	Lower pouring temperature, Increase mold box clamping,	
Oxide and dross inclusion	Entrapment of foreign material	Increase care and cleanliness during pouring,	
Shrinkage cavities	Lack of sufficient feed metal	Promote directional solidification by controlling heat flow, Raise pouring temperature,	Relocate risers and ingates
Misruns	Low metal fluidity	Raise pouring temperature	Reconsider position, size and number of ingates and vents

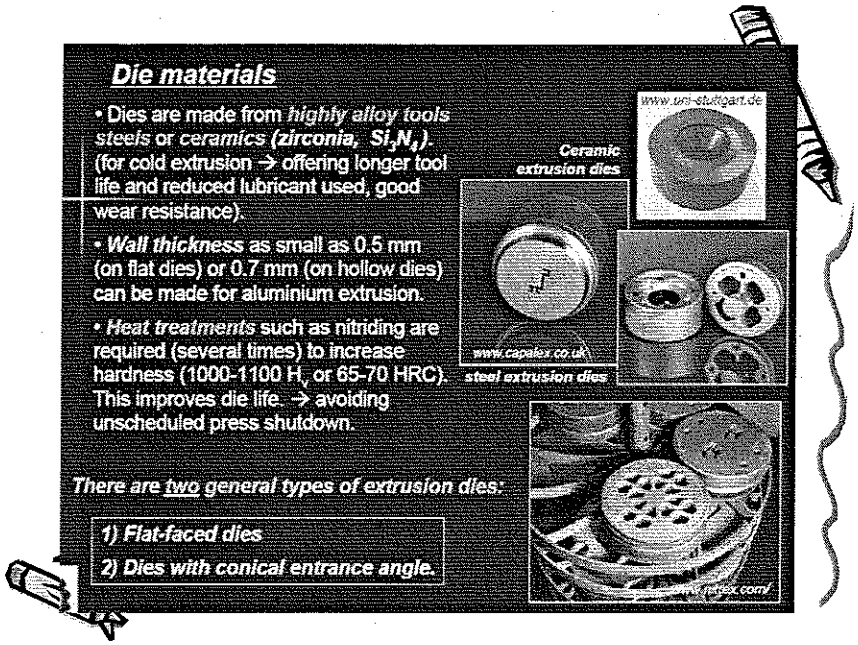
(b) Cooling time sphere to cone = 1.527

Cooling time sphere to cube = 1.238

Cooling time cone to cube = 2.56

3(a) (i) forward extrusion (ii) backward extrusion (iii) impact extrusion and (iv) tube extrusion processes

4(c).



PART B

5a. Write at least three difference with example- 2 marks

b. 30.00^{-0} or $30.00.^{-0.010}$ $30.00^{0.005}$

6. A Write at least three difference with example- 2 marks

7. No of shaft that can be produced (1 mark)

Correct process sequence (.5 marks)

Sequence

Operation	Dimension	Tool used	Outcome
Facing on side 1	1 – 2 mm	Turning tool	Perpendicularity of the side and axis is ensure The length can be controlled
Facing on side 2	To the required dimension	-do-	Length corrected
Turing on one half	2.5mm	-do-	Outer diameter is controlled
Turing on other half	-do-	-do-	-do-
Step Turning	Depth of cut 5 mm for a length of 35mm	-do-	to create a step
Grooving	5 mm depth	Parting/Grooving tool	To create a groove
Taper turning	Smaller diameter 25, outer diameter 30 length 28	Turning tool	To create a taper
Knurling on the diameter 30	Knurling tool	Knurling tool	Knurling operation
Threading @ 20 diameter	Threading tool	Threading tool	Thread cutting

Tread rolling cannot be hot rolling process. It should undergo cold rolling process in order to have strength of the thread and finishing.

(b) the rotational speed =98.07 rpm

radius of rolling machine =600 mm

elongation coefficient =1.56

true strain =0.223

draft and reduction value =6 mm , 0.2

contact length between the rolls and work piece = 60 mm **[7M]**

8B. Explain the defenitions

8.b tool life = 39 minute, cutting sped = 43.4 m/min **[7M]**

b) No, it is not advisable at low speed **[4M]**

9 a) - all furniture's, Assembly of many products **[4M]**

b) welding is more strong than riveting **[4M]**

BITS PILANI, DUBAI CAMPUS

Office copy

SECOND SEMESTER 2012 - 2013

TEST- 2 (Open book)

SECOND YEAR

Course Code: ME F 243 Date: 06-05- 2013

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 30

Duration: 50 minutes Weightage: 15%

Name: . . . . . **ID No:** . . . . . **Section :** . . . .

Instructions: 1. Attempt all questions

1.a) Can thread rolling be a hot rolling process? Explain. **[4M]**

(b) In a single pass rolling operation, the work piece of 30 mm rod is reduced to 24 mm diameter. The original length of rod is 500 mm and has strength coefficient value of 82 x 10^6 N/m^2 and strain hardening exponent n = 0.25. The coefficient friction between the roller and work piece is 0.1. If the power required for this operation is 50 kW, find the *rotational speed* and *radius* of rolling machine.

Find also the following: (i) *elongation coefficient* (ii) *true strain, draft* and *reduction values* of work piece in the rolling operation and (iii) *contact length* between the rolls and work piece. **[7M]**

2.a) A carbide tool while machining a mild steel work piece was found to have a life of 1 hr. & 40 minutes when cutting at 50 m/min. find the *tool life* if the tool is to operate at a speed 30% higher than previous one. Also, calculate the *cutting speed* if the tool is required to have a life of 2 hr & 45 minutes. Assume n = 0.28 **[7M]**

b) Tool life can be almost infinite at low cutting speeds. Would you recommend that all machining be done at low speeds? What are the *limitations* of doing so? **[4M]**

3.a) Explain with examples, the situations in which joining process becomes essential when compared to the other manufacturing processes:- **[4M]**

b) It is mentioned that rivets can be used for making permanent joints. Then why welding is preferred over riveting for making permanent joints? **[4M]**

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2012 - 2013

TEST- 2 (Open book)

SECOND YEAR

Course Code: ME F 243 Date: 06-05- 2013

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 30

Duration: 50 minutes Weightage: 15%

SOLUTION KEY

1.a

Tread rolling cannot be hot rolling process. It should undergo cold rolling process in order to have strength of the thread and finishing.

(b) the rotational speed =98.07 rpm

radius of rolling machine =600 mm

elongation coefficient =1.56

true strain =0.223

draft and reduction value =6 mm , 0.2

contact length between the rolls and work piece = 60 mm **[7M]**

2.a tool life = 39 minute, cutting sped = 43.4 m/min **[7M]**

b) No, it is not advisable at low speed **[4M]**

3.a) - all furniture's, Assembly of many products **[4M]**

b) welding is more strong than riveting **[4M]**

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2012 - 2013

TEST- 1 (closed book)

SECOND YEAR

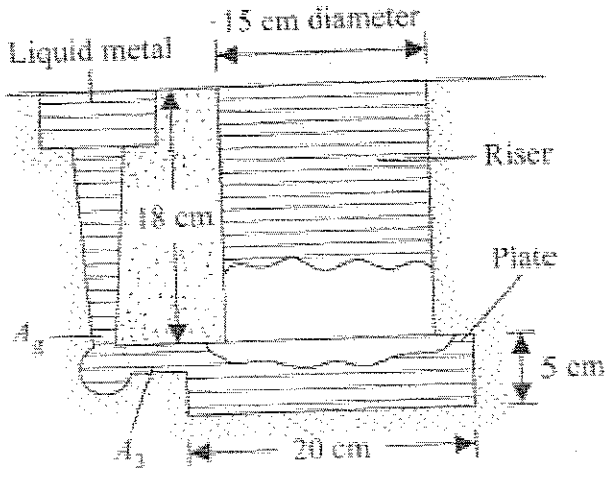
Course Code: ME F 243 | Date: 18-03- 2013

Course Title: PRODUCTION TECHNIQUES-1 | Max Marks: 30

Duration: 50 minutes | Weightage: 15%

Name: . . . . . ID No: . . . . . Section : . . . .
Instructions: 1. Attempt all questions

1. Figure below shows a mould along with the riser for casting a plate 20x20x5 cm^3. Determine the area A_g such that the mould and the riser get filled up within 10 seconds after the downsprue has been filled. It should be noted that $A_3 >> A_g$, since below the downsprue a flat gate is attached to the casting. [8]



2. What are factors you will take to account when providing (a) Shrinkage allowance (b). Machining allowance (c) Taper allowance (d) Shaking allowance on a pattern? [6]

3. The dimensions of three shafts and holes are given in table. For each assembly identify the type of fit and compute the allowance (clearance / interference). [8]

Size of the hole	size of the shaft
(a) 25.00	24.98
(b) 20.00	20.00
(c) 30.00	30.01

4.(a) Give two examples of applications for each of the following types of fits:
(i) Transition fit (ii) clearance fit (iii) Interference fit [4]

(b)What is the difference between accuracy and precision? Explain with a example. [4]

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2012 - 2013

TEST- 1 (closed book)

SECOND YEAR

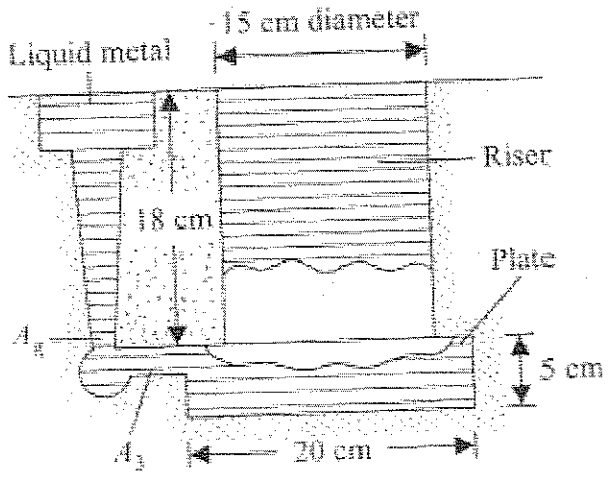
Course Code: ME F 243 | Date: 18-03- 2013

Course Title: PRODUCTION TECHNIQUES-1 | Max Marks: 30

Duration: 50 minutes | Weightage: 15%

SOLUTION KEY

1. Figure below shows a mould along with the riser for casting a plate 20x20x5 cm^3. Determine the area A_g such that the mould and the riser get filled up within 10 seconds after the downsprue has been filled. It should be noted that $A_3 >> A_g$, since below the downsprue a flat gate is attached to the casting. [8]



V= 187 .92 m/s, q= Vx Ag ,

Ag = 2.75 m^2

2. What are factors you will take to account when providing (a) Shrinkage allowance (b). Machining allowance (c) Taper allowance (d) Shaking allowance on a pattern? [6]

(a) Shrinkage allowance — 3 2

- **Provided to compensate for shrinkage of material**
- **Pattern is made slightly bigger**
- **Amount of allowance depends upon type of material, its composition, pouring temperature etc.**

(b). Machining allowance — 2

- **Provided to compensate for machining on casting.**
- **Pattern is made slightly bigger is size.**
- **Amount of allowance depends upon size and shape of casting, type of material, machining process to be used, degree of accuracy and surface finish required etc.**

c) Taper allowance — 1

- **Provided to facilitate easy withdrawal of the pattern.**
- **Typically it ranges from 1 degree to 3 degree for wooden patterns.**

(d) Shaking allowance on a pattern — 1

- **Provided to compensate for shrinkage of material**
- **Pattern is made slightly bigger**
- **Amount of allowance depends upon type of material, its composition, pouring temperature etc**

3. The dimensions of three shafts and holes are given in table. For each assembly identify the type of fit and compute the allowance (clearance / interference). [8]

Size of the hole	size of the shaft
(a) 25.00	24.98
(b) 20.00	20.00
(c) 30.00	30.01

A) Clearance = 0.06 b) Transition
B) C) Interference - 0.06

4.(a) Give two examples of applications for each of the following types of fits:
(i) Transition fit (ii) clearance fit (iii) Interference fit [4]

Transition : Push fit, snug fit

Clearance Fit : door hinges, wheel & axle

Interference Fit ; Dowel pins, bearings

(b)What is the difference between accuracy and precision? Explain with a example. [4]

- **ACCURACY:** Capability to get accurate measure of dimension (Micrometer & Scale) accurate upto one millionth of metre(Micron) — 2
- **PRECISION** : How close together of readings — 2

office copy

A

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2012 - 2013

QUIZ (closed book)

SECOND YEAR

Course Code: ME F 243 Date: 04-03- 2013

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 10

Duration: 20 minutes Weightage: 5%

Name: . . . . . **ID No:** . . . . . .

Instructions: 1. Attempt all questions

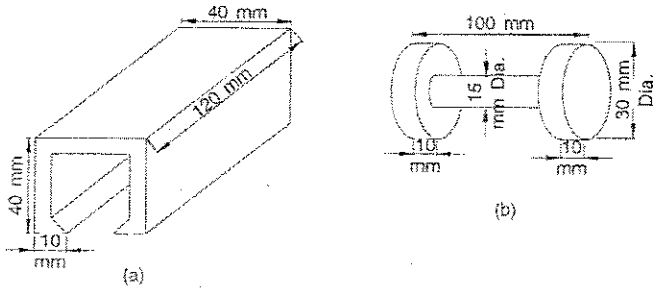
1. Explain ***Chvorinov's Rule*** :- 1 mark

2. Explain the function of ***runner*** and ***riser*** in Casting process :- 2 marks

3. List any ***two components*** that use in our day to day life made by manufacturing process like *metal forming* & *casting* processes :- 2 marks

4 In a foundry, two castings of same *weight* and *material* are to be produced. Shape of three castings are: cube & sphere Find the ***cooling time ratio***:- 3 marks

5. Suggest a suitable pattern for casting the components shown in the figure below. - Justify your selection 2 marks



BITS PILANI, DUBAI CAMPUS

A

SECOND SEMESTER 2012 - 2013

QUIZ (closed book)

SECOND YEAR

Course Code: ME F 243 Date: 04-03- 2013

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 10

Duration: 20 minutes Weightage: 5%

SOLUTION KEY

1. Explain ***Chvorinov's Rule*** :- 1 mark

$$TST \propto C_m \left(\frac{V}{A}\right)^n$$

where TST = total solidification time;
V = volume of the casting;
A = surface area of casting;
n = exponent usually taken to have a value = 2; and
C_m is *mold constant*

2. Explain the function of ***runner*** and ***riser*** in Casting process :- 2 marks

Runner is used to take the molten metal from the sprue base and to distribute — 1 mark

Riser is a hole cut or molded in the cope to permit the molten metal to rise above the highest point in the casting — 1 Mark-

3. List any ***two components*** that use in our day to day life made by manufacturing process like *metal forming & casting* processes :- 2 marks

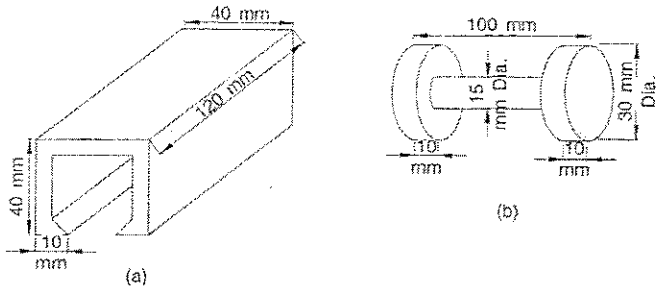
Metal forming : utensils, wires — 1 mark

Casting: Automobile engines, gun barrels — 1 mark

4 In a foundry, two castings of same *weight* and *material* are to be produced. Shape of two castings are: cube & sphere Find the ***cooling time ratio***:- 3 marks

T1/ t2 = 1.54

5. Suggest a suitable pattern for casting the components shown in the figure below. - Justify your selection 2 marks



a. **Loose piece pattern** — 1 Mark
b. **Split pattern** — 1 Mark