

(Manufacturing Processes-I)	2nd midterm Exam (1st semester)	1433-1432
IE 252	Time: 1:30 hours	Date: 22/1/1433

ANSWER THE FOLLOWING QUESTIONS:

Q1-a

- Which of the following casting processes are expendable mold operations (four correct answers): (a) centrifugal casting, (b) die casting, (c) investment casting, (d) low pressure casting, (e) sand casting, (f) shell molding, (g) slush casting, and (h) vacuum molding?
- Shell molding is best described by which one of the following: (a) casting operation in which the molten metal has been poured out after a thin shell has been solidified in the mold, (b) casting process in which the mold is a thin shell of sand binded by a thermosetting resin, (c) sand casting operation in which the pattern is a shell rather than a solid form, or (d) casting operation used to make artificial sea shells?
- Investment casting is also known by which one of the following names: (a) fast-payback molding, (b) full mold process, (c) lost-foam process, (d) lost pattern process, or (e) lost-wax process?
- In plaster-mold casting, the mold is made of which one of the following materials: (a) Al₂O₃, (b) CaSO₄-H₂O, (c) SiC, or (d) SiO₂?
- Which of the following qualifies as a precision-casting process (two correct answers): (a) ingot casting, (b) investment casting, (c) plaster mold casting, (d) sand casting, and (e) shell molding?
- Which of the following casting processes are permanent mold operations (three correct answers): (a) centrifugal casting, (b) die casting, (c) expanded polystyrene process, (d) sand casting, (e) shell molding, (f) slush casting, and (g) vacuum molding?
- Which of the following metals would typically be used in die casting (three best answers): (a) aluminum, (b) cast iron, (c) steel, (d) tin, (e) tungsten, and (f) zinc?
- Which of the following are advantages of die casting over sand casting (four best answers): (a) better surface finish, (b) closer tolerances, (c) higher melting temperature metals, (d) higher production rates, (e) larger parts can be cast, and (f) mold can be reused?
- Cupolas are furnaces used to melt which of the following metals (one best answer):

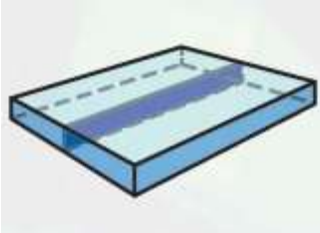
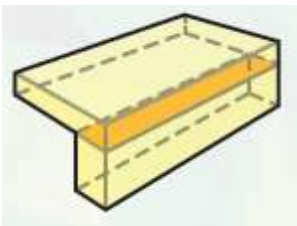
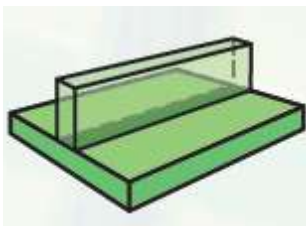
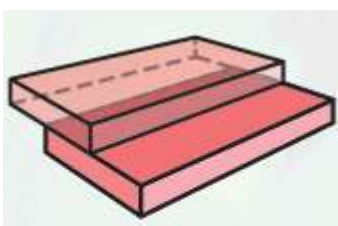
- (a) aluminum,
- (b) cast iron,
- (c) steel, or
- (d) zinc?

10. A misrun is which one of the following defects in casting:
 (a) globules of metal becoming entrapped in the casting,




- (b) metal is not properly poured into the downsprue,
- (c) metal solidifies before filling the cavity,
- (d) microporosity, and
- (e) "pipe" formation?

Q1-b

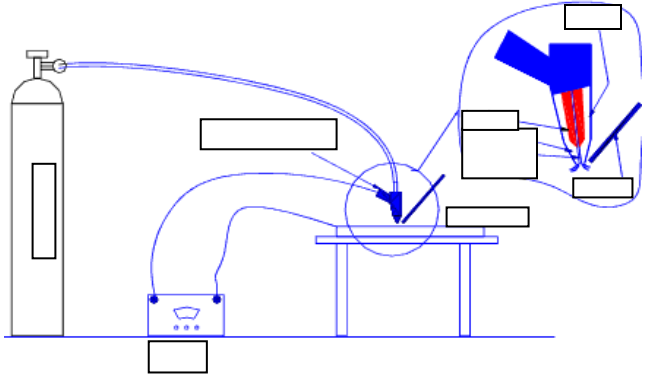
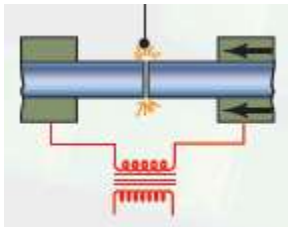
i) Write the name of the welding joint drawn in the figures a-d in the table below

			
a)	b)	c)	d)

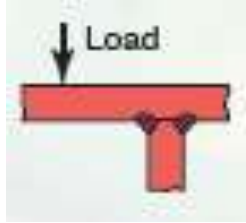
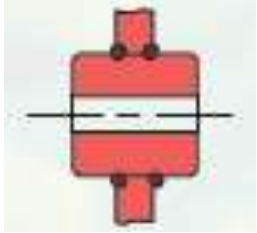
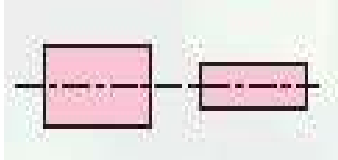
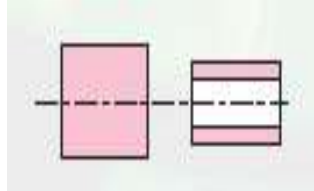
ii) Write the name of the welding flames drawn in the figures a-c in the table below

		
a)	b)	c)

iii) Name the welding processes below and fill the missing data

	
a)	b)

iv) Redesign the following poor welding parts to achieve good welded parts in the table below

 <p>a)</p>	 <p>b)</p>	 <p>c)</p>	 <p>d)</p>

Q2

For the drawing in the accompanying sheet select the following:

- | | |
|--|-------------------|
| a. Parting line | f. Core prints |
| b. Surfaces to add machining allowance | g. Vent locations |
| c. Surfaces to add shrinkage allowance | h. Sprue location |
| d. Surfaces to add draft allowance | i. Riser location |
| e. Core surface | j. Gate location |

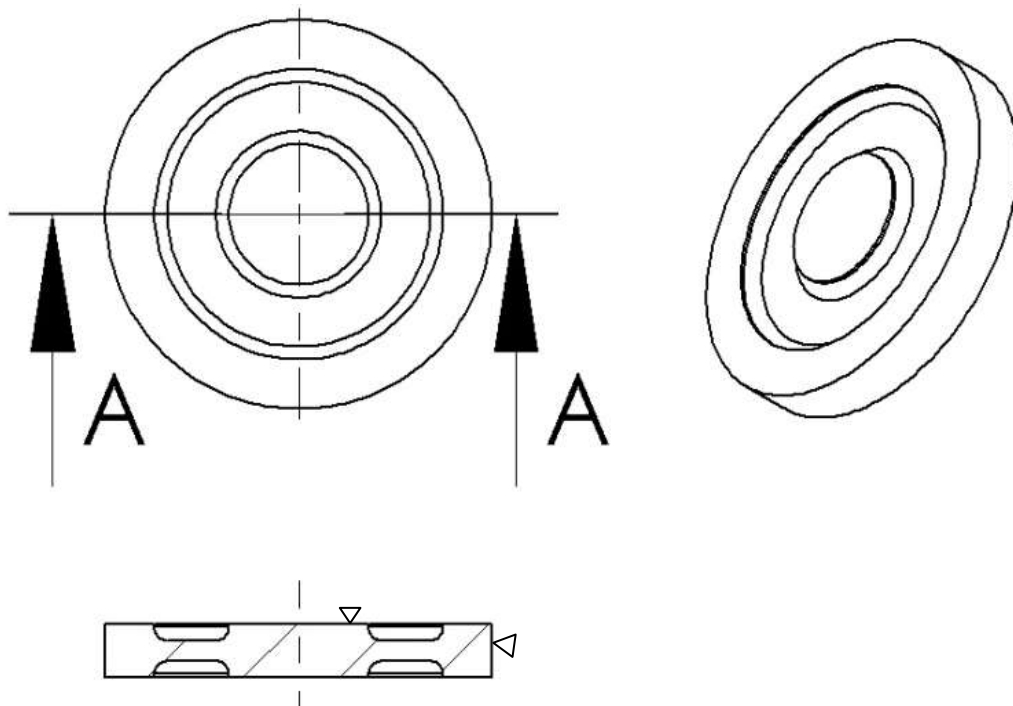


Figure 1 Gear blank

Q3:

The total solidification times of three casting shapes are to be compared:

- (1) a sphere,
 - (2) a cylinder, in which the length-to-diameter ratio = 1.0, and
 - (3) a cube. For all three geometries, the volume = 1000 cm³. The same casting alloy is used in the three cases.
- (a) Determine the relative solidification times for each geometry.
 - (b) Based on the results of part (a), which geometric element would make the best riser?
 - (c) If the mold constant = 3.5 min!cm² in Chvorinov's rule, compute the total solidification time for each casting.

Q4

A cupola furnace charged with three raw materials, their chemical composition is shown below. Neglect gains and losses. Given melting rate 0.6 (Kg/hr)/cm², furnace diameter 1.3 meter, melting ratio 6:1, and percentage of carbon in coke 90%, (O₂ in air 23%). Determine:

- i. The production rate in kg/hr of molten metal?
- ii. The amount of coke needed per hour?
- iii. The amount of air needed per hour?
- iv. The expected chemical composition of the molten metal?:

Charge	Weight	C%	Si%	Mn%	S%
Pig Iron (1)	200 Kg	3.3	1.8	0.8	0.01
Pig Iron (2)	250 Kg	3.4	2.4	0.6	0.012
Scrap	550 Kg	3.25	2.4	0.66	0.09