

Internal Assessment Test - II

Sub:	Metal Casting and Welding	Code:	15ME35A
Date:	03 / 11 / 2016	Duration:	90 mins
		Max Marks:	50
		Sem:	III
		Branch:	Mechanical

Answer Any FIVE FULL Questions

		Marks	OBE	
			CO	RBT
1.	With a neat labeled diagram explain true centrifugal casting.	[10]	C1	L1
2.	With the help of a neat sketch, explain continuous casting.	[10]	C1	L1
3.	Explain the process of nucleation during the solidification of a pure metal and also state the solidification variables.	[10]	C3	L1
4.	State any 10 casting defects and explain 5 of them.	[10]	C2	L1
5.	With a neat diagram explain stir casting setup and define fettling process.	[10]	C1	L1
6.	Define welding. Classify welding process.	[10]	C1	L1

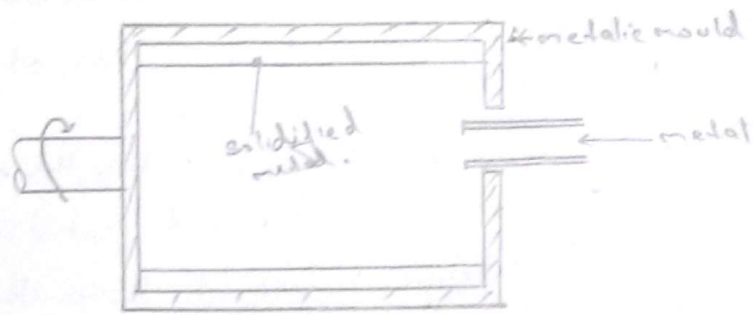
Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	The student will be having the capability to identify suitable manufacturing processes to manufacture the products optimally.	2	1	2			1						
CO2:	The student will be able to identify/control the appropriate process parameters, and possible defects of manufacturing processes so as to remove them.	1	3		3								
CO3:	The student will learn and practice the principles of designing casting pattern and mold.	2	1			3							
CO4:	The student will learn the methods of testing and evaluation of weldment .	1				2		1					
CO5:	Welding codes and specifications.												

Cognitive level	KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PO1 - *Engineering knowledge*; PO2 - *Problem analysis*; PO3 - *Design/development of solutions*; PO4 - *Conduct investigations of complex problems*; PO5 - *Modern tool usage*; PO6 - *The Engineer and society*; PO7- *Environment and sustainability*; PO8 - *Ethics*; PO9 - *Individual and team work*; PO10 - *Communication*; PO11 - *Project management and finance*; PO12 - *Life-long learning*

01) True centrifugal casting:

It is used to produce parts that are symmetrical about the axis, like that of pipes, tubes etc.

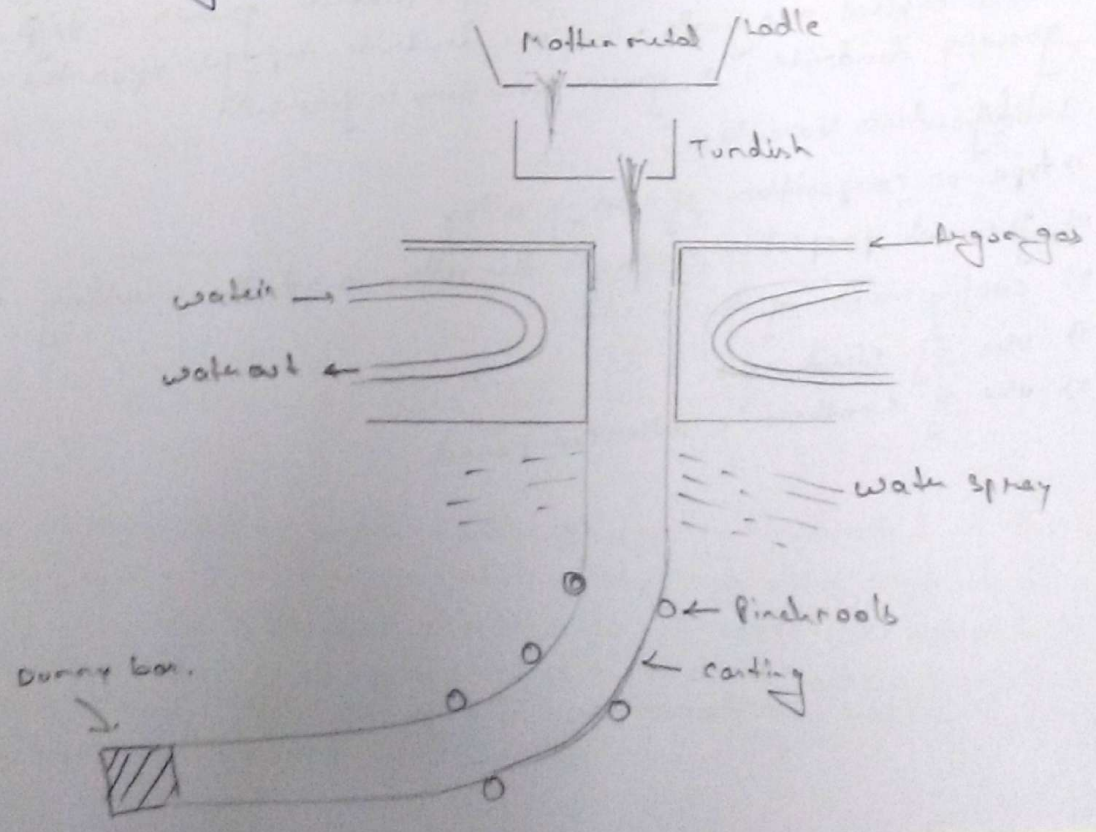


working:

- a) The mold of the desired shape is prepared with metals and the walls are coated with refractory ceramic coating.
- b) The mold is rotated about its axis at high speed in the range of 300 - 2000 rpm. A measured quantity of molten metal is poured into the rotating mold.
- c) The centrifugal force of the rotating mold throws the liquid metal towards the mold wall and holds the molten metal until it solidifies.
- d) The casting cools and solidifies from the outer surface towards the axis of rotation of the mold thereby promoting directional solidification.
- e) The thickness of the casting obtained can be controlled by the amount of liquid metal being poured.

02) Continuous Casting:

It is a casting process in which the operation of pouring, solidification and withdrawing of cast from an open mould are carried out continuously.



working:

- a) The molten metal is continuously supplied from the ladle to the intermediate ladle called tundish from where it is continuously poured into the mould at a controllable rate, keeping the level at a constant position.
- b) The mould, usually made of copper or graphite is open at the bottom and is water cooled so as to extract the heat of the metal.
- c) The process is started by placing a dummy bar at the bottom of the mould upon which the first liquid metal falls.
- d) The molten metal from the tundish enters the mould and takes the shape of the mould. The water cooled moulds control the cooling rate of the metal, so that it solidifies before it leaves the mould.
- e) The metal after coming out of the mould is further cooled by direct water spray for complete solidification to take place.
- f) The solidified metal is continuously extracted by pinch rods, bent and fed horizontally and finally cut to the desired length.

Q3) Explain the process of nucleation and also state the solidification variables.

When nucleation takes place in the liquid metal without the help of any impurities it is known as homogeneous nucleation.

When a liquid is cooled below its freezing point, it starts to solidify and the atoms of the liquid metal begin to bond together forming a very small sized crystal called nuclei, this process takes place at several locations.

The formation of new crystals is known as nucleation and it is called as nucleation point. As the solidification progresses, the crystal increases in size by the progressive addition of atoms and grow until they impinge upon the adjacent growing crystal. It continues in 3-D forming a tree like appearance known as dendrite. The dendrite grows in different directions in each crystal and finally when one dendrite impinges upon the adjacent growing dendrite, a grain boundary is formed.

Solidification Variables:

- 1) type or composition of casting alloy
- 2) thermal properties of both the alloy and the moulding material
- 3) cooling rates of the mould.
- 4) use of blind riser
- 5) use of exothermic riser compound.

Q4) State any casting defects and explain 5 of them.

- 1) Misrun
- 2) Blowholes
- 3) cold shut
- 4) mismatch
- 5) drop
- 6) Flashes on fins
- 7) Fusion
- 8) Metal penetration
- 9) cut or wash
- 10) Scar & blister.

1) Blowholes: It appears as small cavities in the casting
cause: due to hard ramming, very fine grain size sands and improper venting.

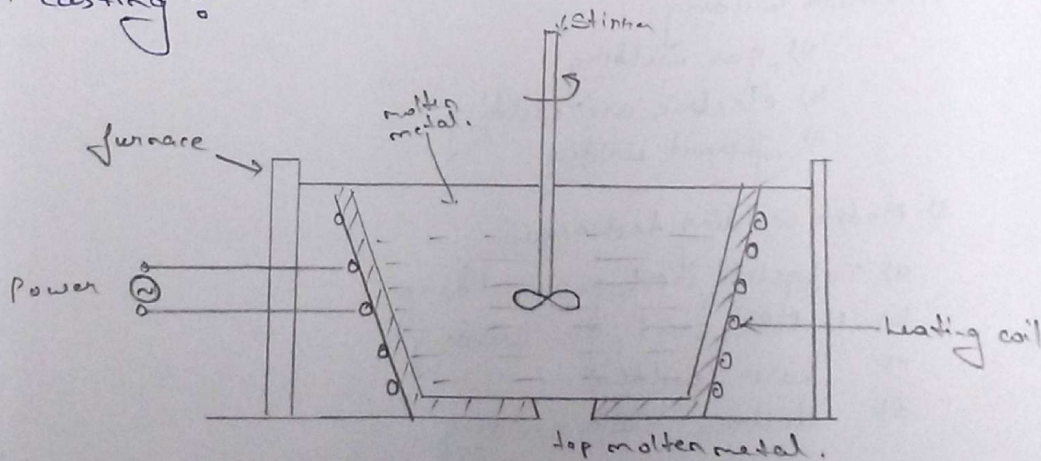
2) Misrun: It is the incomplete filling of the mould cavity
cause: Very low pouring temp and improper designed gates.

3) cold shut: It is an interface within a casting i.e. from where two metal streams met without complete fusion.
cause: very low pouring temp, improper gating design, inadequate amount of molten metal.

4) Mismatch: It is the shift of the individual part of the casting with other.
cause: mis alignment of the two halves of the mould.

5) Drop: It appears as an irregular deformation on the casting surface
cause: Lower strength of the sand mould

Q5) Skin casting:



The schematic representation of skin casting process is illustrated in this form in the above figure. The arrangement consists of a furnace inside which a graphite or cast iron crucible surrounded by a coil of copper wire is placed. The crucible holds the charge of metal to be melted. A powerful alternating current flows through the coil of the wire creating a rapidly reversing magnetic field that heats the metal.

Magnetic field induces eddy current and circular electric currents inside the metal by electromagnetic induction thereby producing stirring action within the molten metal. Meanwhile, the reinforcement or alloying elements are added to the molten metal and then stirred continuously by means of a stirrer for a short duration to create a vortex that forces the slightly lighter particles into the melt. The molten metal is then transferred into a preheated ladle and then poured into the mould of the desired shape. Since Al reacts rapidly with the surrounded oxygen, and inert gas like argon gas is used as the carrier gas to assist injection of the alloying element and pouring metal in a clean form.

Fettling: It is the operation which removes excess metal and other impurities from the casting surface.

Q6) Define welding process?

Welding is a fabrication process in which two or more workpiece, usually metals, are joined permanently to form a single component. Apart from metals thermoplastic can also be joined together by welding process. welding is carried out by heating the edges of the workpiece to a suitable temp. and then fused together with or without the application of pressure. Since a slight gas usually exists b/w the edges of the work-piece, a filler metal is used to supply additional material to fill the gap. But welding can also be carried out without the use of filler metal.

Classification of welding:

- 1) Pressure welding
 - a) Forge welding
 - b) electric resistance welding

- 2) Fusion welding
 - a) gas welding
 - b) electric arc welding
 - c) laser welding.

3) Modern welding techniques:

- a) Tungsten inert gas welding
- b) Metal inert gas welding
- c) Laser welding
- d) electron beam welding