Date 26/8/19

Workshop Assignment:

Q.1 What is a workshop?

Ans Workshop is a place where students acquire knowledge on the operation of various processes involved in manufacturing and production.

Q.2 What is manufacturing? How will you classify manufacturing system?

Ans Manufacturing is the production of workpieces having defined geometric shapes.

=) Classification of manufacturing system (5 types)

1) Primary shaping process: manufacturing of a solid body from an amorphous material. These are (a) casting (b) Powder metallurgy. (c) plastic technology

2) Forming process: In forming, no material is removed but they are deformed and displaced by suitable stresses. i.e.

(a) Forging
(b) Extrusion
(c) Rolling
(d) Sheet metal working.
(e) Rotatory swaging
(f) Thread rolling
(g) Explosive forming
(h) Electromagnetic forming

3) Machining Processes:- To generate the surface by removing material from unwanted regions of input material.

a) Turning (b) Drilling c) Milling d) Grinding
e) EDM f) ECM g) Shaping and planning

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h) ultrasonic maching

4) Joining processes : two or more pieces of metal parts are joined together as a need of non-standard size arises.

a) Pressure welding
b) Resistance welding
c) Diffusion welding
d) Explosive welding
e) Brazing
f) Soldering

5) Surface finishing processes : to provide intended surface finish on the metal surface of job.

a) Plastic coating
b) Metallic coating
c) Organic finishes
d) Inorganic finishes
e) Anodizing
f) Buffing
g) Honing
h) Electroplating
i) Lapping
j) Sanding

Q.3 What is production? How will you classify production?

Ans The art of converting raw materials into finished goods with application of different types of tools equipments, manufacturing set ups and manufacturing processes is known as production.

There are 3 basic types of production.

1) Job production
2) Batch production
3) Mass production

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1) Job production : comprises of an operator or a group of operators to work upon a single ~~joint~~ job and complete it before proceeding to the next job.

2) Batch production : Manufacturing of products (less than number say 200 – 800) with variety of similar parts with very little variation in size and shape.

3) Mass production : involves production of large number of identical products ~~that~~ needs the layout type of plant (Product layout).

Q.4) What do you understand by plant layout? Explain the objectives of plant layout?

Ans Plant layout is the arrangement of physical ~~elements~~ elements of facilities (or machines/equipment) which make the product or service.

OBJECTIVES :-

1) Minimize materials handling.
2) Reduce manufacturing cost.
3) ~~Offer~~ Afford economically output quantity and quality.
4) Maintain flexibility of arrangement and of cooperation to meet changing needs.
5) Maintain high turnover of work in process.
6) Reduce investment in equipment.
7) Avoid back-tracking.
8) Reduce work delays and stop-page.

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Q-3) Describe various types of plant layout and situation in which each type is used.

Ans According to work flow pattern four basic types are:—

(1) Fixed posⁿ layout: in this layout the major part of an assembly or material remains at a fixed position. All its accessories, auxiliary material, machinery, equipment, tools and labour are brought to the fixed state ~~situation~~.

Situation

1) when ~~equipment~~ materials forming or treating operation requires only tools or simple machine
2) when the cost of moving the major piece of material is high.
3) wheng only one or a few pieces of an item are to be manufactured.

(2) Product or line Layout: In this type of layout all the machines are placed in a line according to the sequence of operations.

Situation/Application:

1) The number of end products is small
2) The continuity of material flow can be maintained.
3) The parts are highly standardised and interchangeable.

(3) ~~Product~~ Process or Functional Layout: all operations of the same type are grouped according to the general function they perform.

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Application:
1) variety of products is many.
2) The demand of product is small or intermittent.
3) general-purpose low-cost machines are desirable.

(4) Group Layout: The existing jobshop is partitioned in a few groups of machines where each group produces its associated families of components.

Situation/Application
1) Manufacturing circular metal saws, hacksaw, files and crank shift.

Q.6) Distinguish between product layout and process layout.

Ans

Product Layout	Process Layout
1) In product layout, similar machines are arranged according to the sequence of operation required for manufacturing the product.	1) In process layout, similar machines are arranged in one location for manufacturing the product.
2) It leads to transfer lines.	2) It leads to group technology.
3) Full automation in material handling is possible in this layout.	3) Automation in material handling is not effective in this layout.
4) Inventory requirement is less.	4) Inventory requirement is comparatively more.

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5) Work flexibility is less.	5) Work flexibility is more
6) Monotony in working is more because jobs are repetitive in nature	6) Monotony in working is less as jobs are non-repetitive.

Q-7) What is Engineering material? Explain the role of materials.

Ans Materials that are used as raw material for any of construction or manufacturing in an organised manner of engineering applications are known as engineering materials.

Role of materials:-

1) Timber, steel and cement are the materials which are widely used for engineering application in huge quantities.

2) The consumption of steel in any country is considered as an indicator of its economic well being.

3) For high temperature applications e.g. steam and gas turbines the design engineers keep creating the demand for various high steel alloys.

4) Recently prepared new metallic materials in conjunction with new processing techniques and isostatic pressing and isothermal forging capable of imparting better fatigue properties to aircrafts.

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Q. 8 How will you classify materials?

Engineering Materials

- Metallic
  - Ferrous
    - Steel
      - plain steel
      - carbon steel
      - Alloy steel
    - Cast Iron
      - Grey
      - white
      - Malleable
      - Ductile
      - Nodullar
  - Non ferrous
- Non-Metallic ~~Materials~~
  - Organic
    - Plastic
    - wood
    - paper
    - Rubber
    - Leather
    - Petroleum
  - Inorganic
    - Mineral
    - Cement
    - Glass
    - Ceramic

Q.9) ~~Metal is a~~ What is metal? Explain the properties of metal with suitable examples.

Ans Metals are polycrystalline bodies consisting of great number of fine crystals. Metals are of two types :-

① Ferrous metals: such as pig iron, cast iron, ~~a~~ wrought iron, and steels.

② Non-ferrous metals: such as copper, aluminium, brass, bronze, tin, silver, zinc, etc.

Properties of Metals:

1) Strength: It is the measure of ability of a material to withstand the external forces. Higher the strength higher is the resistance offered to the deformation and higher is the amount of external load it can withstand without failure.

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2) Elasticity :- It is a type of tensile property of a material due to which it resists permanent deformation under applied loads, i.e, the property which enables the material to spring back to its original size and shape.

3) Stiffness: It is the property of material which makes it capable of resisting deflection or elastic deformation under applied loads.

4) Plasticity: It is the property due to which it can undergo permanent deformation without failure or rupture. This property can widely used in several mechanical processes like forming, shaping, extruding, rolling etc.

5) Malleability & Ductility : Malleability is the ability

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8) Fatigue - Property of a material decides the behaviour under a particular type of loading in which smaller load than the one required for material failure in a single application is applied numerous times.

9) Resilience : It is the measure of capacity of a material to absorb energy within the elastic limit. When a material is externally load within elastic limit it absorbs some energy.

10) Creep: The property of a material due to which it is progressively deformed at a slow rate with time at a constant stress is called creep.

Q.10 What is stainless steel?
The steel which when correctly heat treated and finished resists oxidation and corrosive attack from most corrosive media. Minimum chromium content of 12% is required for film formation & 18% is sufficient to resist most severe atmospheric corrosive conditions.

Q.11) Describe briefly the properties and uses of the following non-ferrous metals.
1) Aluminium (Al)
Properties: — 1) Pure aluminium has silvery color and lustre.
2) ductile, malleable and very good conductor of heat and electricity.

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3) high resistance to corrosion.
4) tensile strength varies from 95 to 157 MN/m^2
5) When pure, it is weak and soft for most purposes

Uses: 1) Mainly used in aircraft and automobile parts.
2) Useful metal for cooking utensils.
3) Foil is used as silver paper for food packaging.
4) used as reflectors, mirrors in telescope.

2) Cu
Properties:- 1) Pure Cu has reddish brown appearance soft, malleable and ductile.
2) Good conductor of electricity and heat.
3) Non-corrosive under ordinary conditions.

uses: 1) making electric cables and wires.
2) copper tubes used in heat transfer work.
3) Household utensils.
4) used to ~~perform~~ alloys like brass, bronze, gun metal.

3) Pb: Properties: 1) Bluish grey metal with high metallic lustre
2) high density and easy workability
3) good resistance to corrosion.
4) very malleable.
5) Softest and heaviest of all elements.

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Uses: 1) used in safety plug in boilers, fuses etc
2) used in various alloys like brass and bronze.
3) as sheaths for electric cables.
4) alloy of lead and tin used as solder in joining processes.

4) Zinc (Zn): Properties: 1) Bluish grey metal.
2) tensile strength 19 to 25 MPa.
3) Becomes brittle at 200°C
4) High resistance to corrosion.
5) specific gravity 6.7 and low melting pt of 480°C

Uses: 1) as a protective coating on iron and steel.
2) oxide of zinc used as pigment in paints.
3) for generating electric cells.

5) Mg. Properties: 1) silvery white metal.
2) low density and tarnishes in air.
3) have very good corrosion resistance
4) good high temperature mechanical properties.

Q12 Discuss the various types of aluminium alloy giving the composition properties & uses.

Ans Various Aluminium alloys are:-

1) Duralumin

Composition Aluminium ⇒ 94%
Cu ⇒ 3.5 - 4.5% Manganese 0.4-0.7%
Magnesium 0.4 - 0.7%

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Properties: 1) can be easily forged, casted & worked
2) high tensile strength.
3) low corrosion resistance.
4) High electrical conductivity.

Uses:- 1) used in wrought conditions for forging, stamping, bars, sheets, tubes, bolts and rivets.
2) in aircraft and automobile components.
3) Employed in surgical and orthopedic work.

2) Y - Alloy (Copper - Aluminium Alloy).

Composition: Al = 92.5% Cu 3.5 - 4.5%
Manganese 1.2 - 1.7% Nickel 1.8 - 2.3%
Silicon, magnesium, iron = 0.6% each.

Prop 1) good strength and machinability
2) easily cast and hot forked.
3) heat treated and age hardened.

Uses: 1) used for cast purposes and forged components.
2) In aircraft engines for cylinder heads, pistons, etc.

3) Magnalium

Composition: Al = 85 - 95% Cu 0 - 25%
Ni = 0 - 1.2% Sn = 0 - 3%
Mn = 0 - 0.03% Si = 0.2 to 0.6%

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Properties: Light in weight and brittle.

Uses: Mainly used for making aircraft and automobile components.

4) Hindalium

Components: Alloy of aluminium, magnesium, chromium.

Properties: 1) Hard & strong.
2) good ~~stra~~ scratch resistance.
3) doesn't absorb much heat

Uses: 1) manufacturing anodised utensil.

Q.15 Differentiate between Brass & Bronze.

Ans

Brass	Bronze
1) Brasses are widely used ~~as~~ alloy of Cu (main constituent) and Zn. They also contain small amounts of Pb or Sn or Al.	Alloys of Cu and Sn are generally turned into Bronze.
2) Comp Cu 67% Zn 33%	Comp Cu 75–95% Sn → 5–25%
3) Props: (a) very good resistance to corrosion and fatigue (b) good electrical conductivity (c) excellent elasticity	Props: (a) Higher strength, better corrosion resistance. (b) hard & resists wear & tear. (c) Has antifriction or bearing properties.

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4) Uses
- for decoration
- for plumbing of
- electrical application.

Uses
- for making of musical instruments.
- → machine tools and bearings

Q.14. What is cast iron? Explain the types of cast iron.

Ans It is basically an alloy of iron and carbon and is obtained by remelting pig iron with coke, limestone and steel scrap in a furnace called cupola. The carbon content of cast iron varies from 1.7% to 6.67%.

Types:

① Grey Cast iron: is grey in color due to carbon being principally in the form of graphite.

C → 2.5 to 3.8%. P < 0.15%
Si → 1.1% – 2.8%. & S < 0.1%.
Mn – 0.4 – 1.0%. Fe Remaining.

② White Cast iron: is white in color due to the carbon in this iron is in combined form as iron carbide which commonly specified as cementite.

C → 3.2 – 3.6%. S < 0.02%.
Si – 0.4 – 1.1%. Fe → Remaining
Mn 0.1 – 0.4%.
P < 0.3%.

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(3) Ductile cast iron / Nodular cast iron. When small quantities of Mg or cerium (Ce) is added to cast iron, then graphite content is converted into nodular or spheroidal form well dispersed throughout the material. The resulting structure possesses properties more like cast steel than any other grades of cast iron.

C → 3.2 – 4.2% Ni → 0 – 3.5%

Mn → 0.5 – 1.5%

Mg → 0.1 – 0.8% Remaining Fe

(4) Malleable cast iron. It is an alloy of iron in which combined carbon is changed into free form by suitable heat treatment. It can be obtained by annealing the castings produced from malleable cast iron.

(8) Meehanite cast iron is an inoculated iron of a section

Iron	90 – 92%
Si	4 – 4.5%
C	0.4 – 2.0%

manganese 0.2 – 1.5%
phosphorus 0.1 – 2.0%
sulphur 0.4 – 1.0%

(6) Alloy steel is steel? How will you classify steel? Alloy steel is an alloy of iron and carbon with carbon content maximum upto 1.7%.

Q.15 Write

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Ans: Effect of alloying elements on cast iron.

(1) Carbon : * Reduces melting pt of iron.
* makes it hard.

(2) Silicon * promotes decomposition of cementite into graphite
* Reduces shrinkage

(3) Sulphur * makes CI hard & brittle
* promotes oxidation so kept low as possible

(4) Manganese * makes CI white and hard.
* Reduces harmful effects of sulphur by forming Manganese sulphide (insoluble in C.I.).

(5) Phosphorus * Increases fusibility and fluidity but includes brittleness.

Si → 1.1 % – 2.5 %
Mn – 0.4 – 1.0 %

(2) White Cast iron : is white in colour. Approximately a least the carbon in this iron is in combined form as iron carbide which commonly specified as cementite.
C → 3.2 – 3.6 %
Si – 0.4 – 1.1 %
Mn 0.1 – 0.4 %
P < 0.3 %
S < 0.2 %
Fe → Remain

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Mn 0.0 – 0.02 %
Slag 0.05 – 1.5 %
Fe – Remaining.

Properties: 1) easily shaped by hammering, pressing, forging.
2) easily Bent when cold.
3) tough, high ductility and plasticity
4) High resistance from corrosion and fatigue.

Q.17 What is pig iron? Write the composition of pig iron.

Ans Pig iron is an intermediate product of the iron industry also known as crude iron which is obtained by smelting iron ore in a blast furnace. When the metal had cooled and hardened, the smaller ingots (the pigs) were simply broken from the runner (the sow) hence the name pig iron.

Composition

iron	90 – 92 %	manganese	0.2 – 1.5 %
Carbon	4 – 4.5 %	phosphorus	0.1 – 2.0 %
silicon	0.4 – 2.0 %	Sulphur	0.4 – 1.0 %

Q.18 What is steel? How will you classify steel?

Steel is an alloy of iron and carbon with carbon content maximum upto 1.7 %.

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- Steel
  - Low alloy
    - Low carbon
      - Plain
      - Heat strength low alloy
    - Medium carbon
      - Plain
      - Heat treatable
    - High carbon
      - Plain
      - Tool
  - High alloy
    - Stainless

Q-19 What is the effect of alloying element on steel

Ans

↑ ⇒ increase ↓ ⇒ decrease

Element	Percentage	Properties
Mn	< 1%	Hardenability ↑ Strength ↑
	1% – 14%	Hardness ↑ wear resistance ↑
S	0.08 – 0.15 (MnS)	Machinability ↑
Ni	2 – 5%	Impact Resistance ↑, Toughness ↑
	~~12 – 20%~~	
	12 – 20%	Corrosion Resistance ↑
Cr	< 2%	Hardenability ↑, Strength ↑ Corrosion Resistance ↑

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Mo	< 0.3 %	Hardenability ↑, Strength ↑
V	0.03 – 0.25 %	strength ↑
Cu	0.1 – 0.5	Corrosion resistance ↑, surface quality ↓

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Quest. What are the main constituents of moulding sand? Explain in brief.

Ans: The main constituents of moulding sand are :-

1) The silica grain (SiO_2).
2) Clay (which acts as binder)
3) Water (moisture activates clay & provide plasticity). Some other binder and additives may also be added to the sand to achieve the specific properties.

1) Silica grains:- The silica grains form the major portion of moulding sand (80 - 92 %) & the rest being the other oxides such as alumina is used with or without washing. The grain size may vary in size from a new micrometer to a few millimeters.

2) Clay :- clay are generally used binding agent because of their low cost and wider utility. Clay impart the necessary bonding strength to the moulding sand so that after ramming mould does not loose its shape. The most popular clay types are
Bentonite ($Al_2O_3 \cdot 4SiO_2, H_2O, nH_2O$).
and.
Kaolinite or fire clay ($Al_2O_3, 2SiO_2, 2H_2O$)

3) Water :- Moisture is an important element of moulding sand. Clay acquires bonding action only in presence of required amount of water used normally is 2 to 8 %.

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Q.3 Explain the various properties of moulding sand.

Ans: The properties that are generally required in moulding material are :—

1.) Refractoriness: It is the ability of moulding sand to withstand high temperature of ~~material~~ molten metal without fusing.

2.) Permeability: The ability of moulding sand to allow gases to escape through the mould is termed as permeability.

3.) Cohesiveness: It is the property of the sand due to which sand grains bind together firmly and retain the shape of the constructed mould. Cohesiveness is largely affected by the grain size, clay and moisture contents.

4.) Collapsibility: It is the property due to which sand mould automatically collapses after solidification of casting. It allows the free ~~skin~~ shrinkage for contraction of the castings.

5.) It should be inexpensive and easily available.

6.) It should be sufficiently dense to prevent metal penetration.

~~7.) Its coefficient be sufficient dense to prevent metal penetration.~~

7.) Its coefficient of expansion should be sufficiently low.

8.) It should not chemically react with molten metal.

9.) It can be recycled.

Q.4) How can you classify the different types of moulding sand?

Ans: Types of moulding sand are as follows:—

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Ans Types of moulding sand are as follows:-
1) Foundry green sand.
2) Dry sand
3) Facing sand
4) Parting sand.
5) Core sand
6) Loam sand
7) Backing sand.

Q-6) Explain briefly the various types of mould?
Ans The various types of moulds are as follows:-
1.) Green sand mould.
2.) Dry sand mould.
3) Skin dried mould
4.) Air Dried Mould.
5) Loam mould
6) Cement bonded sand mould
7) Plaster mould
8) Carbon dioxide mould
9) Shell mould
10). Metallic mould.
11). Core sand mould.

1) Green sand mould: 1) The sand mould prepared from natural moulding sand in its green state is called green sand mould.
2) It possesses lower strength & lower permeability.
3) It contain moisture, therefore certain defects like blow holes may occur in casting.
4) Green sand moulds are suitable for producing small and medium sized castings.

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2) Dry sand mould :- 1) Dry sand moulds are prepared from fine grained sand mixed with suitable binder and baking in an oven (at temp 300 to 650°F) before the molten metal is poured in them.

2) It possess higher strength as compared to green sand mould.

3) They are more expensive and consume more time ~~than~~ in making as compared to green sand mould.

(3) Skin dried mould :- 1) The mould is made with the moulding sand in the green (moisture) condition and then the skin of the mould cavity is dried with the help of gas torches or heat lamps. Thus it is the compromise b/w green & dry sand moulds.

2) They are dried only upto a depth varying from 8 mm to 25 mm.

Q.2) Explain in brief the various additives commonly added to the moulding sand.

Ans Additives are those materials which are added to the moulding sand to improve the existing properties of the sand ~~to improve the existing~~. The commonly used additives are :-

(1) Sea coal :- 1) It is added to moulding sand for casting of cast iron to improve the stripping and surface appearance of cast iron.

2) The amount of sea coal addition varies from 1% (for small casting) to 10% (for large casting).

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3) Sea coal is finely ~~divided~~ powdered bituminous coal.

② Pitch and Asphalt :→ Pitch is distilled from soft coal at about 600° F and asphalt is a by product of petroleum distillation. It may be added from 0.2 to 2%.

③ Silica flour :- It is pulverised silica which can pass through 200 ~~sieve~~ mesh sieve. It may be added upto 35%.

④ Graphite : It may be natural or synthetic graphite. It may be added from 0.2 to 2%.

⑤ Wood flour :- It may be added from 0.5 to 2%.

⑥ Corn flour :- It may be added from 0.25 to 2%.

Q.) What do you understand by the term gating system? (Explain with sketch).

Ans) Gating system means all the passages through which the molten metal enters the mould cavity i.e. it includes the pouring basin, runner, gate and riser etc. The manner has a great impact on the quality of casting produced so the gating system should be carefully defined and produced.

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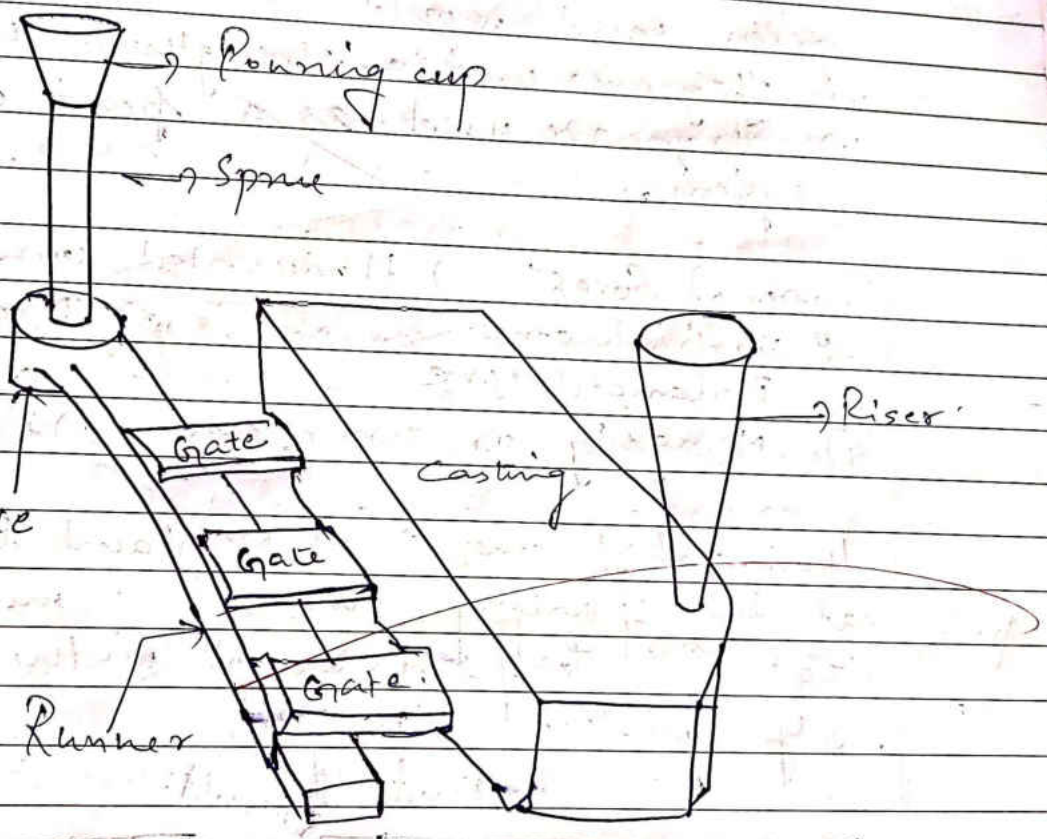
Elements of gating system → 1.) Pouring basin or cup.
2) Sprue
3) Sprue base wall.
4) Runner
5) Runner extension
6) Ingate
7). Riser.



Gating system :-

Q.8) What is core? What are its use? Explain atleast two types of core with neat sketch.

Ans Core :- Cores are defined as a body of sand which is used to form the hollow interior of the casting or a hole through the casting. These are prepared separately in a core box. Cores are held and located in the moulds

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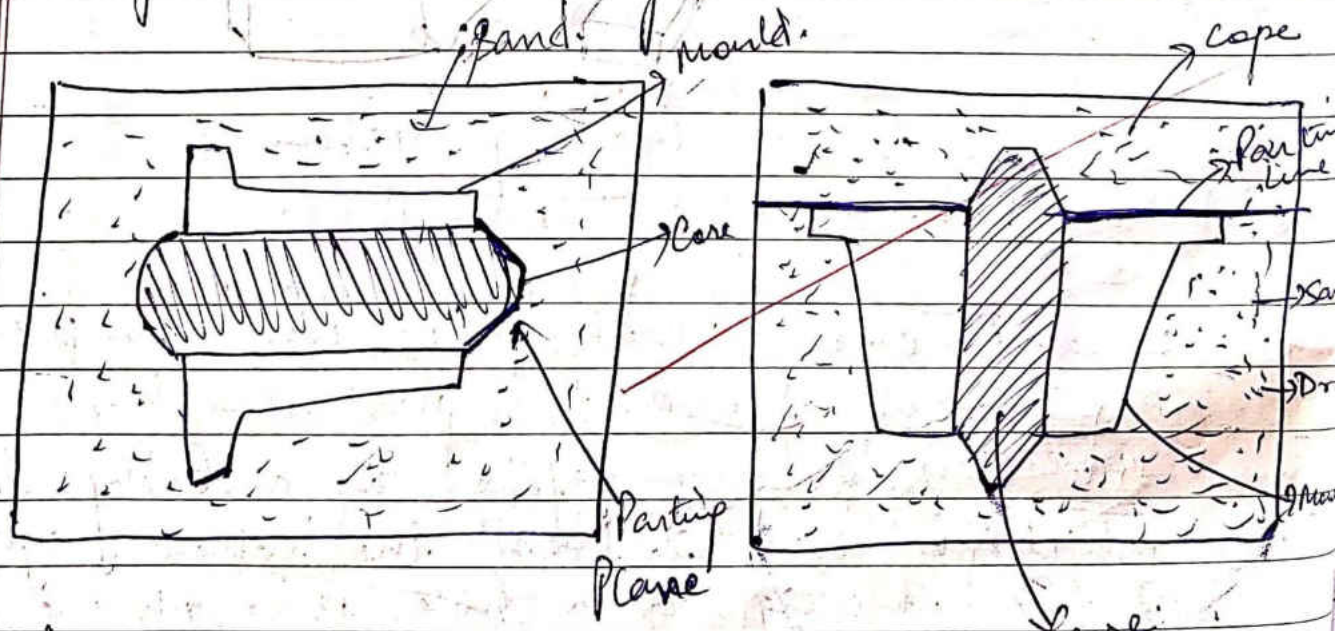
4) Hanging or corner core 6) Ram up core

Horizontal core → It is placed horizontally at the parting line of the mould such that one half remains in the cope & other half in the drag.



1) Horizontal core.. 2) Vertical core.

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2) Vertical core :- This is placed in a vertical position both in cope and drag halves of the mould. The amount of taper on the top is greater than that at the bottom.

Q.9) What are chaplet and why are they used for?

Ans chaplets are metal shapes used for supporting large and odd shaped cores which can not be adequately supported by their core prints.

1) When the molten metal is poured, chaplet melts and becomes a part of the casting so chaplets should be of the same material which is being cast.

3) Dirty, rusty, greasy or wet chaplets should be properly cleaned and dried before use.

4) If possible, use of chaplets should be avoided because sometimes these are not completely fused and create problem in further machining of the cavity.

Q.10) Explain the procedure of making a green sand mould using a split pattern.

Green sand: It is also known as tempered sand. It denotes a well prepared foundry sand which contains just enough moisture to give it sufficient bonds. Moulds in this sand are known as green sand moulds and do not require dry baking before pouring the molten metal into them.

Green sand moulding :- Moulding which is carried out in green sand i.e. when

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pouring is done in the sand mould with the sand in its green or natural state green sand moulding, for this:-

1) Green sand mixture is prepared & consisting of silica sand (10-15)% clay and (4-6)% moisture content, mixed and riddled and given the required cond^n by proper tamping
2) The first placed on the floor followed by pattern.
3) The drag part of the flask placed on the floor and rammered.
4) The other half of the pattern is placed in position, followed by the cope.
5) Runner and riser are placed in position and the box filled with sand & rammed properly.
6) Vent wire is applied ~~to~~ to provide the vents.
7) The cope is then rolled over and the pattern pieces are taken out of the boxes.
8) Molten metal is poured into the mould through the down sprue hole or runner.

Q.11) What is pattern? What is different b/w pattern and casting?

Ans A pattern may be defined as a model of the desired product (called casting) constructed in such a way that it can be used for forming an impression called mould (cavity) is filled with molten metal, it solidifies and produces a casting (desired product) so the pattern

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is the replica of the casting.

Q.12) What are the common materials used for pattern making?

Ans The pattern maker is basically a wood worker so the tool used by the pattern maker are nearly same as used in carpentry shop.

1.) ~~Materials~~ Measuring and Layout tools:
Rule, caliper rule, try square, flexible rule, combination square, marking gauge, dividers, T-level, calipers.

2) Sawing tools → Panel saw, Dovetail saw, rifle saw, compass saw, Back saw, coping saw.

3) Planning tools:- Block plane, Bench plane, circular ~~plane~~ router, Rabbet, cose box plane.

4) Boring tools:- Brace, Hand drills, Augerbit, Twist drill, counter sink, Bit gauge.

5) Clamping tools:- C clamp, Bar clamp, Hand screw, Pattern maker's vice, Pinch dog.

Q.13 What are allowances? Explain briefly common allowance provided to pattern?

Ans Pattern is having different size as compared to casting because it carries certain allowances due to metallurgical and mechanical reasons. The various allowances are:-

1) Shrinkage and contracts in size. ~~To compens~~ As metal solidifies and cools it shrinks and contracts in size. To compensate for this, a pattern is made larger than a finished casting by means of a shrinkage or contraction allowance. Contraction is different for different metals.

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2). Machining or Finish allowance :- For good surface finish, machining of casting is required. For machining, extra metals are needed. This extra metal is called machining ~~met~~ or finish allowance. The amount of this allowance varies from 1.6 to 12.5 mm.

3) Draft or Taper allowance :- At the time of withdrawing the pattern from the mould, the vertical forces of the pattern are in continual contact with the sand, which may damage the mould cavity. This danger is greatly decreased if the vertical surfaces of a pattern are tapered inward slightly. The slight taper inward on the vertical surface of a pattern is known as the draft.

4) Distortion or camber allowance.
5) Shake or rapping allowance.
6) Mould wall movement allowance.

Q.14 Explain the functions of a pattern.

1) A pattern prepares a mould cavity for the purpose of making a casting.
2) To produce seats for cores in the moulds so need core prints on the pattern.
3) Runner, gates and riser may form a part of the pattern.
4) Pattern establishes the parting line and parting surface in the mould.

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5) Patterns properly made and having finished and smooth surface ~~may~~ reduce casting defects.

6) A pattern may help in establishing locating pins on the mould and therefore on the casting with a purpose to check the casting dimension.

7) Properly constructed patterns minimize the overall cost of casting.

Q.1[v] Difference b/w pattern & casting:

Ans 1) The material of the pattern is not necessarily same as that of the casting. Pattern may be made from wood.

2) The colour of the pattern may not be same as that of the casting.

3) Pattern carries an additional allowance to compensate for metal shrinkage.

4) It carries additional allowance for machining.

5) Surface finish may not be same as that of casting.

6) Sharp changes are not provided on the patterns. They are provided on the casting with the help of machining.

7) Pattern may be in many pieces while casting is in one piece.

Q.1[5] Define the following —

1) Core print :- Cores are used for making cavities (holes) and hollow projections in the casting. For all those castings, where coring is required ~~the~~ provision should be made to

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support the core inside the mould cavity. This provision is provided by the pattern. The pattern is made larger (core print) so that it can produce the cavity in the sand for core supporting (called core seat) along with the cavity for product. The extra position on the pattern is called core print.

2) Mould or cavity: A mould can be described as a void or cavity created in a compact sand mass with the help of a pattern which (mould) when filled with molten metal will produce a casting.

3) Core box: Core boxes are used for making cores they are either made single or in 2 parts. They may be made either from wood or metal. Wood is generally used for making core boxes, but metal core boxes are preferred where cores are to be prepared in large numbers on mass production basis.

4) Riser: A riser, also known as a feeder, is a reservior built into a metal casting mold to prevent cavities due to shrinkage.

Q.16 What are the two stages of solidification and what occurs during each?

Ans Casting is a solidification process where the molten material is poured into a mould and then allowed to freeze into the desired final shape. Solidification

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ocurs in two stages

1) Nucleation : occurs when a particle of a stable solid forms from within the molten liquid. Each nucleation event produces a crystal or grain the final casting.
As a result nucleation generally occurs at a temperature somewhat below the equilibrium melting point.

2) ~~Grain~~ growth : The second step in the solidification process is known as growth, which occurs as the evolved heat of fusion is continuously extracted from the liquid material. The direction, rate and type of growth can be controlled by the way in which heat is extracted.

Q.19 Discuss the role of casting volume and surface area as they relate to total solidification time (t_s) and Chvorinov's rule.

Ans The amount of
from a casting
directly to faulty gating
super heating faulty pouring
casting or improper flux
observations
which starts in mould
time can
t_s

	Modify gating system. Provide harder ammering. (or) Provide proper flux.
Lack of collapsibility	Improve mould collapsibility
Low strength of mould core	Improve core collapsibility

t_s = time from
V = volume of

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A = Surface area.
B = Mold constant.

Q.20) Why is it desirable to make the pattern as small as possible?

A pattern may contain projections known as core prints if the casting requires a core and need to be made hollow. Runner, gates and risers used for feeding molten metal in the mold cavity may form a part of the pattern. Patter properly made and having finishing and smooth surfaces reduce casting defects.

Q. Explain the various types of casting defects with cause and remedies?

Casting defects:

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Defects	Common causes	
1) Blow holes	a) Excess moisture content in moulding sand.	a) Control moisture content.
	b) Rust and moisture on chills, chaplets.	b) Bake cores properly.
	c) Cores not sufficiently baked	c) Ram the mould less hard.
2) Porosity	(a) High pouring temp.	(a) Regulate pouring temp.
	(b) Gas dissolved in metal charge.	(b) Modify gating and ~~rising~~ risering
	(c) Slow solidification of casting	(c) Increase flux proportion.
3) Shrinkage	(a) Faulty gating & risering	(a) Ensure proper directional solidification by modifying gating risering chilling.
	(b) Improper chilling	
4) Inclusions	(a) Faulty gating	Modify gating system
	(b) Faulty pouring	Provide harder ramming.
	(c) Improper flux	(c) Provide proper flux.
5) Hot tears or hot cracks	(a) Lack of collapsibility in mould	Improve mould collapsibility
6) Cuts & washes	Low strength of mould & core	Improve core collapsibility

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7)	Drops	Low green strength in moulding sand and core	Modify sand composition for increased green ~~str~~ stren
8)	Fusion	Low refractoriness in moulding sand.	Improve refractoriness
9)	Shifts	Worn out or bent clamping pins	Repair or replace dowels.
10)	Swells	Too soft ~~ra~~ ramming of mould low strength of mould and core.	Provide harder ramming. Incre. strength of mould and core.
11)	Hard spots.	Faulty metal composition	Suitably change the metal composition.

Q.23 Explain briefly the inspection of casting.

Ans Inspection of casting is done to ascertain various characteristics. Generally the inspection of casting is carried out ~~by~~ to ascertain the required surface finish, dimensional accuracy, various mechanical and metallurgical properties and soundness. Various tests used for inspection of castings are:-

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1) Measurement of the final dimensions:- The casting dimension can be measured through various calipers or gauges. The final dimension obtained is compared with the design dimension and dimensional accuracy can be calculated.

2) Measurement of surface finish:- The surface finish of a casting can be measured by perthometer, roughness tester, and by using profilo-meter. Usually root-mean square values are measured.

3) Destructive testing:- As the name suggests ~~destr~~ destructive, the casting sample is prepared after cutting the final casting such types of test s are required to measure mechanical and metallurgical properties of the product.

4) Non-destructive testing:- (1) "Visual Inspection" is carried out to check the final appearance of the casting ~~mag~~, major cracks, swells, tears etc. may be detected by this method.

(2) Radio graphic "Inspection" is used to ~~solid~~ identify and measure the internal defects in the casting. Generally x-rays are used to identify the internal defects in castings.

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